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AN EXPLORATION OF THE LONG-TERM IMPACTS OF SHORT CPD WORKSHOPS

MICHAEL JOHN COLE

A thesis submitted in partial fulfilment
of the requirements of the
University of Northumbria at Newcastle
for the degree of
Doctor of Philosophy

*Department of Social Work, Education
and Community Wellbeing*

March 2018

Abstract

The purpose of this PhD study is to explore the impact of, and conditions influencing, the impacts of short subject specific episodes of CPD on teachers' practices and pupils' learning. Implications for teachers' professional development will be discussed.

A three-phase sequential mixed-methods approach was employed. Phase 1 semi-structured interviews were used to establish the nature and extent of change to teaching practices following a short CPD workshop. 110 pre-course questionnaires were used to establish participants' expectations, and 80 post course impact questionnaires were used to identify impacts on teaching practices and pupils' learning. Finally, five semi-structured interviews were carried out to explore the emerging themes, of the significance of self-determination theory (SDT) and teacher agency (TA), in further detail.

The key findings from this sequential mixed-methods study suggest that one-day science subject specific CPD workshops can have valuable impacts on teachers' practices and pupils' learning. However, new resources and ideas gained as a result of engaging with the CPD may remain latent until the occurrence of a 'critical event', which acts to trigger new practices. Significantly, critical events emerge because of teachers' determination to implement new changes and their relations with the socio-political educational environment.

The interplay between a teacher's self-determination and their socio-political environment, impacts on agency and capacity to implement new practices. An understanding of such interactions is essential to understanding the nature and extent of changes to practices following a teacher's engagement with CPD.

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Glossary of Terms and Abbreviations

CIQ	CPD Impact Questionnaire
CPD	Continuing Professional Development
DCSF	Department for Children, Schools and Families
DFE	Department for Education (Government)
GTCE	General Teaching Council for England
INSET	In Service Training
ITE	Initial Teacher Education
ITT	Initial Teacher Training
NCTL	National College for Teaching and Leadership
OECD	Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment
PCK	Pedagogical Content Knowledge
QTS	Qualified Teacher Status
SDT	Self-Determination Theory
SLC	Science Learning Centres
TEEQ	Teacher Efficacy and Expectations Questionnaire
TTA	Teacher Training Agency
TDA	Training and Development Agency for Schools

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Declaration

I declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others.

Any ethical clearance for the research presented in this thesis has been approved. Approval has been sought and granted by Faculty Ethics Committee / University Ethics Committees.

I declare that the word count of this thesis is 84326 words.

Name: Michael John Cole

Signature:

Date: 01st March 2018.

Chapter 1: Introduction

In this chapter, I will introduce the context of this study and outline the rationale for the research. I will begin by outlining the history of science teachers' continuing professional development (CPD) in England. I will go on to suggest the importance of self-determination theory (SDT), and notions of teachers' agency as important frameworks with which to make sense of the extent of changes to teachers' professional practices following engagement with short episodes of subject specific CPD. Finally, I will provide an overview of the structure of the thesis.

1.1 My personal background within the study

I began my career in science education in 2000 as a science teacher. At the time, much of the CPD on offer was usually only available through the Local Authority provision. The prime focus was often training in relation to government and political priorities, and imposed external strategies and frameworks. The CPD often involved exposure to prescriptive and performative models of how to teach science. The CPD I experienced seemed a long way from my experience of teacher education at University, where *development* of teaching activities, resources and strategies was encouraged. We were encouraged to read widely and reflect carefully upon our lessons. Having entered the teaching profession the training became very different. It was now about implementing national strategies – and 'teachers' standards' – which say little of subject knowledge. Centrally directed initiatives dominated the CPD agenda (Bolam, 2000; Bottery, 2003).

Unlike other professions where CPD may be well ordered and systematic and carefully specified in accordance with career stages (Bishop and Denleg, 2006), CPD opportunities for teachers seemed uncoordinated and its availability very limited. It was for this reason I chose to complete a Masters in Science Education.

During this time, I followed the opening of the network of Science Learning Centres with some interest. For the first time outside of university study, I read of the value of engaging and enthusing teachers with developments in contemporary science and of the importance of the latest peer-reviewed evidenced based educational research. The then newly formed National Network of Science Learning Centres (SLCs) fostered the implicit notion that teachers are professionals with a desire to access and engage with research informed subject and pedagogical knowledge. Much was made of the ways in which the SLCs would work collaboratively with education and science departments within their host Universities. This appeared much developed from the CPD provision that I had experienced as an early career teacher. SLCs made a strong case for connecting subject specialists with subject specific CPD which stood as a significant milestone.

I was later appointed a professional development leader (PDL) within Science Learning Centre North East, and then to Deputy Director of CPD provision. This provided me with a privileged position to become involved with the design and

delivery of the CPD and also to witness and seek first-hand accounts from teachers of the differentiated impacts on their practices.

1.2 Science teachers' CPD provision in England

CPD was a term first used by Richard Gardner at York University in the mid 1970's (Leaton and Denley, 2005) and was an umbrella term used to capture all learning experiences available to teachers during their teaching careers. That is to say Gardner's definition purposefully did not differentiate between teachers own classroom based experiences, collaboration with colleagues, or workshops with which teachers could engage (regardless of length and duration).

In 1988, Kenneth Baker, the Secretary of State for Education introduced the Education Reform Act. This reform included the enactment of the National Curriculum, and also saw the introduction of 'INSET' (In Service Training days) for teachers (Ball, 1993, p. 4). Specifically, INSET (or 'Baker' days as they were dubbed by the profession) included five days of teacher 'training' over the course of an academic year. The emphasis on training, imposed in this way, marked a shift away from Gardner's notion of teacher 'development', this being an important point that I will revisit later in the thesis (Chapter 2).

1.3 A case for subject specific CPD

Since its implementation in 1988, the National Curriculum has undergone several changes. In addition, there are constant advances of scientific and technical knowledge. As strong subject and pedagogical knowledge can lead to enhanced pupil learning (Scott, 2010, p. 3), subject specific CPD for science teachers' is likely to command a particularly important role in terms of teachers' ongoing professional development.

Leaton and Denleg (2005) carried out a study into the supply of science teachers' CPD provision, and produced a map of science teachers' CPD provision. It was evident within this that a wide range of professional, academic and subject organisations act as providers of subject specific CPD for science teachers. Arguably, there has been significant opportunity, at least in terms of the supply, of CPD aimed at science teachers. However, the challenge of coordinating and quality assuring the array of CPD provision has proven to be an ongoing challenge. The link between CPD provision and the demand for it is far from a straightforward process.

Despite the supply of science specific CPD, and the reports of its benefits (CST, 2000) pupils' attitudes to science education, and aspirations for progression in science are still in need of attention. Pupils see 'science' and 'science education' as two different things (Jenkins and Pell, 2006). It is not uncommon, for students to have positive attitudes towards science in a universal sense – the sorts of

science that they consider as important, relevant, and that can impact positively on society, but can have less positive attitudes towards 'school science' (Jenkins and Pell, 2006, p. 2). For a wide range of students of school age, there can often be the attitude that science education 'is simply not for me' (Archer et al., 2015). Even when students do find science lessons interesting and relevant, they may not enjoy them as much as they enjoy lessons in other subjects (*ibid*, p. 1).

The study of science is an important endeavour at a societal level. Many of the major international challenges over the next 50 years (climate change, food security, medicine development, energy generation) will draw upon scientific knowledge, and have need of scientific solutions. Meeting these challenges will require well-qualified science graduates. Although a school science curriculum geared towards producing future scientists could arguably be justified, there is also a value in more Confucian principles, of students studying the subject for its own sake - pursuing science for the sake of innate intellectual curiosity. Subject specific CPD is likely to have a role to play in supporting teachers with either endeavour.

1.4 Science Learning Centres (SLCs) and subject specific CPD.

In 2000, the Council for Science and Technology (CST) published a report (CST, 2000) which presented the views of primary and secondary science teachers in terms of their professional development needs and expectations. The report made a clear case for the importance of subject specific CPD to meet the individual needs of science teachers. The report made the claim that 'many pupils are

dissatisfied with, if not turned off by, the quality of the experience that they are receiving in their school science education' (CST, 2000, p. 27). It also acknowledged the difficulties of matching supply and demand of CPD, citing evidence that only 2% of the 'total population of teachers comprising the relevant client group' actually access the 'vast amount of support material and resources that is produced and sponsored by very many companies, professional bodies, charities, education organisations and institutions' (*ibid*, p. 24).

The report (CST, 2000) concluded with a recommendation for the creation of a 'Centre of Excellence' in Science. It was argued that the Centre of Excellence should:

- 'encourage and enable science teachers to seek and adopt new teaching strategies and approaches in their work with pupils;
- provide support services to new and inexperienced science teachers, as well as weaker members of the science teaching profession; and
- add value at the national level in developing the professional practice of science teaching.' (*Ibid*, p. 6)

Following recommendations of the establishment of a Centre of Excellence in the CST report (2000), and then for a national network of science learning centres (Roberts, 2002), the Department for Education and Skills (DfES) in partnership with the Wellcome Trust, invested £51m in the creation of a network of science learning centres comprising a National Science Learning Centre at York, and nine

regional science learning centres across England (Bishop and Denleg, 2006, p. 86).

The original aim of the national network of Science Learning Centre was: 'To bring exciting, contemporary science into the classroom and to enable teachers to refresh and extend their skills, so that young people gain the knowledge and understanding they need – both as citizens and scientists of the future' (Clark and Thom, 2012, p. 2). The Network of Science Learning Centres began operation in the autumn of 2004, and in 2013 was restructured as STEM Learning with its seven key outcomes listed as including increasing participants confidence, motivation and subject knowledge, and increasing pupils engagement, achievement and pursuit of STEM subjects and careers Post-16 (STEM, 2013).

Science teachers' perceived values and attitudes towards subject specific CPD tend to be much more positive than their attitudes toward more generic forms of CPD, driven for instance by government agendas (Leaton and Denleg, 2005, Varga-Atkins et al., 2009).

In line with the aims of the Science Learning Centre network (SLCs), the purpose of the range of CPD on offer was to; 'improve science teaching to inspire pupils by providing them with a more exciting, intellectually stimulating and relevant science education, enabling them to gain the knowledge and the understanding they need - both as the citizens and as the scientists of the future' (SLC, 2014). This would

be achieved by supporting teachers by ‘enhancing their professional skills by learning more about contemporary scientific ideas and in experimenting with effective teaching approaches and gaining experience of modern scientific techniques’ (SLC, 2014).

The CPD programme provided by the SLC included a range of courses, but all with the ultimate aim of enhancing participants’ practices, with the full expectation that enhanced practices would lead to positive impacts on pupils’ learning.

Teachers were able to select from a menu of courses on offer, and so could attend courses that were of highest personal or professional interest or priority. This presents a marked shift away from generic forms of CPD, which, findings suggest, by their more general nature may be of less intrinsic interest to subject specialists.

The range of CPD courses on offer supported an equally wide range of specific intended outcomes. Yet, the tenor of the course specific aims can be traced back to the mission aims of the Science Learning Centre. For instance, the course objectives below were included in marketing materials sent to schools advertising a CPD workshop held at Science Learning Centre North East.

Table 1: Extract of CPD workshop objectives from a course flyer.

CPD Workshop Objectives	
Participants will develop an understanding of:	1. The problem-solving approach used in the NHS
	2. Relating diagnostic tests to case studies
	3. The roles of scientists within the NHS
	4. How to use the case studies in school

It can be seen that the first, second and third outcomes aim to highlight the relevance of science education by providing a medical context, and the fourth outcome provides the opportunity to consider how a medical type case study may be applied and implemented within the science classroom to enhance teaching and learning.

1.5 Participants' self-determination and agency: Self-determination theory

Teachers who attended SLC CPD provision were arguably a self-determined group. Many had, after all, searched for a particular course in the first case and, importantly, made this selection from a wider programme of possible courses on offer. Many participants had then made the necessary administrative and organisational arrangements to come away from the classroom and engage with the CPD. This is a different approach in many ways to the 'typical' or historical INSET day in which the process of engagement with CPD is often decided by school leaders, rather than the individual participant flexing their teacher agency by 'acting purposefully and constructively to direct their professional growth' (Calvert, 2016, p. 4) .

The apparent self-selection and desire to meet their own individual CPD needs raises an important question of the significance of teachers' self-determination and agency within the change process. It could be suggested that a teacher, who sees value in the subject specific CPD, may be more self-determined to implement new

practices and ideas, than they would in response to more generic CPD, of less personal professional interest.

I will explore the concepts of self-determination and teacher agency more fully within the literature review (Chapter 2), and then again within the Findings and Discussion (Chapters 4, 5 and 6).

1.6 Rationale of the study and research questions.

CPD is considered an important source of knowledge with which teachers' motivations and confidences can be increased, and their pedagogies enhanced (Guskey, 2002, CST, 2000). As a result, pupils benefit from enhanced engagement, achievement and progression in science. However, many scholars are sceptical of the efficacy of short courses to bring about meaningful change to teachers' practices (Harland and Kinder, 1997, Day, 1999, Guskey, 2000, Adey, 2004, Cordingley et al., 2005). Short courses, it is argued, fail to provide the sustained opportunities for support, collaboration and reflection. However, as valuable as ongoing support and collaboration may be, participants who are self-determined within the process of change, are likely to make their own individual meaningful changes to practice closely aligned with their own professional values and competencies. Sweeping generalisations that short CPD workshops are insufficient to bring about meaningful change is likely to do a disservice to the influence and effect of a teacher's personal resources and determination within the change process. Moreover, such claims fall counter to my experiences of the

accounts from teachers, who reported impacts following engagement with short episodes (one-day courses) of subject specific CPD.

This study will therefore seek to add to the existing literature by exploring impacts of short subject specific CPD courses, over time. In addition, I will explore the conditions, which have an influence on this change process.

1.7 Specific research questions

This study will explore two main research questions.

1. To what extent can a one-day science subject specific CPD course impact on teachers' practices?
2. What are the conditions that influence the change process?

Each question has a number of sub-questions, highlighted below:

Research Question 1: To what extent can a one-day science subject specific CPD course impact on teachers' practices?

- a. What are CPD participants' perceptions of the extent of change?
- b. What are CPD participants' perceptions of the nature of change?

- c. How do the effects of one-day subject-specific CPD courses on participants' practices change over time?

Research Question 2: What are the conditions that influence the change process?

- a. What conditions are required, or hinder, the impact of one-day subject-specific CPD?
- b. What conditions contribute to long-term effects?

1.8 Research design

This study has been designed upon a sequential mixed-methods approach. Mixed-methods research encourages the use of multiple worldviews, or paradigms (beliefs and values), rather than the typical association of certain paradigms with quantitative research and others for qualitative research (Creswell, 2003a). A mixed-methods approach is also practical in the sense that it combines inductive and deductive thinking (Creswell, 2011). This is a pragmatic approach for collecting, analysing and 'mixing both quantitative and qualitative data during the research process' (Creswell and Clark, 2007) and helps to understand the extent of change following CPD more fully. This is because, on the one hand, 'objective' measures of the extent of change can be considered. Yet, in association with this, the details of more 'subjective measures such as how participants think and feel' about the change process (Fullan, 2001b) can also be documented, and analysed. The combination of data from various sources will help to provide a richer picture

of the conditions that may influence changes to participants' practices, following their engagement with CPD.

The CPD courses selected for this study have been drawn from a random selection of short courses that were run through Science Learning Centre North East between 2006 and 2012. These were all courses designed to impact positively on participants' classrooms practices.

The participants were randomly selected and represent primary and secondary science teachers. Data were collected as follows:

Table 2: Participant sample for mixed-methods phase

Mixed-Methods Phase	Research Instruments
Phase 1: Teacher Interviews	9 Teacher Interviews
Phase 2: Surveys	110 Teacher Expectations and Efficacy Questionnaires (TEEQ) 80 CPD Impact Questionnaires (CIQ)
Phase 3: Teacher Interviews	5 Teacher Interviews

A modified version of Guskey's (2000) framework for evaluating the impact of professional development was used to establish the nature and extent of change to participants' practices. In order to establish the most significant conditions influencing change, Clarke and Hollingsworth's (2002) Interconnected Model of Teacher Growth, will be considered as a framework for analysis, as this model makes a clear distinction between the internal 'personal domain' of the teacher,

and the 'external domain'. Yet it highlights an interconnection between the teacher and their professional environment.

1.9 Chapter summary

In this section I have introduced the rationale for subject specific CPD for science teachers. Subject specific CPD is likely to be held in higher regard by teachers, than generic (non-subject specific) CPD (Varga-Atkins et al., 2009). Science teachers are likely to consider that it will hold both more interest and value to them as teaching professionals.

Educational change is a complex and political process, and the influence of the teachers' environment can influence their agency, which in turn will influence the extent of change. However, teachers who feel self-determined to bring about intentional change may be able to push back against, and be resilient, in their environment. It may not be appropriate to condemn all short one-day courses as having no or little impact on teachers' practices, particularly if these courses are subject specific and valued by the teachers attending them in the first instance. A teacher's self-determination to bring about change may be a significant conditioner of changes to practices.

A sequential mixed-methods research approach will combine survey and interview data with inductive and deductive reasoning, to explore the nature and extent of

change, following a one-day CPD course. Guskey's (2000) framework for analysis, and Clark and Hollingsworth's (2002) model of teacher growth will be considered as analytical frameworks within this study.

Chapter 2: Review of Literature

2.1 Introduction

In the previous chapter the case for the importance of subject specific CPD for science teachers was introduced. The educational environment within which teachers work is a complex system involving the interaction of individual teachers with a range of socio-cultural and political factors which each have a bearing on the work of the teacher (Hoban, 2002).

The purpose of this chapter is to explore some of the key studies within the field of teachers' continuing professional development relevant to this study, allowing me to place my study in context. Specifically, this chapter will establish what is known about the impacts on teachers' professional development, as well as the factors that may account for the efficacy of CPD endeavours. Particular attention will be given to how the design and structure of CPD workshops, the teachers role within the CPD process, and the influence of extraneous factors - beyond the immediate CPD workshop environment, may account for change. By reviewing existing research on teachers' CPD, this review will also highlight current gaps that exist and identify potential research opportunities, and so provide the rationale for this particular study. It will conclude with the important aspects that influence the research focus and design of my own research study.

I will explore the role of the teacher within the change process following their engagement with CPD. It is individual teachers who effect and mediate changes to practices within the classroom environment, so, it is important to understand their

motivations, experiences, and capacities. In addition, it is important to develop an understanding of the influences of the educational socio-political context on individual teachers as they attempt to implement changes to their practices. Theoretical perspectives of self-determination and teacher agency will be discussed in relation to processes of changing teacher practices.

2.2 A definition of CPD, and the case for subject specific CPD.

For the purposes of this study, I will set out a definition for the term 'Continuing Professional Development (CPD)'. The term CPD was first used in the 1970's by Gardner, to emphasise the on-going continuing nature of teacher education and learning (Berry, 2008, p. 7). Gardner's point, was that CPD should be seen as ongoing and continuing (Berry, 2008), rather than one-off discrete events, such as the annual five statutory INSET days. In 2003, a study (Hustler et al.) found that many teachers use a plethora of terms synonymously with CPD, including, for example; Baker days, personal or professional development, teacher development, ongoing training, INSET, and staff training. Many other authors (Adey, 2004, Cordingley et al., 2007, Cordingley et al., 2005, Day, 1999, Guskey, 2000) make a case for effective CPD as an ongoing process, as opposed to a short one-off event. The rationale for teachers' CPD is that the process should be designed to enhance professional knowledge, skills, and attitudes, so that they might in turn, improve student learning (Guskey, 2000).

Day (1999) provides a definition of CPD which not only encompasses the processes, but also outlines the outcomes:

‘[CPD is]... 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, which constitute, 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 throughout each phase of their teaching lives.’(Day, 1999, p. 4).

I consider that Day’s (1999) definition covers all eventualities and experiences that can lead to teacher development, it is therefore a compelling definition of CPD.

Within this definition, teachers’ learning leads to teachers feeling empowered to make changes to their practice. CPD is regarded as a positive and beneficial developmental process that can involve formal and informal, planned and unplanned, learning opportunities (Day, 1999). I think it is particularly noteworthy that Day’s (1999) definition suggests that teachers have capacity to act as enablers of change, meaning that teachers are seen to have the power to implement change (or not) (Grove, 2008, Brown and McIntyre, 1982, Common, 1983). Which, in my view, rightly positions the teacher of the crucial mediator of classroom change.

The specific research focus of this particular study is the exploration of impact of short episodes of planned formal subject specific CPD. Within the context of this study, impact is considered to include an effect, change, or benefit to teachers’ professional practices. These may be intended or unintended consequences of the original CPD. Central to my theoretical thinking is the assumption that CPD can act as the stimulus or initiation point of a change process (Fullan, 2001a), on

which the iterative process of enacting practices and reflecting upon them (Clarke and Hollingsworth, 2002) can lead to further change, as will be explored in my research.

Therefore, for the purposes and focus of this particular study, CPD will be defined as one-off subject specific workshops, which are no more than one-day long in duration. However, it is important to note that within this definition, I do not assume that the participants' professional learning ends with the conclusion of the CPD workshop – but continues on their return to their respective classroom through further planned, unplanned, formal or informal learning.

CPD, it is suggested, can be a productive and valuable activity for teachers to be engaged with, as noted in a House of Commons report (2010, p. 45):

‘...there is now substantial evidence that teacher quality is the most important variable in determining how pupils learn. Improving the quality of those entering the profession is important, but the effects of this will take time to work through the system. Accordingly, it is also necessary to increase the quality of teachers already in post. Recent research has demonstrated the significant impact that professional development can have on teacher effectiveness – often as much as an extra six months of pupil progress per year’ (House of Commons, 2010, p.45).

Therefore, CPD is seen as a way of increasing teacher effectiveness. Research suggests that the benefits of CPD can also lead to increased confidence, for instance Davies and Preston (2002) highlight the impacts of CPD on teachers' thinking, knowledge, and affective outcomes including increased confidence, not

just on their behaviours, and practices. Although this UK based study was a relatively small scale study and confined to the authors own HEI institution, the authors did explore the impact of CPD on teachers' personal and professional lives, which went beyond the remit of observable classroom behaviours and practices. Questionnaire surveys including closed and open ended questions were completed by 45 (out of 66) MA Ed students, a rate of more than 30% non-responders may present some potential bias in the findings. However, in my view, it was interesting to note, within the data collected, that fewer respondents reported impacts on children's performance, than they did on more personal impacts, such as gains in their perceptions of their own teaching competences, subject knowledge, and perceptions of promotion prospects. The significance of personal professional impacts will be explored more fully within my study.

Of equal of interest, in my view, is Chambers (1999) study which reported that CPD participants considered that involvement with their own research projects as part of the CPD process impacted on their *personal* professional development, and heightened their awareness of educational issues. Chambers (1999) study is again UK based, although it drew upon data from international students involved in a master's programme. Seven completed dissertations were analysed, and seven related questionnaires were completed plus nine additional questionnaires (representing a 50% response rate) so issues of non-response bias, and subsequent potential challenges to validity of findings need to be taken into consideration. However, based on the data available, Chambers considers learning as a *personal* professional process, concerned with improvement. Learning as a result of reflection is viewed as an essential part of the process. I

would argue, that this may be expected considering the personal investment that professionals are required to make when undertaking such an academic programme. In that sense, it could be argued that CPD participants will be somewhat determined to implement change in practice.

Lyle (2003) carried out a small-scale study in the UK, and one in which the researcher herself was closely involved. Lyle does declare her own potential bias: as an advocate of research-based professionalism. Whilst there may be challenges to the objectivity of findings, the author's insider information, gathered through field notes, adds an extra layer of insight to the overall discussion of findings. The importance of CPD as a means to promote increased reflection emerged from her study. This research involved analysis of portfolios of three teachers, specifically to examine evidence of the impact of the CPD on participants' teaching practices. This was supported by the authors own field notes which were generated during the two-year period in which the CPD programme ran. Lyle took a socio-cultural perspective of learning; and so raised awareness of the influence of the policy environment on individual teachers. In light of this, Lyle raised the notion of the importance of teachers' feeling empowered to reflect upon and subsequently adapt their practices over time. This process of reflection and adaptation of practices *over time* is one of the key concepts to be explored within my particular study.

Powell and Terrell (2003), generated an important UK based study in which they not only identify impacts of CPD at various levels, but they also highlight the

interaction between these levels. Powell and Terrell (2003) make the case that impact can occur at an individual, classroom, or organisational level, and the links between each of these are far from simplistic. In addition the authors raise important questions about how the impact of CPD should be measured. Their study draws upon both questionnaire (n=49) and interview data (n=6). However, the low response rate (50%) to questionnaires, and the fact that findings relate to one CPD programme only, I would suggest may present a challenge to the overall generalisability of findings and may represent a biased response. Nevertheless, the reported findings are representative of the evidence collected. Based on their findings Powell and Terrell (2003) caution against a simple cause and effect view of CPD provision and its subsequent impacts on pupils' learning. Teachers within the study perceived very positive gains in terms of cognitive and affective outcomes as a result of engagement with CPD. However, evidence of impact at an organisational level was less clear. Powell and Terrell highlight concerns about analysing impacts of CPD through purely statistical means, through for instance effect size: and they raise legitimate questions of the appropriateness of analysing impact through a purely scientific lens. They make a compelling case for the role of teachers' professional judgement and their own professional evaluation of the impacts of CPD as part of the research process. These considerations will be reflected within the design of my particular study, and this will be discussed more fully in a subsequent section.

CPD is increasingly seen, by policy makers and teaching professionals, as a key part of the career development (Thurgood et al., 2013). Educational policy directives in England (DfE, 2016) provide evidence that CPD is seen as a critical

component in educational improvement efforts. Changes in structures, curriculum or assessment are seemingly an ongoing phenomenon in the UK education system (Priestley et al, 2015). Since the introduction of the National Curriculum in 1988 the science curriculum has undergone six major overhauls. CPD is viewed by Ofsted as a key means of supporting such changes, by informing teachers, enhancing their ability to implement reforms, and changing attitudes and behaviours which are no longer considered appropriate or are out of date (Ofsted, 2006). However, I argue that CPD should be seen as much more than a support mechanism for implementing externally imposed reforms. CPD viewed in these terms leaves restricted room for teacher autonomy and professionalism, and says little of the value of CPD on a daily or ongoing basis. McLaughlin and Talbert claim that 'improving schools invest in the development of their staff' (McLaughlin and Talbert, 2001). Nevertheless, science teachers' attitudes to the efficacy of CPD to bring about change can be lukewarm. Finegold's (2006) teacher survey drew upon 825 quantitative telephone interviews, with 12 detailed follow up interviews. The telephone interviews were completed by teachers and science leaders in schools across England, representing all school types and all age ranges. Finegold's study therefore presents a significant sample of teachers from a wide range of schools within England, which is a strength of the study, and it draws on both qualitative and quantitative data. The study demonstrated that teachers' attitudes to CPD tended to cluster into four main categories, characterised by the research team as 'Believers, Seekers, Sceptics and Agnostics' (Finegold, 2006, p.3). A key finding I consider to be particularly significant in Finegold's (2006) study is that teachers' attitudes to CPD related to government initiatives scored the lowest satisfaction ratings, whilst updating subject knowledge and teaching skills were rated by teachers as the most

satisfactory areas for CPD provision. In other words, the potentially intrinsically interesting areas of CPD for a subject specialist are rated more favourably by teachers. Finegold (2006) is yet another researcher to draw attention to the potential impacts of CPD at an *individual* level – with the potential to increase a teacher's confidence and morale. However, he highlighted that much of the CPD available supported government priorities, and is in effect depersonalised and does not support a teacher's individual autonomy, or individual needs.

Finegold (2006) views access to subject specific CPD as an opportunity to support 'career-long learning that moves beyond the day-to-day needs of the school and helps to enhance teachers' professional self-image and aspiration' (Finegold, 2006, p. 2). With potential impacts at the individual personal level, further detailed exploratory analysis of the individual experiences and impacts of the teachers could have added a further level of detail to the analysis. The notion of individual, idiosyncratic impacts is an area that will therefore be explored further within my study.

The pervasiveness of educational policy has an influence on how teachers view certain types of CPD:

'...since the 1988 Education Act, Conservative and Labour Governments have developed policies that result in greater control of teachers' time and limits to their personal autonomy. Limited time for subject-based professional development means that many teachers are increasingly directed towards fairly instrumental, information-led training, such as briefings on examination syllabi. The training in turn feeds into a school

development plan, which is informed by Government objectives and priorities. The training is, in effect, depersonalised' (Leaton and Denley, 2005, p. 27).

The potential risks to teacher autonomy are evident in an Ofsted report (2006) which aimed to disseminate 'best' practice in CPD provision: 'Arrangements for identifying staff's individual needs were too subjective in about a third of the survey schools. These schools relied too heavily on staff's own perception of their needs' (Ofsted, 2006, p.4). This apparent lack of trust in teachers' own professional judgement leads to the implication that schools and school managers need to take more control. In my view, the depersonalisation of any CPD endeavour, and the subsequent effect on teachers' perceptions of autonomy may well be important characteristics accounting for the reported failure of many CPD activities to support meaningful change. Teachers are, however, more likely to value CPD involving the exploration of subject specific practical applications, with likely benefit to individual teaching practices, and students' learning (Varga-Atkins et al., 2009).

CPD endeavours are more likely to fail when teachers perceive poor quality provision, lack of relevance to the individual, and too much of a focus on government agendas. In a 2009 (*ibid*) survey 78% of secondary teachers felt that too much CPD time was devoted to government agenda. This again, I believe highlights the importance of the perceived value of subject specific CPD by the individual teachers.

The CST (2000) report makes the point that 'subject related CPD of individual teachers should be treated distinctly from other CPD requirements concerning whole school issues, matters of administration and national initiatives' (*ibid*, p. 5).

The subject specific nature of the CPD is an important quality of the provision with the focus on specific subject knowledge and related subject pedagogy of more interest to teachers and is considered of higher relevance and value. Subject specific CPD is therefore potentially an important condition of any meaningful change process as outlined in the CST report:

'While many factors are associated with the level of attainment in school science which pupils reach, the research evidence confirms the common sense view that the personal attributes, knowledge, skills and competencies of their teachers are critically important and influential. Developing and improving the professional practice of science teachers therefore lies at the heart of raising the level of attainment which their pupils achieve during their compulsory schooling, and hence school standards and effectiveness in science education... The effectiveness of science teachers stems mainly from their attitude, their confidence, their knowledge of the subject and how to teach it (pedagogy)'. (CST, 2000 p. 9).

Subject specific CPD may be considered to hold a more prominent position by teachers in comparison to more general CPD endeavours. However, the subject specificity alone is unlikely to be sufficient to lead to participants' professional learning. In the next section, I will critically explore key findings from the literature to discuss what is required to make CPD *effective* at leading to change.

2.3 'Effective' CPD.

The purpose of this section of the chapter is to explore existing research in relation to the factors influencing the effectiveness of CPD. This section will provide an analysis of research findings in an attempt to elicit the factors required to make CPD effective at leading to change. It must be noted that comparing results across studies is far from straight forward. The threshold for effectiveness can, and is, defined in a number of ways. Teachers' views of the quality of CPD, may be gathered at the time of CPD provision, or their views may be collected shortly after the course - once they have had time to return to school, and presumably have had time to reflect on the efficacy of CPD approaches. On occasions, attempts are made to elicit actual changes to classroom practices, and on rarer occasions still, the educational impacts on students learning are sought (Guskey, 2000).

Often research studies rely on the assumption that CPD aims can be translated into clear observable outcomes, and as a result, I would argue that, unintended consequences or impacts are often missed.

In addition, the majority of research studies, presumably due to pressures of time and resources, look for relatively immediate impacts, often within weeks or months of CPD participants having attended a course. As a result, longer-term impacts will remain undetected. One of the key significant features of this particular study is that longer-term impacts will be sought, contributing to an important area of the literature base.

These are important points to consider, as it has proven to be a challenge to compare studies when different criteria for effectiveness are given and when potential impacts are sought at different times. For this reason, the literature will be discussed and analysed in a chronological order to show how ideas about the effectiveness of CPD have developed over time.

The question as to what are the components that make CPD effective was tackled by Joyce and Showers (1980), who analysed over 200 studies to investigate the effects of various types of CPD. Joyce and Showers were based in the U.S but drew on studies published within the international literature. They concluded that for CPD to impact on classroom practices, four components should be included: Presentation of theory, modelling or demonstration, practice under simulated conditions, feedback and coaching for application. They suggest that the most effective CPD is likely to combine all four of these components. However, I think it is important to acknowledge that very few of the 200 (plus) studies, used within Joyce and Shower's analysis, reported on transfer or implementation of new knowledge and skills into teachers' classroom practices. Many of the studies reported whether new skills were acquired or demonstrated by the teacher – but did not directly provide the detail of subsequent changes to classroom practices. In addition, these suggested components of effective CPD appear to focus primarily on anticipating teacher behaviours, as opposed to supporting more affective teacher outcomes. In the model developed by Joyce and Showers (1980) they suggest that CPD provides the opportunity to change practices by acting as a means by which teachers develop new knowledge and skills which, through support, they subsequently incorporate into their practices. Although over 200

studies are examined, Joyce and Showers report that most of the studies made claims on general effects only – as noted in differences between treatment and comparison groups. The value of the various components of the CPD were not examined. Also, very few of the studies moved beyond establishing teachers' acquisition of new knowledge and skills. Particularly importantly, it was much less clear what was actually transferred into practice, and so Joyce and Showers had to develop 'working hypotheses' (Joyce and Showers, 1980, p. 381) regarding *expected* levels of impact.

Nevertheless, they make a useful distinction between raising awareness of new approaches and practices, and how these are actually transferred into practice. Crucially, within their model the teacher has an active role in joint planning and resource development. However, since the publication of their research there has been a period of radical education reform in the UK, and it is likely that education policy since 1979 has influenced the extent to which teachers' professional judgement can now actually be supported (Bishop and Denleg, 2006; Priestley et al 2015). It is for this reason that the factors influencing the extent to which teachers' professional judgement can be supported within the classroom is an area of interest, and an opportunity for further exploration within my study.

Day (1999) made clear the case for the importance of reflection at the centre of any teacher-learning endeavour. He made clear the significance of the opportunities for teachers to work in partnership with other professionals, both inside and outside the organisation as a means of avoiding 'single loop' learning

(Argyris and Schon, 1974) and to provide a method of 'confrontation of thinking and practice'. Reflection in this way, presents 'a model of a teacher, who, given particular circumstances, is able to distance himself from the world in which he is an everyday participant and open himself up to the influence of others' (Day, 1991, p. 49). In the context of my own research study, and a focus on the impact of short CPD workshops, I consider Day's analysis to be particularly important. As once teachers complete the short CPD workshop, it is their ongoing engagement with the reflective process that is likely to be a key feature of sustaining changes to their classroom practices. Reflection involves the emotional self as much as the cognitive and rational. CPD participants' critique of new practices involves 'the value implicit in that practice' which is influenced by the 'the personal, social, and broad policy contexts' (Day, 1999, p. 223).

Reflection in this way provides teachers with choices, and possibilities, and 'emancipation' from 'conventional practice' (Day, 1999, p.223). Choice and autonomy are an implicit part of this process. Day also recognises that changes to practices need not be 'transformative' or 'radical' but may also be 'evolutionary' and 'additive' (Day, 1999, p.223).

However, rather than providing new empirical research evidence, Day's (1999) paper provides a synthesis of a range of theoretical evidence to consolidate and support the notion of the importance of collaborative partnerships within the CPD process, placing particular value on the role of teacher reflection. As plausible as such claims may be, they lacked further empirical verification. Day (1999),

however, does provide a convincing account of the need for teachers to become learners within the CPD process. As such it is not just the purposes of reflection that are important but also the emotional, personal, and social side of this learning and reflective process. Therefore, the context in which this reflection takes place is also important. Day's (1999) findings drawing upon his synthesis of wide range of theoretical and conceptual thinking does align with more recent developments in understanding of the significance of teachers' self-determination, and notions of teachers' agency within the change environment. Also, whilst Day (1999) discusses the importance of sustained systematic reflection, he concedes that for sustained improvement it is 'essential for teachers in all institutions to engage from time to time in the kinds of reflective practice partnerships which make relationships between reflective practice, change and Improvement explicit' (Day, 1999, p. 230). It is clear that in Day's view the connections between individual teachers and the environments within which they work can have a bearing on the process of change. The role of these interactions - between individual and environment - will therefore be explored more fully within my study.

Harland and Kinder (1997), add to our understanding of effective CPD by providing an important UK based study in which they provide a model of effective *subject specific* CPD. The study's findings are based on data gathered from five primary schools in the UK over a period of three to four years. However, although their research focuses on a subject specific science CPD programme, little is reported on the particular school contexts or the biographies of the teachers who took part in the study. This raises the question as to what extent their findings are applicable in secondary schools, where science teachers may have academic

science backgrounds and schools' structures different from the primary schools which formed the focus for their particular study. With such a small number of cases study schools, there is also a valid question as to the extent to which these findings can be generalised more broadly. Nevertheless, based on their research Harland and Kinder (1997) present a 'tentative' typology of CPD outcomes which they suggest are significant in explaining subsequent improvements to teaching practices. Moreover, the outcomes are ordered in a hierarchy of importance in relation to the scale of the impacts on practice. Table 3 provides an outline of the hierarchy of outcomes.

Table 3: Ordering of CPD outcomes, adapted from Harland and Kinder, 1997 p 76-77.

	CPD Input		
3rd Order Outcomes (lowest impact)	Material and provisionary outcomes	Informational outcomes	New awareness outcomes
2nd Order Outcomes	Motivational and attitudinal outcomes	Affective outcomes	Institutional outcomes
1st Order Outcomes (highest impact)	Value congruence outcomes	Knowledge and skills outcomes	Intention to Impact on practice

Harland and Kinder (1997) focused more on the outcomes and effects of CPD provision than on a general theory of the processes which lead to change. Nevertheless, their research sought to build on earlier understandings of effective CPD (Joyce and Shower 1980) by providing a *typology* of outcomes. Harland and Kinder (1997) suggest that impact on practice can be achieved, to some extent, even if not all outcomes are present. However, they conclude 'that in order to maximise the chances of CPD leading to a change in classroom practice, all nine 'outcomes' (prioritised in the order suggested above) need to be present as pre-existing conditions or be achieved [by the CPD activities]' (*ibid*, p 77). This notion, of some interdependence of outcomes, sits at odds with Joyce and Showers (1980) framework of CPD, and also with Adey's (2004) 'chain characteristic' factors of effective CPD.

I would suggest, of particular note within Harland and Kinder's (1997) model is the importance of the development of *new* knowledge and skills. They elevate the importance of new skills and knowledge, within the CPD process, above its status in earlier models of teacher development (e.g. Fullan, 1991). Subject specific CPD workshops can provide a valuable opportunity for teachers to develop an awareness of new substantive knowledge and skills. However, in my view, Harland and Kinder (1997) provide little clarification of what is considered to be 'improved teaching quality', a bench mark by which CPD activities are considered to have been successful. They do acknowledge that CPD may lead not just to intended consequences as a result of teachers' engagement with the CPD programme, but also may lead to consequences which may not have been directly

intended within the aims of the original CPD provision. They also report a more complex model of professional development than earlier models. For instance, reporting that, 'no regular pattern of linear progression through the nine outcomes – or even a subset of them – was apparent...' (Harland and Kinder, 1997, p. 81). Inherent within these findings is the emergence of the individual nature of teacher development. 'Far from being a uniform progression through the outcome-types, the case-study teachers displayed a wide diversity of individualistic routes through the various categories of CPD effects' (Harland and Kinder, 1997, p. 81). The recognition that change can be more of an idiosyncratic process is compelling given the complex socio-political landscape in the UK. Harland and Kinder (1997) provide some evidence that the outcomes of CPD are therefore influenced by individual teachers and the contexts within which they work. The implications of which will act as an important area of focus within my study.

Guskey (2000) recognises that change is a gradual and difficult process and that changes to practices are influenced by a range of contextual factors. However, less is revealed of the interplay between teacher and context, and this provides an opportunity for further exploration within my own study. In his analysis of successful CPD endeavours Guskey (2000) searched for common practices across a range of different CPD practices. As a result, he has identified four principles common to effective CPD activities:

1. A clear focus on learning and learners,
2. An emphasis on individual and organisational change,
3. Small changes guided by a 'grand vision',
4. Ongoing professional development that is procedurally embedded.

Although Guskey looked for the effects of CPD across a range of studies in the U.S. The criteria for selection within his analysis is less clear - other than including CPD endeavours which were considered to have been successful in achieving their aims. That is to say, Guskey identified principles of CPD which were present in successful CPD programmes only. No comparison was made to establish whether similar principles were present in less successful or failed CPD endeavours. In addition, the relative importance of each of Guskey's four identified principles is not apparent. Guskey does acknowledge that these principles have emerged from 'early analyses' (Guskey, 2000, p. 36) and are in need of further development. These interactions between individual teacher and their professional working environment is an area to be explored more fully within my study.

Guskey (2000) views access and engagement with CPD as essential to improving teaching practices, and suggests that teachers' attitudes and beliefs only change once they have witnessed benefits to pupils' learning outcomes (Guskey, 1986). CPD therefore needs to be sustained and ongoing to support the teacher within the change process. Guskey's underlining theoretical model of teacher change (1986), says little about the interactions between teachers' motivations, capacities, or contexts, or how these may influence the CPD process.

Garet et al. (2001) provide a comprehensive analysis of a wide variety of CPD programmes. Like many earlier studies, they support the notion that CPD should

be sustained (measured in years) and that longer-term CPD efforts are more likely to lead to impacts on teachers and their practices. Garet et al. (*op. cit.*) also highlight the significance of collaboration, coherence and congruence with school needs. However, they also draw out the important role of the actual subject matter content within the CPD process suggesting that this subject content provides the basis of active learning opportunities for teachers who are then more likely to develop enhanced skills and knowledge:

‘Our results confirm the importance of professional development that focuses on mathematics and science content. Much of the literature on professional development focuses on the process and delivery system; our results give renewed emphasis to the profound importance of subject-matter focus in designing high-quality professional development’. (Garet et al, 2001, p.935).’

The emergence of the significance of content – particularly subject matter content and related Pedagogical Content Knowledge (PCK), as opposed to general teaching strategies, are particularly notable within Garet et al, (*ibid*) findings and those of Desimone et al. (2002). As with the earlier studies of effective CPD, the processes and context of the CPD remain considerations too. Cycles of formative evaluation (and reflection), collaboration, and a focus on school and individual teacher context are all important conditions to be met within the CPD effort for impacts on teachers’ practice to occur.

Garet et al’s (2002) U.S. based study gathered survey data from 1027 randomly selected teachers, which I consider to be a particular strength of this study as this data was drawn from a nationally representative sample of teachers who had

attended a wide spectrum of CPD: from short workshops to more sustained programmes of activity, as part of the Eisenhower programme. The survey data was collected within the following year of the CPD activity, but by the authors own admission, data collected over a longer timeframe would likely have been beneficial. Nevertheless, the survey provided a range of quantitative data from teachers in relation to their experiences, and their views of the effects of the CPD that they had attended. The results of this analysis were used to develop a causal model; gathering direct empirical evidence to test the link between ‘effective’ characteristics of CPD, as identified within the literature, and the extent to which these different characteristics impacted on teachers’ acquisition of new skills and knowledge, and subsequent changes to classroom practices (Garet et al, 2002). This U.S. based study was significant in that it added empirical findings to existing hypotheses of the characteristics of effective professional development. I do think it is important to consider however, that CPD within the Eisenhower programme supported centrally initiated major curriculum innovation initiatives (Bennet et al, 2011) which may have a bearing on the ways in which teachers interacted with the CPD process. Nevertheless, the study did focus on professional development specifically available to science and mathematics teachers, and it did provide some useful insight into the relative effectiveness of various approaches to CPD. Whilst Garet et al’s (2002) study reports that longer term and more sustained programmes of CPD are *relatively* more effective than shorter episodes of CPD – as by their very nature longer term courses can incorporate more features of effective CPD, there is also a clear indication that shorter episodes of CPD *can* have an impact. However, detailed analysis of the nature and extent of these impacts was not fully explored. This is an opportunity and an area to be explored more fully within the context of my study.

Another study I consider of significance, due to its subject specific CPD focus is, Jauhiainen et al. (2002) study which gathered data from 98 surveys completed by teachers in Finland to establish their views on the impact of a science CPD programme. The survey comprised fifteen closed questions and one open question. The researchers analysed the data gathered to establish the factors contributing to the impact of a subject specific Physics CPD programme on teachers' subject matter knowledge and pedagogical content knowledge (PCK). Ninety-eight questionnaires were returned from participating teachers up to two years following engagement with the CPD. Results indicated that 54% of teachers had adapted new elements within their teaching, and a further 17% had implemented a new teaching style. Again, noticeable within these findings is the importance of subject specific content. However, the subject content considered by the participating teachers to be most valuable was that which had a 'ready useable' fit in the classroom. Jauhiainen et al. reported that 'teachers were not so interested in general approaches connected to the philosophy of physics and physics education' (2002, p. 6). In addition, other valuable features of the programme included opportunities for collaboration in small groups – as opposed to ongoing post course email collaboration. Opportunities for reflection during the programme were also important features of the training. Jauhiainen et al. (*ibid*) study would appear to indicate that some components of the CPD process may well have a heavier bearing on facilitating change than others. Subject content knowledge and PCK with a highly applicable classroom fit, opportunities for reflection and small group discussion, emerge as key conditions in explaining impact on classroom practices.

I consider this research to be of particular value due to its focus on science specific CPD and teachers' perceptions of how various components of the programme impacted on practice. The researchers did report variation in teachers' perceptions of effectiveness of various parts of the CPD programme – as I would suggest might be expected within a group of teachers working within different contexts. However, teachers tended to consider the subject specific elements of the programme to be of more value than the more general approaches. These claims align with Finegold's (2006) findings. The value of the subject specific nature of CPD is an area to be explored more fully within the context of my study.

A further study I consider to be of significance - due to the science subject specific CPD focus, and data collected from teachers working within school in the U.K - is research by Adey (2004). Adey proposed a model for effective CPD, which was formed from his study of CPD associated with the Cognitive Acceleration in Science Education (CASE) programme. Adey's model comprises four 'blocks' contained in each is a list of factors which must be met for CPD to be effective. The blocks comprise; *The nature of the innovation* – to include an adequate theory-base and methods and materials which have been tested for effectiveness; *The quality of the CPD programme* – which needs to be of sufficient duration and intensity, sufficiently high quality materials, and to employ methods which reflect the teaching methods being introduced, and to provide opportunities for in-school coaching; *School senior management commitment and unity of vision* – to include commitment to the vision, and to embed structures necessary for change to take place; *Departmental or Group mutual teacher reflection* – in which teachers in a

group effectively share their experiences of the innovation, are provided with opportunities for reflection, and take ownership for the innovation. Adey contends that the blocks act with a 'chain characteristic', should even one of them be dysfunctional then CPD will result in no impact. Adey stated that for each factor:

'...If one of the links is weak or broken, there is little or no opportunity for providing compensation by strengthening a different link. Looked at this way, the process of effective professional development is both complex and fragile and it becomes surprising not so much that it fails so often, but that it is occasionally successful' (2004, p. 194).

Adey also argues that 'background variables' of government policy do not act in a similar 'chain characteristic' way in that although policy can support innovation and positively influence the impacts of CPD, it is not essential. I would argue that it is not this clear cut, and that educational policy can severely influence the CPD process, and its subsequent outcomes; an issue I will return to later in Chapter 5.

Adey's proposed framework for effective professional development is based on the CPD associated with the Cognitive Acceleration in Science Programme of which he was a developer. The research of the Cognitive Acceleration in Science Teaching approach involved quantitative data collected both from teachers and from pupils to establish effects on academic achievement. However, the efficacy of the CASE approach itself must be considered separately from Adey's list of essential factors of CPD programmes more generally. Although Adey (2004) argues that the CPD model proposed by him should meet the test of a theoretical model – empirical evidence of its predictive power is not provided. Adey's (2004) draws mainly on synthesis of theoretical evidence and empirical evidence within

the existing literature base, he also reflects on the effectiveness of factors contributing to changes in teachers' practices following engagement with CASE CPD programme. Adey proposed that effective CPD requires many factors to be set into a favourable position and that this is a fragile process, and his model proposes that the effect of a deficit in any of the 14 essential factors cannot be mitigated through attention to other factors – a very brittle process indeed. Whilst some areas of the literature base have been considered within the formulation of this model, the influence of other potentially significant theoretical frameworks do not take a prominent position. For instance, I would suggest the influence of educational policy is likely to be more pervasive and influential within the entire CPD process than perhaps Adey suggests it is. In addition, the fragility of such a 'chain characteristic' model says little of teachers' self-determination or agency within this framework. As valuable as Adey's (2004) list is in identifying a range of factors likely to impact on the effectiveness of CPD, it is less clear of the ways in which educational policy, or individual teachers own motivation, commitment, or determination within the change process can impact on the nature and extent of change. These are areas to be explored more fully within the context of my study, as it is clear from the literature to be discussed in sections 2.5 to 2.8 of this chapter, that these factors may be significant in explaining classroom change.

Within the context of my study Boyle *et al* (2005) findings are particularly significant – as they make an explicit claim that one-day workshops (which are the focus of my study) are not enough to sustain development, as these workshops lack enough time, resources, activities and content. Observation of practice and sharing of best practice were identified as the most common long term

professional development opportunities for primary and secondary teachers. The active involvement of teachers in the CPD effort and willingness to observe practice and share practices with colleagues resonates very closely with my own professional experience. Boyle et al's (2005) study involved 854 completed questionnaires from 'a national geographically and demographically representative sample of 50 per cent of the 140 plus local education authorities (LEAs) in England' (Boyle et al., 2005, p. 49). However, as a way of ensuring that the completion of the questionnaire was not perceived as an onerous exercise for teachers, the questionnaire was reduced to closed and open response questions covering no more than two sides of A4. This presents something of a compromise, as a longer questionnaire may provide further data which may lead to richer analysis. Interestingly, a higher proportion of teachers reported engagement with longer term CPD efforts, than they do with shorter CPD workshops. However, I would argue that these longer term efforts commonly relate to observation and sharing of practice. This particular study says little of the *personal* professional impacts of the CPD, beyond identifying some changes to teaching practices. It does indicate that teachers are generally active at engaging with CPD, only three percent of the sample, reported that they had not been involved with any conferences, workshops, or longer term CPD efforts. I would suggest that this indicates the importance of teachers' determination to develop practices and share ideas with colleagues. And so, conceptual perspectives in relation to teachers' determination and motivation will be explored more fully within my study.

Cordingley et al (2005) have carried out a number of reviews of the literature and suggests that collaboration between CPD participants can have a strong influence

on supporting changes to practices. Cordingley et al (2007) suggest that it is essential to pay attention to 'teacher learning and their needs as [it is] to the delivery of new knowledge' (Cordingley et al, 2005, p.16). CPD which resulted in classroom impact had a large component of support for participant autonomy, specialists required participants to explicate 'individual starting points', allowed teachers structured time to develop bespoke materials and strategies which could be supported when applied to their own practice. Cordingley et al (2004, 2005, 2007) suggest that effective CPD strategies, and by this they mean approaches to bring about learning in the classroom, are composite in nature. Cordingley et al (2007) report that "Changes in teacher practice resulted from teachers learning more about teaching strategies, learning theories, the use of technology, educational policy and subject knowledge" (Cordingley et al., 2007, p. 1). Although the researchers were UK based, studies were reviewed from the international literature base. More studies reviewed took place within the US than any other country, followed by studies from the UK. These findings correspond with those earlier findings reported by (Garet et al., 2001). In addition, Cordingley *et al.* (2007) highlight the importance of opportunities to foster participant autonomy – providing opportunities for teachers to develop their own bespoke materials and strategies relevant to their own individual contexts. Cordingley et al (2007) study, has increased understanding of 'the distinction between professional development (content) and professional learning (processes), and the specialist's role in providing and facilitating both' (Cordingley et al., 2007, p. 17). The authors note however that 'none of the studies was designed to answer our review question directly' and so as a result 'the data provided in the studies retrieved was sometimes limited' (Cordingley et al., 2007, p. 17). Results from reviews of this type require some careful interpretation as detailed and important contextual

information that individual studies can contain may be lost. In addition, reviews by Cordingley et al (2005, 2007) on longer term CPD endeavours (more than 12 weeks' duration), may contribute little in terms of developing an understanding of what makes shorter workshops of CPD effective. Also, by the authors own consideration 'limitations of the evidence reviewed mean that we are cautious about putting forward any definitive interpretation of the implications of this review for the practices of specialist CPD. It is clear that we need more rigorous independent evaluation of CPD initiatives' (Cordingley et al., 2007, p1-2). My study will therefore add to the understanding of the impact of shorter episodes of specialist CPD.

Penuel et al. (2007) researched factors influencing CPD effectiveness - in terms of teacher learning and the ability to implement the new practices, and constructed a theoretical framework which included; the focus of CPD (on subject content, teaching strategies or a mix of these); the scope for teachers' active learning; the programme coherence (the perceived alignment of CPD activities and teachers' own goals); its duration and time span; the role of colleagues; and local support/barriers (resources and hindrances in the school) (ibid p.928)). The findings by Penuel et al. (2007) show that classroom impact depends prominently on factors within the implementation context. However, I consider it is important to note that although 454 teachers and 28 CPD providers were surveyed within Penuel et al's (2007) US based study, the focus of the research included only one CPD programme: The GLOBE Programme, an international earth-science education programme. Nevertheless, the CPD programme was delivered in a number of ways and so the potential variability in CPD design 'makes GLOBE a

good context for studying how particular features of professional development are associated with different implementation outcomes' (Penuel et al., 2007, p. 934). A particular strength of this study is that its impact was explored two to three years after the CPD had occurred, a timeframe in excess of many other research studies.

Although the GLOBE CPD programme is an international offer, Penuel et al's (2007) study relates to the CPD provided within the US only, so it is unclear what particular influence UK educational policy might have on the change process. The average duration of CPD input was 20 hours – in excess of much of the science CPD on offer in the UK. Nevertheless, Penuel et al's (2007) theoretical perspective gives 'central importance to both learning processes among teachers and to the particular curricular and school contexts in which professional development takes place' (Penuel et al., 2007, p. 927). By focusing on one CPD programme Penuel et al's (2007) study provides a valuable opportunity to understand the influence of particular contextual characteristics on the implementation of new practices. Some of the key messages to emerge from Penuel et al's (2007) study resonate with the developing understanding of the ways in which teachers interact with their school contexts within the change process. However, even the average course duration was several times the length of the one-day workshops which will act as a focus within my particular study, so it is unclear whether such factors are equally relevant. However, this will provide an opportunity within my study to contribute to this research area.

In a study of one and two day workshops offered through the SLC South East, Ratcliffe and Hanley (2005), found that the positive results of surveys in relation to whether one or two day workshops had the expected impact on classroom practices was very high. This is particularly interesting 'given the overwhelming body of research which supports professional development for change as that happening over a long time period, linked closely to local circumstances and providing opportunities for reflection' (Ratcliffe and Hanley, 2005, p. 7). Their results would suggest that short one-off workshops can be sufficient for triggering change. Each of the days of the two-day workshops were separated by a gap of two months to provide the opportunity for teachers to try out new approaches and reflect upon these. The study findings suggest that teachers did begin to take ownership of changes to classroom practice as a result of engaging with the CPD, this was evidenced by teachers evaluating the success of their implemented new practices and sharing their reflections with other teachers. However, teachers attending the one-day workshops also reported high degrees of satisfaction with those strategies and resources considered to be directly beneficial to classroom practices. 'The experience for the vast majority has been of immense benefit in introducing new resources or pedagogy' (*ibid*, p. 7). Ratcliffe and Hanley's (2005) UK based study comprises evaluation surveys, including open and closed questions, which were completed for ten different two-day workshops: 96 surveys were completed on day one and 46 surveys were completed on day two. In addition, 127 participant surveys were completed in relation to ten one day workshops. There was, however, a noted high rate of attrition between the days of the two day course but, the reasons given for this did not relate to course quality, but external demands on the teachers. By the authors own admission there was 'very limited follow-up interview study with participants on the two day workshop

model to ascertain its longer term impact' (Ratcliffe and Hanley, 2005, p. 5). However, the researchers were 'only successful in gaining access to four teachers predominantly with positive experiences of the full two days' (Ratcliffe and Hanley's, 2005, p. 5). Much of the data reported related to satisfaction with the course itself, and related to motivations for attending, rather than the nature of impacts on practices. Although open ended responses and follow up interviews did provide additional information in relation to impact, little is offered in terms of which factors, or combinations of factors, contributed to the reported impacts. In addition, the study reports on impacts of the CPD between the first and second day of the course. A longer timeframe of research would be useful in to order to establish the sustainability of these reported impacts. Nevertheless, this study provides a number of research findings onto which my study can build.

In my view, these findings have provided an indication of a potentially significant development in the understanding of what makes CPD effective. One-day workshops with a focus on pedagogical content knowledge and co-construction of approaches and strategies with direct applicability to the classroom environment emerge as providing sufficient stimulus for initiating change. Ratcliffe and Hanley (2005) suggest that the introduction of new resources and teaching ideas was considered to be of 'immense benefit' (Ratcliffe and Hanley, 2005, p. 7), to the vast majority of teachers: a sense of ownership and satisfaction within the CPD process are important conditions to support change. This is encouraging considering that this particular framework for CPD has been developed to help mitigate against financial and practical constraints which may constrain teachers' engagement with longer and more sustained, programme of CPD.

A survey of 274 teachers following engagement with a 90-minute earth-science CPD workshop (Lydon and King, 2009) demonstrated that on the day of the course the majority of teachers (88%) reported their intentions to increase their use of practical work. The post-course survey, which was completed one year after the event provided strong evidence that the 90-minute workshops resulted in long-term change in participants' teaching practices – in that all participating schools had modified their schemes of work. I would argue this is a particularly noteworthy study, as against earlier claims to the contrary, there is a strong indication that short subject specific workshop *can* have long term impacts.

Although few barriers to classroom change were reported, those that were reported related to the lack of organisational support. (Lydon and King, 2009, p. 81). I consider that the timeframe of Lydon and King's (2009) UK based study was a clear strength, ensuring that impact data could be collected regardless of when the Earth science unit was taught within the academic year. However, the response rate to the survey was low, at 33%, so it is important to consider potential implications for non-response bias when making claims to the generalisability of the findings, as it is unknown to what extent the course impacted on the non-responders. The majority of the survey comprised closed-response questions, which possibly limited the opportunity to explore the significance of contextual factors, and the ways in which these may influence the process of change.

Unlike many earlier models of successful CPD, Lydon and King (2009) make the claim that ‘Short-duration, well-structured CPD episodes, based on practical and interactive science teaching ideas, presented to whole science departments by experienced presenters, can have long-term impact on those involved’ (Lydon and King, 2009, p. 63). The strong evidence of impact of short episodes of subject specific CPD within the sample of teachers who did complete the survey, is not only encouraging, but worthy of further exploration.

Adey (2004) was highly cynical of the capability of short episodes of CPD to bring about change:

‘There is universal condemnation in the research literature on professional development for the one-shot ‘INSET day’ as a method of bringing about any real change in teaching practice. Perhaps the only exception to this rule is the introduction of a very specific technical skill, such as the use of new piece of software (Adey, 2004, p. 161).

However, these reported impacts of shorter course (Lydon and King, 2009) challenge earlier reported research suggesting that CPD needs to be long term and sustained for impact to occur (Harland and Kinder, 1997, Day, 1999, Guskey, 2000, Adey, 2004, Cordingley et al., 2005). Moreover, Adey’s ‘exception’ to the rule (2004), should be expanded to include CPD regardless of its length.

Particularly in relation to Subject specific CPD, in which participants are provided with the opportunity to explore evidence based teaching strategies which have a clear curriculum fit; and where specialist support is provided for participants to take ownership of the implementation of new practices. In a nutshell short CPD

workshops *have* been shown to be sufficient to begin the process of implementing new teaching practices.

I would suggest that analysis of key research (Adey, 2004, Cordingley, 2005 and 2007, Day, 1999, Guskey, 2000, Ratcliffe and Hanley, 2005, Lydon and King, 2009) indicates that, to some extent there is agreement regarding the nature of effective CPD. In order to be effective, CPD must provide substantive knowledge, ideas or skills relevant to the needs of the teacher. It should support teachers' autonomy, and provide opportunities for reflection and adaptation. Impact can occur at a personal, professional, or organisation level, and contextual factors can interact with individuals to influence change. The key emerging theme is that the processes leading to the impact cannot be understood through simplistic cause and effect relationships is particularly convincing. A key message that I will take forward in the design of my own study is that personal and contextual factors – not just characteristics of the CPD workshop - must be taken into may account to develop an understanding of the process leading to classroom change.

Much of the literature reviewed would appear to challenge any rationale or justification for CPD which comprises one-off workshops. Short courses are, by definition, neither long term nor sustained, and provide little opportunity for mentoring or coaching the teacher within the school environment. One-off workshops are often considered to be ineffective and of little value, probably best summarised by Adey (2004), although Wilson and Berne's point is noteworthy:

‘Teachers are loathe to participate in anything that smacks of the 1-day workshops offered by outside ‘experts’ who know (and care) little about the particular and specific contexts of a given school. Similarly, researchers appear hesitant to study traditional professional and staff development: Why study something that so many teachers dismiss as less than helpful?’ (1999, p. 197).

Yet evidence (Ratcliffe and Hanley, 2005, Allen and Sims, 2017) suggests that teachers attending shorter episodes of CPD have instigated some important changes to their professional practices, and may even remain in the profession longer than those who have not attended such CPD (Allen and Sims, 2017).

In line with Harland and Kinder (1997) findings, I would argue that some change in practice can be achieved even if some of the factors listed by Day 1999; Adey, 2004; Cordingley et al., 2005, Joyce & Showers, 1988, as necessary for providing ‘effective CPD’ are absent. It could be suggested that not all ‘necessary’ factors are equally important in terms of affecting change. CPD activities which relate to teachers individual subject expertise, which support teacher autonomy, and have direct applicability to classroom practices appear supportive of instigating changes to teaching practices. One of the major messages to emerge from the review of the literature is that to understand the impact of CPD, regardless of its duration, it is important to understand the *interactions* between individual teachers and the environments within which they work. Simple cause and effect models of CPD provision are unsatisfactory, and do not account for the idiosyncratic ways in which teachers may negotiate change in diverse working environments. In order to make sense of the sometimes competing claims within the literature into the

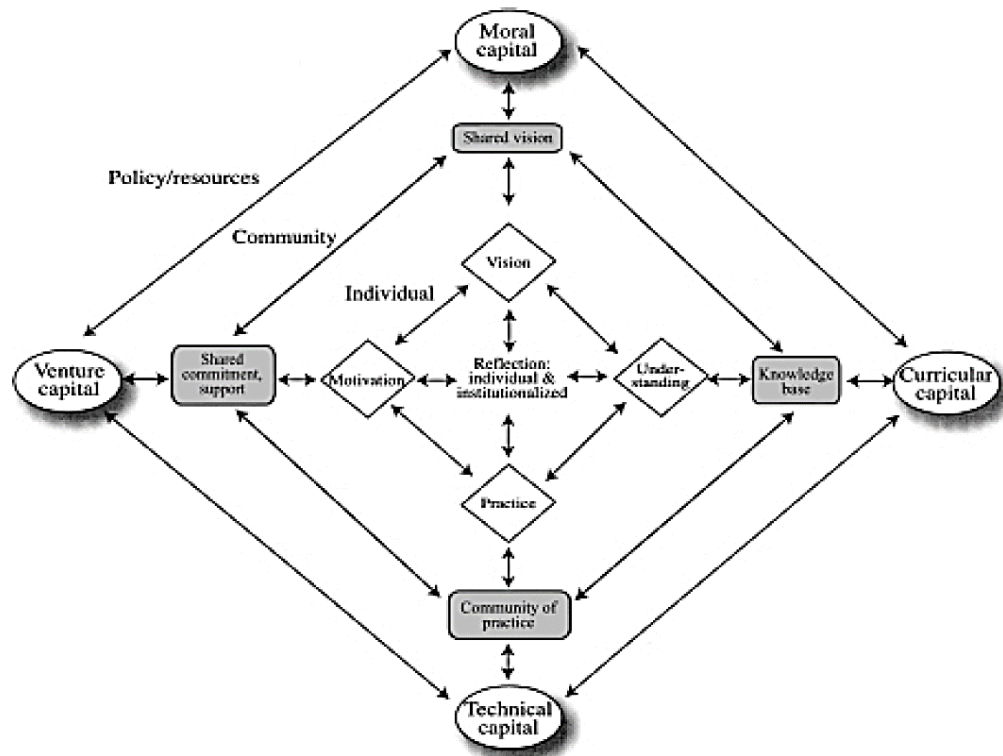
effectiveness of CPD, it will be important to explore relevant overarching conceptual frameworks.

2.4 A conceptual framework for change

In this section I will explore how key findings from research into the effectiveness of CPD may relate to significant broader theoretical understandings of teacher learning. It is clear from the studies reporting on the effectiveness of CPD (Adey, 2004, Cordingley, 2005 and 2007, Day, 1999, Guskey, 2000, Ratcliffe and Hanley, 2005, Lydon and King, 2009) that teachers' professional development is a complex process. There are many interacting and interrelated factors influencing educational change (Hoban, 2002). To make sense of the reported constituents of effectiveness it will be necessary to consider possible conceptual frameworks which elucidate the relationships between the individual needs of the teacher within the CPD process, and the organisations within which they work. This is because although each of the studies of CPD effectiveness provided varying accounts of what should be required to influence changes to classroom practice – each study acknowledges the teacher working as part of a larger educational system.

Shulman and Shulman (2004) position the teacher at the centre of the change process. In this model shown in Figure 1, teachers' professional vision, motivation, understanding, and practice act as key components on which to enact reflection and change, but each are, in turn, influenced by community and by policy.

Figure 1: Levels of analysis: individual, community, and policy (Shulman and Shulman, 2004 p.268).

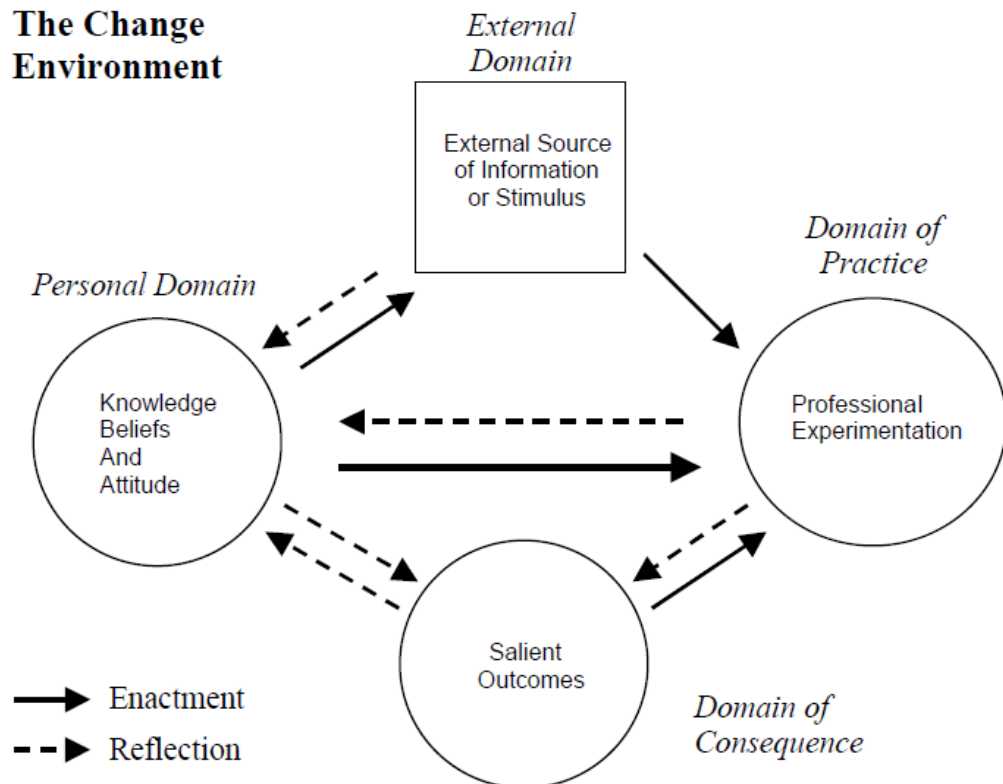


As any population of teachers will likely hold a range of beliefs and attitudes it would be useful to transpose onto Shulman and Shulman's model, the concept of Spillane's (1999) 'Zones of Enactment' which give an indication of the 'interplay of teachers' capacity and will to reconstruct their practice with teachers' incentives and opportunities to learn' (Spillane, 1999). This provides an indication of how the relative degree of change may be influenced by teachers' personal resources such as their motivations and capabilities, and their determination to influence change. In addition, identification of the degrees of necessity and sufficiency within the various conditions shown within the model, would add important detail, and allow an exploration of whether all conditions are equally important.

At the very centre of the model is an indication of the importance of reflection.

Reflection is a process which can lead a teacher to gain a deeper understanding of practices (Dewey (in Tomlinson, 1997, p. 369), Hoban (2002), Schön (1987)) and was considered of value in key research studies (Joyce and Showers, 1980, Day, 1999, Harland and Kinder, 1997, Guskey, 2000, Garet et al., 2001, Jauhiainen et al., 2002, Adey, 2004, Boyle, 2005, Cordingley, 2005, Penuel et al, 2007, Ratcliffe and Hanley, 2005, Lydon and King, 2009) reviewed in section 2.3. Reflection is also a process within the fabric of Clark and Hollingsworth's (2002) model of teacher growth, as can be seen in Figure 2.

Figure 2: The interconnected model of teacher growth (Clark and Hollingsworth, 2002).



As with Shulman and Shulman's (2004) model there are external domains of influence that exist outside of the teacher's personal domain. However, the personal domain should occupy a significant place within this model, as change can only be enacted through the personal domain of the teacher.

Each of these models will, at varying points, within the discussion of this study's findings, provide a valuable framework for analysis.

2.5 The teacher, as the mediator of change

In the light of the case I've set out in the previous section of the need for a theoretical understanding of the CPD process, I will now discuss the specific role of teachers, as the mediators of change, within the CPD process. Whatever the qualities of an 'effective' CPD programme, the success of the CPD depends on what the teacher does and what they think (Fullan, 2001a). It is teachers who mediate the intended aims of CPD (Kim, 2013). Educational change is a complex process involving the interaction of interrelated factors (Hoban, 2002). Central to any change process are the ways in which teachers value the change, and are influenced by their own motivations, and cultural and political structures (Harland and Kinder, 1997, Penuel et al, 2007). A teacher's vision, and philosophy, and how they interact with the cultural political environment is likely to influence their commitment to change, and the ways in which this is implemented and sustained.

Attention as to what makes 'effective' professional development often neglects the role of the teachers' motives and capacities, the ways in the teachers themselves understand new practices and ideas, and how they choose to mediate change. Spillanes (1999) provides the concept of Zones of Enactment 'the space where reform initiatives are encountered by the world or practitioners and practice', the size of the zones are dependent on the teachers' capabilities and motivations. These in turn interact with, and are influenced by, the school context (Millett and Bibby, 2004).

Models of effective CPD should quite rightly take account of the 'ingredients' for effectiveness, but consideration should also be given to how and why individual teachers implement change in the way they do, in the complex educational environment within which they work. One-day CPD workshops can only ever provide a potential for the initiation of, or triggering of, change. Yet studies (Ratcliffe and Hanley, 2005, Lydon and King, 2009) have shown that one-day workshops can lead to teachers establishing and embedding change over time. In my view, this raises questions as to what it is that motivates CPD participants to embed changes to practices, and how they navigate and operate within the socio-political environment to sustain these changes over time.

Implementation and continuation of change will be influenced by school culture and politics, but also by the individual teacher – by their own internalised motivation and vision (Fullan, 2001b). I would suggest that CPD that acts in some way to empower teachers by building their confidence, capacity, and their

professional capital (Bell and Gilbert, 1996) is likely to be more successful than CPD endeavours that do not. Teachers interact with the cultural and political environment through an internalised process of reflection (Clarke and Hollingsworth, 2002). Reflection can have more impact on changes to practices than learning from others (Baird, 1992).

Boyle *et al* (2005) argue that one-day workshops are not sufficient to sustain development, however, such short workshops have been shown to be successful (Lydon and King, 2009). Teachers are central to the change process and so CPD that acts in some way to empower them to bring about changes to practice, which they themselves value in some way, must surely be more significant than the length of the CPD. This view in no ways negates the influence of the political environment on the change process. However, we do need a better understanding of the significance of CPD that is of interest to individual teachers, and the ways in which teachers' personal resources and characteristics interact with the socio-political environment to influence the change process. For this reason, in the next section I will explore the importance of developing an understanding of teachers' self-determination within the CPD process.

2.6 Teachers' self-determination

Much of the literature (Adey, 2004) is clear in its condemnation of the capability of one-off short courses to affect classroom practice and impact positively on pupils' learning. Long-term sustained and collaborative efforts are considered reliable and

key ingredients of effective CPD (Cordingley et al., 2005). However, I argue that there is nothing particularly laudable about collaboration and team work per se. Team work can 'block, change or inhibit progress as easily as it can enhance the process' (Little, 1989, p. 531). Evidence suggests for instance, that large-scale participation during the early stages of a change effort is sometimes counterproductive (Huberman, 1984). Elaborate needs analyses, endless meetings, and long and tedious planning sessions can often confuse and alienate teachers if there is no action. People can be burned out by the time it is appropriate to enact change because they have been exhausted by extensive planning, meetings, and discussion (Fullan and Stiegelbauer, 1991, Fullan, 2001a). An over-abundance of unproductive meetings, and team dynamics marred by internal politics can often stifle, and disrupt change.

Research into CPD effectiveness could focus more on important issues of *quality*. I would argue that a very simple, straight forward yet powerful quality indicator is the extent to which teachers consider the CPD to be of value to them. This measure of value, which draws on a teachers' professional judgement, and their own professional knowledge, could suggest a key indicator of effectiveness.

This view has been supported by conversations and meetings I have had with teachers who had engaged with the subject specific CPD workshops. Teachers would report that the one-day courses that they had attended had in fact, to some extent, impacted positively on their professional practices and that students had

benefited as a result through different teaching techniques and the up-to-date scientific knowledge and careers awareness.

Motivation to attend CPD in the first instance may well be a significant indicator of the likely success of any future intended changes to teachers' practices. Teachers' motivation to attend CPD is a likely result of a combination of professional judgement, perceptions of their own efficacy to bring about intended changes, and expectations that the selected CPD is going to be of value to them.

In contrast, CPD courses in which teachers feel pressured or have no choice but to attend are likely to reduce feelings of teacher autonomy (Hargreaves and Fullan, 2012). Self-Determination Theory (SDT) would suggest that an adverse impact is likely in terms of teachers' determination to bring about changes that are imposed upon them.

I consider that teachers' professional views of the likely usefulness of CPD are significant, as expectancy-value theory suggests that 'a person's motivation to perform a behaviour is the product of expectations about his or her own ability to perform the task, and the value of that goal to the person' (Eccles et al., 1983). This could explain the lack of impact of the CPD when teachers are required to attend a CPD workshop which they themselves perceive to be of little intrinsic interest or value. If the content and focus of the CPD is of professional interest to teachers and in an area within which they have a high degree of competence, they

are more likely to have the confidence to perform the 'goals' of the CPD. This would suggest that subject specific CPD, an area that science teachers have a certain degree of confidence and, presumably, an area of interest, are likely to have both the motivation and competence to implement changes to practices (Eccles et al., 1983).

Wigfield and Eccles (2000) researched this concept further to explain that a person's choice of tasks or goals, and persistence on those tasks, can be determined by the individual's expectancy and value concerning the task or goal. Other theorists in this area (Atkinson and Cartwright, 1964, Eccles et al., 1983) argue 'that individuals' choice, persistence, and performance can be explained by their beliefs about how well they will do on the activity and the extent to which they value the activity' (Wigfield and Eccles, 2000, p. 68). We may see therefore, longer term change if teachers are intrinsically motivated to attend the CPD and have high levels of self-determination to implement changes to their practices.

A key overarching message within the CST (2000) report was that 'the Government should ... ensure that [CPD] positively encourages, empowers and enables science teachers to develop and improve their professional practice' (CST, 2000, pp. 5, pp. 29). Ownership is likely to secure internal commitment. A key recommendation in the CST (2000) report was that CPD must be 'teacher designed' and be easy for teachers to access, use and apply (*ibid*, pp. 5, pp. 29), so that science teachers can use this in 'their *own* learning and development' (*ibid*, pp. 5, pp. 29).

However, as highlighted in the CST report, the majority of teachers 'were not engaged in a subject related, class room based, systematic process of continuing professional development (CPD) matched to their individual needs...and that those in the early years of their careers reported that their individual CPD tailed sharply away once their status as Qualified Teachers was confirmed at the end of their first induction year.' (CST, 2000, pp. 4).

CPD that meets individual teachers' needs and interests is likely to result in more meaningful change because it supports teachers' feelings of autonomy and ownership within the change process. Research that explores the effects of short episodes of CPD should take account of the *quality* of the CPD – in terms of the subject specific components, and the degree to which this supports a teacher's intrinsic interests and self-determination.

Subject-specific CPD can act as a powerful mediator for change (NFER, 2014, ISOS, 2015). SLC CPD implicitly places a focus on subject specific CPD and offers substantial choice through a coordinated CPD provision. Ownership of teachers' learning, personal and professional development is considered to be of considerable value within the process. The wide-range of subject-specific CPD available through the SLC is likely to support teachers' autonomy. Teachers have a range of CPD to choose from, and therefore can select that which they consider of highest importance and relevance to themselves. It is this support for self-

determination promoted through SLC provision that I consider to be a highly influential factor in explaining impact of these short courses. The CST (2000) report illustrated the lack of autonomy science teachers had in terms of CPD provision:

‘The teachers reported having little say in their individual CPD or the courses they do attend, and very real difficulties in identifying and accessing suitable products and services for their individual CPD, as well as constraints of time and money. What INSET they have received recently was mostly taken up by whole school issues, matters of administration rather than teaching science, and such national initiatives as those concerning literacy, numeracy and ICT. Only rarely did they have the opportunity to refresh their subject related substantive and pedagogical knowledge and skills (CST, 2000, p. 15).

The teachers were also critical of the adequacy of existing appraisal arrangements for identifying their individual strengths and needs. (*ibid*, p.16).

The literature discussed so far indicates the importance of teacher autonomy and choice within the CPD process. CPD programmes imposed on teachers, are likely to perpetuate a culture of low trust amongst teachers (Cochran-Smith, 2001, Bolam, 2000, Bottery, 2003). Ratcliffe and Henlay (2005), and Bishop and Denleg (2006) highlight the significant role of subject specific CPD. Subject specific CPD has the potential to be of intrinsic interest to subject-specialist teachers and to support autonomy within the professional learning process (CST, 2000).

Engagement with subject specific CPD has the potential to re-establish a culture of high trust (Bottery and Wright, 2000) as there is much potential to support teachers’ autonomy and professional judgement within the process. Bottery and Wright (2000) extend the notion of ‘professionalism’ to a notion where teachers are better informed and professional development takes account of their personal and contextual idiosyncratic needs and requirements. Teachers become decision

makers, and are therefore active and self-determined within this process. This is a long way from the simplistic cause and effect understandings of the CPD process, as the teachers' expertise is central to the CPD and change process. For the purposes of my own study I will be particularly interested in exploring the conditions which can influence change - beyond simply tallying changes to practices. Bottery and Wright present a convincing argument for the need for a more 'ecological approach' (Bottery and Wright, 2000, p.475) to understanding teacher professional development and professional identity. They present a case that 'being truly professional, involves a belief that teaching transcends the classroom, and requires of teachers that they take an active interest and have a duty to participate in issues that affect educational policies' (Bottery and Wright, 2000, p. 484). They caution of the consequences and impacts on teachers' professional development when CPD is influenced by government educational priorities and policy.

The ability for subject specific-CPD to keep teachers in touch with developments within their specialists subjects (Roberts, 2002) may well be powerful intrinsic motivators - important drivers of classroom change.

During longer-term CPD programmes, it is of course possible to support and guide participants with the implementation of a new practice, but there is little opportunity within one-off workshops. Adey argues that 'most researchers consider that there is little point in studying something considered to be of little value' (Adey, 2004, Wilson and Berne, 1999). However, on the basis of Ratcliffe and Henlay's (2005)

and Lydon and King's (2009) findings, I disagree and suggest there is a case for studying the longer term impact of short subject specific courses. The lack of research investigating impact of shorter episodes of CPD, over time, is an area of the research literature in need of expansion and exploration.

In my view, research needs to move beyond a simple list of factors of CPD effectiveness, towards a framework which seeks to explain why such factors are necessary or significant in a complex socio-ecological environment influenced by educational policy. One-off workshops of CPD have been shown to be sufficient at triggering the process of long-term change to teachers' practices. However, by themselves one-off workshops can only ever initiate the change process. In the next section I will seek to explain the position of the individual teacher within this process, by exploring Self-Determination Theory (SDT) in relation to CPD endeavours in more detail. This will form a conceptual framework to help explain why subject specific CPD is likely to be such a powerful mediator of change on teachers' practices.

2.7 Self-determination and motivation for change

I would suggest that the lack of research seeking to report the longer term effects of short CPD courses is surprising considering the claims of Burchell, Dyson and Rees, (2002) that impacts can continue developing over time. In their case study approach, involving two teachers who had engaged with a Master's degree in education, data was collected through teacher interviews shortly after the course and twelve months later. This allowed for a wider range of change to unfold.

Burchell, Dyson and Rees (2002) argue that teachers' internalised understanding and perception of change is viewed as central to understanding the processes leading to impact. This is an important point to take forward in my study, and will be reflected in the mixed methods design. Particularly Burchell, Dyson and Rees (2002) point that simplistic notions of cause and effect interactions: of teachers attending CPD and direct gains in pupils' attainment provide little understanding of the processes leading to impact. Their study highlights the importance of teachers self-report as an opportunity to understand the processes that lead to change, establishing the 'relationship between professional development and impact' (Dyson and Rees, 2002, p. 219).

In addition, very little is reported of the influence of teacher motivation for change. Teachers are the ultimate mediators of change, and if they are supported and motivated, by, for instance, engaging with CPD of interest to them, with subject-specific CPD, then there is potential for change to occur. As reported by Grove (2008):

'When teachers feel intrinsically motivated and enthusiastic to attend professional development (through feelings of autonomy), feel competence to implement the professional development strategies and form supportive relationships, greater implementation of professional development may occur' (*ibid*, vii).

Grove (*ibid*), in relation to her teacher CPD study, relates very closely with the Self-Determination Theory (SDT) developed by Deci and Ryan (1985) which states that autonomy (e.g. choice), competence (e.g. skills), and relatedness (e.g. collegiality) influence one's intrinsic motivation (Grove, 2008).

SDT is a framework which can help to explain changes to practices, as a result of teachers engaging with shorter CPD courses. It seems that many studies exploring the characteristics of 'effective' CPD may not have given sufficient attention to teachers' intrinsic motivation to implement changes to practice because of engaging with professional development. Certainly many researchers (Guskey, 1986, Howey and Vaughan, 1983, Berman and McLaughlin, 1978, Wood and Thompson, 1980) provide convincing evidence of the ineffectiveness of the deficit model of CPD. Since the introduction of the 'Baker Days' in 1988, professional development has often been viewed as a requirement or as something 'done to teachers'. Deci et al (1991), Deci (1975), Deci and Ryan (2002), highlight three essential psychological needs required to support an individual's psychological wellbeing and growth: autonomy, competence, and psychological relatedness. Specifically, Deci and Ryan (2002) claim that each of the three psychological needs must be satisfied for optimal growth, function and motivation – and that these needs are universal. Conversely, if these needs are not satisfied, it is claimed, that there are negative consequences on an individual's wellbeing, growth and determination. The attitudes of teachers to various forms of CPD, and their motivations to initiate changes to practices, is likely, in part, to be explained by Self-Determination Theory.

Clarke and Hollingsworth (2002) provide evidence for teacher change as a complex process involving teachers as active participants in the change process where teachers are active in 'shaping their professional growth through reflective participation in professional development programs and in practice' (*ibid*, p.2). A

process that must, by definition, require a level of intrinsic motivation. SLC CPD can provide teachers with a wide range of choice, or subject specific CPD, and therefore support teachers' self-determination. SDT provides a theoretical lens for exploring why even 'one-shot' CPD approach can result in detectable impacts on teaching practices:

'If a teacher feels she has the ability to make changes to her classroom practice after attending a professional development training session that she has personal causality to attend, she will more likely feel intrinsic motivation to perform the behaviours of that training' (Grove 2008, p16)

Within this statement, there is no reference to the length of training required or how sustained the CPD must be – the key factor is that of intrinsic motivation.

Intrinsic motivation, and factors effecting intrinsic motivation, become increasingly important when considering the complexity of classroom and school environments and underlying educational policy. Implementing changes requires significant personal investment in time and energy, a process likely to succeed only if teachers feel self-determined, motivated, and to have sufficient efficacy to make those changes happen. Research by Deci, Koestner, and Ryan (1999) suggest that behaviours linked to extrinsic rewards are unlikely to be sustained over time (Grove, 2008). This is an important message to designers of CPD programmes.

It is clear is that individual teachers, and the ways in which they interact with their professional environment are at the centre of any CPD process. Supporting teachers' autonomy, efficacy, competence and relatedness, emerge from the literature as integral to developing explanations of CPD effectiveness.

From my review of the literature, it has become clear that the importance of supporting teachers' autonomy in the CPD process emerges as a key theme; allowing teachers to have some choice over attending the training and adapting practices for their own needs has been identified by Grove (2008). Finegold (2006) identifies that subject specific CPD is of more personal professional interest to teachers, and Garet et al., 2001, Ratcliffe and Hanley, 2005, Lydon and King, 2009, discuss the subsequent increased impact of CPD focused on (new) subject matter and related PCK, as opposed to that focused on general teaching strategies. Guskey's (2000) framework places emphasis on the individual, as well as organisational change, and Adey (2004) discusses the need to develop a sense of ownership of the CPD innovation (Adey, 2004).

The literature I have reviewed also highlights the importance of supporting, drawing upon, and building teachers' competence and efficacy within the CPD process is widely recognised (Deci and Ryan, 2000, Grove, 2008, Joyce and Showers, 1980, Day, 1999, Harland and Kinder, 1997, Guskey, 2000, Garet et al., 2001, Jauhiainen et al., 2002, Adey, 2004, Boyle, 2005, Cordingley, 2005, Penuel et al, 2007, Ratcliffe and Hanley, 2005, Lydon and King, 2009). Particular so as changes in practices may not always be immediate. Supporting a teachers

expectations of their ability to implement new practices is an important factor in their motivation and determination within the CPD process (Wigfield and Eccles, 2000, Grove, 2008).

The need to support teachers' relatedness to colleagues as part of the CPD process, through opportunities for feedback, guidance, advice, peer support has also emerged from research findings (Deci and Ryan, 2000, Vygotsky, 1980, Grove, 2008, Garet et al, 2001, Day, 1999, Adey, 2004, Cordingley, 2007).

What is particularly significant is that the many reported qualities of effective CPD – as discussed in section 2.3, map very neatly onto the key elements of Self-Determination Theory: autonomy, competence, and relatedness. I would suggest that SDT may be a potential underlying theoretical framework for which the impact of short courses is likely to be understood.

Significantly, one-day CPD workshops can span the SDT framework – in that characteristics of the CPD can support a participant's autonomy, competence, and relatedness, and meet their expectations and provide perceived value. The reported impacts on teachers' practices following engagement with short CPD workshops (Ratcliffe and Hanley, 2005, Lydon and King, 2009) are likely explained through the theoretical framework of SDT, in that participants are likely to perceive a feeling of ownership and degree of control, and choice as to how the selected CPD approaches will be implemented. This explanation would likely be supported

with similar findings from Leithwood et al's (1994) review of the research literature which provides an indication of factors influencing teachers' commitment to change. The researchers synthesise a number of factors which can impact on teachers' commitment to the change process, but each worthy of further empirical study into how these components could be supported within CPD workshops. They make the case that individual teachers construct change, and teachers' willingness and commitment to any reform effort can be influenced heavily by teachers' own interpretation of the personal professional value of the change process, and their perceptions of their capacities to implement change. These very personal emotional factors are often overlooked in studies seeking to establish impacts of CPD. The significance of personal professional interactions will therefore provide an area to explore within the context of my study. Leithwood et al (1994) argue that curriculum reform requires a high level of commitment from teachers and that this commitment 'cannot be assumed' (Leithwood et al, 1994, p. 40). Leithwood et al provide further evidence to challenge any notion of a simplistic cause and effect CPD process. They provide a particularly convincing account of the very human nature of the change process. Teachers' personal goals, self-efficacy, and self-concept, and emotional reactions to the change process, within the contexts within which they work, are all identified as important conditions influencing change.

Kushman's (1992) US based study also provides a clear indication of the importance of valuing teachers' expertise, and supporting teachers' sense of self-efficacy. Within the context of establishing the conditions influencing the impact of CPD, these are areas I will explore within the context of my study. Whilst

Kushman's (2002) study reports on data collected from 63 schools, data from a wider range of schools to include a nationally geographically and demographically representative sample may support findings further. Nevertheless, Kushman indicates that the extent of teacher commitment can be context specific. Schools that involve teachers more in decision making are more likely to foster organisational commitment from them. In addition teachers' perceptions of job satisfaction and self-efficacy were shown to be positively related to the extent of organisational commitment. Again, like others, Kushman indicates the very human interactions which can have a significant bearing on any process of change. Change is enacted at teacher level and teachers have the imperative role of interpreting change efforts. Significantly, CPD activities in which participants feel coerced into attending CPD or have little choice in taking part are unlikely to have successful outcomes (Brooks, 2006).

2.8 Teacher Agency

In the previous section I discussed that Self-Determination Theory (SDT) is likely to be a significant framework with which to understand teachers' engagement with, and their motivations, within the CPD process. However:

'People can be encouraged to change, but if the structure of the system in which the individuals work does not support them to allow enough flexibility, improvement efforts will fail. Similarly, if the organisation's governance, policies, structures, time frames, and resource allocation are changed but the individuals within the organisation do not have opportunities to learn how to work within the new system, the improvement effort will fail' (Todnem and Warner, 1994).

For CPD endeavours to lead to changes to teachers' practice, teachers must be have the necessary agency in the school environments in which they work. Autonomy is not equivalent to agency. For changes to teaching practices to occur, teachers must actively seek out and purposefully implement new practices. However, teachers work within complex socio-cultural environments, therefore, developing the necessary agency is far from a straight forward mechanical process.

The OECD, to some extent, has recognised the significance of the influence of the teachers' environment on determining the extent of the quality of teaching:

'The quality of teaching is determined not just by the 'quality' of the teachers – although that is clearly critical – but also by the environment in which they work. Able teachers are not necessarily going to reach their potential in settings that do not provide appropriate support of sufficient challenge and reward.' (OECD, 2005, p. 9).

In their acknowledgement that a teacher's agency will be influenced by the environment in which they work, Priestley et al (2015) propose an ecological approach to the understanding of teacher agency. In this view, agency is not seen as a capacity of an individual but instead agency emerges 'from the *interplay* of individuals' capacities and environment conditions.... It is the *interaction* between capacities and conditions that counts in making sense of teacher agency.' (Priestley et al., 2015, p. 3).

Priestley *et al* make the point that *good* teacher agency is desirable for the simple reason that it contributes significantly to the overall quality of education. Within Priestley *et al*'s concept, *good* teacher agency 'makes the overall operation of the system more *intelligent*' (2015, p. 147).

The conditions influencing teacher agency need to be explored in order to understand the success, or otherwise, of subject specific CPD endeavours. The concept of ecological agency, in the context of short subject specific CPD workshops, is a particularly important concept. It is likely to help provide an understanding of the nature and extent of change to teaching practices when teachers return to their school environment.

'[Agency] is not something that people can have – as a property, capacity or competence – but is something that people do' (Priestley *et al.*, 2015, p. 627). Teacher agency encompasses the intentionality and decision making of the teacher to bring about a purposeful and positive change, yet the teacher must work through and interact with their environment to make this possible make the point that teacher agency denotes a quality of the engagement of actors (teachers) with their contexts. Therefore, agency is not something that teachers possess, instead it emerges from the teachers', presumably productive, interactions with their environment (Priestley *et al.*, 2015, p. 626).

The centrality of the teacher to any classroom based change process should require some level of theoretical and empirical understanding of teacher agency within, for instance, research or evaluations of CPD endeavours. However, 'existing change models tend to both underplay and misconstrue the role of teacher agency in educational change (Leander & Osborne, 2008 p.626). 'Teacher agency, that is, agency that is theorised specifically in respect of the activities of teachers in schools, has been subject to little explicit research or theory development' (Priestley et al 2015, p. 626).

Moreover, teacher agency has been undermined by educational policy through 'several decades of policies that worked to de-professionalise teachers by taking agency away from them and replacing it with prescriptive curricula and oppressive regimes of testing and inspection' (Priestley et al 2015, p. 624). Evidence-based approaches to teaching enhance knowledge within the educational system and potentially making the system more intelligent. However, teachers still need to take ownership of these approaches. Within their own classroom and school, teachers need to be able to negotiate the multitude of complexities which will likely require nuanced and refined teaching approaches. However, some see the wholesale adoption of 'evidence-based' approaches as sufficient in its own right, but this provides little room for teacher agency to emerge. Indeed, 'some see teacher agency as a weakness within the operation of schools and seek to replace it with evidence-based and data-driven approaches' (Priestley et al 2015, p. 624).

Teachers have individual identities, philosophies, assumptions, beliefs and values, all of which may be impacted by educational policy. The context within which teachers work will be influenced by a range of socio-cultural and political factors. The influence of the interaction of the teacher with their environment is a pivotal point in understanding the nature and extent to which teachers can enact change to *their* practices.

Making changes to practices is not a simple mechanical process. Teachers with intentions to bring about change in their own classroom practices will need to negotiate the nuanced political environment in which they work. Spillane's (1999) concept of Zones of Enactment may provide a useful view of the extent to which these intended changes to practice manifest in reality.

Priestley (2015) makes the case that Neoliberal influences on education policy have contributed to a narrow focus on certain desired educational 'outcomes', or in Biesta's (2004) terms, has led to 'outcome steering' (*ibid*).

A culture of performativity within the educational system means that test score and performance in inspection regimes, are favoured over many other possible 'outcomes' including those affective outcomes such as pupils' interests and engagement within the subject. Evetts reports 'a shift from notions of partnership, collegiality, discretion and trust to increasing levels of managerialism, bureaucracy, standardisation, assessment and performance review' (2011, p.

407). The pervasive culture of performativity can have the effect of undermining teachers' sense of professional autonomy (Gleeson and Husbands, 2001), and therefore is likely to impact on teachers' sense of professionalism and teacher identity. This effect is juxtaposed against Donaldson' findings:

'The most successful educating systems invest in developing their teachers as reflective, accomplished and enquiring professionals who are able to teach successfully in relation to current expectations, but also have the capacity to engage fully with the complexities of education and to be key actors in shaping and leading educational change. (2011, p. 14).

The political backdrop can provide a challenging environment in which teachers are to return to work with intentions to implement change following engagement with a CPD workshop. They are 'faced with an educational dilemma: how to deal with external productivity demands on the one hand, while simultaneously teaching for the knowledge society with moral purpose' (Sahlberg, 2010, p. 48).

Consequently, teacher agency is limited. However, even though performativity erodes teachers' agency Helsby (1999) suggested that teachers with high confidence in their own capacity and authority are able to act with a high degree of agency in the face of performativity' (ibid, p. 125).

An implicit expectation of much CPD is that teachers will become active agents of classroom change. The influence of the political environment is often neglected in

many theories of change. Therefore, an important aim of this study is to establish what happens when teachers have the intention to bring about change, but work within contexts framed by cultures of performativity and pervasive accountability practices.

This ecological view of agency, as an emergent phenomenon ‘highlights the importance of the environment [so that] the achievement of agency will always result from the interplay of individual efforts, available resources and contextual and structural factors as they come together in particular and, in a sense, always unique situations’. (Biesta and Tedder, 2007, p. 137). This is a major reason for the employment of a mixed-methods approach within this study.

2.9 A gap in the literature, and implications for further research

Within this section of the chapter, I will highlight a number of gaps in the research literature in relation to developing an understanding of the impacts of teachers’ CPD, and I will highlight the opportunities for further research that this presents to me. One of the key overarching themes to emerge is that there is a significant gap in the literature in relation to understanding the longer-term impacts of short CPD workshops.

In earlier sections of this chapter I established that the process of implementing changes to classroom practices is a conscious and purposeful effort on behalf of

teachers, and one that requires teachers investing their time in this process. Yet research can often focus on the immediate effects on classroom practices, and so changes that are more adaptive and evolutionary occurring over much longer and extended time periods may remain undetected. I would therefore suggest that there is always a need to explore the longer term effects of CPD endeavours.

A number of potential limitations in previous research into professional development have made them inadequate and ineffective (Todnem and Warner, 1994). This point is particularly true, I would suggest, in terms of the needs of establishing the impact of one-day CPD workshops over time. Often evaluations are too shallow, completed on the day of the CPD itself and simply measure teachers' initial reactions to the CPD workshop. Teachers' positive reactions to the workshop can result in positive claims of the CPD effectiveness, with little attention given to impacts on teachers' professional learning, classroom practice, or pupils' learning. Occasionally, evaluations of CPD workshops will simply provide an account of the actual activities completed by teachers, with little insight at all to teachers' views, attitudes or beliefs:

'We need better understanding about the effects of professional development at various levels, the conditions and processes that lead to success, as well as information about possible unanticipated outcomes. We cannot be satisfied with tapping only participants' initial reactions to a professional development experience or activity' (Guskey, 2000).

Another limitation is that CPD research studies are often carried out too soon after the CPD event. I consider this to be a major shortcoming as changes to classroom practices require time for adaptation, adjustment, and refinement of strategies and

approaches. Therefore, it is important to gather information of changes and impact over longer periods of time, as was clearly the case in Constable and Furlong's (1991) two-year long evaluation of a short subject specific course. When changes in teaching approaches are involved, teachers almost always gain better results the second year of the implementation than they do the first (Guskey, 2000). The first year is often time of experimentation. In the second year, efforts are typically more refined and efficient (Guskey, 2000). The dynamics of the teacher change environment as outlined by Clarke and Hollingsworth (2002), and Guskey (2000) can have a strong bearing on the impact of any CPD episode.

In order to ensure that research into the impact of professional development is truly enlightening and meaningful, I suggest that it must explore teachers' motivations and capacities to make changes to their teaching practices within their school environments.

Guskey's (2000) model of classroom impact suggests that changes in practice are often small and incremental. In addition, Clarke and Hollingsworth's (2002) model of teacher growth suggest iterative cycles of enactment (of practices) and reflection upon them can lead to changes over time. It would argue that it is not just possible, but probable, that longer-term changes to teaching practices remain undocumented. If short subject specific courses can lead to impact then the conditions supporting this impact will be of interest, particularly as much research suggests that impact following such short CPD endeavours is highly unlikely.

Research studies exploring the impact of short subject specific CPD courses remain largely absent from the published literature, as are studies investigating the impact of short episodes of CPD over time. My research study will seek to add to this research area by exploring the longer-term impacts on teachers as a result of engaging with short episodes of CPD. With such little research documenting the longer term impact of short one-day courses, this study will generate research findings which are likely to be particularly timely considering the recent introduction of the DfE (2016) standard for teachers' professional development. Additionally, the most current Ofsted framework requires school leaders to 'ensure that all teaching staff benefit from appropriate professional development and that performance is rigorously managed' (2012, p. 5).

A key area of attention within my research study is that changes to classroom practices may lead to minor improvements in the short term, which cumulate in larger effects over time. In the short-term changes to practices may not be easily discernible or detectable yet become more visible over time. Studies into CPD impacts are often too shallow and too brief, and rarely look for longer term, or the unintended impacts.

Within the course of my professional experience within the field of teacher education I have realised that changes to practices following a CPD workshop may not be immediate. Changes can occur many months after teachers have engaged with the CPD. Guskey's (2000) findings make the same point that change to practice is not always easy, immediate, or automatic but a much longer-

term process that may not be detected immediately after a CPD course. This is a point that is not always reflected in research studies.

Barriers and challenges to implementation are an important consideration. Barriers are likely to effect the timeline over which changes to practices occur. Robinson and Sebba (2004) identified lack of time as the most commonly reported barrier to implementation of new practices. Support offered from the school management team and colleagues are also major factors in whether change was implemented (Lydon and King, 2009). Arguably, working under competing demands and commitments is likely to require a certain level of determination on the part of teachers to implement any change to teaching practices.

Fullan (1993) in addition to Guskey (2000) also found that implementing professional development and making changes to classroom practices often takes more time than expected (*op cit*). It has been recognised that teachers may acquire new teaching strategies, but it may take years to integrate these into the classroom (Fullan, 1993, Chance and Chance, 2001). Changes in teaching practices tend to be gradual, radical changes to teaching practices rarely occur (Guskey, 2002). Findings from a study Grove et al (2009) into the impact of professional development suggested that changes to teachers' practices were often subtle, and that these small and subtle changes to practices indicated that that teachers were carefully considering the changes they make. Changes to practices may take place over a number of years and will therefore be missed by research studies which take place soon or shortly after a CPD workshop taking place.

It has been noticeable that the vast majority of studies into the effectiveness of CPD, occur within six months of the CPD workshop, so important changes to practice may well be missed. My study will explore the impacts on teaching practices up to a period of five years after the CPD workshop. Findings are therefore likely to make a valuable contribution to the research literature. The absence of research seeking to report the longer-term effects of CPD is surprising considering the claims of Fullan (1993), Guskey (2002), Burchell et al (2002), that impacts can continue developing over time.

Implications for study design

Following my review of the literature a number of implications have emerged which will influence my study design.

Within recent studies of the impact of CPD endeavours, Guskey's (2000) five-stage impact model is often utilised as a framework for analysis, and this is a model that will be important within the data collection phases of this study. The utility of this approach is that it proposes a distinct five-stage model. Level one concerns establishing participants' initial reactions to the CPD event. Many evaluations of CPD begin and end at this stage. But, my study will give attention to all five levels of analysis. The second level of analysis examines participants' learning as a result of engaging with the CPD. The third level of analysis identifies changes to participants' practices. The fourth level of analysis includes an

examination of the organisational support and change that participants' experience. The fifth and final level of analysis includes a consideration of the impact on pupils' learning. Since its inception, Guskey's framework (*ibid*) has been widely used to provide information of the impact of CPD at all levels. The levels of analysis will provide a useful framework for data collection within this study, as the intended purposes of the one-day CPD workshops aim to positively affect participants, which in turn, it is assumed, will result in enhanced learning experiences for pupils. It is for this reason that Guskey's framework (*ibid*) for CPD evaluation will guide the collection and the initial analysis of data in relation to Research Question 1: Establishing the extent of impact of a one-day science subject specific CPD workshop on teachers' practices.

However, Guskey's framework (2000) alone will not be sufficient to structure evidence and frame conclusions in relation to Research Question 2: Establishing the conditions which influence the change process. The ways in which teachers conceptualise and describe change will be an important area to explore within this study, and so appropriate methods of collecting and suitable strategies to analyse teachers' perspectives will need to be considered. Powell and Terrell (2003), make the point that impacts at the personal professional level are rarely considered. Instead policy can assume an unproblematic direct link between teacher engagement with CPD and impact on pupils' learning. They make the case that:

'This positivist stance reflects a restricted representation of the complexities inherent in the interplay between teaching and learning. This apparently

neat and tidy, cause and effect relationship ought to be treated sceptically. It suggests a simplistic conceptualisation of teaching as a technical-rational pursuit'. (Powell and Terrell, 2003, p. 391).

Their study demonstrates that teachers' perceptions of impacts are important considerations within the change process. This will be a point reflected within the design of my study. In addition, I fully concur with Davies and Preston's (2002) view that establishing the impact of CPD is a much more complex process than simply identifying gains in pupils' achievement. Within the context of my study I will also need to be mindful of Fung's (2000) view that teachers' personal, professional and social contexts have a strong bearing on the change process, and that teachers construct change, rather than transmit it. That is to say, change is a very personal process. Teachers' professional judgement and decision making are important components of the change process (Grove 2008). Teachers are affected by and influenced by pervasive educational cultures and policy, and this in turn influences the extent to which they enact change.

Agency to generate classroom change emerges through teachers' interaction with their environment (Priestley et al., 2015). In order to establish the conditions which may be most salient to bring about changes to teaching practices within the context of this study with a focus on short subject specific CPD, it will be important to consider the significance of Clarke and Hollingsworth's (2002) Interconnected Model of Teacher Growth (see Figure 2) .

This model makes clear the distinction between the internal ‘personal domain’ of the teacher, and the ‘external domain’. The model highlights interactions between these domains, and the influence of ‘salient outcomes’, which will influence and frame teachers’ enactment of pedagogy, and their subsequent reflection upon this. Clarke and Hollingsworth’s model (*ibid*) will be revisited in subsequent sections as an initial framework for interpreting this study’s findings, particularly in relation to understanding how and why teachers interact with their educational contexts, in the way they do, to enact change.

The need to capture the personal, social and political influences of classroom change will therefore be reflected in my study design, and discussed more fully in Chapter 3.

2.10 Conclusion

Within this chapter, I have reviewed existing research to strive to establish the extent of understanding of the likely impacts of CPD, and the factors influencing its effectiveness. Longer term studies in relation to short CPD workshops appear to be underrepresented, as too do studies exploring the interactions of CPD participants with the wider educational environments, in order to gain detailed explanations of impacts.

The discourse on effective CPD has tended to focus on the components and structure to the CPD course itself and makes little reference to the participants' personal resources. However, only teachers can mediate changes to their classroom practices. Teachers will filter and amplify the intended objectives of CPD and in turn, potentially affect, change, and become benefactors of the CPD as a result of engaging with it. Teachers alone implement changes to practices with their own classrooms and this requires them to draw on their professional judgement. Professional judgement is likely to be influenced by teachers own attitudes, values, motivations, beliefs, experiences, competencies and expectations.

In order to acknowledge the instrumental role of the teacher in the change process, Self-Determination Theory, and Teacher Agency have been considered as important frameworks for reaching an understanding of how and why teachers engage with CPD and implement subsequent changes to practice. My research study will therefore seek to explore the nature and extent of changes to teaching practices over time and the key conditions that have a bearing on these changes.

In the next chapter, I will set out the rationale for a sequential mixed-methods approach that will seek to answer the specific research questions of this study.

Chapter 3: Design of the Study & Initial Analysis

3.1 Introduction

This chapter will serve to provide a more detailed understanding of the link between these original research questions, the subsequent research methods employed, the resulting findings, and the conclusions drawn.

In this chapter, I will outline the rationale for a mixed-methods approach (Tashakkori and Teddlie, 2003a), which was designed in order to answer the specific research questions outlined below:

1. To what extent can a one-day science subject specific CPD course impact on classroom practices? Specifically:

- What are participants' perceptions of the extent of change?
- What are participants' perceptions of the nature of change?
- How do the impacts of one-day subject-specific CPD courses on participants' practices change over time?

2. What are the conditions that influence changes to teachers' practices?

Specifically:

- What conditions are required, or hinder, the impact of one-day subject-specific CPD courses on classroom practice?
- What factors contribute to long-term effects?

Issues of the reliability and validity of the research findings will be discussed, so that judgements can be formed as to the robustness and generalisability of the conclusions reached.

This sequential mixed-methods study will explore impacts of short subject specific workshops several years (mean 2.9 years) after the original CPD event. This will avoid limitations of studies that have searched for effects too soon. Exploring impacts over this timeframe – potentially several academic years since the participant attended the CPD workshop, will provide a unique opportunity to consider changes to practices that have occurred over such an extended timeframe. In addition, it will be possible to consider changes to practices that have become adapted and refined over the course of time.

It is rare for such an exploration so far after the CPD event particularly in the context of short CPD courses where there is little confidence that meaningful long-term change is possible. In addition, this sequential mixed-methods study will add to the explanatory understanding as to why changes to practices may or may not occur. The study's findings will therefore move beyond production of a list of impacts, to provide an explanatory framework for such impacts. This study is unique in that it investigates the impact of short subject specific CPD courses over an extended time-frame using a sequential mixed-methods approach.

In this particular study, the contexts of teacher, school, and CPD, with their multitude of facets, ambiguities and complexities play a critical role in the design of the study. Research should involve a systematic and critical enquiry with aims to contribute towards the advancement of knowledge (Bassey, 1999, cited in Briggs et al., 2012, p. 5). As such, this involved an active effort, as the researcher, to ensure a robust study design, particularly in light of the fact that teachers' professional development and learning take place in complex socio-political settings.

Teachers, who are the ultimate mediators of classroom change, work in complex socio-ecological environments. Therefore, the impacts (affects and effects, and changes to practices), because of engaging with CPD, may lead to a range of intended or unintended consequences. In addition, and as discussed in Chapter 2, changes to teaching practices may, in the short term, not always be discernible. Yet, in the long term, change could become more visible: as opportunities to make alterations to practice becomes available, or as minor, subtle or previously hidden changes and improvements to practice may cumulate over time, making them more noticeable.

Within this chapter, I will therefore provide the rationale for employing a mixed-methods research approach within this study, combining both quantitative and qualitative methods. I will explain how through the mixed-methods approach knowledge has been generated in respect of the impact of short episodes of subject specific CPD on participating teachers' practices, as well as detail revealed

of the factors that hinder and condition teachers' capacity to make changes to their practices.

3.2 Rationale for a mixed-methods approach

I selected a mixed-methods approach to answer the specific research questions of this study, as the aim was to explore complex social phenomenon – the effects of CPD on teachers' learning, and on their classroom practices within a system influenced by compounded educational policy. As such, and for reasons that will be will become clear, I considered that a sequential mixed method approach, drawing upon the strengths of both qualitative and quantitative research methods, to be an appropriate method to elicit robust research findings. This particular design, a sequential explanatory mixed-methods design is considered to be one of the most popular mixed-methods designs in educational research (Creswell, 2003a, Creswell et al., 2003c). Within this particular study, the sequence of methods included: Phase 1 (Qualitative Methods), then Phase 2 (Quantitative Methods), and finally Phase 3 (Qualitative Methods).

To bring about changes to teaching practices, teachers need to work through their environment (Priestley, 2015). Qualitative research is able to capture the detail of such 'interactions' and can help to provide an examination and understanding of complex phenomenon within context. It is also open to capturing details of events which may be unexpected, or unanticipated by me as the researcher. Hence, to begin, the initial exploratory phase (Phase 1) of the study, utilised qualitative

research methods to instigate the development of an understanding of the complex teacher-environment negotiations and interactions, which may lead to changes in teachers' practices.

The design of Phase 2, the quantitative phase of the study, was shaped by the findings of the initial analysis of Phase 1 findings. This ensured that data collected through the Phase 2 questionnaires would build on and complement the data collected within Phase 1. Question items on the survey instruments were therefore not pre-determined in advance of Phase 1, but developed sequentially in response to interview findings from the interview analysis. An advantage of the questionnaires was that they could be issued to a larger number of teachers than I had resource to achieve through interviews alone. Moreover, this phase of the study provided the opportunity to explore associations between certain factors of interest, which emerged from the interview analysis. This phase of the study also helped to provide an indication of how representative and consistent findings were across a larger population of CPD participants, which ultimately led to refinement of the initial theory generated within the earlier part (Phase 1) of the study.

As social phenomena should be interpreted against the background of the relevant context (Hodder, 1994), the benefits of the qualitative approach were again captured in the final phase (Phase 3) of the study, which sought to further build a more holistic, and more complete picture of a complex professional development process. Phase 3 contextually rich, in-depth semi-structured interviews, provided data which helped to provide an interpretation of how and why participants engage

with the CPD process, and why and how subsequent changes to practices occur within their school environments.

Quantitative and qualitative research methods each carry their own merits.

However, both quantitative and qualitative methods are subject to a number of criticisms in terms of their appropriateness and credibility for establishing valid, objective and robust conclusions in terms of understanding complex social and political situations – such as those of a school and professional development environment. However, when used in combination it is argued that quantitative and qualitative methods complement and support each other and aim for a more complete analysis (Greene et al., 1989, Tashakkori and Teddlie, 1998, Creswell, 2010).

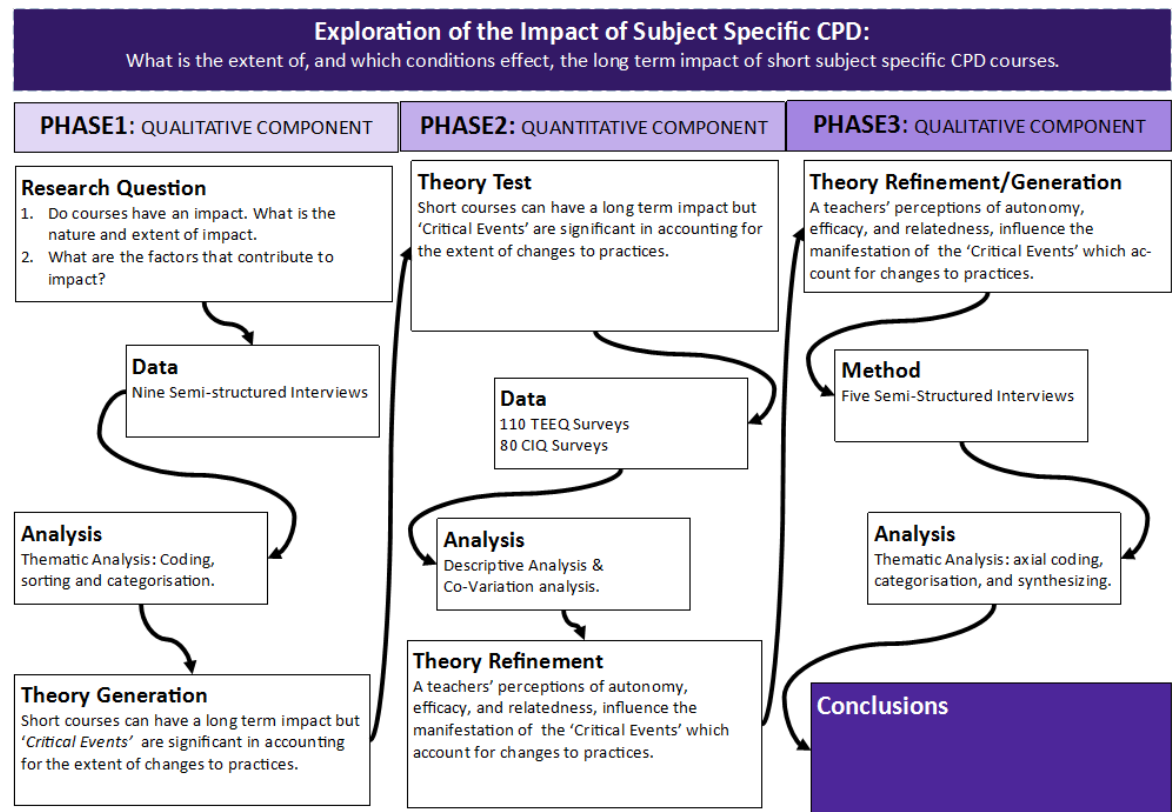
Taken together, the three phases of this sequential mixed-methods approach captured, to a greater extent than either method would alone, the rich and complex social phenomena of teacher and school environment interactions. Operationally, each phase of the study was completed in a sequential order, however, the final subsequent analysis and discussion involved drawing together and ‘mixing’ both quantitative and qualitative data that had been collected during the entire research process (Creswell, 2003b, Denscombe, 2008) which helped to understand the impact of subject specific CPD more comprehensively. By taking this approach, the study drew upon strengths that offset the weaknesses of both quantitative and qualitative research, and also generated a wider range of evidence to explore the research questions. As a result, I had a wider range of data collection tools and

analytical techniques at my disposal. In this way the mixed-methods approach provided a 'common sense' and practical way of understanding the complex real life situations (Creswell, 2011) as opposed to being bound by traditional tools and analytical techniques associated with either quantitative or qualitative research. This also ensured that both inductive and deductive thinking could be combined, leading to greater insight and understanding of the research questions. It seemed a natural way then, to employ mixed-methods as the preferred mode for understanding the impacts of subject specific CPD on teaching practices in complex socio-political environments.

Mixed-methods research has been described as the 'third research paradigm' (Johnson and Onwuegbuzie, 2004, cited in Creswell, 2011), and has intellectual routes within early work of Campbell and Fiske (1959) on mixing methods (Creswell, 2003b, Creswell and Clark, 2007). 'Mixed-methods research has evolved to the point where it is a separate methodological orientation with its own worldview, vocabulary, and techniques' (Tashakkori and Teddlie, 2003a, Creswell and Clark, 2007). 'Tashakkori and Teddlie (1998, 2003a) contrast the mixed-methods approach with research paradigms that have favoured the use of either quantitative or qualitative methodologies' (Denscombe, 2008). It supports a paradigm that might encompass all of quantitative and qualitative research, such as pragmatism (Creswell, 2011).

The visual model of the procedures for the sequential explanatory mixed-methods design of this study is presented in Figure 3.

Figure 3: Mixed-methods design: Exploring the long-term impact of short courses



As can be observed within the diagram above, constructivist approaches were employed to gather the views and perceptions of the CPD participants', and then interpreted to establish key emerging themes and to generate theory. In addition, positivist research approaches were also employed, so that the emerging theory could be tested and new data generated, facilitating further consideration and potential refinement of the theory.

3.2.1 Philosophical foundations

'Pragmatism is a set of ideas articulated by many people, from historical figures, such as John Dewey, William James, and Charles Sanders Peirce, to

contemporaries, such as Cherryholmes (1992) and Murphy (1990)' (Creswell, 2007). Significantly, pragmatism places fundamental importance on the research questions, which are considered 'more important than either the method or the philosophical worldview that underlies the method' (Tashakkori and Teddlie, 2003b). In an emancipatory view of the mixed-methods study approach Mertens (2003), makes the point that transformative scholars 'recommend the adoption of an explicit goal for research to serve the ends of creating a more just and democratic society' (*ibid*).

This sequential mixed-methods design required experience of both quantitative and qualitative methods. This at times proved to be time-consuming in order to become sufficiently familiar with a wide range of *methodological* literature that doctoral study requires. Equally, it was crucial to develop awareness and knowledge of the *methods* for collecting quantitative and qualitative data and the associated measuring instruments such as open-ended questions, semi-structured interviews, as well as closed attitudinal scales. In addition, it was essential to understand the logic of both inductive analysis identifying a central phenomenon, and also hypothesis testing, and the ability to use and interpret statistical analyses, as well as qualitative coding schemes and thematic analytical techniques. It was also necessary to understand the research qualities of reliability and generalizability; as well as associated issues of credibility, and validation strategies. These issues will be discussed in further detail, according to each phase of research within this chapter.

Central to the successful completion of this study was my own professional development in terms of developing a secure understanding and solid grounding within mixed-methods research. This was supported by engaging with the seminal literature base on mixed-methods research to ensure that the procedures used were consistent for conducting a robust and credible inquiry. I then implemented this knowledge within the practice of this particular research study. It became very clear in the planning and implementation stages that successful completion of a three-phase mixed-methods study would require extensive time, resources, and effort on my part. The length of time required for a sequential mixed-methods approach is recognised to be dependent on the number of phases within the study design. This particular study had three distinct phases: each with its own data collection, data analysis and interpretation phases. As a result, this study took several years to complete. However, this is also one of the major strengths of this study.

A key supposition of pragmatism is that quantitative and qualitative methods are compatible, and this is a supposition supported by my experiences within this study. Thus, both the quantitative data and qualitative data, collected sequentially (or in other cases, concurrently), are assumed to act together to shed a more detailed understanding on the research questions than either qualitative or quantitative methods would alone. However, it must be recognised that, scholars have raised questions of the 'commensurability' of quantitative and qualitative methodologies. There are differing views on how quantitative and qualitative elements of research should be used, and whether they can in fact be integrated, combined, or used in tandem. (Creswell, 2003b).

‘For some writers the philosophical premises of quantitative and qualitative methodologies are considered to be incompatible, which leads them to advocate their use “in parallel,” each playing to its respective strengths. Other writers have sought to find common ground between the two alternatives and have made efforts to highlight the similarities between quantitative and qualitative approaches as a basis for combining their use (Creswell 2010)

However, I would suggest, that there is no simple dichotomy between the concepts and designs of quantitative and qualitative research approaches.

Moreover, to accept that there is one would not ‘do justice to the variety of epistemological and ontological assumptions that underpin the others (Denscombe, 2008). As Johnson et al. (2007) acknowledge, ‘the dividing lines [of quantitative and qualitative approaches] are much fuzzier than typically suggested in the literature’ and ‘positions are not nearly as ‘logical’ and as distinct as is frequently suggested’ (*ibid*, p.117).

Having carried out and reflected upon the practice of a sequential mixed-methods study, my informed view is that the combination of different ‘typical’ quantitative and qualitative tools, and the subsequent employment of their associated analytical techniques, is an essential, common sense, and pragmatic approach to understanding complex social phenomenon. As Creswell 2010 argues, within mixed-methods research:

‘The focus is on the consequences of the research, on the primary importance of the question asked rather than the methods, and on the multiple methods of data collection to inform the problems of the study. It is pluralistic and orientated toward “what works” and professional practice’ (Creswell, 2010)

Mixed-method was a highly appropriate approach for providing detailed information about how changes to teaching practices, in complex social environments, can unfold following engagement with short episodes of subject specific CPD. The combination of inductive and deductive thinking was an essential and critical part of the process through which to make meaning of such complexity.

3.3 Ethical considerations

Ethics plays a key role in the design of social research (Guba and Lincoln, 1994). This study followed the 'Ethical guidelines for educational research' of the British Educational Research Association (BERA, 2014). Particular consideration was given to the ethical issues of voluntary participation, informed consent, the right to withdraw, and confidentiality and anonymity.

Participants were provided with written and oral briefing about the purpose and process of the study, and that the findings may contribute to an enhanced understanding of teacher professional development. Consent was gained before questionnaires or interviews were completed. Participants were made aware of their right to withdraw, at any point, and that participation was voluntary. An example of a participant information sheet and consent form can be found in Appendix 1.

Interviews were scheduled at a time of participants' convenience, and within the participants working environment, and questionnaires were completed when participants were attending a CPD event at the Science Learning Centre.

Interviews lasted no more than one hour, and questionnaires took approximately 20 minutes to complete.

Participant confidentiality and anonymity has been maintained throughout the study. Names of participants and their schools are not identifiable. Personal details were not processed with the substantive data. Interview transcripts were checked by participants for accuracy.

No attempt was made by me, as the researcher, to influence classroom practices, or to require participants to alter their classroom practices.

3.4 My role as researcher

As a researcher, I consider 'truth' as a legitimate concept, and a desirable aim of any research study. As such the aim of this study is to establish the truth, as much as this can possibly be achieved, in terms of identifying the conditions which influence the impacts on participants' practices following engagement with subject specific CPD. As a researcher, I take a 'critical realist' philosophical perspective, which as defined by Creswell is:

‘A philosophical perspective that validates and supports key aspects of both quantitative and qualitative approaches... an integration of a realist ontology (there is a real world that exists independently of our perceptions, theories and constructions) with a constructivist epistemology (our understanding of this world is inevitably a construction from our own perspectives and standpoint)’ (Creswell, 2011).

Within the role of pragmatic researcher – the role I have adopted within this study, I consider ontological objectivity as desirable, yet possibly unachievable. Reality is both singular in that a reality exists outside of our own perceptions, yet within practice there are limitations to accessing ‘reality’ - as reality is also multiple, in that within the social world there are varied and individual interpretations of the nature of the phenomenon (Creswell, 2009). Particularly as perspectives are dependent on personal beliefs, values, and experiences (May, 1997). However, during the data collecting phases of the study it was important for me as the researcher to suspend my own beliefs and predefined ideas as much as possible, and reflect the values of the participants, as opposed to interpreting the same event with my own, possibly different, values. Though, it is impossible to be completely objective as Eisner (1993, p. 5) makes an important point that ‘what they say [research participants] depends upon the questions we ask’.

My role as researcher was inevitably closely bound up with the study. Not only did I have a professional interest in exploring the research questions, I was also, during part of the study, employed as a CPD leader with specific responsibilities for the design and quality assurance of much of the CPD that forms the focus of this study. I was therefore inextricably linked with the earlier parts of the research. However, I was at the same time to some extent privy to ‘inside’ knowledge in that

as well as working for the organisation providing much of the CPD, I had worked in a number of schools as a science teacher and engaged with a range of CPD, and also had successfully completed a Masters qualification in education as part of my professional development. This insider knowledge likely contributed to the rigour of research findings, as according to Eisner (1993, p. 5) 'perception of the world is perception influenced by skill, point of view, focus, language, and framework. The eye, after all, is not only a part of the brain; it is a part of tradition'. In this sense, I am perhaps also a co-operative researcher (Reason, 1988b) focusing on joint interpretation, learning and understanding. It was nevertheless important to maintain procedural objectivity, and to ensure some distance between myself, as researcher, and the phenomenon under investigation.

My professional and personal vested interests in the successful completion of a high quality research project, may have manifested in active and deeper engagement with the data and with more robust analysis, than may have otherwise been achieved – therefore providing a deeper understanding of the research questions. However, although I may have been able to take steps to work towards achieving procedural objectivity, achieving ontological objectivity remains a very different matter, as 'researcher characteristics can influence the objectivity of the research study' (Ball, 1993, p. 36). However, as researcher, a privileged role (Van Maanen, 1998), I was in the position to gather a wide range of accounts and perspectives of participants' experiences of the CPD process, and as such develop a wider understanding of the subsequent change processes. Further issues in relation to reliability and validity of findings will be discussed in the following section.

3.5 Establishing the criteria for ensuring research quality

The study comprised three phases. Phases 1 and 3 employed qualitative methods, and Phase 2 quantitative. For these reasons, the issues of establishing the validity of the data will be discussed separately.

3.5.1 Establishing credibility, transferability, dependability, confirmability: Phases 1 and 3

The social nature of educational research can pose particular challenges in terms of measuring reliability and validity (Pappas and Tucker-Raymond, 2011). For these reasons, it became imperative within my role as researcher, to ensure a high degree of confidence in the fidelity of the data and findings. Guba's framework (1981) provided a useful construct for these purposes. In particular, attention was given to the criteria of credibility, transferability, dependability and confirmability of the data.

During the interviews, triangulation occurred through member checking, follow-up questions formulated as necessary, creating the opportunity to seek clarification on certain issues, all helping to reduce ambiguity, as well as providing the opportunity to explore key issues in further analytical detail which allowed for development of rich, thick descriptions. In order to ensure participants' felt that they could provide an honest and full account of the CPD and change processes, it was important to work to ensure a good rapport with the participants and explicit

communication on my part that I was not seeking a particular answer to the interview questions, was an important part of this process.

Bias was avoided as much as possible by recording a full and honest account of the interviews, and working to ensure a good rapport with interviewees so that participants could provide a full and honest account, and that they were not unduly influenced by my position as a CPD provider/leader within the CPD process. These attempts at providing 'distance' between participants, helped to ensure that participants could provide a more unbiased account of the nature and extent of impact following their engagement with the CPD. It is still important to note, however, that validity of findings can only be made as valid as possible, and cannot be 'proved' (Gronlund, 1990). After the interviews, interviewees received full interview transcripts to ensure these represented their accounts accurately.

Themes common within transcripts were highlighted and coded, and specific statements from participants have been used directly within the analysis and discussion, to support the authenticity, of the study's findings. Interview notes and transcripts were prepared in the same standardised way, in an attempt to improve dependability (Silverman, 2011). However, ensuring findings are repeatable at another time, may depend on similar levels of rapport between interviewer and interviewee.

3.5.2 Establishing reliability and validity: Phase 2

In the process of completing the questionnaires that are seeking details of the nature and extent of impact, it should be acknowledged that participants may feel that they need to 'look' for impacts – and so may over-report implemented changes to practices and to pupils' learning. As the CPD workshop occurred, on average, several years prior to completion of the questionnaire, the passage of time may affect the accuracy of a participant's memory of specific changes.

Questionnaire items were established and adapted from existing peer-reviewed research instruments, including TIMSS Surveys (IEA, 2007) and Braund (2011), helping to ensure credibility and validity of measurement items.

Data have been drawn from larger sized sample than could be achieved through interviews, which helps to support the reliability of the findings. In order to avoid response shift bias (Howard and Dailey, 1979) of a traditional pre and post-test survey, a retrospective pre-test (Lamb and Tschillard, 2005) was used to provide more reliable data, by ensuring that the participants' understanding of the various items measured were consistent in time. They were required to draw upon their professional judgement to consider the nature of changes to their practices as a result of engaging with the CPD.

The questionnaires provided a number of advantages over other data collection techniques: The questionnaires were relatively easy to administer, a large number

of questionnaires were completed, and so a significant amount of data collected. A number of questions elicited data in relation to participants' motivations, teacher efficacy, and expectations, attitudes, opinions, beliefs, values, and behaviours, which provided considerable opportunity for rich data analysis. The large quantity of data collected was sufficient for a range of descriptive and inferential statistical analytical techniques.

Although the questionnaires did undergo a period of pilot testing to ensure that questions were clear to the reader, and that participants completed the questionnaire items in the way intended. It may be possible that when used for the actual data collection, some participants experienced a level of fatigue or experienced a lack of interest when completing the questionnaires. However, in response to feedback from the pilot testing of the questionnaires, I have mitigated against this to some extent by reducing the number of questionnaires items, so that the questionnaire could be completed within approximately 20 minutes.

The questionnaires included a large proportion of closed-ended questions, which may have a lower validity rate than more open-ended question types, as participants are 'forced' to respond to one option or another. Alternatively, participants may choose not to respond to a questionnaire item at all. Additionally, the participants who choose to respond to a particular question may be different from those who chose not to respond to others, thus creating bias. However, only a small number of 'non-responses' were identified within the questionnaire data.

Questionnaire answer options may have affected the validity of findings as certain answer options may be interpreted differently by different participants. For instance, the answer option “partly agree” may represent different meanings to different participants. This is true also of answer options that are framed in terms of the ‘extent’ of the use of particular new resources or practices, for example, ‘occasionally’ may take on different meaning with different participants, depending on the participants’ context.

3.6 Research tools

In this section, I will briefly outline the rationale for the research tools employed, and how they contributed to the findings of the study.

To achieve the aims of the study and to answer the specific research questions, research instruments aligned with a mixed-methods approach were developed to provide the wide range of data necessary for the subsequent analysis. Table 4 indicates the data collection approach for each stage of the study.

Table 4: Data collection tools

Mixed-Methods Phase	Research Instruments
Phase 1: Teacher Interviews	9 Teacher Interviews
Phase 2: Surveys	110 Teacher Expectations and Efficacy Questionnaires (TEEQ) 80 CPD Impact Questionnaires (CIQ)
Phase 3: Teacher Interviews	5 Teacher Interviews

Within the scope of this sequential mixed-methods approach, data collection tools associated with ‘typical’ qualitative and quantitative research were used. The mixed-methods approach allowed me, as researcher, to collect, rigorously analyse both qualitative and quantitative data and then integrate and link the two forms of data concurrently by combining and merging them, so that one builds on and embeds with the other (Creswell, 2011). Both forms of data were given equal priority in this study, and the procedure framed within the theoretical world views and conceptual lenses of self-determination theory and teacher agency.

While designing this mixed-methods study, I gave attention to three major issues that Creswell (2003c) identifies as requiring consideration: priority, implementation, and integration. I consider both quantitative and qualitative methods to be of equal importance (priority) within this study. The qualitative data provided a framework and model on which to make sense of the quantitative data, and the quantitative data in turn, opened up questions which necessitated review and (re)interpretation of the qualitative data. Although the study was implemented as a sequential mixed-methods approach, the subsequent analysis was more cyclical and iterative in nature. The integration of data by mixing and connecting

of quantitative and qualitative data occurred throughout the study and aided the depth of the analysis.

Further detail and rationale for development and utilisation of each of the research tools, and the procedures for the subsequent analysis of the data generated will be discussed in the following three sections, each relating to a specific phase of the study.

3.7 Phase 1: Qualitative component

This initial phase of data collection and analysis was an attempt to: (1) explore participants' views as to whether or not such short episodes of CPD had in fact had an impact on themselves / on their teaching practices. And so, acted to put a 'mark in the sand', providing me with an initial impression of possible impacts – particularly important in light of the plethora of earlier studies strongly suggesting impact was unlikely; (2) explore the factors facilitating or hindering changes to teaching practices.

Semi-structured interviews, a face-to-face verbal interchange (Fontana and Frey, 1994) were used as part of the process of exploring participants' views as to why CPD may (or not) have an impact on classroom practices, and to establish the conditions which may have influenced these changes. Semi-structured interviews were selected as this format ensured that my pre-planned questions could be

asked, yet at the same there was opportunity to ask follow up questions to elicit further information in relation to the key issues (Opie and Sikes, 2004) and in addition, it was possible to change the direction of questioning depending on participant responses (Drever, 1995).

To lead into the interview process and to create the 'interview context' (Silverman, 1993) an information sheet (Appendix 1) outlining the aims and nature of the research was sent to each of the participant teachers.

An important consideration within the interview process was the relative status between myself, as researcher, and the participants (Denzin, 1970). Interviews were completed in the participants' 'natural environment' (Wilson, 1996) – their school, and often the classroom in which they worked. This was an attempt to ensure the participants would feel more comfortable, and as a result likely to express their views more freely, leading to the discussion of substantive content which could help address the research questions. In addition, I always took the opportunity to ask introductory questions (Kvale, 1996) to promote a 'natural conversation'.

However, there was still variation in the way participants responded to interview questions. The majority of participants did in fact appear to speak freely, whilst others would seem to speak more reservedly, some would seek confirmation that their responses were 'correct' – perhaps telling me what they thought I might want

to hear. In these instances, I responded by reaffirming the purposes of the study, and reiterating, for instance, that I was not seeking 'proof' that engagement with an episode of CPD had resulted in changes to practice.

Interviews were transcribed on the same day as the interview whenever possible, and always within a few days of the interview. As soon as transcription was complete, participants received a copy by email, and were encouraged to check and verify that the transcript did provide an accurate record of their responses to the interview questions. This was part of the process of triangulation, and ensuring accurate subsequent analysis (Reason and Rowan, 1981).

3.7.1 Sample

The sample comprised nine randomly selected teachers. The only requirement of the random selection was that teachers were to have attended a CPD event no sooner than 6 months before the date of the interview. This sampling method employed procedural objectivity to ensure that subjective bias, at this stage, did not have a bearing on the validity of the findings. This method did result in the need for some considerable travel as the North East region of England encompasses a large geographical area. Nevertheless, for the purposes of seeking validity of the research findings this was an effort worth bearing.

3.7.2 Framework for design

The semi-structured interview questions were constructed specifically for this research project. The questions were based on an adapted version of Guskey's (2002) model, which provides a framework for the collection of data in relation to impact of CPD at five different levels.

The five levels of the Guskey (*ibid*) model was the first coherent evaluation scheme for professional development episodes in education (Bennett et al., 2011). Three other CPD evaluation models (Abell, 2007, Hahs-Vaughn, 2007, Muijs, 2008) are extensions of this scheme.

In summary the five levels of interest within Guskey's (2002) model, which provides a framework for evaluating CPD are:

- Level 1: participant's reactions to the CPD;
- Level 2: participant's learning as a result of the CPD;
- Level 3: organisational (i.e. school or department) role in support and change;
- Level 4: participant's use of new knowledge and skills;
- Level 5: effect on student learning outcomes.

Braund *et al* (2011) make the point that based on the reported frequency of evaluations by Guskian level, level 1 evaluations of CPD are most frequent

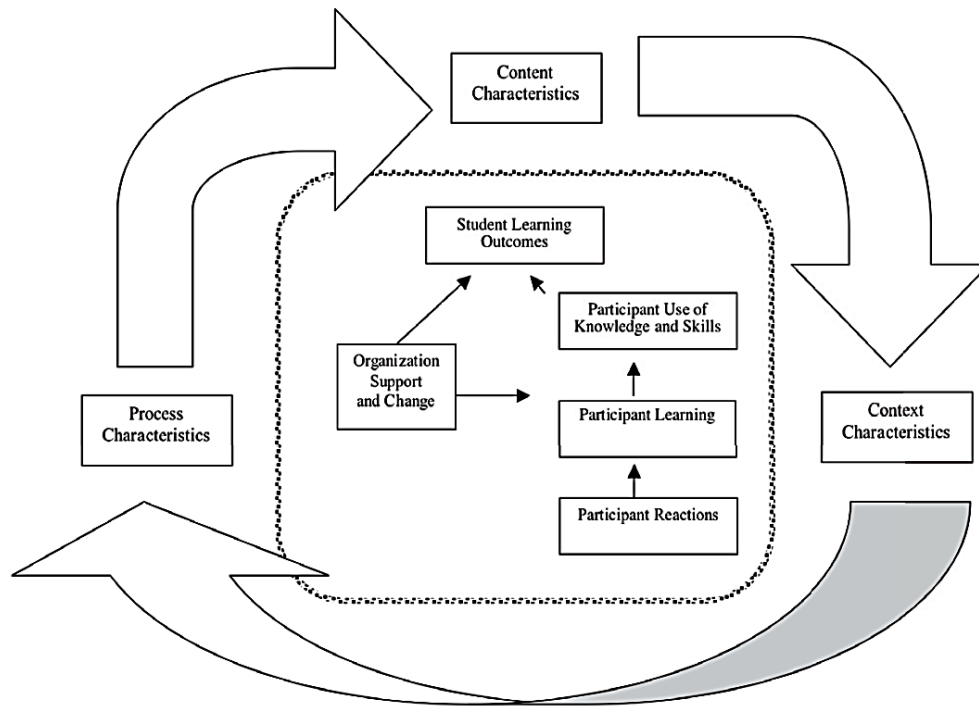
(Braund *et al*, 2011). This study, however, seeks to establish participants' perceptions of changes at all five Guskey levels. Although Guskey's evaluation model seeks to identify impact at various levels, for the purposes of this study the model needed to be extended to provide a framework to explore the conditions influencing CPD impacts on participants and on their teaching practices.

On the factors influencing the impact of CPD, Muijs *et al* (2004) make the case for the importance of 'pre-conditions' as being important influences on the subsequent impact on teaching practices. Preconditions include teachers' contextual factors, such as their motivations for attending, and their personal professional interests in the CPD workshop.

Hahs-Vaughn *et al*. (2007) combine Guskey's model with a Logical Evaluation Model (Rossi, 2004) to create a 'Hybrid evaluation model'. The hybrid model seeks to establish the effect of 'inputs' including CPD strategies and organisational support, directly impacting on 'outputs' of the CPD process, such as participants' satisfaction with the CPD, and their quality of learning. As well as the subsequent impacts on participants' practices and on student learning.

Abel *et al*. (2007) developed a model which identifies the influence of 'context' characteristics (including school factors), 'process' characteristics (such as how the CPD is administered) and 'content' characteristics (of the CPD itself), on the impact of CPD across all of Guskey's (2000) five levels.

Figure 4: An adaptation of Guskey's (2000) model (from Abel et al, 2007).

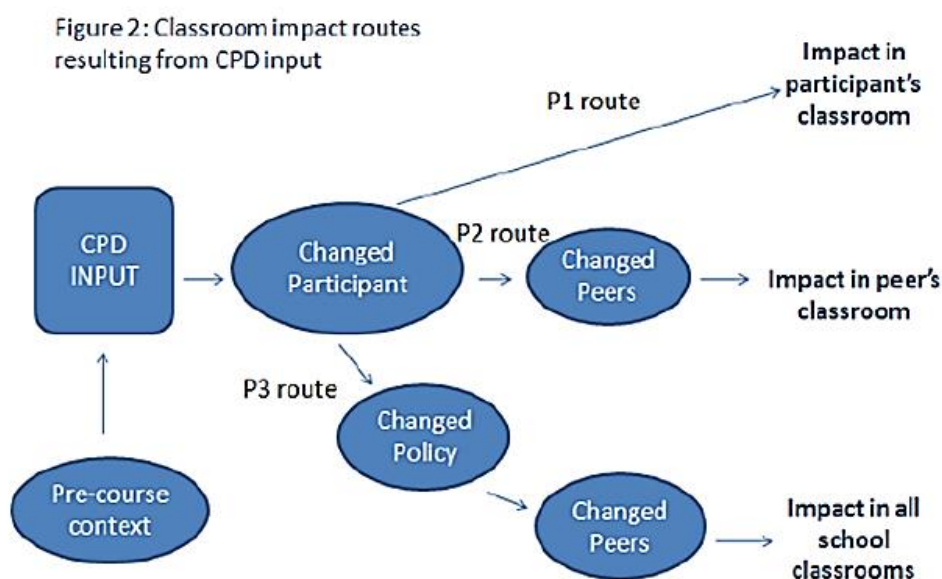


Significant within this model, is that in addition to establishing conditions impacting upon the outcomes of the CPD, Guskey's (2000) model level 3 outcomes (organisational support) are no longer positioned within the linear hierarchy. This is in recognition of findings, which suggest that teacher change is not explained through a linear progression of Guskey's hierarchy. Participant reactions to the CPD need not necessarily be positive for changes to practices to be enacted, this positivity can come later – once teachers have witnessed the value of changes to their practices. Moreover, Guskey's level 3 factors (organisational support), can condition and influence effects at all other levels. This model therefore not only provides a framework to consider impact at various levels but also seeks to

identify reasons for this impact. It is for this reason that this remained an influential model within the structure of the data collection methods within this study.

Bennett et al, (2010) propose the 'Classroom Impact Routes' model (Figure 5). Whereas Guskey's model mainly provides a framework for evaluating the impact on the participant's classroom, Bennett et al (*ibid*) differentiate additional trajectories for classroom impact (Bennett et al., 2011).

Figure 5: Classroom impact routes resulting from CPD input (Bennett et al., 2011)



Bennett et al (2011) routes of impact model, is also a useful model for consideration within this study, particularly in terms of establishing the nature and extent of change. The CPD may impact not just on an individual teachers'

classroom practices, but may be cascaded beyond the participants' immediate classroom environment, and may influence policy changes.

3.7.3 Pilot testing

I piloted an initial interview schedule to test the efficacy of the questions, and also to test my ability as an interviewer. As a result of this pilot testing, I reduced the number of key questions to six, with the flexibility to ask follow up questions, as appropriate. In this way, I was able to respond to the participants' individual circumstances. The interviews lasted approximately 20-30 minutes, and the views of the two participating teachers were that this was adequate for the purposes of discussing the impact of the CPD; and at the same time it did not overly impose on their other competing pressures and commitments. Based on this pilot, I considered the duration of the interview sufficient to explore the impact of CPD in appropriate detail, for this particular exploratory phase of the study. It became very clear to me of the need to ease into the interview questions, and the need to keep the interview as conversational as possible to ensure that teachers felt comfortable and not judged in terms of the extent of their use of CPD ideas and resources. A question on the interview schedule relating to the barriers participants faced when implementing CPD, helped to highlight to participants that there was acknowledgement on my part that any changes to practices following CPD was not an unproblematic process, and there may be a whole range of factors influencing any potential impact. This also seemed to provide some 'distance', so that should participants report lack of impact, this need not be viewed as a deficit on their part, or on that of the CPD provider. As a result participants appeared to

be quite comfortable providing, what seemed to be, open and honest accounts of impact processes.

The key initial exploratory interview questions, to begin the process of addressing the research question, are indicated below.

Phase 1 Initial Interview Questions:

- What effect has the course had on your practice? On pupils' learning?
(*Prepare to ask follow up questions on stages of use*).
- Why is that? (*Prepare to ask follow up questions on stages of concern*).
- Do you feel with more time either on the course or in school you would have been able to adapt the resources to suit the needs of your pupils?
- Which aspects of the course were the most useful in heightening your awareness of ...?
- Could the course be adapted in the future to help teachers prepare for implementing ... in the classroom?
- If you had to summarise the main facilitators or barriers to implementing ... what might that be?

3.7.4 Analytical framework: Inductive logic of qualitative study

In recognition that a multitude of factors within the CPD process and the school contexts are likely to influence changes to participants' practices, it was essential

to discover the perspectives of those CPD participants who will actually affect those changes. Specifically, it was important to understand the processes (Ambert et al., 1995, pp. 880-881) which led to any reported changes in classroom practices – an exploration of the reasons for the development of change, rather than a simple focus on the input (CPD) and output (changes to practice) measures. It is highly unlikely that within a population of teachers, that a single cause will explain changes to practice. Interpretations of participants' views and feelings of the conditions that influence change, were based on the data collected through these semi-structured interviews. This was an attempt at developing a depth of understanding about the situations that teachers consider were most influential in explaining change.

Interpretation of the captured data draws upon and requires inductive thinking processes. In a practical sense, interview transcripts were coded to reflect thinking and to identify key emerging themes. Coding and comparing transcripts to identify key links and concepts helped to provide a more comprehensive understanding of the research questions (Roberts, 2002), and so helped to develop an emerging understanding of the key processes influencing changes to practices following the CPD.

Interpretation of participants' accounts and the generation of an initial theory to explain the nature and extent of classroom change is an iterative, but also a reflexive process (Giddens, 1990, Soros, 1998). The model I generated as part of this phase of the study was revised and refined through several cycles of revisiting

the interview transcripts and their coding schemes, and testing out the models robustness, as well as exploring other possible explanations or interpretations of the processes leading to impact. This application of a grounded theory approach allowed me to explore the different layers of meaning in the participants' accounts.

Impacts were considered in relation to Guskey's adapted framework, and then through thematic analysis major themes were established across the interview sample. The major central theme emerging from the interview findings was that contrary to the consensus in the literature, short subject specific CPD courses can have an impact on teachers and on their teaching practices. However, these changes may take considerable time to become embedded and can depend on the curriculum content, the teacher's level of responsibility at the time of their attendance at the CPD workshop, and on whether a teacher gains additional responsibility at a later time, either within the same school or within a new school.

3.7.5 Phase 1 data coding and analysis

This phase of the study involved interviewing nine CPD participants, with the aim of exploring the impact of short-episodes of subject specific CPD on their practices, and to begin the process of identifying the conditions which influence the implementation of any such changes to practices. Each one of the interviews was transcribed, and then the interview data analysed through a sequence of initial coding, categorisation and sorting of the codes, and then finally synthesising these codes into key themes and theorising (Saldaña, 2015). Within this section, I will illustrate the processes by which Phase 1 data was analysed and interpreted.

Initial Coding

I began the process of analysis by examining each transcript to identify the initial codes to emerge from the data. I used Saldana's definition of a code '[A code] is a word, phrase, or sentence that represents aspect(s) of data, or captures the essence or feature(s) of data' (Saldaña, 2015). This worked as a pragmatic way to reduce the volume of data into a series of meaningful codes, which later in the process could be categorised. An example of an extract of the initial coding process is illustrated in Appendix 2. For the purposes of coding, I have placed the interview transcript into the left hand column of the table. The right hand column represents my attempt to reduce the data into a set of initial codes. This is a process that was completed for all nine transcripts.

Category and Concept Formation: Focused Coding

Once initial coding had been completed for each of the transcripts, I began the process of focused coding. This was an attempt to draw together the major categories emerging from the interview data. In practice this was something of an organic process in which initial codes were allocated and then often upon deeper reflection, and comparison across transcripts, could be reallocated to respective categories, which themselves were refined and adjusted, until a final set of categories emerged. Based on the analysis of Phase 1 interview data, the five emerging categories were:

1. Participants' engagement with, and outcomes of, CPD involve affective and cognitive outcomes.
2. The levels of knowledge and experience of people within the CPD process (both the participants attending, and those providing the CPD), influences the outcomes of the CPD.
3. Exemplification of practice and the degree of the curriculum fit of the CPD approaches is a key determinant of potential impact.
4. A lack of time, and competing demands on the participant diminishes the quality of the innovation and implementation of changes to practices.
5. School cultures and structures have a significant bearing on the manifestation of CPD outcomes.

As an example of how these five key themes are supported by the interview data collected within this phase of the study, I have illustrated an example in Appendix 3. Within the process of focussed coding (category formation), I transferred the initial codes into the left hand column of the table, and I then organised these in relation to the emerging categories – which are displayed in the right hand column.

Summary of Focused Coding

As with the process of initial coding, I also analysed each of the nine transcripts through 'focused coding'. Table 5 indicates the prevalence of the key themes (categories) across the range of interview transcripts.

Table 5: Focused coding (category formation) per transcript

Focused Code (Category)	Transcript No.
(1) Participants' engagement with, and outcomes of, CPD involve affective and cognitive outcomes.	1, 2, 3, 4, 5, 6, 7, 8, 9
(2) The levels of knowledge and experience of people within the CPD process (both the participants attending, and those providing the CPD), influences the outcomes of the CPD.	1, 2, 3, 4, 5, 6, 7, 9
(3) Exemplification of practice and the degree of the curriculum fit of the CPD approaches is a key determinant of potential impact.	1, 2, 3, 4, 5, 7, 8, 9
(4) A lack of time, and competing demands on the participant diminishes the quality of the innovation and implementation of changes to practices.	1, 2, 3, 4, 5, 6, 7, 9
(5) School cultures and structures have a significant bearing on the manifestation of CPD outcomes.	1, 2, 3, 4, 5, 6, 7, 8, 9

The Generation of Theory

The processes of initial and focused coding acted as formative stages in establishing the key emerging categories and themes. However, it was clear through listening to the participants, and reading through their interview transcripts, that the key identified themes interacted together in ways, which may help explain the extent of change following their engagement with the CPD. For instance, changes to teaching practices could not be accounted for by participants own interests and own perceptions of the value of the CPD alone. Even though CPD was considered by participants to be of good quality for reasons of expertise of colleagues administering the CPD, the opportunities for networking with peers,

and participants' exposure to and engagement with new resources and teaching strategies; it was the *interactions* between the participants and the cultures and structures of their schools environment, which the data suggested, had a particularly significant bearing on the extent of change. As an example, regardless of how interesting a participant might find a new resource or idea, the extent to which the new resource or ideas fits *directly* with the existing curriculum has a particularly significant bearing on its likely implementation. Universally within this Phase 1 sample, participants reported that they were provided with no additional directed time on their return to school, that they had competing professional priorities, and therefore had only limited opportunity to adapt or tailor the new CPD approaches to fit with the curriculum. Therefore, any adaptations or refinements to the new CPD approach were likely to occur over a longer timeframe. In order to capture these details, for each of the transcripts I produced a narrative summary to help provide an indication of how the interactions between participants and their school/classroom environments can account for impact. An example of a narrative summary can be found in Appendix 4.

(Initial) Generation of a Model to Explain the Impacts of Short-Episode of CPD

Following the iterative probes of qualitative data analysis, the detail of the interactions of various themes identified in the focused coding stages led to initial development of the model shown in Figure 16. This model was developed through analysis of findings from Phases 2 and 3 also. However, Phase 1 findings indicated that interactions of themes 1, 2, & 3, with themes 4 & 5 (as outlined in Table 5) can help to provide an explanation of the occurrence of initial changes to teaching practices, and also of ongoing further changes, refinements or evolution

of practices. I have defined these interactions as 'critical events', it is only when these critical events occur that changes in practice will likely occur. Within the immediate phase – the first six months following engagement with the CPD workshop, it is more than likely that there will be no change to teaching practices. This is despite the fact that participants may see the value of the new CPD approach, but lack of opportunity within the environment limits impact. Over a longer time-frame however, 'critical events' are more likely to occur.

Critical Events

The interview data suggested that participants' positive reactions to the CPD workshop were in no way indicative of when changes to practices would occur, or of the extent of change. The significant 'critical events' identified through initial analysis of the interview findings included: (1) interactions with the curriculum, (2) interactions within the school (culture and policy), (3) influences of a leadership responsibility. Whenever, any of these critical events moved into a favourable position e.g. (1) a curriculum link became obvious, or (2) innovative practices were encouraged by the school, or (3) leadership responsibility helped to affect change, then participants reported impacts on practices as a result. Remarkably, this impact could be delayed for several years (Participants 1 and 4), until a time at which a critical event occurred.

3.7.6 Summary of phase 1 analysis

Some change to teaching practices, as a result of engaging with a short episode of subject specific CPD, were reported by all participants within the interview sample.

However, there was significant variation in the length of the passage of time before changes to practices occurred. This 'delayed' impact can be explained by the constraints of the curriculum, or by school structures and cultures. Nevertheless, and quite remarkably, new teaching approaches gained as a result of CPD, appear to remain latent until an opportunity within the participants' environment support their use.

However, once new practices were implemented there was also a difference in the extent of use. Again this was explained by the extent of opportunity within the curriculum to embed changes, but is also influenced by the authority of the teacher leading on the change. In addition, differential impact can be partly explained by the extent to which participants value the suggested new practices, in the first instance: 'The time we invest [In implementing and adapting CPD approaches] depends on how good the idea is' (Participant 6).

The Phase 1 study findings suggest that changes to teachers' practices are likely to follow 'critical events' - facilitative interactions between the teacher and the environment in which they operate.

The initial analysis of Phase 1 findings was necessary to ensure Phase 2 of this mixed-methods study would build on these findings. Significantly, the notion of 'critical events', the facilitative interactions between the participant and their school environment is explored more fully in the next stage (Phase 2) of the study.

3.8 Phase 2: Quantitative component

The notion of the significance of critical events generated within Phase 1 of the study had an influence on the focus and structure of Phases 2 and 3 of the study. The Phase 1 findings, that the impact of CPD on teachers' practices was unlikely to occur immediately after the CPD workshop, unless the 'environmental' conditions are favourable was explored more fully. In addition, this phase of the study involved the collection of additional data, which through statistical analysis, led to the discovery of associations between a range of conditions of interest.

The data collection of this phase of the study required the development of two new research tools: a Teacher Efficacy & Expectations Questionnaire (TEEQ) (n=110), and a CPD Impact Questionnaire (CIQ) (n=80).

3.8.1 Participants' expectations of impacts

The TEEQs were developed to identify participant teachers' expectations of the likely impacts as a result of engaging with the CPD workshop. These questionnaires were designed to elicit data that could provide the basis of statistical analysis for exploring how various participant and school contextual factors might relate to participants' expectations of the nature and extent of change. As part of the process of collecting contextual information, the questionnaires also captured information in relation to participants' perceptions of their own teacher efficacy (Tschannen-Moran and Hoy, 2001). The TEEQs were completed by participants who had opted to attend a short one-off subject specific

CPD course, and were completed in advance of the commencement of the workshop.

3.8.2 Participant perceptions of impacts

CIQs were developed with the aim of establishing teachers' perceptions of the impact of the CPD on their own learning, on their practices, and on pupils' learning. The CIQs were also designed to provide sufficient data to explore associations between a range of contextual factors and the nature and extent of impacts. The CIQs included a retrospective pre-test (Lamb and Tschillard, 2005) and were completed no sooner than six months following the CPD event. The mean time of CIQ completion after CPD attendance was 2.9 years. The range of CIQ completion was 6 months to 5 years after the original CPD workshop. As with the TEEQ questionnaires, the CIQs also captured contextual background information in relation to the participants' and the schools within which they worked. Data collected through the CIQs were analysed statistically to detect indications of relationships between the context of the teacher and school, and the nature and extent of change.

3.8.3 Sample

110 TEEQs questionnaires were completed by randomly selected CPD participants. This helped to ensure that subjective bias did not influence the accuracy of the findings. This was also an opportunistic sample in that participants were randomly selected from groups of teachers who were in attendance at a subject specific CPD event. Those willing to take part in the study completed the

TEEQ as part of the registration process. The fact that teachers were in attendance at the CPD workshop suggested that they were likely to have specific expectations of the CPD.

80 CIQs questionnaires were completed by participants who had been randomly selected from an opportunistic sample. They included teachers who had returned for *another* episode of another subject specific CPD workshop. However, the focus of the CIQ related to a different – an earlier - CPD event to the one participants were currently attending. Participants were reminded of the aims and objectives of the earlier episode of CPD, and were then asked to report on the subsequent impact on teaching practices and pupils learning using the retrospective pre-test. One issue to be mindful of is that CIQ questionnaires were completed by participants who had returned for further CPD. It may be that a teacher who has returned for additional CPD, may hold different perceptions (may have more positive views) about the CPD, than for instance, a participant, who may not return.

In the case of both the TEEQ and CIQ questionnaire completion, participants were given a verbal and written explanation of the purpose of the study, and asked to self-complete the respective questionnaire, which took approximately 20 minutes to complete.

3.8.4 Framework for design – TEEQ.

The TEEQ was developed to establish participants' expectations of the likely impacts on teaching practices and pupils' learning following engagement with a short episode of CPD, and to explore associations between various contextual factors and participants' expectations of impact.

Muijs et al (2004) acknowledge the importance of 'preconditions' having a bearing on the likely impact of CPD on teachers' practices, and Abel et al (2007), identify the influence of contextual factors. One such contextual factor of significance is that highlighted by Grove (2008) who outlines participants' self-determination as significant in explaining changes to teaching practices. In order to add a further level of understanding (and to build on the work of Phase 1), a range of contextual background information was considered, including participants' perceptions of their teacher efficacy, and participants' motivations for attending the CPD. These areas have been identified as areas of significance in relation to understanding the processes leading to implementing changes to teachers' practices (Grove, 2008).

Motivation to attend the CPD in the first instance has been shown to be a significant factor in determining the likely success of any intended CPD aims (Grove, 2008). CPD endeavours in which teachers feel coerced to attend are less likely to be successful in achieving intended aims, than those in which teachers perceive themselves to be working with a higher degree of autonomy. In developing the TEEQ, questions were included to establish the extent to which participants felt personally and professionally motivated to attend the CPD.

The TEEQ also provided the opportunity to establish what exactly participants expected to 'take away' from the CPD, and what they anticipated the likely impacts to be. The TEEQ were completed before the teacher engaged with the CPD, so provided an opportune time to elicit participants' expectations, and their perceptions of the value of the CPD. This was important information to gather as Wigfield and Eccles (2000) report that teachers' 'choice, persistence, and performance can be explained by their beliefs about how well they will do on the activity and the extent to which they value the activity' (Wigfield & Eccles, 2000). Significantly within this study (Phase 1), is the view that a teachers' perceptions of the 'value' of the CPD approach may be influenced not just by their own personal professional interests, but can also be influenced by the nature of the curriculum and the school environment, and the authority they have to make changes. The TEEQ therefore provided the opportunity to examine exactly what teachers expected to gain from the CPD workshop, and their expectations of the nature and extent of impact on return to school.

In addition, self-efficacy is recognised as an important construct, which can influence the nature and extent of change to teachers' practices. 'Bandura formally defined perceived self-efficacy as personal judgments of one's capabilities to organize and execute courses of action to attain designated goals' (Zimmerman, 2000, p. 3). This is an affective outcome that has proven extremely important in teaching and learning situations (Tschannen-Moran, Hoy, & Hoy, 1998). In general, teacher efficacy is defined as teachers' belief or conviction that they can

influence how well students learn, even those who are considered difficult or unmotivated (Guskey, 1994, p. 628). An early, large-scale investigation on the implementation of new programmes found teacher efficacy to be the most powerful variable in predicting implementation success (Berman and McLaughlin, 1978).

‘Self-efficacy beliefs have also shown convergent validity in influencing such key indices of academic motivation as... level of effort, persistence, and emotional reactions (Tschannen-Moran et al., 1998) and (Armor, 1976, Ashton, 1984, Brophy, 1977, Guskey, 1988, Trentham, 1985) have produced similar findings. Schools can be busy and demanding environments, and as established in Phase 1 of this study, can influence a participants’ capacity to implement changes to teaching practices. Therefore, I designed the TEEQ to collect data in relation to teachers’ perceptions of their own teacher self-efficacy (incorporating, and adapting, the teacher self-efficacy scale developed by Riggs and Enochs, 1990), so that any associations in terms of their expectations of subsequent impact can be explored.

The TEEQ comprised 22 questions, with 136 items in total. In particular the TEEQ sought to establish:

- Details of participants’ professional background.
- Participants’ key motivations for attending the CPD workshop.
- Key characteristics of participants’ current teaching practices.

- Participants' perceptions of their teacher efficacy.
- Participants' expectations of the impacts of the CPD.

The majority of items on the questionnaire were either multiple choice or based on a five point Likert scale providing participants with a range of options in response to each question. Opportunities were also provided for open-ended responses in relation to a number of the questions. The final version of the TEEQ can be seen in Appendix 5.

3.8.5 Framework for design - CIQ

The CIQ was developed with the key aims of establishing the changes to participants' teaching practices and to pupils' learning following engagement with CPD. It also provided contextual information which could later be analysed to explore associations between the participants' context and the nature and extent of change.

Arguably, the most desirable impact is at Guskian level 5: the impact on pupils' learning. Establishing this would involve measuring impacts in terms of changes in pupils' knowledge, skills, attitudes, values, social or emotional development. However, isolating and objectively measuring the effects of any one CPD episode on pupils' learning is both challenging and problematic. Outside of Randomised Control Trials (RCTs) separating the myriad of potential causes and influences of changes in pupil outcomes remains a significant challenge. For these reasons,

teacher participants were encouraged to draw upon their own professional judgements to identify any changes to their teaching practices and pupils' learning as a result of engaging with the CPD. The retrospective pre-test helped to support reliability of findings.

As with earlier stage (Phase 1) of this study, an adapted version of Guskey's framework (2002) provided a basis for capturing participants' perspectives of the nature and extent of change. When considering the point made by Priestley et al (2015) that teacher agency is likely to emerge from an interaction between individual teachers and their environment, it was useful to expand the framework to capture detail of the participants' professional background, as well as information in relation to the context within which they work. Although this detail of the interactions is best explored through participant interviews in Phases 1 and 3 of this study, the questionnaires provided data which through analysis gave an indication of the associations between the influences of one (contextual) factor upon another (nature and extent of change). The interviews in the final Phase (3) of the study then provided opportunity to follow-up a further and deeper exploration of key questions raised in relation to patterns that emerged from Phase 2 and Phase 1 data combined.

The CIQ questionnaire comprised of 34 questions with 222 items in total. The intention of the survey questionnaire was to:

- Establish participants' reactions to the CPD (Guskey Level 1).

- Identify participants' learning from the CPD. (Guskey Level 2).
- Establish information related to the school structures and environment.
(Guskey Level 3).
- Identify changes to classroom practices. (Guskey Level 4).
- Identify impacts on pupils' learning. (Guskey Level 5).

And also:

- Establish details of the professional background of the participant.
- Establish participants' key motivations for attending the CPD workshop.

A copy of the overarching framework for the CIQ can be found in Appendix 6, and the actual exemplified version of the CIQ can be found in Appendix 7.

As with the TEEQ most items on the CIQ questionnaire were either multiple choice or based on a five point Likert scale providing participants with a range of options in response to each question. In addition, opportunities were provided for open-ended responses in response to a number of questions.

Establishing Participants' Reactions to SLC CPD (Guskey Level 1)

The premise of much CPD that aims to change teachers' attitudes, beliefs, or dispositions directly is that these affective changes will lead to change in school or classroom practices that will ultimately result in improved learning for students.

However, this “change in attitudes comes first” approach evolved in a large part from the work of early change theorists such as Lewin (1935), who derived many of his ideas from psychotherapeutic models. However, this sequence of change events has been challenged (Guskey and Huberman, 1995, Huberman, 1983, Huberman, 1984). According to Guskey & Huberman, (1995), Clarke and Hollingsworth (2002), significant change in teachers’ attitudes and beliefs occurs primarily after teachers see the actual benefits of the changes to practices, and gain first hand evidence of improvements to pupils’ learning. The crucial point is that it is not the CPD per se, but the experience of successful implementation that changes teachers’ attitudes and beliefs – teachers will believe that the CPD is effective once they have seen it work (Guskey, 1985, 1986).

Establishing participants’ reactions to CPD is important for determining whether participants’ felt their time was well spent and the experience worthwhile.

However, in the case of this study participants’ reactions may provide an indication of the nature and extent of change, particularly in light of the fact that participants’ reactions are gathered at least several months after the CPD workshop. At this point they are likely to have observed the effects that changes to practices may have had.

Establishing Participants’ Learning (Guskey Level 2)

Professional development is a purposeful and intentional process designed to enhance the professional knowledge and skills of teachers so that they might, in

turn, improve the learning of all students. Therefore, a critical component in this research study is to gather evidence on the new knowledge and skills that participants claim to have acquired as a result of their CPD experience. As well as reported changes in their attitudes and beliefs.

Implementing new ideas or practices effectively, is likely to require sufficient conceptual understanding on the part of teachers. They must know which aspects of a new approach are most crucial, and also must develop the capabilities necessary to make appropriate contextual adaptations. In the absence of such knowledge and skills, applications are likely to be mechanistic, and ineffective (Huberman, 1992).

The CPD of interest within this study had explicit aims to change participants' attitudes, beliefs, practices and teaching strategies. The CPD was designed to provide the opportunity for participants to be involved in 'next steps' action planning to ensure that they had the opportunity to consider how new practices and strategies could be aligned within their own individual classroom contexts. This is a common approach (Joyce, 1976). However, it is also recognised that as important as these procedures are, they rarely change teachers' attitudes significantly (Jones, 1980). The efficacy of action planning was analysed as part of the CIQ data.

The CIQ has been designed to gather data on the nature of participants' learning as a result of the CPD, including changes such as enhanced knowledge and skills, but also affective changes such as changes in their confidence levels.

Establishing Organisational Support and Change (Guskey Level 3)

Assessing participants' concerns about implementing change is a crucial part of this study, as identification of these concerns may help answer many 'why' questions related to use, partial use, or non-use of newly acquired knowledge and skills. Sometimes, the school environment may pose structural or procedural barriers to the implementation of new ideas or practices (Guskey, 2000).

Fullan, (1993) makes the point that 'Unfortunately for those interested in change, organisation cultures have a better track record of maintaining the status quo than they have of changing themselves. Some of the best and most promising improvement strategies have been seriously stifled or halted completely because of seemingly immutable factors in the organisation's culture' (Fullan, 1993).

The effects of CPD workshops may well vary depending on contextual characteristics of the school environment. Some of the most significant organisational factors influencing teachers' capacity to implement change have been identified as vision and leadership (McLaughlin, 1993, Purkey, 1983) collective commitment and cultural norms, organisational policies, protection from

intrusions, and provision of time, and physical resources. (Guskey, 2000). Therefore, a key part of the CIQ aimed to gather information in relation to characteristics of the participants' school environment.

Establishing Changes in Teachers' Practices (Guskey Level 4)

Establishing participants' use of new knowledge and skills and the determination of the extent to which these new practices are different to 'older' practices is another key focus for this study. The practices associated with the new knowledge and skills gained through the CPD experience may already be part of participants' teaching repertoire. Therefore changes to practices need not be large scale and transformative, but may be adaptive and evolutionary. Items on the questionnaire were designed specifically to identify a range of scales of change.

A major issue in establishing changes to practices is identifying new practices that are the result of the CPD itself, and not due to other, extraneous factors. Teachers work in complex environments where multiple factors affect their practices. Isolating the professional development experience as the true cause of change in practice is recognised as a challenging aspect in any research. Therefore, participants' retrospective views of the influence of the CPD on changes to practices will be gathered and analysed. Phase 3 interviews will provide further opportunity to explore these emerging findings.

A significant feature of the structure of this study is that it explicitly captures participants' views of the impacts of the CPD on pupils' learning experiences. Clarke and Hollingsworth (2002), case that significant change in teachers' attitudes and beliefs occurs primarily after they gain evidence of improvements in pupils' learning, is an important one. This is likely to be a significant contributor in reinforcing change in teachers' practices. Questions focusing on participants' perceptions of the extent of change on pupils' learning experiences have therefore been included within this questionnaire.

3.8.6 Pilot testing

Both the TEEQ and CIQ questionnaires were piloted. They each went through a series of trials and pilot testing based on a framework set out by Larossi (2006) which can be viewed in Appendix 8.

Piloting the survey in this way resulted in a number of small, but significant changes, to each questionnaire. I altered the wording of a number of questions to reduce ambiguity, and reduced the number of questionnaire items slightly so that each questionnaire could be completed within approximately 20 minutes, which was considered the upper-end of acceptable length of time required for completion.

3.8.7 Analytical framework

Both descriptive and inferential statistics were used to analyse the questionnaire data. Descriptive statistics have been used to summarise and represent the data as clearly as possible. A key part of this phase of the study involved exploring conditions which can have a bearing on the nature and extent of change. Data were analysed for co-variation. Inferences were drawn and interrelated factors explored so that relationships between the various contextual factors and the nature and extent of impacts could be explored, and discussed fully.

Within the study it was impossible and never the intention to physically control the variables under investigation. Neither the CPD nor the classroom situations were manipulated in anyway. Instead, I sought to study the 'natural' educational settings in an attempt to maintain ecological validity, and so the data were manipulated statistically.

Seeking to identify co-variance within the data helped to reveal possible connections. Although it could not be assumed that these connections were simple or direct. However, more than likely there are many other parts to the organismic web that connect any two data sets – but nevertheless establishing a possible connection is an important part of the analytical process. Phase 3 of the study provided further opportunity for probing the possible connections between the various connection which emerged through the analysis of the data.

3.8.8 Phase 2 analysis

Analysis of Phase 2 data provided the opportunity to establish participants' perceptions of the nature and extent of change following their engagement with the CPD workshop, and also the possible associations between contextual factors and impacts.

In particular, Phase 2 Analysis provided the opportunity to explore four key areas in more detail:

- The perceptions participants have of the value of the subject specific CPD they were attending.
- Participants' expectations and their reports of the nature and extent of change, following engagement with the CPD.
- How the nature and extent of change may be related to contextual factors within the participants' professional background.
- How school contexts might influence the change process.

Questionnaire Analysis

To ensure that Phase 3 interview schedules were designed to elicit a further level of detail to the overall study's findings, Phase 2 data required an initial analysis, to inform the process of the subsequent interview design. TEEQ and CIQ surveys were analysed through descriptive statistics and inferential co-variation analysis.

TEEQ Survey Analysis

The TEEQ survey data was analysed to provide information in relation to the professional background and details of the current teaching practices of the participants and how this might relate to what it is participants expected to gain from the CPD. In addition, this data provided the opportunity to analyse links between participants' professional background and their sense of teacher efficacy. In particular, descriptive analysis of the TEEQ data revealed the following:

Participants' Professional Background

- Including, Prior history of engagement with CPD, Length of teaching experience, Level of management or leadership responsibility at the time of CPD, Comfort level with teaching science, Influences on choice of CPD, Descriptions of current teaching practices, Views on restrictions of change.

Participants' perceptions of their Teacher Efficacy

- Descriptions of levels of participants' perceptions of teacher efficacy

Participants' Learning - Expectations

- Description of participants learning expectations.

Participants' Practice - Expectations

- Description of participants' expectations in terms of changes to practice.
- Expectations of how quickly resources, materials, ideas gained from the CPD will be used in practice.

Impact on Student Learning - Expectations

- Description of participants' expectations of influence of CPD on students' learning.

School Structures and Organisation - Expectations

- Description of participants' expectations of who else at school expected to benefit from the CPD.

In addition, I identified the co-variation between a number of the above factors. This was an important part of the analytical process, as factors that vary together are usually linked together in some way – albeit possibly through a complex interconnected web of interactions.

CIQ Survey Analysis

I analysed CIQ survey data for similar contextual background information to that collected with the TEEQ survey, but in addition data was analysed to provide descriptions of participants' reactions to the CPD, and to report on the impacts on their learning, on their teaching practices, and on pupils' learning. Specifically, the following items have been analysed:

Participants' Reactions to CPD

- How well CPD matched expectations.
- Extent to which CPD challenged teaching.
- General feelings about CPD course.
- Usefulness of CPD in terms of improving classroom practice.
- Effectiveness of CPD at improving pupils' engagement
- Likely sustainability of CPD.

Impacts on Participants' Learning

- Description of impacts on participants' learning.

Impact on Participants' Practice

- Description of impacts on participants' practice.

Impacts on Students' Learning

- Description of impacts on students' learning.

School Structures and Organisation

- Description of who else in school might benefit.
- Limitations or restrictors on how science should be taught.

In addition, as with the TEEQ data, I have explored the co-variation between various factors to identify possible interconnections between them.

3.8.9 Summary

The details of the full analysis will be explored more fully within the Findings and Discussion sections of this thesis. However, for the purposes of framing Phase 3 data collection of this study, the following findings from Phase 2 were particularly significant:

1. CPD which meets the individual needs of the teacher is considered highly important by the participant – more so than CPD which meets the needs of the institution.
2. Participants reported high degrees of teacher efficacy, before engagement with the CPD.
3. The vast majority of participants expected to share the CPD learning with colleagues.
4. A management responsibility is associated with perceptions of CPD as being useful to practice, with larger increases in student engagement and increased likelihood of sustainability of the implemented CPD approach.
5. Participants who considered themselves subject specialists are associated with more significant changes in teaching practices, compared to those who feel 'quite capable' of teaching science.

6. CPD which strongly met participants' expectations is associated with perceptions of CPD as being useful to practice, with larger increases in student engagement and increased likelihood of sustainability of the implemented CPD approach.
7. CPD that challenges existing teaching to a large extent is associated with perceptions of CPD as being useful to practice, with larger increases in student engagement and increased likelihood of sustainability of the implemented CPS approach.
8. Participants feeling very positive about the CPD experience is associated with perceptions of CPD as being useful to practice, with larger increases in student engagement and increased likelihood of sustainability of the implemented CPS approach.
9. Participants' concerns about implementation of new practices, is strongly negatively associated with perceptions of the CPD as being useful to practice. Concerns are negatively associated with potential to influence student engagement, or the likelihood of the sustainability of potential new practices.

I have produced the model in Figure 6, to summarise some of the emerging findings, which indicate the conditions which impacting on the nature and extent of change. The green highlighting indicates conditions facilitating changes to practices, the amber highlighting indicates conditions which bear some influence on promoting change, and the red highlighting indicates conditions which act to oppose change.

[illegible]

3.9 Phase 3: Interviews

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noteworthy constructs with which the conditions influencing the nature and extent of change on teaching practices can be understood.

Within this final phase of the study, I took the opportunity to explore the significance of Self-Determination and Agency, more explicitly. This phase of the study sought to gather data to establish the extent to which participants' perceptions of autonomy, competence and relatedness influenced the implementation of changes to practices within the socio-political school environment.

Participants were selected through purposeful and opportunistic sampling. They were teachers who had attended short episodes of subject specific CPD. Interviews were carried out between 1 to 5 years after they had attended the CPD.

Three individual teacher interviews were carried out, in addition; a fourth interview involving a pair (group interview) of teachers was completed. 'Such interviews are useful... where a group of people have been working together for some time or common purpose, or where it is seen as important that everyone concerned is aware of what others in the group are saying' (Davies and Preston, 2002).

3.9.1 Sample

The professional profile of the participants interviewed, is given in the Table 6.

Table 6: Phase 3: Interview sample

Participant	Role	Time since CPD
A	Science Teacher	1 Year
B	Science Teacher	1 Year
C	Science Teacher	4 Years
D	Assistant Head Teacher	5 Years
E	Head of Science	4 Years

3.9.2 Framework for design

The key framework for data collection tools designed within phase 1 and 2 of the study comprised adapted versions of Guskey's hierarchical model of impact. However, for this final phase I constructed semi-structured interviews to explore, in further detail, pertinent conditions which had influenced impacts on teachers' practices. Hence, for these particular interviews the details of the nature and extent of change provided the context for establishing the explanations of impact. Based on the earlier literature review, and the findings to emerge from Phase 1 and 2 of the study, the theoretical frameworks of Self Determination Theory (SDT), and Teacher Agency (TA) formed a basis for structuring this final phase of data collection and analysis.

The central tenet of self-determination theory is the concept of innate and universal psychological needs. The needs for competence, autonomy, and relatedness must be continually satisfied for people to develop and function in healthy or optimal ways (Deci & Ryan, 2000). The concept has proven essential

for making meaningful interpretations of a wide range of empirically isolated phenomena. (Deci & Ryan, 2000).

The following interview questions were adapted from The Basic Need Satisfaction at Work Scale has been used most often (Deci et al., 2001, Ilardi et al., 1993).

Establishing the Impact of CPD

- Can you tell me about the CPD you attended? What were the intended aims outcomes?
- How do you feel about it?
- Has the CPD had an impact on your own practice? What evidence could you offer for this?
- What are the factors that might have contributed to that impact?

Establishing Autonomy

- To what extent can you make inputs to decide how your job is done?
- To what extent do you feel you can be yourself at work?
- How autonomous do you feel in your classroom?

Establishing Competence

- To what extent do you get feedback that you are good at what you do?
- To what extent do you learn interesting new skills on the job?
- To what extent, on most days do you feel a sense of accomplishment when working?
- To what extent do you feel competent at what you do?
- Do you get the chance to show what you are capable of?

Establishing Relatedness

- To what extent do you like the people you work with?
- To what extent do people at work like you / friendly towards you?
- To what extent do you like, feel obligation, to the pupils to teach?

Communities of Practice

- To what extent are approaches that directly impact on student learning important?

- To what extent is intellectual renewal/ curiosity important?

The questions were part of a semi-structured interview, which allowed the opportunity to ask follow up questions, to develop a deeper understanding of the key issues to emerge.

3.9.3 Pilot testing

Key aims in this particular pilot were to ensure that the questions were appropriate in that they gleaned a sufficient level of response, and to ensure that the questions were sufficiently probing. Questions eliciting an understanding of motivation and self-determination relate to the psychological needs of an individual participant, and not to an 'external' impact of CPD itself. Therefore, care was taken to ensure questions were asked sensitively. One teacher colleague was selected by convenience sampling. It became clear that with an earlier version of the interview questions, the meaning of some of the questions could be too ambiguous – with the teacher often asking for clarification. In addition, there were initially too many questions, and some of the questions elicited responses which could be seen as somewhat too 'political' – and perhaps critical of their school environment. To ensure that the interviews became more 'naturalistic' and more neutral, I reduced the number of key questions and checked these for clarity. This provided further space within the interview to ask follow up questions. The interview length was 40-60 minutes long. These were longer than Phase1 interviews, but this length of time was required to explore the key questions in depth. As with earlier Phase 1 interviews there was a need to ease into the interview process, to help ensure that

the interview was unthreatening, naturalistic and conversational, helping participants to feel comfortable. This was achieved, in part, with a review of the CPD workshop that participants had attended, and a conversation around the impact as a result of their engagement with the CPD. This approach provided the climate and groundwork for the discussion of the mediating factors that had influenced this change.

3.9.4 Analytical framework

Within this third and final phase of the study, interview transcripts were analysed in the same way as those in Phase 1. In addition, within the reflexive process of interpreting findings the data and findings of earlier stages of the study were also taken into account within the iterative process of theory generation. This process of generating a 'thick description' of the context has been explained by Denzin as:

'It goes beyond mere fact and surface appearances. It presents detail, context, emotion and the verbs of social relationships that join persons to one another. Thick description evokes emotional and self-feelings. It inserts history into the experience. It establishes the significance of an experience, or sequence of events, for the person or persons in question. In thick description the voices, feelings, actions, and meanings of interacting individuals are heard' (Denzin, 1989, p. 83).

Participants' narrative or stories of processes leading to changes in classroom practices consist of a multitude of layers, which can be interpreted at an individual, community, or political level. However, at first glance a range of issues may be attached together and presented as a single clear cut issue, and without careful in-depth interpretation, may confirm 'the myth of single causation' (Westerlund and Sjostrand, 1979). The interpretative process presented an opportunity to explore a

range of other possible meanings. Accounts provided through interviews were interpreted against participants' specific and often unique contexts (Wolcott, 1994).

3.9.5 Phase 3 data coding and analysis

This final phase of data collection and analysis formed a particularly strong part of the study process. Phase 2 & 3 analysis had suggested the variation in the nature and extent of change following engagement with CPD may well be explained by the professional background of the participants, and the school context.

In combination with the earlier phases of analysis, Phase 3 data provided the opportunity for further deeper exploration of the research questions. In particular, the role of a participants' self-determination within the CPD process, and the relationships between the various psychological needs of self-determination and interactions within the school environment at all stages of the CPD process.

Each of the transcripts were coded, sorted into categories, and synthesised, so that key themes and theory could emerge.

Initial Coding: Value Coding:

An example of a segment of a coded transcript is included in Appendix 9. I employed 'value coding' (Saldana, 2013) in an attempt to capture the attitudes, values, and beliefs of teachers in terms of how they viewed the importance of their perceptions of autonomy, competence, relatedness, within the CPD process. I have included codes to help capture the essence of the point made by the teacher,

reducing the size of the data to aid categorisation. At various points, I have also added my own comments, which began the process of axial coding (Saldana, 2013) drawing together some of the relationships between the data. Finally, I sorted and categorised the key themes to emerge from the transcript, and have indicated these underneath each transcript.

Sorting:

Once each of the transcripts had been initially coded, the key categories were sorted, as in the example below - which illustrates two of the key categories to emerge from the full transcript of the segment shown Appendix 9. An example of sorting is illustrated below:

Key Emerging Category: CPD should support teachers' feelings of autonomy and professional judgement.

Related coding within the transcript:

- CPD should be more than telling teacher 'what to do', the system should allow for the teacher to use their professional judgement about how to adapt and refine practices as necessary.
- Levels of autonomy are related to experience and knowledge.
- Teacher views that the educational environment is constantly changing. Yet, CPD approaches can be ongoing (e.g. not lost with curriculum change), as teacher sees value.
- Engagement with CPD can be motivated through seeking a change of routine, as much as it can be inspired by wanting to improve teaching and learning of pupils.

Key Emerging Category: Importance of Professional Knowledge, and need for Reassurance within the CPD process.

Related coding within the transcript:

- Teacher receives positive feedback from observations and from pupils. Yet, remains uncertain as to whether this counts as good feedback. Still needs reassurance.
- Recognition that knowledge and experience impact positively pupils' learning, and also facilitates engagement with the CPD process.
- Perceptions of feeling judged are considered to be reasons preventing teachers from collaborating.

I then compared and related each of the full range of key codes to emerge from the interview transcripts together, and these overarching themes are discussed in detail, within the Findings and Discussion chapters.

Synthesising and Theorising:

Table 7 below summarises some of the pertinent points to have emerged within each phase of this study.

Table 7: Research findings summary

RQ1. To what extent does subject specific CPD impact on practice?		
Phase 1: Interviews	Phase 2: Surveys	Phase 3: Interviews
Majority of teachers reported that SLC CPD has had an impact on their own, and colleagues, teaching practice, although this was 'mechanical' or 'routine' (Guskey, 2000)	95% of teachers considered the CPD to be at least 'quite useful' at improving practice, whilst almost half (49%) considered the CPD as 'very useful' at improving practice'.	Changes made in closer proximity to the CPD workshop are likely to be 'mechanical' – closely resembling those explored within the workshop.
The impact of CPD is not always immediate (only one-third is). Impact may occur several months, or even years following the course.	85% of teachers considered CPD to be at least 'quite effective' at increasing students' engagement with science, with almost one third of the sample (31%)	Changes to practices can become refined and adapted over time, as teachers' reflect upon the implementations to practice, and adapt these in light of professional judgement or changing curricula.

<p>Impact on practice could be immediate when;</p> <ul style="list-style-type: none"> * teachers feel they have autonomy to implement change. * teachers feel they work in 'supportive' departments. * resources provided on the day of CPD have direct application to the curriculum. 	<p>considering the CPD to have been 'very effective' at increasing students' engagement.</p> <p>A key emerging theme was the aim of <i>extending</i> knowledge to <i>continue</i> to engage students.</p> <p>Only one third of teachers (36%) implemented changes straight away. Almost half (48%) implemented changes later in the term. 12.5% of teachers implemented changes later in the year. With 1% of teachers implementing changes several years later.</p> <p>Only 2.5% of teachers felt this CPD would not be sustainable in the long term.</p>	<p>Changes to practices impact on teachers, by providing enhanced professional interests.</p>
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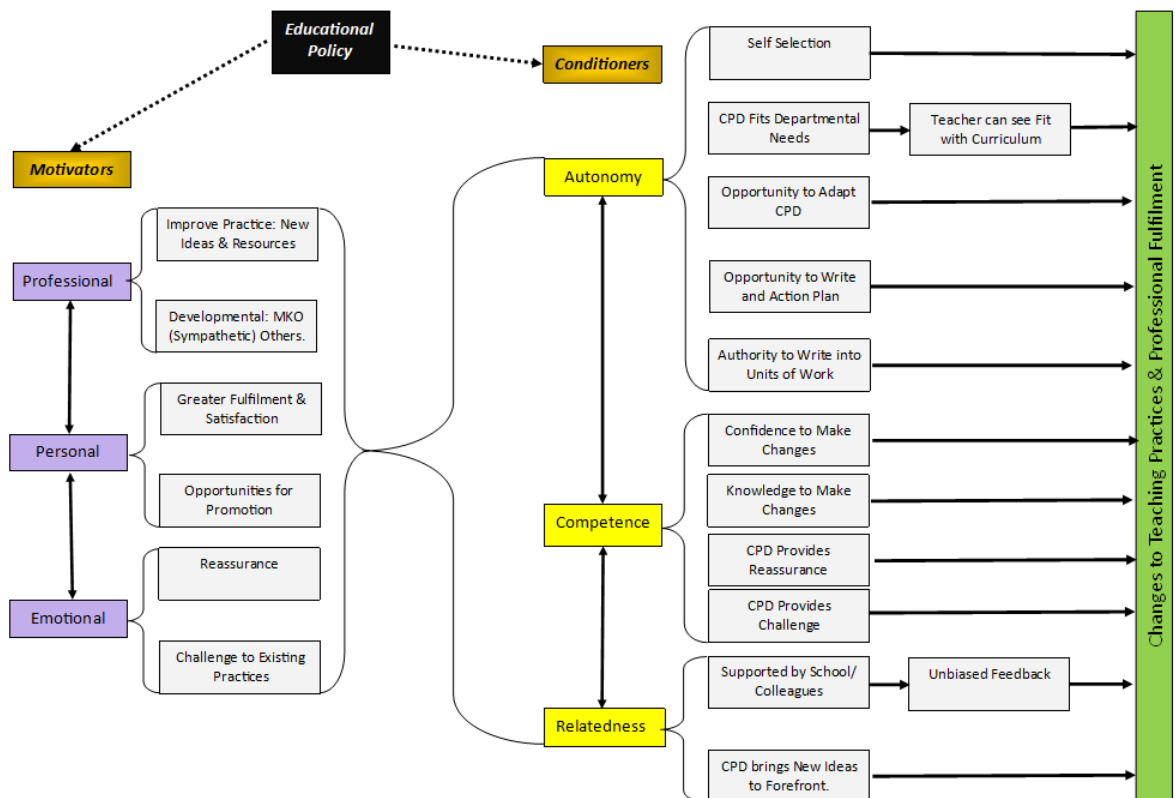
RQ2. What are the conditions that influence the nature and extent of change?		
Phase 1: Interviews	Phase 2: Surveys	Phase 3: Interviews
<p>As teachers' circumstances change over time e.g. more autonomy e.g. through promotion, or change of school. Or change in school policy, then</p>	<p>88% of teachers considered the CPD matching their own identified needs as being at least quite important, with almost two-thirds (65%) identifying own needs (autonomy) as very</p>	<p>A teacher's perceptions of autonomy, competence, and relatedness influence the nature and extent of change.</p>

<p>impacts of CPD often continue, and influence of impacts can extend into colleagues practice.</p> <p>Where departments or schools were not considered to be supportive (lack of relatedness), there was very little evidence that ideas and resources discussed on the day of the CPD are adapted to fit with curriculum, if they did not already have a direct curriculum link.</p> <p>In the majority of cases when circumstances change i.e. new curriculum, and there is a clearer fit with the curriculum then teachers will utilise these ideas and resources</p>	<p>important.</p> <p>CPD that addresses own identified needs (autonomy) and of help to other teachers (relatedness) was considered to be the most important choice in selection of CPD.</p> <p>Teachers, before attending CPD, already considered their existing practice to be 'quite good' overall, and pupils to be learning 'quite effectively' overall (competence). Teachers considered themselves to have 'high' levels of teacher efficacy, overall (competence).</p> <p>It was considered that there was 'little' restriction when implementing chosen practice (autonomy).</p> <p>Statistically significant factors corresponding to CPD impact included:</p> <ul style="list-style-type: none"> • Teachers having a management responsibility (autonomy and competence) • CPD meeting teachers' expectations (autonomy). • CPD Challenging 	<p>Cultures of performativity, and issues of trust, influence the change process.</p> <p>The extent of change e.g. influence change beyond the individual's classroom is highly dependent on receptiveness of colleagues.</p> <p>Authority (leadership responsibility) facilitates change.</p>
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	<p>existing teaching to a <i>large</i> extent (competence)</p> <p>Analysis revealed that Competence, Autonomy, and Relatedness, were conditions influenced or supported in the CPD process- in the cases where CPD impact was reported.</p>	
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In an attempt to draw together some of the major themes a result of radial analysis of data within all three phases of the study, I developed the model in Figure 7 below. This model highlights the various personal factors, set against a backdrop of educational policy, which have emerged from the study as significant within the change process. The model should be read from left to right. The categories highlighted within the grey boxes have emerged as important factors in terms of participants' motivations to engage with the CPD in the first instance, or as conditions which are important in explaining the ensuing changes to practices.

Figure 7: Model of personal and professional interactions within the CPD process



In addition, the feelings of autonomy, relatedness, and competence can be interrelated, and this is a point that will be discussed more fully in subsequent chapters.

A key overarching point to have emerged from the analysis is that the school environment bears heavily on the extent to which a teacher feels autonomous, competent and related within the CPD process. These perceptions are shaped and influenced by the educational policy, which manifests within the school environment. For instance, if a teacher feels they have autonomy to adapt the new teaching approaches to work within their own classroom context, then changes in

practice are more likely. However, the opportunity to adapt approaches is still heavily influenced by school contexts.

3.9.6 Initial analysis summary

Based on findings from this study, there is evidence to suggest that there is a pervasive determination for teachers to become 'better' teachers and to make use of 'new' ideas, and that short CPD workshops can have a role to play. However, teachers' motivations to engage with CPD, and their capacities to implement changes to practices, are heavily influenced by the socio-political school environment. Evidence generated within this study would suggest that these socio-political cultures do not always reflect the educational imperatives of the teachers themselves, and this has a bearing of how changes to practices are implemented. These are issues which will be discussed in much fuller detail within the subsequent Findings and Discussion chapters.

3.10 Summary

Within this chapter, I have outlined the processes by which the data were collected and analysed. As this study comprises a sequential mixed-methods approach, the content of this chapter was structured within three key sections to reflect each stage of the study. Each section has addressed an explicit phase of the study.

This sequential mixed-methods approach was designed to harness the benefits of both qualitative and quantitative research paradigms in order to establish the

impacts and factors affecting the impacts, of one-day subject specific CPD workshops.

During the course of the study, the research sample has comprised:

- 9 teachers selected for interview. (Phase 1).
- 110 teachers randomly selected for TEEQ (Phase 2).
- 80 teachers randomly selected for CIQ (Phase 2).
- 5 teachers selected for interview (Phase 3).

I have worked to ensure that the data collected is valid and reliable, and potential limitations have been discussed.

The next part of this study, the Findings and Discussion chapters, are not structured in the same sequential way as the phases of the mixed-methods approach. Each subsequent Discussion chapter will instead explore the key themes to have emerged from the study, and will draw upon data from each of the three methodological stages to support the quality and robustness of the discussion.

Chapter 4: Findings & Discussion 1: The Impacts of Short Subject Specific CPD Workshops

4.1 Introduction

The findings and subsequent discussion within this chapter have been drawn from the preceding analysis of participants' interviews, questionnaires and course documentation. In this chapter, I draw together the relevant data collected and analysed during the three phases of my mixed-methods research approach. It will act to provide a focus for considering the first of my research questions: an exploration of the extent to which one-day science subject specific CPD courses affected teachers' practices. After a brief overview, I will discuss this issue of impact on practices through three major themes, which emerged from the data sets.

Findings from the study suggest that even following a short episode (one-day workshop) of subject specific CPD, valued changes in pedagogy and classroom practices are reported by participants. The teacher participants reported wide ranges of benefits to their teaching practices, and to pupils' engagement and learning.

The most significant changes to teachers' practices following the CPD are reported to be the following: increased knowledge of activities or resources to use in teaching; increased knowledge of activities or resources to help colleagues (with their practices); increased confidence in ability to make the most of teaching

resources; increased confidence in participants' own ability to acquire interesting resources; and increased confidence in ability to boost pupils' confidence.

As a result of enhanced knowledge of new activities and resources, participants within this study reported that the pupils they taught benefited in a number of ways. Specifically, pupils were more willing to discuss science; pupils showed a greater interest in science; pupils were more engaged in practical activities; pupils' attitudes to science improved; and pupils showed a greater motivation to succeed in science.

However, whilst participants reported gains in pupils' affective outcomes, in particular pupils' interests and attitudes and engagement with science, similar positive gains in academic attainment were not reported to the same extent.

Also significant, was that as well as reporting changes to their practices, participants also reported *affective* changes, such as enhanced feelings of confidence, and professional satisfaction. Notions of enhanced professional satisfaction were supported through participants witnessing enhanced pupil outcomes, but also more prosaically through the act of trying out something new – by trying out new activities and resources, which they may not have done had they not attended the CPD. Not only did participants report an increase in professional satisfaction because of attending the CPD, but it was also suggested that seeking enhanced professional satisfaction can be a motivation for attending the CPD in

the first instance. Suggesting that, although positive benefits to pupils' engagement and learning remain an important outcome of CPD, these desired outcomes are also coupled with participants' desires to satisfy their own affective emotional outcomes - to enhance their own professional interests. Participants' personal affective outcomes emerged as an important part of the CPD process, in that feelings of increased confidence or the feeling of intellectual rejuvenation brought about by having access to 'new' ideas, which they feel empowered to use, can help drive change.

Findings from the study suggest that small changes to teaching practices can lead to participants' perceptions of significant impacts. New practices, or resources, gained because of engagement with the initial CPD workshops can be refined and modified over time, and so may not always remain recognisable, compared to the original teaching approaches and resources, explored within the initial CPD workshop. This evolution of practices and resources is an important process in ensuring that 'new' approaches are adapted in response to unique school contexts. However, it can make the process of identifying the impact of CPD more difficult to detect, if one is looking for the 'original' CPD approaches in practice. This presents an important case for the value of teachers' professional judgement and their professional views of the impacts of CPD. The CPD participant is in a unique position to help unpick and trace the subtle and perhaps otherwise hidden changes to practices, which occur within a complex and dynamic classroom environment.

Participants tended to underestimate how long it would take anticipated changes to teaching practices to occur. For instance, the majority of teachers surveyed on the day of their attendance at the CPD workshop reported that they expected changes to teaching practices to occur immediately after the course. Whereas in fact the majority of actual (rather than expected) initial changes to practices occurred later in the school term, or even later during the academic year. This biggest determinant of time taken until the initial implementation of changes to practices was the occurrence of an appropriate fit between the content of the curriculum, and the suggested CPD resources or practices.

Once participants had made changes to their practices, they reported that these changes were highly likely to be sustained over time. Moreover, the passage of time provided further opportunity for cycles of enactment and reflection (Clarke and Hollingsworth, 2002) leading to refinement and adaptation of resources and practices. Adaptation of, or sharing of, new practices is hastened by exposure to critical events, which can include a change in the curriculum, a change in teachers' leadership responsibility within the school, and participants' evaluation of the effectiveness of those initial practices.

This chapter is structured around the three major sub themes of Research Question one, so that the nature and extent of impact can be discussed in detail.

Key Theme	Page
Participants' perceptions of the nature of change (4.2)	175
Participants' perceptions of the extent of change (4.3)	205
Participants' perceptions of changes over time (4.4)	217

4.2 Participants' perceptions of the nature of change

A starting point for a discussion of the nature of change following teachers' attendance at a CPD course is to consider the aims of the CPD itself. CPD is a conscious effort (Day, 2004b) to bring about change. The CPD discussed within this study takes the form of short (one-day) science specific structured workshops.

This first section will focus on participants' perceptions of the nature of change following their engagement with the subject specific CPD. A particular emphasis by the designers of the CPD is to support changes to teachers' practices and pupils' engagement and learning. As has been outlined (in Chapter 3), a modified version of Guskey's (2002) model has provided a useful framework for analysis.

Furthermore, unlike earlier models of teacher change, Guskey's model shows how teachers' affective changes (change in beliefs and general feelings about the effectiveness of the CPD) alters only after they have experienced valued changes in practice and pupils' learning. The earlier models of teacher change suggest that these affective changes happen immediately following engagement with the CPD.

More recent empirical findings (Clarke and Hollingsworth, 2002), also support the notion that teachers' affective changes are not so easily manipulated. Teachers will use their own professional judgement to evaluate the impacts of CPD, before changing their attitudes and beliefs about it.

Changes to practices, can only ever be mediated *through* the classroom teacher, who happens to be positioned within a complex web of personal, social and political factors. My findings suggest that any model of teacher change must acknowledge the personal resources the teacher brings to the CPD process and the consequent influences of the social and environmental interactions within which they work. Chapters 5 and 6 will explore, in more detail, the influences of the socio-political environment on teachers' practices.

In this section, I will discuss the study's findings in relation to, participants' perceptions of the nature of changes because of engaging with the CPD. The fact that these were collected 2.9 years (mean average) after the course occurred, makes these findings particularly noteworthy. Particularly when considered in relation to models of teacher change (Clarke and Hollingsworth, 2000) which indicate the significance of ongoing cycles of enactment and reflection of practices.

4.2.1 Participants' reactions to the CPD: Participants' beliefs and attitudes

Aubrey (1988) highlighted the challenges of establishing the nature and extent of change following CPD. Without question, the task of objectively untangling the impact of CPD against a background of a complex social world incorporating multiple influences is a major challenge. It is for this reason that the CPD participants' professional and informed perceptions of the nature and extent of change will be considered and discussed.

One of the participants interviewed as part of Phase 3 of the study outlined the purpose of CPD, as she sees it:

"I think that, the whole point of CPD is to bring things to your attention, you don't necessarily have to use them. It's brought it onto your radar then you can adapt it or you cannot use that, or you can use a different one, or you can pick and choose, it's about giving you a toolkit isn't it, so that there are different tools at your disposal". (Participant C)

There is much within this statement that aligns with the original aims of the CPD, particularly the notion of ideas being brought to teachers' attention and then the opportunity to try out a number of these ideas in practice.

Teachers attend CPD courses with various needs and expectations. As attendance at the CPD course requires a choice of selection, booking a place on the course, and then participation within the workshop, it is likely that teachers' expectations of the likely outcomes are related to their needs. Although there were no specific questions within the questionnaires, which asked about what exactly

participants felt they ‘needed’ from the CPD workshop, they were asked about their expectations - what they hoped to gain. The results are listed in Table 8:

Table 8: Participants’ expectations of their own learning (n = 80)

Participants Learning Expectations: Ranked	Number	%
Resources or ideas to use in my teaching	71	88.75
Resources or ideas to help colleagues	65	81.25
Knowledge of teaching strategies	64	80.00
Subject Knowledge	51	63.75
Networking with other teachers	51	63.75
Clarification about policy, curriculum, or practice	37	46.25
Assessment	33	41.25
Other	1	1.25

Over 80% of participants reported that they hoped to gain knowledge of teaching strategies, and resources or ideas to use in their own teaching or to help colleagues.

Participants’ satisfaction ratings of the CPD in terms of the extent to which it met their expectations was very high, this can be observed in Table 9 below.

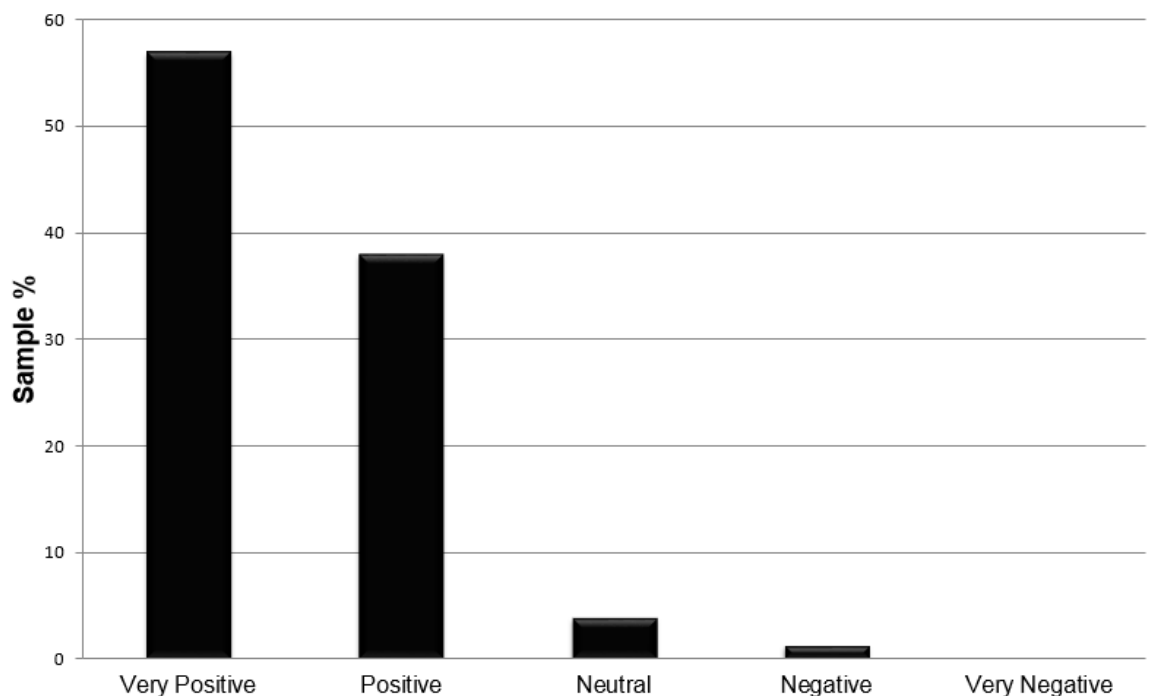
Table 9: Extent to which CPD matched participants’ expectations (n = 80)

How well did CPD match your expectations?	Number	%
Very good match	47	59.49
Good match	29	36.71
Poor match	3	3.80
Very poor match	0	0.00

96% of participants considered that the CPD provided at least a 'good' match to meeting their expectations. 60% of participants considered that the CPD provided a 'very good match'. From this, it may be assumed that participants had in fact enhanced their knowledge of teaching strategies, resources and ideas that they could use in their teaching as a result of attending the CPD workshop.

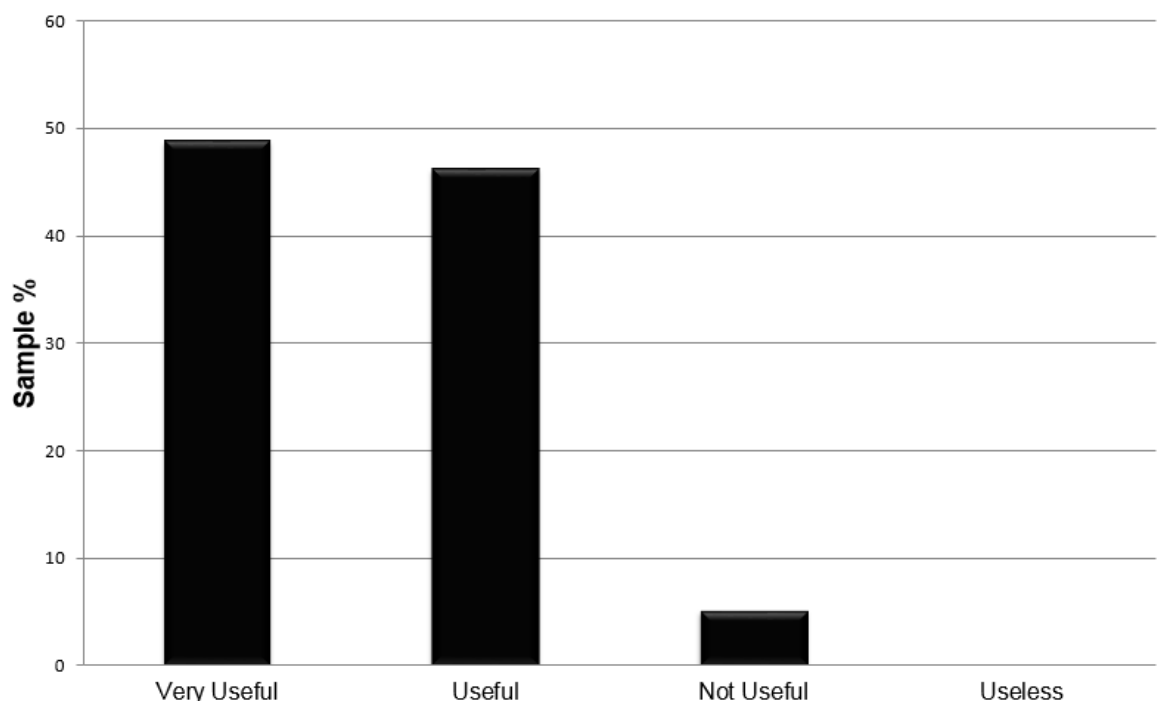
Moreover, participants' general feeling about the CPD were overwhelmingly positive, as can be seen in the graph below.

Figure 8: Participants' general feelings about the CPD



Unlike many attempts at evaluating CPD to gather teachers' reactions, this data was not collected on the day of the course, but was collected an average of 2.9 years after the CPD workshop. For such positive feelings to persist it is highly likely that teachers have witnessed the benefits of the CPD. This is an assumption based on findings of Guskey (2002) and Clarke and Hollingsworth (2002) who report that teachers will value the CPD once they have seen the merit and value of the actual implementations in practice. That is teachers enact and reflect upon strategies, the effects of which, will inform their general feelings about the effectiveness of the CPD. Therefore the data presented in the two charts in Figure 9 and 10, is informed by teachers' actual experiences of trialling the CPD strategies, and observing its effects.

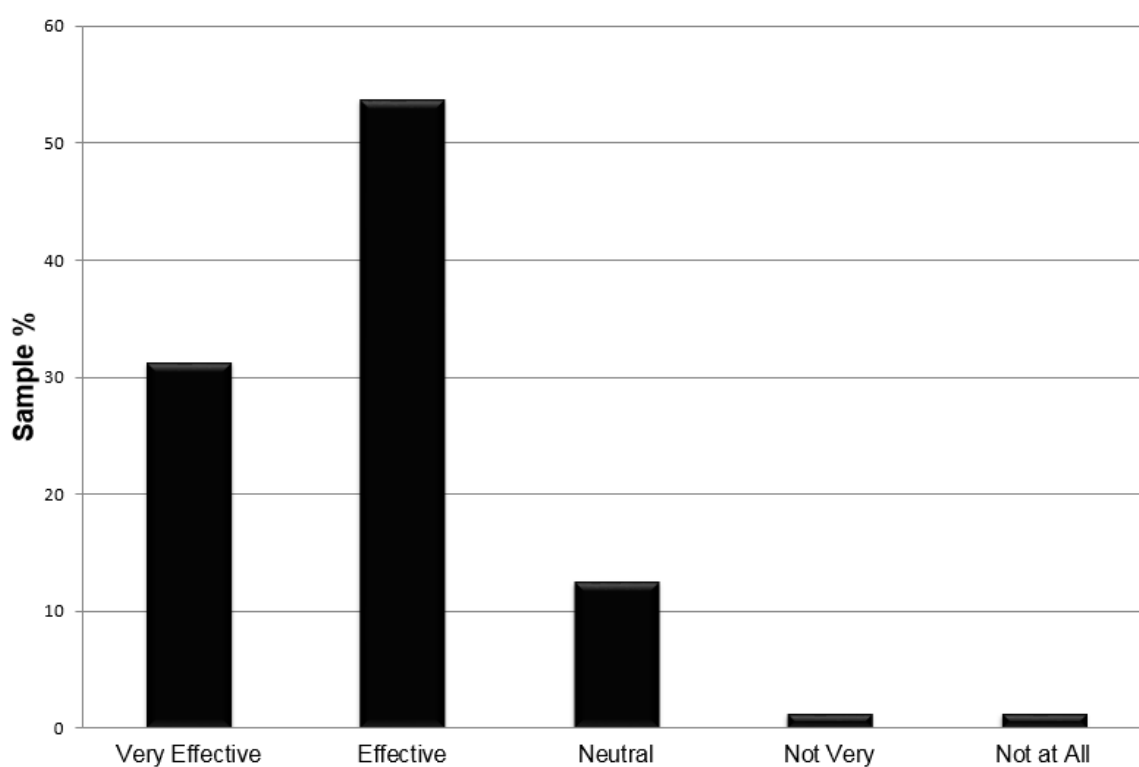
Figure 9: Usefulness of CPD at improving practice



95% of participants considered the CPD to be at least 'useful' at improving practice, whilst almost half (49%) considered the CPD as 'very useful' at improving practice'.

The chart shown in Figure 10 provides a similar indication of participants' views, this time in terms of the perceived effectiveness of the CPD strategies at increasing pupils' engagement with science.

Figure 10: Effectiveness of CPD at increasing pupils' engagement with science



85% of participants considered CPD to be at least 'quite effective' at increasing pupils' engagement with science, with almost one third of the sample (31%)

considering the CPD to have been ‘very effective’ at increasing pupils’ engagement. 13% of the sample felt it had neither been effective nor ineffective, with 2.5% considering CPD to have not been effective.

Participants’ reactions to the CPD process take on a particular significance within this retrospective study. As previously mentioned Guskey’s (2002) model of the teacher change, indicates that positive reactions to the CPD process are likely to align with positive teachers’ perceptions in terms of their learning, and of subsequent changes to their practices. The next section will explore teacher perceptions of their learning in further detail.

4.2.2 Changes in participants’ learning

Participants’ perceptions of changes to their learning was captured through the questionnaire data. The series of tables below highlight the key reported changes:

The table below indicates the reported changes to participants’ subject knowledge.

Table 10: Subject knowledge changes (n = 80)

Changes in Subject Knowledge?	Number	%
Not at all	9	11.25
A little	16	20.00
Partly	18	22.50
Quite a lot	33	41.25
Highly	4	5.00

89% of participants reported at least some subject knowledge changes as a result of attending the course. 46% of the sample reported that their subject knowledge had changed 'quite a lot'.

The table below indicates the reported changes to participants' knowledge of teaching strategies.

Table 11: Changes to knowledge of teaching strategies (n = 80)

Changes in Knowledge of Teaching Strategies	Number	%
Not at all	2	2.50
A little	13	16.25
Partly	21	26.25
Quite a lot	39	48.75
Highly	5	6.25

97.50% of participants reported that their knowledge of teaching strategies had changed to at least some extent as a result of attending the CPD, with 55% of teaching reporting that their knowledge of teaching strategies had changed at least 'quite a lot'.

The table below indicates the reported changes to participants' knowledge of activities or resources.

Table 12: Changes to knowledge of activities or resources (n = 80)

Changes in Knowledge of Activities or Resources to use in teaching	Number	%
Not at all	1	1.25
A little	6	7.50
Partly	15	18.75
Quite a lot	46	57.50
Highly	12	15.00

99% of participants (all but one teacher) reported that their knowledge of resources or activities to use as part of their classroom teaching had changed as a result of attending the CPD. 72.50% reported this knowledge had changed at least quite a lot.

The table below indicates the reported changes to participants' knowledge of curriculum or policy.

Table 13: Changes to knowledge of curriculum or policy (n = 80)

Changes in Knowledge of curriculum or policy	Number	%
Not at all	10	12.50
A little	10	12.50
Partly	29	36.25
Quite a lot	26	32.50
Highly	5	6.25

Teachers' knowledge of curriculum or policy had changed in 87.50% of cases.

But, just over one third (38.75%) of participants considered that their knowledge had changed at least 'quite a lot' in this area.

The table below indicates reported changes to participants' knowledge of activities and resources to help colleagues.

Table 14: Changes to knowledge of activities or resources to help colleagues (n = 80)

Changes in Knowledge of Activities or Resources to Help Colleagues	Number	%
Not at all	2	2.50
A little	4	5.00
Partly	19	23.75
Quite a lot	42	52.50
Highly	13	16.25

97.50% of participants considered that their knowledge of activities or resources to help colleagues had changed following the CPD. 68.75% of participants considered that their knowledge had changed at least 'quite a lot'.

The table below indicates reported changes to participants' knowledge of support networks.

Table 15: Changes to knowledge of support networks (n = 80)

Changes in knowledge of Support Networks	Number	%
Not at all	6	7.50
A little	15	18.75
Partly	35	43.75
Quite a lot	18	22.50
Highly	6	7.50

92.50% of participants reported that their knowledge of support networks had changed following the CPD, with 30% claiming their knowledge of these networks had changed at least 'quite a lot'.

The table below indicates reported changes to participants' ability to boost pupils' confidence.

Table 16: Changes in ability to boost pupils' confidence (n = 80)

Changes in Confidence in Ability to Boost Pupils Confidence	Number	%
Not at all	1	1.25
A little	11	13.75
Partly	22	27.50
Quite a lot	39	48.75
Highly	7	8.75

98.75% (all but one teacher) reported changes in their confidence in their abilities to boost pupils' confidence. 57.50% of participants reported at least 'quite a lot' of changes in their confidence to achieve this.

The table below indicates reported changes to participants' ability to challenge all pupils.

Table 17: Changes to ability to challenge able pupils (n = 80)

Changes in Ability to Challenge Able Pupils	Number	%
Not at all	3	3.75
A little	9	11.25
Partly	24	30.00
Quite a lot	37	46.25
Highly	7	8.75

96.25% of participants reported changes in their confidence of their ability to challenge more able pupils. 57% of participants considering at least, quite a lot, of change in their levels of confidence in this area.

The table below indicates reported changes to participants' ability to increase pupils' awareness of future careers.

Table 18: Changes in ability to increase pupils' awareness of future careers / futures in science (n = 80)

Changes in Confidence to Increase Pupils Awareness of Futures / Careers in Science	Number	%
Not at all	23	29.11
A little	20	25.32
Partly	22	27.85
Quite a lot	12	15.19
Highly	2	2.53

71% of participants reported changes in their confidence to increase pupils' awareness of futures and careers. Only 18% of participants felt that their confidence had increased, 'quite a lot' or more.

The table below indicates reported changes to participants' ability to acquire interesting resources.

Table 19: Changes in confidence in ability to acquire interesting resources

Changes in Confidence in Ability to Acquire Interesting Resources	Number	%
Not at all	3	3.75
A little	10	12.50
Partly	14	17.50
Quite a lot	45	56.25
Highly	8	10.00

Participants' confidence in their ability to acquire interesting resources changed in 96.25% of cases, with 66.25% of participants feeling that their confidence in this area had changed at least 'quite a lot'.

The table below indicates reported changes to participants' confidence to make the most of resources.

Table 20: Changes in confidence to make the most of resources (n = 80)

Changes in Your Confidence in Ability to Make the Most of Resources	Number	%
Not at all	3	3.75
A little	8	10.00
Partly	16	20.00
Quite a lot	45	56.25
Highly	8	10.00

Participants' confidence in their ability to make the most of resources changed in 96.25% of cases, with 66.25% of participants feeling that their confidence in this area had changed at least 'quite a lot'.

The table below indicates reported changes to participants' ability to make abstract science more 'visible' to pupils.

Table 21: Changes in ability to make abstract science more visible (n = 80)

Changes in Ability to Make Abstract Science More Visible	Number	%
Not at all	6	7.50
A little	13	16.25
Partly	20	25.00
Quite a lot	35	43.75
Highly	6	7.50

Participants' confidence in their ability to make abstract science more visible changed in 92.50% of cases, with 51.25% of participants feeling that their confidence in this area had changed at least 'quite a lot'.

The table below indicates reported changes to participants' confidence to teach cutting edge science.

Table 22: Changes in confidence to teach cutting edge science (n = 80)

Changes in Confidence in Teaching Cutting Edge Science	Number	%
Not at all	15	18.75
A little	14	17.50
Partly	27	33.75
Quite a lot	23	28.75
Highly	1	1.25

Participants' confidence in their ability to teach cutting edge science changed in 81.25% of cases, with only 30% of participants feeling that their confidence in this area had changed 'quite a lot', or more.

The table below indicates reported changes to participants' confidence in teaching 'wow' science.

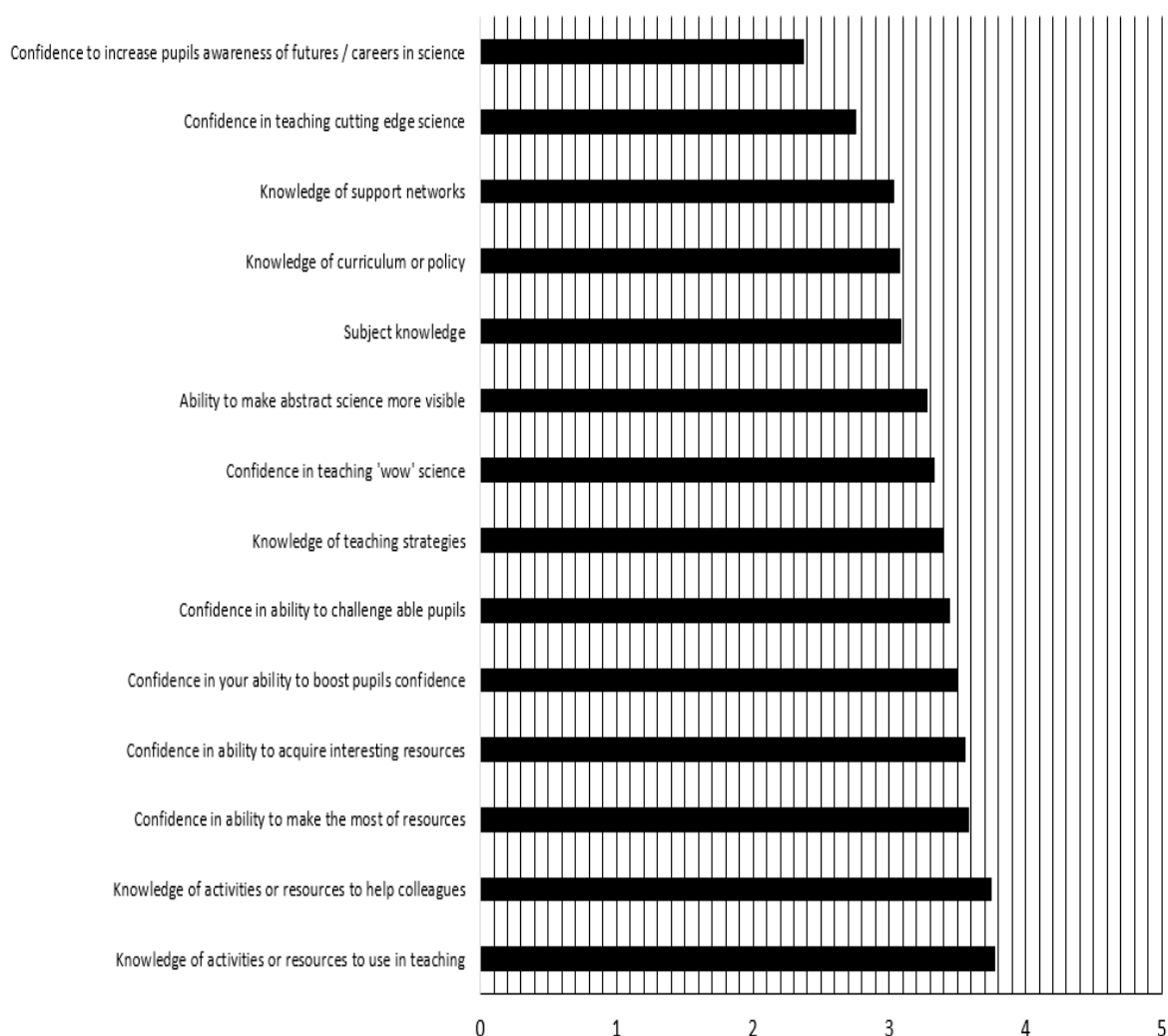
Table 23: Changes in confidence in the teaching of 'wow' science (n = 80)

Changes in Confidence in Teaching 'Wow' Science	Number	%
Not at all	8	10.00
A little	9	11.25
Partly	21	26.25
Quite a lot	33	41.25
Highly	9	11.25

Participants' confidence in their ability to teach "wow" science changed in 90% of cases, with 52.50% of participants feeling that their confidence in this area had changed 'quite a lot', or more.

Figure 11 provides an overall ranking of the mean scores, in relation to the size of the changes reported by participants.

Figure 11: Change in participants' learning: Ranked lowest to highest



The most significant changes in participants' practices following the CPD were considered to be increased knowledge of activities or resources to use in participants' own teaching, and increased knowledge of activities or resources to help colleagues.

Four of the top five changes to participants' learning entail participants' enhanced knowledge or confidence in the use of 'resources'. This matches participants' expectations of the CPD, and is perhaps indicative of what participants' expect to

gain from short episodes of CPD, and what is in very concrete terms, considered to be valuable about such workshops.

4.2.3 Changes to participants' practices

Both questionnaire and interview data provided insight into participants' views on the changes to classroom practice. The table below shows that only 2.5% of participants considered that the CPD had not improved their teaching style and strategies. Whilst almost two-thirds (64%) of participants considered that the CPD had improved their teaching style and strategies at least 'quite a lot'.

Table 24: CPD improved teaching style and strategies (n = 80)

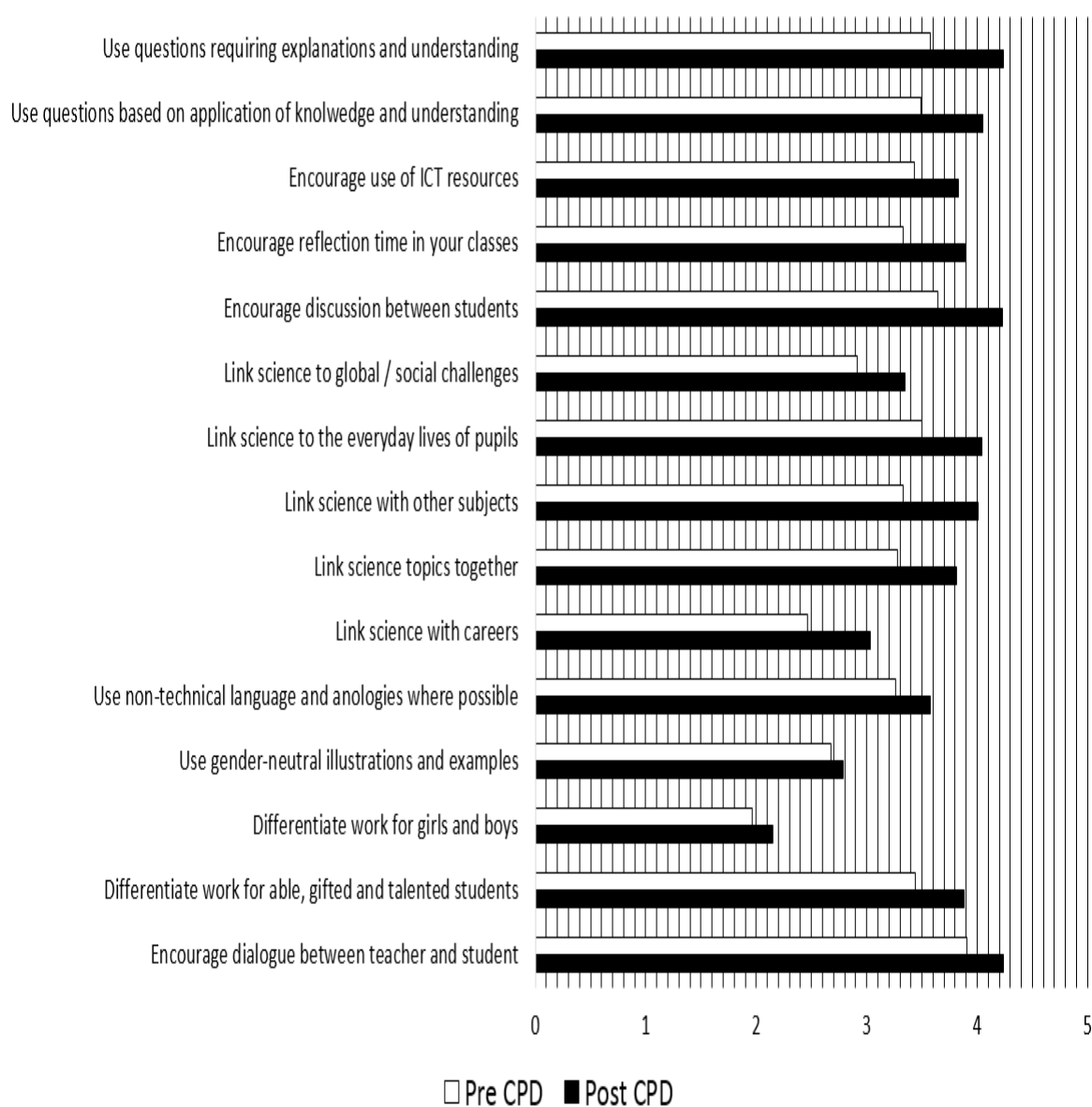
Has attendance at the CPD improved your teaching style and strategies?	Number	%
Highly	12	15.00
Quite a lot	39	48.75
Partly	21	26.25
A little	6	7.50
Not at all	2	2.50

Further support of changes to teaching practices was also evident in the interview findings, as illustrated in the following interview extract:

'I definitely changed some of the way my lessons were delivered, [because of the CPD]. Especially heart dissections, just the way she explained it to make it more engaging, like put it into a context, that was really useful'
(Participant A)

In all questionnaire items, participants reported changes to their practices following engagement with the CPD. The chart below highlights the results of a retrospective pre-test (Lamb and Tschillard, 2005) in an attempt to avoid response shift bias (Howard and Dailey, 1979). Figure 12 indicates how teaching practices post CPD compared to those same practices before participants' engagement with the CPD.

Figure 12: Retrospective pre-test: Participants' practices pre and post CPD



The table below provides a ranking of the size of the changes to teaching practices pre and post CPD. Percentage changes are based on differences between mean scaled scores.

Impact on Participants' Practice: Sorted DIFFERENCE	% Change
Link science with careers	23.17
Link science with other subjects	20.42
Use questions requiring explanations and understanding	18.44
Encourage reflection time in your classes	16.82
Encourage discussion between pupils	16.21
Link science topic together	16.16
Use questions based on application of knowledge	16.05
Link science to the everyday lives of pupils	15.43
Link science to global / social challenges	15.12
Differentiate work for able, gifted and talented pupils	12.79
Encourage use of ICT resources	11.66
Use non-technical language and analogies where possible	9.82
Differentiate work for girls and boys	9.69
Encourage dialogue between teacher and pupil	8.44
Use gender-neutral illustrations and examples	4.10

Table 25: Changes in participants' practice: Ranked (n = 80)

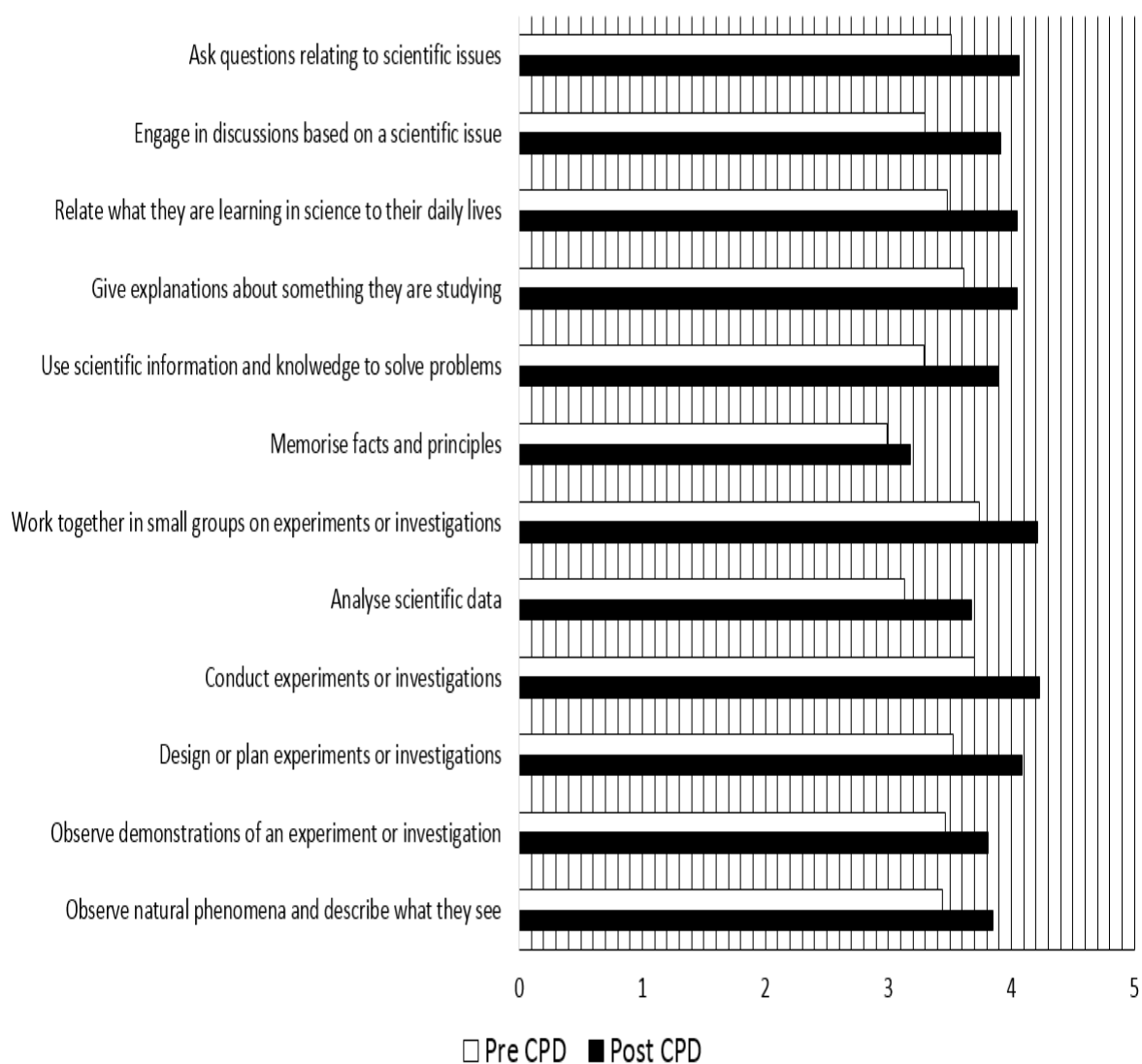
Captured within the open-ended responses of the questionnaire data, participants reported changes in terms of the use of new practices, such as “more dramatic practicals” or “the use of investigations in all areas of science”. In addition, they also made reference to affective changes, reporting how their teaching practices had changed as a result of increased confidence to implement new practices such as being “more confident when teaching physics” and being “more confident and less likely to stick to scheme of work”.

Interview data, provided further details of more nuanced changes to participants’ teaching practices. For instance, participant A reported that in some respects the CPD provided “A *different* way of explaining [the topic] or a *different* practical that might be useful”. (Participant A). Therefore, although changes to teaching practices are reported, and that participants may value the ‘different’ or new approaches within their own right, it is important to acknowledge that simply because practices are different from previous practices, benefits to pupils’ learning should not be assumed. It is for this reason that in the following section, the changes to pupils’ learning and engagement will be examined.

4.2.4 Teachers' perceptions of changes in pupils' engagement and learning

A further retrospective pre-test was used in the questionnaires, on this occasion to gather participants' views of the changes in pupil activity since the time of the participants' engagement with the CPD. The chart below indicates how the sorts of activity pupils were engaged with post-CPD compared to those before participants' engagement with the CPD.

Figure 13: Retrospective pre-test: Pupils' engagement and learning



The table below provides a ranking of the size of the changes to pupils' activity pre and post CPD. Percentages changes are based on differences between mean scaled scores.

Table 26: Changes to pupil activity: Ranked (n = 80)

Impact on Pupil Activity: Ranked DIFFERENCE	% Change
Use scientific knowledge to solve problems	18.54
Engage in discussions based on a scientific issue	18.48
Analyse scientific data	17.57
Relate what they are learning in science to their daily lives	16.38
Design or plan experiments or investigations	15.86
Ask questions relating to scientific issues	15.67
Conduct experiments or investigations	14.32
Work together in small groups on investigations	12.57
Give explanations about something they are studying	12.19
Observe natural phenomena and describe what they see	11.92
Observe demonstrations of an experiment or investigation	10.12
Memorise facts and principles	6.35

Interview data provided further insight into how the changes reported in pupils' engagement and activity may have influenced their learning. Participant A, provided some intriguing reflections of the impact of new teaching practices and the links to pupils' learning:

“I think it [New Approach] was just more effective for kids learning, more than anything, I don’t think that necessarily the lessons are any better, to how they were previously, but the kids outcomes were better. So their learning was better because it was more well targeted as to how they pick up information. So it was more on the kids understanding than it was teacher pedagogy”. (Participant A)

This, on first read through, is quite a contradictory statement to read. But, what I interpret as being said here is that the participant’s existing pedagogy has become a little more refined - and a little more effective, it has become a slightly altered pedagogy. The participant is not in any way describing large-scale changes, on the contrary, she is describing smaller adaptations and refinements to existing practices, which nevertheless go onto have important effects in terms of supporting pupils’ learning.

The table below highlights the reported changes in pupils’ confidence, levels of interest and motivation, and attainment.

Table 27: CPD impact on pupils’ learning: Ranked (n = 80). Scale 1-5

Impact on Pupil Learning: Ranked	Mean	Reported Change
Pupils are more willing to discuss science	3.81	‘Quite A Lot’
Pupils are showing a greater interest in science	3.76	‘Quite A Lot’
Pupils are more engaged in practical activities	3.71	‘Quite A Lot’
The attitudes of pupils to science has improved	3.67	‘Quite A Lot’
Pupils show a greater motivation to succeed in science	3.67	‘Quite A Lot’
Pupils’ attainment has improved	3.33	‘Partly’

It is perhaps significant that teachers' perceptions of pupils' attainment did not increase to the same extent as pupils' interests and attitudes. This in part is likely to be due to the difficulty in separating the effects of the influence of the CPD from a range of other extraneous factors which are compounded together, particularly in attempts to raise attainment levels in high stakes assessments. Participant D highlights this point:

'I did see an improvement during my tenure there in terms of the way students approached GCSE studies, and the outcomes of GCSE went through the roof... and that I feel was not solely down to [the CPD], but it was down to a lot of things we were doing'. (Participant D).

The findings from this mixed-methods study have provided evidence of impacts of short subject specific CPD workshops on teachers' practices, and on pupils' engagement and learning. However, participants' also reported additional impacts of the CPD beyond their practices and beyond pupils' learning. This will be discussed more fully in the following section.

4.2.5 Personal and professional change: Professional rejuvenation

Guskey's model has provided a useful framework for analysis, so far. But stage 3 interviews of this mixed-methods study revealed that the nature of change is more than the sum of the parts – that is to say that whilst CPD may provide new ideas or approaches for teachers to incorporate into their practice, with the aim of benefiting pupils' learning, the actual impacts of CPD go beyond this.

A key finding of this study was the recognition of some of the less obvious, perhaps unintended, impacts of CPD. The benefits of engaging with CPD are more complex than the acquisition of new ideas or knowledge (Davies and Preston, 2002). Data from this study supported the notion that CPD was important to teachers in terms of building their own confidences, self-esteem, and feelings of agency.

Arguably, the changes to participants' practices and pupils' activity, highlighted within this study, are small and subtle changes – but these lead to positive feelings of teacher satisfaction with the CPD process. Based on the interview findings, it is suggested that these subtle changes are a small yet significant part in contributing to ongoing teacher growth and fulfilment. This is captured in the transcript below:

“It's boring to stay the same If you just teach every day and you just it's mind numbingly dull, I need something to keep myself stimulated and also I want to get better at what I do because that's something I, I just can't see the point of doing something if you don't want to do it properly or better . I think it makes your job more interesting, it's just boring if you stay the same, you need something else, it's not enough to just stand there and teach day in day out the same thing over and over because that could be soul destroying.” (Participant C).

This participant uses some quite emotive language – particularly that it would be 'soul destroying' to teach the same thing every day. By offering 'new' ideas and resources, it could be suggested that CPD has an important role in changing the

way participants' view their jobs, and in a sense can provide feelings of greater personal and professional fulfilment, which go above and beyond teachers' general thoughts and feelings about the 'effectiveness' of CPD itself.

The study's questionnaire data highlights the high degree of feelings of participant satisfaction with the CPD. Based on the interview findings I would suggest that there are other factors which can account for participants' feelings of such 'satisfaction' other than improvement in pupils' outcomes alone – as important as these are. Interview data provides further evidence of teachers' feelings of increased personal and professional fulfilment as a result of their engagement with subject specific CPD. This is illustrated in the transcript extract below:

“I often find that I don't get a lot of intellectual stimulation from the kids, everyday, you know, you're teaching them the same thing everyday, or you teach the same topic over and over again, and sometimes that can be quite boring, and I find that's a really important way to interest myself, to go home and research different ways of teaching things and to try and change a lesson up makes it again interesting for me and I think that helps the way I deliver it because if I've taught that lesson ten times in the last year I'm going to be bored when I teach it but if it's going to be innovative and new I'm interested as well and I think that enthusiasm sparks off on the kids, and they respond well to it, so I think that really is important.” (Participant A).

In this extract, the teacher highlights that the changes introduced as a result of the CPD heighten her *own* interest and enthusiasm for teaching. The ability to take some level of control and influence changes to her own teaching practices provide her with more intellectual stimulation.

This indicates that the ultimate motivation of participants' engagement with CPD is not necessarily just improved pupil outcomes. Even short CPD workshops can heighten participants' feelings of increased professional fulfilment and self-esteem, as indicated by Participant A: "When I did some of the stuff that I was taught in the CPD, I do think that the kids had more enjoyment, and I definitely felt more successful afterwards." (Participant A).

In addition to the sense of professional fulfilment and enhanced pupil outcomes, CPD was also identified as an opportunity to provide support for potential career promotion. This is highlighted in the transcript extract below:

"I think it's important to teach to the best of your ability and be aware of developments in the subject and learn more about teaching effectively, and getting more ideas for teaching well. I think that is what the pupils need, but I also think if you can do these things well, like being an outstanding teacher and ensure pupils are learning then you are more likely to be promoted, or there will be opportunities for promotion" (Participant B).

Again, feelings about the personal and professional capital of engagement with CPD emerge as important outcomes of the CPD process, but also as important motivators.

Change brought about by CPD can affect more than professional development, but also impacts on personal development and teacher individual priorities too. This was noted too by Day (2004b): 'Professional development must extend beyond classroom practice, such that support for the personal and long-term

needs of the teacher as artists, connoisseur, craftsperson and technician are legitimated' (Day, 2004).

The idiosyncratic and individual nature of teachers' needs and expectations of CPD are well recognised. In considering the nature of the impact of CPD, it is essential to consider the wide-ranging benefits (Davies and Preston, 2002).

Clearly, these extend beyond the classroom, to teachers' feelings of intellectual stimulation and professional satisfaction.

Interestingly, 35% of participants had gained an additional leadership or management responsibility since attending the CPD course. This may indicate that participants attending these short subject specific CPD workshops have clear ambitions for promotion, or that engagement with CPD does make participants more promotable – perhaps through enhanced teaching repertoires, or perhaps through increased confidence, interest and enthusiasm for teaching. However, it is not possible to compare this data with teachers who may not share the same enthusiasm for CPD, as participants' within this study. However, two interview participants (A and B) considered there was a link between attendance at CPD and future promotion prospects through better teaching, and this was implied too by participant D. In addition, a recent study (Allen and Sims, 2017) has demonstrated an association between short episodes (one-two day courses) of CPD and teacher retention. Short episodes of CPD may therefore have powerful and important impacts beyond, or as a result of, triggering changes to teaching practices.

4.3 Participants' perceptions of the extent of change

In this section, I will explore the study's findings in relation to the second part of Research Question 1: participants' perceptions of the extent of change, following engagement with CPD. Based on key themes to emerge from the data, this section will be structured around three parts:

- That often changes to practices were a refinement and improvement of *existing* practices.
- Subtle Changes can lead to an accumulation of personal professional Impacts
- New ideas and approaches are often cascaded to colleagues.

The fact that accounts of changes in teaching practices following short episodes of CPD are reported at all may seem surprising considering the condemnation of the efficacy of short CPD workshops within large parts of the literature. However, findings from this study demonstrate that participants perceive that personal and professional changes do occur.

4.3.1 Refinement and Improvement of existing practices.

Participants report considerable improvements to teaching practices and pupils' engagement as a result of their engagement with the CPD. Yet, when the detail of these changes is explored, much more subtle effects are observed. For instance although the vast majority of teachers within the study report on positive changes

to practices, the actual differences between their prior practice and current practice, are often much more subtle.

This is perhaps not so surprising. Teachers in the sample are already teaching using a variety of approaches considered ‘good practice’ – as benchmarked against literature (Ofsted, 2013) and are highly motivated to continue improving their practices. Data from the study would suggest that participants within this sample are not seeking to address significant gaps in their subject or pedagogical knowledge, but are looking for ways to support and enhance their current practices. This can be observed within the questionnaire data. Over 80% of participants reported, in open-ended responses the changes they would like to make to their teaching practices as a result of attending the CPD workshop. Overwhelmingly these changes related to refinement and development of existing practices, rather than filling gaps or meeting a deficit in their professional knowledge or expertise. This is illustrated by a sample of the questionnaires response below:

As a result of attending CPD, participants expected to (emphasis added):

- “Gain **more** engaging investigations/practicals/worksheets”.
- “Be **more** confident in conducting experiments”.
- “Use **more** specific and fit for purpose ideas for science course”.
- “Gain a **better** understanding of how to provide for G&T pupils”.
- “Gain a **better** idea of resources to be used in school”.
- “Gain a **better** idea of how to introduce and teach forensic science”.
- “**Improve** differentiation”.
- “**Improve** quality of [pupils] written responses”.
- “**Improve** teaching with better strategies”.

- “**Develop** questioning...”
- “Gain **alternative** AfL techniques”.
- “Challenge strong pupils **more** effectively”.

(TEEQ Survey)

This was also a theme to emerge from interview data, as illustrated in the extract below (again, emphasis added):

“I can’t see the point in being a teacher if you don’t want your pupils to learn, or you don’t want them to learn as best as they possibly can, otherwise what’s the point. That’s what you’re supposed to be doing, you’re supposed to be teaching, so if there **is anything that can make that better** then why would you not do it?”. (Participant C)

This data provides some evidence of the reflected thinking of participants, within this sample. A key inference emerging from the study’s findings is that participants in this sample appear to expect that the CPD provision can add value to their current practices, or ‘that a perception exists that CPD is ‘better’ than their current ‘best practice’” (Murchan et al., 2007). It is interesting to consider why teachers should place such a value on external CPD, as opposed to generating these refinements and improvements internally. This consideration resonates closely with work of Dadds (1997) who identifies the perceived high status value of an external CPD providers. The value of the ‘external other’ could be seen to be important in clarifying key ideas and supporting developments and refinements to practices, particularly before participants engage with the active process of enactment and reflection, and begin to adopt and embed and refine successful practices within their own classrooms. The well-informed or ‘more knowledgeable’

external other appears as a key part of the teacher change process. This is reflected to some extent in the transcript below (emphasis added):

“I definitely changed **some** of the ways my lessons were delivered... the way she explained [Heart Dissections] to make it **more** engaging...and she just told me a completely **different** practical that I’d never done before, which I think helped the kids understand the concepts easier”. (Participant A)

What is clearly being said here is that the CPD impacted upon *some* areas of practice, and even when changes were implemented as a result of ideas gained during the external CPD provision, these acted to enhance what was being done already – for instance the ability to make dissections *more* engaging. The photosynthesis practical activity *replaced* a previous practical – due to it being perceived to be *more* beneficial than the previous one.

This provides some insight into what, on the outside, may be perceived to be very subtle changes to practice, yet because the teacher has drawn upon their own reflective practices and professional judgement to embed *selected* practices the perceived changes are considered to be more significant overall. In the example of the extract above it can be seen that as a result of these subtle changes to existing practice, pupils are now considered to be ‘more’ engaged with the dissection, and they understand the concepts ‘easier’ as a result of changes to the practical activity. Subtle changes to existing practices can be perceived by participants to have significant impacts on pupils’ learning. This finding was also

evident within questionnaire data, where retrospective pre-tests demonstrated modest perceived changes in practices (Figure 12), yet pupils' attitudes, motivations, and interest were considered to have changed more considerably (Table 27).

4.3.2 Subtle changes can lead to accumulation of personal professional impacts

Teacher change, or change sequences, can be fleeting (Clark and Hollingsworth, 2002), but can also give rise to professional growth and feelings of professional fulfilment.

It is important to consider the conditions required to stimulate change sequences, and foster the transformation of these sequences into longer-term growth patterns. Unless this is considered fully then there is a risk of mistaking short-term change for long-term growth (Clarke and Hollingsworth, 2002). This study provides evidence to show the small initial changes to practice as a result of the CPD can undergo cycles of refinement and further change which culminate in more significant effects. This is illustrated in the interview extract below:

“It [the CPD strategy] worked well for probably the first three years, and then after that it started to dip off because we, of course you are constantly evolving your scheme of learning, and I think we just found different ways of doing it, which we thought were better so we basically took the [CPD strategy] kind of ideology, for want of a better word, and made it our own. So instead of using the model they used we kind of tweaked it and made it more relevant”. (Participant D).

What is evident within the statement above is that the ongoing processes and cycles of 'enactment and reflection' (Clark and Hollingsworth, 2002) which lead to the refinement of strategies. This provides some evidence of ongoing teacher growth instigated, in part, by attendance at an initial short episode of subject specific CPD.

Of particular interest in this quotation is the word 'ideology'. In the everyday meaning of the term this is not a particularly neutral word. Eagleton (1991) in his book *Ideology*, quotes John. B. Thompson, as the single most widely accepted definition, 'to study ideology is to study the ways in which meaning (or signification) serves to sustain relations of domination' (Eagleton, 1991). Implicit in this definition is power-interest 'who is saying what to whom and for what purposes' (Eagleton, 1991). Ideology can have notions of stereotypical perceptions, fanaticism, and is a long way from more empirical or pragmatic views and measures. Although arguably 'ideology' need not be a term to be overly concerned about if taken in the context of the 'noble' intended outcomes of CPD which aim to maximise pupils' learning and educational experiences.

Although the use of the word ideology was not used in the following transcript, the notion of taking the essence of an idea, and using this was something that emerged in Transcript C:

"For the whole time we were doing that course [Curriculum] we used it [the Problem Based Learning approach] to teach that aspect of the course... until we stopped doing that course. Now I do try to do similar things but maybe not so structured, but similar things when I'm teaching A-Level

biology... but I use the idea and they do like it because they do like to come up, they like to work as a detective and come up with the diagnosis, and work things out from themselves". (Participant C).

In this way, it can be seen that the CPD, albeit a short course, can act as a 'seed' of an idea, which the participants' expertise can be developed and enhanced over time. In addition, as noted in the previous section, the changes as a result of CPD can go beyond influencing teaching practices and enhancing pupils' learning, by affecting teachers' feelings of successfulness, professional interest, and sense of professional fulfilment.

The earlier linear model (Guskey, 2000) of teacher change placed pupil outcomes as the ultimate goal of teacher CPD. However, when this is coupled with increased satisfaction with respect to teaching, linked to and interconnected with a strategy that becomes a regular part of practice through refinement and modification, then this is likely to lead to long-term teacher growth (Clarke and Hollingsworth, 2002). These study findings suggest that short subject specific CPD workshops can act as a trigger for ongoing teacher growth.

Participants within this sample had high expectations of the likely impact of the short episode of subject specific CPD and also reported perceptions of high levels of teacher efficacy (Table 38), and motivation to engage with the CPD in the first instance and to make changes to their practices. As evidenced in the questionnaire and interview data participants anticipated, and often sought out

opportunities for improving their teaching practices, and had high expectations of the CPD. Using Guskey's (2002) and Clarke and Hollingsworth's model (2002) for analysis, it can be seen that the reported gains in knowledge, beliefs, and attitudes, and subsequent professional experimentation, which leads to impacts on pupils' learning can lead to feelings of increased satisfaction. Participants within this sample may therefore generate very positive feelings and notions of CPD and report on its usefulness and value, which in turn will act upon their personal feelings of agency, and successfulness.

The Clarke and Hollingsworth (2002) model of teacher growth makes clear the interactions between teacher's personal, practice, and external domains and how the processes of reflection and enactment act to interconnect these domains. However, it is also important also to take into account the underlying drives or motivating factors to initiate such enactment and reflection in the first instance.

Evident within this sample are the high levels of autonomy and teacher efficacy (Questionnaire Data). In addition, participants acknowledge that they do not always teach science as well as they might like to, but will actively seek opportunities to improve their science teaching. This has emerged as an important driver for attending the CPD: to improve current practices. It could be argued that these are measures of professionalism: participants taking responsibility and seek opportunities for professional self-improvement. They may demonstrate an awareness of participants' current capabilities with an idea of their desired objectives. Evidence of participants' professional reflection is evident within the

data, with over 90% of participants reporting that the CPD workshop they attended challenged their current teaching practices, at least to some extent. This is quite remarkable considering the CPD workshops were only one-day in duration.

Short CPD workshops can be seen to be able to provide a trigger for change, which the participants within this sample are able to use to their own benefit. Both in terms of enhancing pupil experiences, but also for providing a source to support their own ongoing intellectual rejuvenation (Participants A, C, and E), and potential future career prospects (Participants A, B, and D).

4.3.3 Spheres of influence: Dissemination of new practices

Action planning can be seen as a conscious effort to plan to anticipate and where new changes to practices could be implemented, and how these might be sustained over time. Questionnaire data revealed that 60% of participants produced action plans following their engagement with CPD, and 80% of these action plans were incorporated into the school's schemes of work, and so will likely influence the practices of participants' colleagues.

Moreover, participants had clear expectations that the CPD would be of benefit to other teachers. Table 28 highlights a ranked order of participants' expectations.

Table 28: Expectations on sphere of influence $n = 110$

Sphere of Influence – Expectations: Ranked	%
<i>Other teachers who participants consider will benefit:</i>	
The whole department or key stage team	56.60
One or a few other teachers	31.13
The whole school	22.64
Student teachers	20.75
Teachers in other departments	3.77
Nobody else	2.83
Teachers in other schools	1.89
Other	1.89

97% of responses indicated that participants expected other teachers to benefit as a result of the CPD. The expected influence of the CPD ranged from affecting one or two teachers, to whole departments, to teachers across the school, and even teachers in other schools.

Before engaging with the CPD, 24% of the group of participants expecting to share ideas with other teachers expected to share the CPD ideas with colleagues to a 'large extent', and 76% of the participants expected to share these ideas 'a little'. However, when compared to participants questioned several months after engaging with the CPD workshop (CIQ data) almost 69% of participants claimed to have shared their ideas to a 'large extent' with others.

The actual mechanisms by which ideas were shared were through both formal and informal means. Almost half of participants shared ideas through informal conversations with colleagues, but in addition, more formal methods of communication were also employed through departmental and school meetings. These were similarly in line with participants expectations of sharing practice pre-CPD.

The table below indicates the specific practices of sharing the CPD ideas after the workshop. This was a free choice question; participants were asked to select all options that applied.

Table 29: Sharing practices following CPD (n = 80)

What did happen in school after to spread CPD ideas?	%
Meeting with colleagues in department or key stage	50.00
Chat with one or more teachers	47.50
Whole school or department training event	41.25
Putting teachers resources on school VLE/Portal	40.00
Production of new training materials	22.50
Nothing	3.75
Other	3.75

It can be seen from the data in the table that in the vast majority (96.25%) of cases, participants engaged with a range of practices to share ideas with other teachers.

However, it cannot be assumed that the teachers involved through this cascade approach have made subsequent changes to their own practices. They may not receive the necessary support to make the changes, or they may be more reluctant to make changes for a variety of reasons. This point emerged during interviews with participants C and E:

C: 'How do I put this, there are some people who are very keen and helpful and there is always a group of teachers that perhaps, I don't know, are not really interested, or don't see it as important, should I put it like that, they are stuck in their ways a little bit.

E: Perhaps there are people who find it easier to produce and share resources and there are people who are not so sharey and they don't find it as easy, or are more reluctant, or are not as confident to share so.

C: Or somehow feel they are losing something if they do share.

E: People sometimes say I don't know how to do that, and that's absolutely fine, but when you have actually produced and shared something that could address that but people are using something else, that's worse.

C: Yes, some people are very reluctant to change, and I don't know, there is no easy way of making them is there really? You just have to keep persevering.

What is evident in the extracts above is that the sharing of ideas is an interactive process. The person receiving ideas must be receptive to them. So although, the data from this study gives a good indication of CPD participants' willingness, and relatedness to colleagues, it is highly likely that there will be variance in the extent to which colleagues practices will be influenced.

4.4 Changes over time

This section will explore the final part of Research Question 1: How do the effects of one-day subject-specific CPD change over time?

This will involve discussion of two key areas:

- The importance of time in the change process.
- The sustainability of change.

4.4.1 The importance of time in the change process

The passage of time has significant implications on both the nature and extent of change. Guskey notes that ‘Teachers tend to make changes in the classroom gradually. Radical changes rarely occur, even after an effective professional development program or teacher training’ (Guskey, 2002, cited in Grove 2009).

The nature of initial change as a small-scale change is certainly supported by the findings from this study. Small subtle changes were reported, yet a high proportion of teachers viewed these as being ‘very useful’ for improving practice, and at least ‘effective’ at engaging pupils, as well as impacting on their own personal professional development.

Many changes to practice can be effortful and can require a degree of perseverance as implementing professional development and making changes to classroom practices often takes more time than expected (Fullan, 1993; Guskey, 2002). This point was mirrored by findings of this study, as the extract below illustrates:

“Time is of the essence, and while the course was useful and provided some useful ideas there wasn’t any time at school to tailor these or develop any further, any spare time would be spent on anti-bullying policies, strategies, marking books and keeping on top of all of the schools priorities, they all take most of my spare time.” (Participant 3).

This statement tells a lot about the perceived priorities of subject CPD, in this instance reduced in importance by other initiatives. It also tells something of the drive teachers must possess in order to attend subject CPD in the first instance and then to implement changes, seemingly in spite of the odds.

Even initial change does not occur immediately after the CPD. Even when it does at first occur it is most likely to be ‘mechanical’ and ‘routine’ – in that the implemented practices not been adapted or refined to be tailored to the needs of the teachers’ circumstances: the changes are largely a transposition of ideas from the CPD directly into practice, because refinement and adaptation requires enactment of practices and reflection upon them – processes which take time.

Before embarking on the CPD, participants had preconceived notions of the immediacy of impact. Table 30 shows these expectations.

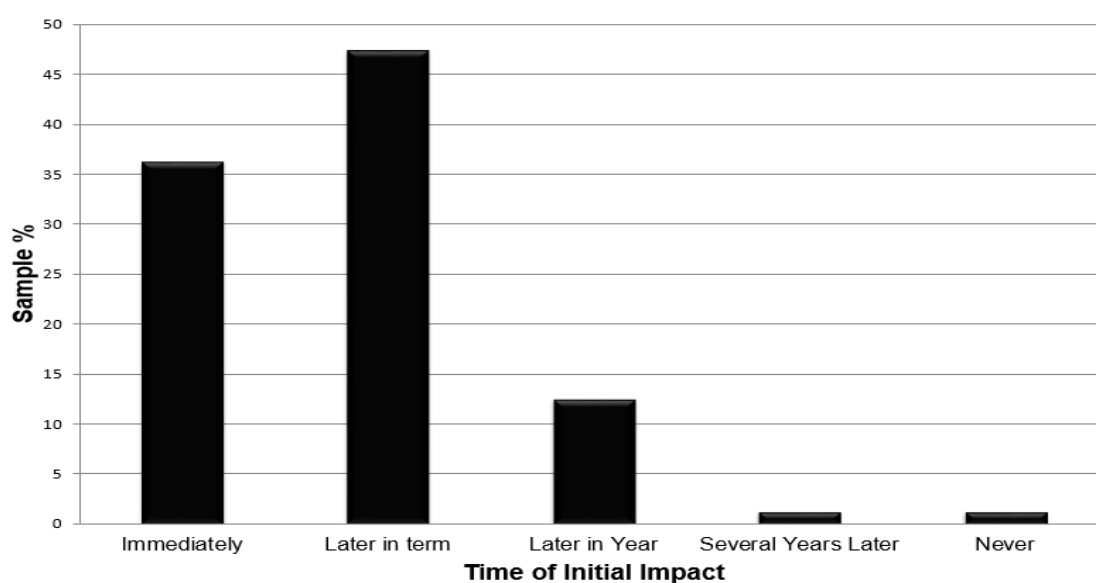
Table 30: Expectations of immediacy of impact on participants' practice $n = 110$

Participants Practice Expectations: Ranked	Number	% Yes
Straight away	61	57.01
Within a few weeks or in the next topic	39	36.45
Later in school year	5	4.67
Several years after the course	0	0.00
Will never be used	1	0.93
Other	1	0.93

The majority of participants expected to make changes to practice straight away or within a few weeks or the CPD. 95% of participants considered that impact would be relatively immediate, for instance within a few weeks of the course. This though was in contrast to the *actual* reported timescales of impacts.

The chart below indicates when first impacts occurred following the participants' engagement with the CPD.

Figure 14: Time taken for actual changes to occur ($n = 80$)



Only one third of participants (36%) implemented changes straight away. Almost half (48%) implemented changes later in the term. 12.5% of participants implemented changes later in the year. A very small percentage (1%) of participants implemented changes several years later. These findings are contrary to expectations, and I think could explain why many evaluations of CPD efforts fail to detect changes to teaching practices; as evaluation studies often occur immediately, or shortly after, the course has taken place. Therefore, according to this data such evaluations would miss almost two-thirds of reported impacts.

The occurrence of delayed impacts, occurring several months after the CPD had taken place, was a finding that emerged from Phase 1 interviews:

“Actually, I haven’t had the chance to use it. I certainly enjoyed the course and thought it was interesting, I liked the idea of pupils working in that way, but I haven’t been able to use any of the ideas because I don’t have time in the curriculum to teach it.” (Participant 2)

However, the same teacher reported that in the following academic year, a new school policy required all teachers to share ‘good’ practice at a departmental level. As a result of this he shared ideas and resources gained from the CPD, and as a result senior colleagues adopted these approaches within schemes of work.

The absence of an appropriate curriculum fit often accounted for delayed changes to teaching practices. This is noted in the interview extract below:

“The sessions on different practicals, less so [less useful], but definitely the parts about how to teach energy and other changes to the physics curriculum, I’ve approached this in a different way since the course, and made those impacts almost immediately.” (Participant B).

When questioned about why the session on different practical approaches had not had the same immediate impact the teacher talked of how the curriculum fit was not made as explicit. She felt that to implement these changes she would have to study the curriculum in more detail to identify the relevance. This is something that would take more time – particularly considering that physics was not her subject specialism. Therefore, any further impacts would likely occur at a later date, potentially when the participant became more aware of appropriate curriculum links.

It can be seen that over time changes to teachers’ practice as a result of CPD can move from ‘mechanical’ to ‘refined’, once for instance, they have been trialled in the classroom and then adapted to fit more appropriately with the individual context. This is an iterative process that takes time. The opportunity for enactment, experimentation and reflection is an essential part of this process. This is evident in interview with Participant D, when he discusses how after three years of using strategies established during CPD he “kind of tweaked it and made it more relevant”. (Participant D). The ongoing processes and cycles of enactment and

reflection lead to refinement of approaches. This provides some evidence of ongoing teacher learning - instigated in part by attendance at an initial episode of subject specific CPD. Participant C also supports the notion of ongoing change:

“Now [Several years later] I do try to do similar things but maybe not so structured... but I use the [CPD] idea and they [Pupils] do like it.”.

As noted in an earlier section, it can be seen that the CPD, albeit a short course, can act as a ‘seed’ of an idea, which can be implemented and developed over time, and can have a multitude of impacts.

The refinement and renewal of implemented strategies takes time, often many years. In the participant interviews that took place within a closer proximity to their attendance at the CPD, there was little discussion of refinement of ideas, but more reference made to more ‘mechanical’ change.

However, time was not the only significant factor in instigating refinements to implemented practices. Participants also discussed the importance of drawing upon their own personal resources: their knowledge, professional judgement and subject expertise.

This is a point that has been made by Dadds (1997):

‘Yet even the longest CPD course is short compared to the never-ending learning of good professional development. This is why the evolution of informed personal theories of practice is crucial. When the formal CPD course has ended, professional judgement in the classroom goes on, often without continuing support. So the learning has to be made personal for it to be used independently’ (Dadds 1997).

Data provided evidence of ongoing professional judgement and teacher growth, which also provides a measure of participants’ perceptions of the value of the CPD, and demonstrated by their persistence and performance within the change process. (Wigfield and Eccles, 2000).

Participants would appear to value the outcomes of subject specific CPD, as evidenced by their ongoing persistence and refinement of implementation. These are points that will be discussed in more detail in the next section.

4.4.2 The sustainability of change

Harland and Kinder (1997) acknowledge the importance of the psychological ‘affective’ outcomes of CPD, but claim this must be coupled with new knowledge in order for the impacts to be sustainable:

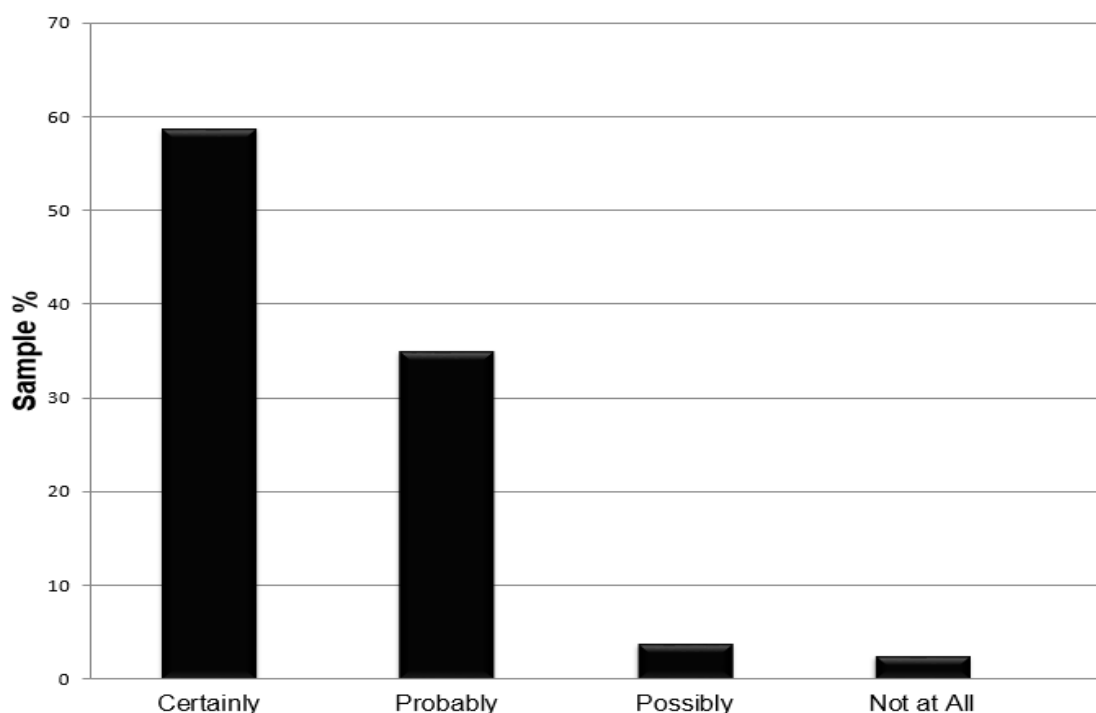
‘Affective outcomes acknowledge there is an emotional experience inherent in any learning situation... initial positive affective outcomes (e.g. feeling excited and elated by new approaches) could sometimes be short-lived without a sense of accompanying enhanced expertise... increases in self-confidence... may need to go hand-in-hand with increases in a sense of competence in new knowledge and skills’ (Harland and Kinder, 1997).

The importance of the initial feelings of ‘excitement’ and ‘elation’ was reiterated in the interview with Participant D:

“Well there are courses that I’ve been on and come back and thought, well there are a couple of good ideas there but nothing that really rocks my world, and that is possibly about your new experiences and also your needs at the time, so had I gone on a course to find out about, I don’t know, something that wasn’t relevant to me then – I wouldn’t be on that course – but that might hold teachers back a bit” (Participant D).

One of the key strengths of this study is that the data was collected (almost 3 years on average) since participants attended the CPD workshop. The overwhelming majority of participants felt the CPD would be sustainable in the long term, with almost three fifths of the sample (59%) expressing high degrees of confidence that the CPD would be sustainable in the long term.

Figure 15: Likely sustainability of CPD (n = 80)



This is likely to be due to the fact that participants have made changes to their practices and reflected on the associated, presumably positive, impacts aligned with these. Small subtle changes have become sustainable and integrated into longer-term growth.

Although initial change may begin with the introduction and implementation of new ideas and resources, which aim to enhance existing practices, it is important to acknowledge that these initial changes will, over time, go through cycles of modification and then evolve into practices that may be far removed from those originally observed or anticipated – perhaps becoming unrecognisable from earlier forms. These changes though are likely to be supported and conditioned by personal, social and political influences – which will be discussed within Chapters 5 and 6.

Based on findings of this study, it is suggested that small cumulative changes may continue manifesting over time. These small subtle changes which lead to refinements in pedagogy are likely to be important contributors to teachers' perceptions of satisfaction with the CPD, and ongoing teacher growth.

From a perspective of researching and detecting changes to teacher practices, it is highly likely that 'intended' and implemented practices will evolve over time – and

so will likely provide challenges in terms of their detectability from an outsider's perspective – particularly if it is assumed that the intended outcomes of a CPD workshop will lead to clearly identifiable changes in practices. It is for this reason that teachers' perspectives of change – several years after attending a course are so valuable.

4.5 Chapter conclusion

In this chapter, I have discussed the nature and extent of change following a short CPD workshop. In doing so I have provided a response to the first of the research questions: To what extent can a one-day science subject specific CPD course impact on teachers' practices?

Participants within the sample were overwhelming positive about the CPD experience. Feelings of positivity are (iteratively) associated with impact on practice and pupil learning, but also with participants' feelings of personal success and professional fulfilment, as a result of trying something new and observing successes.

Participants reported changes to their own learning and their levels of confidence, particularly in the use of new ideas and knowledge. Less so for clarifications of policy or curriculum. Pupils' attitudes, motivations, confidence, and interests in

science were all reported to increase, as too was attainment – but less so than the more affective outcomes.

Although participants reported the use of new ideas and approaches, these act as refinements or improvements of existing practices as opposed to totally different ways of working. Nevertheless, small subtle changes were seen to have significant impacts on teachers' views of the importance of the CPD, both in terms of pupils' outcomes, but also in relation to their own personal professional interests.

Change is more likely to take place in a timescale of months, rather than days, and practices can be refined and adapted after trial and testing of the CPD, and can be ongoing over several years. The vast majority of participants consider the changes to practices are sustainable in the long term.

The next two chapters will explore the conditions that influence the implementation of new ideas and resources into existing teaching practices. This will provide a basis for answering the second research area of the major research questions.

Specifically, Chapter 5 will focus on the significance of the participants' self-determination in accounting for changes to teachers' practices. Then, Chapter 6 will consider the significance of the interplay between the teachers' socio-political environment on their psychological resources.

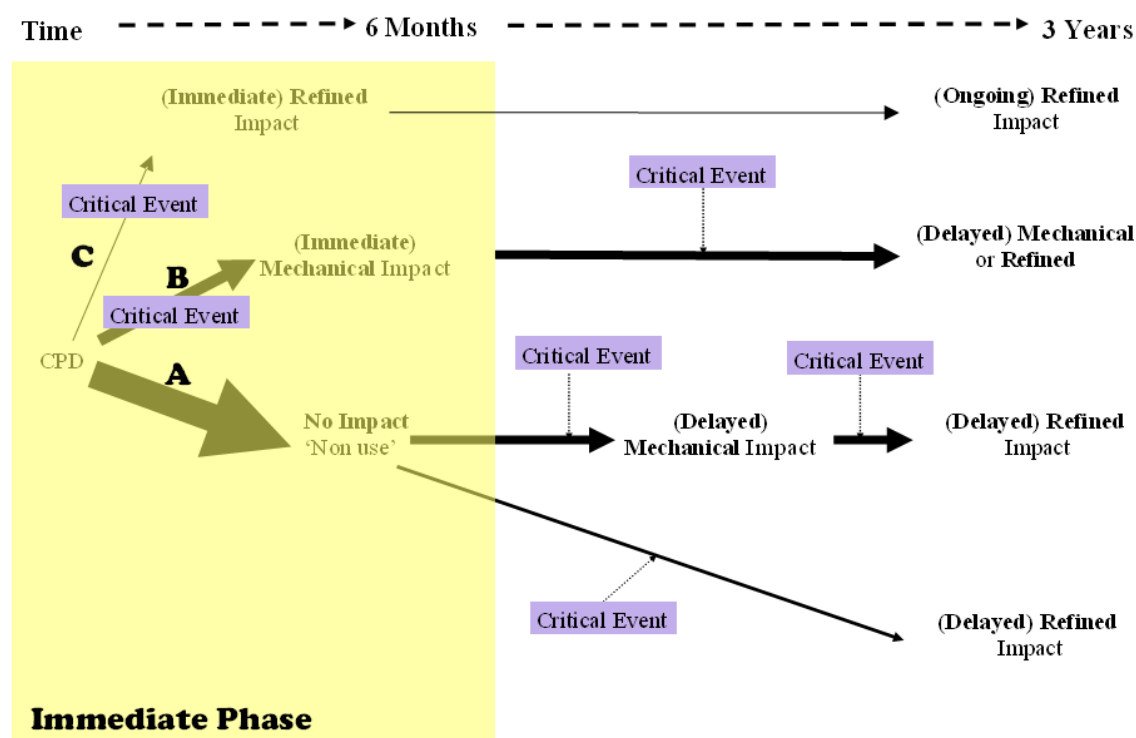
Chapter 5: Findings and Discussion 2: The Significance of Teachers' Self-Determination in Explaining Changes to Practices

5.1 Introduction

Within this chapter, I will draw upon the data to build upon an understanding of the findings discussed within the previous chapter: the nature and extent of change following participants' engagement with subject specific CPD. Specifically, this chapter, and then the next, will seek to explain the *conditions* which can influence the changes to teachers' practices following their engagement with CPD.

In an earlier phase (Phase 1) of the study, the concept of 'critical events' was posited as a way of providing an explanation for the point at which changes to participants' practices are triggered, following their engagement with the CPD. Based on the empirical evidence collected across all three phases of the study and in line with the process of generating theory, 'an integrated set of conceptual hypotheses' (Glaser, 1998) were developed and formed a model to indicate the significance of critical events in accounting for changes to teaching practices. The model that I have developed posits that critical events emerge as a result of the interactions between the participant and with their school environment. A graphical representation of the model is shown in Figure 16, and I have provided a further account to explain each of the critical event pathways in more detail.

Figure 16: The significance of 'critical events' in influencing change



The model highlights three possible likely occurrences immediately after participants' engagement with the CPD. **(A)** More than likely there will be no immediate impact, this was a finding discussed at length in Chapter 4. Although, over time more 'critical events' are likely to occur and impacts on teachers' practices can become more likely. **(B)** A critical event can lead to teachers implementing changed practices – and these practices are likely to be 'mechanical in nature, in that they mirror those introduced at the actual CPD workshop. Although over time, following further critical events these can become adapted and refined. **(C)** The most unlikely possibility is that a critical event will lead to immediate and refined impact: that is to say, at a very early stage, following the CPD, the implemented changes to teaching practices will include adapted versions of the ideas and resources introduced within the CPD workshop.

This term 'mechanical change' as applied within this model should be taken to mean that the new ideas and resources implemented in practice are largely representative of those explored within the CPD workshop, they have not yet been adapted or refined to make them more effective. However, change can become more refined and adapted over time. The shift from mechanical change to refined change occurs through processes of enactment and reflection. These changes are again conditioned by 'critical events'.

For the purpose of this part of the discussion, I will now illustrate some of the evidence interpreted from the interview data to support the proposition of each of the three impact scenarios, A, B, and C. I have highlighted within each segment of interview transcript referenced below, the association between critical events and subsequent impacts:

Evidence for Route A: *Initial Impact may not occur for several months:*

[Interviewer] *How long do you think it took before you made use of the new knowledge you had gained in the CPD course in 2005.*

[Participant 1] Probably not really until starting work in a new school in September 2008 [i.e. No Impact for 3 years]. ... Results in the science department were amongst the lowest in the school [Critical event]. With ideas from the twilight course and experience in the previous school [Critical event] I was able to make some significant changes [Delayed Impact] to the way lessons were taught. I have

a very supportive department [Critical event] who were fed up of seeing science at the bottom of the results tables, and I think the fact that I had come from a higher attaining school convinced many of them that I was making the right sorts of changes [Critical event]. Our results have increased significantly for the last year, and this has been acknowledged positively by the head teacher.

Evidence for Route B: Initial Impact is likely to be Mechanical in Nature.

[Interviewer] *How long did it take to change your practice following the course?*

[Participant 3] I used the [CPD] resource straight away [Immediate Mechanical Impact] and have used it every year. In fact it's probably more useful now than it has been.

[Interviewer] *You mentioned that it would have been useful if on the day of the course you were given a number of other [teaching approaches] to fit in with schemes of work.*

[Teacher 3] Time is of the essence, and while the course was useful and provided some useful ideas there wasn't any time at school to tailor these or develop any further [Mechanical Impact], any spare time would be spent on anti-bullying policies, strategies, marking books and keeping on top of all of the schools priorities, they all take most of my spare time.

I've also found that the general idea [Adapted/Refined Impact], of introducing [the CPD approach] to students is a good way of introducing a topic [Critical event], and have used this with most groups pupils respond well to this as it gets them thinking from lesson one... Our KS3 curriculum is currently under review [Critical event], and current KS3 results are a significant concern for the school [Critical event],

event] and I can see that this is an approach that might be important [Critical event] with addressing that [Delayed Refined Impact].

Evidence for Route C: Initial Impact can occasionally be 'Refined'.

[Interviewer] *Do you feel you had sufficient time back at school to implement the changes you would have liked?*

[Participant 6] Well the time we invest depends on how good the idea is. Ideas from a course like this will be discussed in department meetings and those that we think will be useful and appropriate for our students will then be adopted by a member of staff and developed [Critical event] and trialled before the rest of the department gets to use them [Refined Impact], and they get written into scheme of work.

The model illustrates the variation in nature and extent of change on participants' practices following their engagement with a subject specific CPD workshop, and how various interactions (critical events) between the participants and their school environment can influence the nature of change. It is particularly significant that (A) There is often no immediate change. But, over the course of time 'critical events' can help to trigger changes to classroom practices and subsequent changes in pupil activity and learning. (B) Immediate change is often 'Mechanical'. When changes to participants' practice do occur immediately after the CPD workshop the changes are often mechanical or routine, but over time further critical events can trigger more refined or adapted changes to practices. (C) Occasionally immediate impact is adapted or refined. Adapted changes to

practice can occur shortly after a course, but this requires significant personal and social resources on behalf of the participating teachers.

The majority of studies evaluating the impacts of short CPD courses often take place shortly after the event and they are therefore likely to be seeking effects too soon, and any impacts observed are likely to be more mechanical in nature. Often, it is only the impacts indicated within this yellow zone of the *Critical Events Model* presented in Figure 16 that are captured. This means that claims of ‘no impact’ may be made. However, over time, a larger number of critical events can trigger the implementation of changes to practices, as well as triggering further refinements and adaptations.

Findings from this study indicate the importance of the interactions of aspects of participants’ psychological factors, with aspects of the socio-political environment in which teachers’ work, as significant events in triggering, and influencing the nature and extent of change, to teaching practices.

Within this particular chapter, I will focus on the significance of psychological factors in explaining changes to participants’ teaching practice. In the next chapter, I will consider the significance of the interplay between the teachers’ determination, and their school’s socio-political environment, in accounting for change.

The reason for separating the chapters in this way is to acknowledge that teachers are shaped, to some extent, by their socio-political environments, yet they can still *individually* influence their own classrooms and practices, and that their psychological and emotional needs can affect the ways in which they interact with, and approach, the change process.

Within a model of teacher change, such as Clarke and Hollingsworth's (2002), consideration must be given to *why* the Personal Domain (the Participant) mediates change in the way they do. There is no direct link between the external domain (in this case, the CPD workshop) and the classroom.

Any change to practice must be mediated through the teacher. Teachers' cognitive and affective psychological resources will influence the change process. Clarke and Hollingsworth's model (2002) can account, to a certain extent, for the idiosyncratic and individual nature of teacher change, but I would suggest the model does not provide a detailed picture of the psychological mediators that can help explain *why* change takes place, why it is triggered in the first instance.

Teachers' engagement with the process of enactment of new practices requires them to invest something of their 'selves' in the process (Nias, 1996). This investment is highly likely to include cognitive elements, for instance teachers' desire to increase their own knowledge of resources with the aim of enhancing

pupils' outcomes. However, affective factors are significant too, for instance the feelings of satisfaction from the intellectual rewards of teaching (Day, 2004a, Hargreaves, 1998, Lortie, 1975). How a teacher *feels* about making changes to practice is important in explaining both their inclination to engage with CPD in the first instance, and triggering change, but will also influence the extent to which they make changes to practice. Emotion and cognition are interconnected (Frijda et al., 2000, Nias, 1996) and so by considering both, a deeper understanding of the ways in which teachers mediate the change process can be provided.

Findings from this study suggest that psychological influences such as an individual's feelings of self-determination and feelings of teacher-efficacy can provide important frameworks with which to understand how and why changes to teaching practices are mediated.

Discussion within this chapter, will be framed within the seven key themes to have emerged from the study's findings. These themes are highlighted within the contents table below.

Key Theme	Page
Views of CPD as a worthwhile process (5.2)	237
Importance of Addressing 'own' needs (5.3)	243
Seeking Intellectual Rejuvenation (5.4)	246
Possession of knowledge of 'current' and 'new' practices (5.5)	252
Confidence in personal capacity to bring about change (5.6)	256
Teacher autonomy and authority (5.7)	268
Motivations to become a 'better' teacher (5.8)	273
Seeking Reassurance (5.9)	278

The first of these themes highlights the notion that participants must view the CPD itself as a worthwhile process. The aims of the CPD must chime with participants' needs, and the quality of the provision must be such that teachers can reasonably expect such provision to support their aims, and meet their expectations.

The next two themes explore how CPD that addresses participants' 'own' needs are considered by them to be more important and impactful than CPD that merely meets institutional requirements and expectations. Participants within this study sought out new resources and practices to impact positively on pupils' learning, but they also sought to promote their own intellectual rejuvenation. There is evidence of an interrelationship between cognitive and affective outcomes.

Within the next two themes, I will explore the significance of participants' existing professional and pedagogical knowledge within the change process. The extent of participants' existing pedagogical knowledge is likely to influence the nature and extent of classroom change: The extent of participants' existing subject and curriculum knowledge influenced the extent of changes made to practice. In addition, participants need to have the confidence they have the capacity or agency to implement their desired change.

In the final two themes of this chapter, I will begin to explore the apparent paradox, to emerge from this study. That participants within this study reported to have high

levels of teacher-efficacy, yet were less confident that they were teaching science as well as they would like, and sought reassurance that they were ‘doing the right thing’. These findings are explored much more fully in the next chapter (Chapter 6) in which the influences and interaction of the social and political environments on teachers’ practices will be discussed in more detail.

5.2 Participants’ perceptions of CPD as a worthwhile process

The extent of participants’ levels of satisfaction with the CPD, was positively associated with their perceptions of its usefulness to practice, its impact on pupils’ learning, and the likelihood that the changes to practices will be sustained over time. The full detail of these associations can be seen in the following three tables.

Table 31: Association between general feelings towards the CPD and its usefulness to practice

Usefulness to Practice	Participants’ Feelings about the CPD					
	Very Positive	%	Quite Positive	%	Neutral	%
Very	32	71.11	6	20.00	0	0.00
Quite	13	28.89	24	80.00	0	0.00
Not Very	0	0.00	0	0.00	3	100.00
Not at all	0	0.00	0	0.00	0	0.00
Total	45		30		3	

Table 32: Association between general feelings towards the CPD and its likelihood of increasing pupils' engagement

Student Engagement Increase	Participants' Feelings about the CPD					
	Very Positive	%	Quite Positive	%	Neutral	%
Very Effective	20	44.44	4	13.33	0	0.00
Quite Effective	21	46.67	21	70.00	1	33.33
Neither	4	8.89	5	16.67	1	33.33
Not Very Effective	0	0.00	0	0.00	1	33.33
Not at all Effective	0	0.00	0	0.00	0	0.00
Total	45		30		3	

Table 33: Association between general feelings towards the CPD and its likely sustainability

Sustainability of New Practices	Participants' Feelings about the CPD					
	Very Positive	%	Quite Positive	%	Neutral	%
Certainly	31	68.89	15	50.00	0	0.00
Probably	11	24.44	15	50.00	2	66.67
Possibly	3	6.67	0	0.00	1	33.33
Not at all	0	0.00	0	0.00	0	0.00
Total	45		30		3	

A key inference emerging from the study findings is that teachers in this sample appear to be convinced that the professional development on offer can add value to their current practice or as Loxley reports that a perception exists that CPD is

'better' than their current 'best practice' (Murchan et al., 2007). It is interesting to consider why participants who report that their practice is 'Good' 'quite a lot of the time' and report high levels of teacher efficacy, place such a value on *external* CPD. This resonates very closely with work of Dadds (1997) who identifies the perceived high status value of an external provider's input. It is important to consider this in terms of implications for teacher development and professional growth. Participants consider the well informed 'other' a key part of the CPD process. These findings resonate with the work of Spillane et al (2002), and of Dadds (1997) who made the point that: 'Many attenders on CPD courses have pinned their hopes on finding someone else's Holy Grail as the ultimate answer to the complexities and dilemmas of their work' (Dadds, 1997).

This is illustrated to some extent in the transcript below, where Participant A discusses the importance of external 'people' within the CPD process:

"External people [are important] Because I think sometimes children [pupils] say what they think you want to hear... so I think it's important to have an external point of view, just completely independent, no bias at all, and just say exactly, that would help". (Participant A).

Participants held a range of expectations of the potential gains of engaging with the CPD, they particularly expected to gain new resources and ideas to use within their own teaching, or new ideas to support colleagues teaching. The fact that participants did report high levels of teacher-efficacy and 'good' practice even prior to the engagement with the CPD, and yet still had very clear expectations that the

CPD could improve their practices, is very significant. Particularly as 'Expectancy-value' theory suggests that a person's motivation to perform a behaviour is the product of expectations about his or her own ability to perform the task and the value of that goal to a person (Eccles et al., 1983). It would be reasonable to suggest that as participants within the sample have clear expectations of the CPD, express high levels of satisfaction with it, and are science specialists, that they are likely to have high levels of motivation to implement the new resources and ideas. Some changes in teaching practices are therefore highly likely as a result.

These notions of expectancy-value were also noted in interview findings:

"I can't see the point in being a teacher if you don't want your students to learn, or you don't want them to learn as best as they possibly can, otherwise what's the point. That's what you're supposed to be doing you're supposed to be teaching, so if there is anything that can make that better then why would you not do it?" (Participant A).

What I think is communicated in the extract above, is the participant's conviction to carry out the role, of science teacher, as effectively as possible and to impact as positively as possible on pupils' learning. The participant places value on the CPD, as noted that this can make teaching more effective in terms of supporting pupils' learning.

The questionnaire data also supported the notion of the high value participants held with regards the CPD workshops. The vast majority of participants reported

that they expected to see changes in pupils' understanding of science concepts, attitudes and skills as a result of attending the CPD

96% of participants considered that the CPD they had attended was at least a 'good' match in terms of meeting their expectations. Almost 60% considered that the CPD provided a 'very good match' in terms of meeting expectations. The extent to which CPD met participants' expectations was positively associated with participants' perceptions of the usefulness of CPD to practice. This was also true in terms of participants' perceptions of increases in levels of student engagement, and also in terms of the likelihood the changes to teaching practices would be sustainable in the long term. The full detail of these associations can be seen in the following three tables:

Table 34: Association between extent to which CPD met expectations and usefulness to practice

Usefulness to Practice	Expectations of CPD					
	Very Well Met	%	Met	%	Poor Match	%
Very	32	68.09	6	20.69	0	0.00
Quite	14	29.79	23	79.31	0	0.00
Not Very	1	2.13	0	0.00	3	100.00
Not at all	0	0.00	0	0.00	0	0.00
Total	47		29		3	

Table 35: Association between extent to which CPD met expectations and increases in student engagement

Student Engagement Increase	Expectations of CPD					
	Very Well Met	%	Met	%	Poor Match	%
Very Effective	20	42.55	4	13.79	0	0.00
Quite Effective	23	48.94	20	68.97	0	0.00
Neither	4	8.51	5	17.24	1	33.33
Not Very Effective	0	0.00	0	0.00	1	33.33
Not at all Effective	0	0.00	0	0.00	1	33.33
Total	47		29		3	

Table 36: Association between extent to which CPD met expectations and likely sustainability

Sustainability of New Practices	Expectations of CPD					
	Very Well Met	%	Met	%	Poor Match	%
Certainly	34	72.34	12	41.38	0	0.00
Probably	11	23.40	16	55.17	1	33.33
Possibly	2	4.26	1	3.45	0	0.00
Not at all	0	0.00	0	0.00	2	66.67
Total	47		29		3	

Analysis of questionnaire data revealed clustering around participants' expectations of increasing their knowledge of resources and ideas to use in their

teaching, and Phase 3 interview data highlighted the importance of the subject specific nature of the CPD:

“I think if it’s science specific CPD, they [teachers] get a lot more out... They want to learn their craft and get to be better teachers” (Participant D).

A comparison of the effectiveness of subject specific and more general CPD was CPD provided by Participant B:

“The CPD like behaviour management and assessment for learning is not as useful as science specific CPD because, there is assessment for learning generally, but when you do assessment for learning with practical work it looks very different, so you don’t get to learn about that with general CPD. But the CPD we get through the school is always more generic, and so I would say less likely to have an impact” (Participant B).

Participants’ motivations to attend CPD, and their subsequent engagement with it, may provide some indication of their views of professional learning: that increased teacher subject pedagogical knowledge leads to better teaching and learning.

5.3 Addressing ‘own’ needs within the CPD process

Participants provided evidence of the importance of their autonomy within the CPD process. 99% of participants’ indicated the importance that the CPD matched their own identified development needs and expectations. The majority (62%) of participants self-initiated their attendance onto the CPD course. However, even

within the group of teachers who did initiate their own attendance onto the CPD workshop, their engagement, feelings of autonomy, and professional judgement within the process of making changes to practices still emerged as significant considerations. This is captured neatly to some extent in the interview extract below:

“I don’t think it would have been CPD I’d have picked had I chosen one myself, but actually I think it was one of the most useful ones I could have gone on at that point... It definitely sparked a bit of curiosity in me, perhaps to go away and think about the same practice but in different areas”
(Participant A).

For those participants who did select and self-initiate their own attendance, this process still needed to be authorised and confirmed by a senior leader within the school. Engagement with CPD entails personal professional investment on the participants’ part. This is evidenced in the transcript below:

“It was me [who initiated attendance], it was a case of thinking about where I need more support, and what I needed to know more about, otherwise it wouldn’t have happened... the school didn’t have a problem with me going, but it was just as case of me asking the heads permission to go”
(Participant B).

As is highlighted in the extract above the process of booking onto a course requires the participant’s awareness of the CPD workshop in the first instance, and then a requirement for them to negotiate to secure their attendance. This provides an indication of the determination on behalf of the participant. What is noticeable

within this interview extract is that it is the classroom teacher who is the active agent within this process.

As participants within this study are all teachers who actually attended the CPD in question, it is difficult to assess how many respective requests to attend CPD were declined by school leadership teams. Nonetheless, decisions to attend CPD can be blocked by a line manager. As classroom practitioner, participants are not always in a position to authorise their own attendance at external events, and so are limited in the extent to which they can take full ownership of this process.

Questionnaire and interview data revealed that, the majority of participants within this sample were seeking 'better' ways to teach science. Perhaps unsurprisingly, intrinsic motivations to engage with CPD were considered by participants to be important: Over three-quarters (76%) of participants considered that CPD that addressed their own identified needs was very important to them, with almost all (99%) considering addressing own identified needs as being at least 'quite important'. Participants meeting their own needs was considered by them to be more important than CPD that meet the needs of the institution – for instance the school's needs as highlighted in the school's development plan.

However, increasingly clear from Phase three interview responses was not just the notion that attendance at CPD was a useful endeavour to increase the repertoire of teaching and learning approaches. But that, engagement with CPD could be

motivated by an individual's need to increase the personal satisfaction with the occupation of teaching.

Teachers attend CPD for a variety of reasons. Attendance at CPD can provide a dual purpose: it can provide teachers with new ideas and resources, which may enhance the learning experiences of pupils. However, at the same time engagement with the CPD and subsequent changes to practices can make the profession of teaching more fulfilling and personally and professionally rewarding. It could be argued, that harnessing participants' personal professional interests in the CPD is at least as important as the anticipated benefits to the pupils. Each supports the other.

5.4 Seeking intellectual rejuvenation

Interview data strongly suggested that teachers within the study sought new ideas, resources, and practices, to avoid repetition. A compelling theme to emerge from the interview findings was that CPD has an important role to play in intellectual and professional rejuvenation of teachers. That is to say, the CPD outcomes operated beyond the realms of the planned aims of the CPD. The intended outcomes of the CPD involved raising awareness and building confidence to engage with science subject pedagogy, with the ultimate aim of enhancing pupils' learning. The expected mechanisms of impact very much aligned with Guskey's view of CPD impact: *Teachers' Reactions → Teachers' Learning → Teachers' Practice → Students' Learning* (Guskey, 2000).

However, findings from this study indicate that subject specific CPD also acts to support participants' innate professional interests and intrinsic motivations.

Changes to teaching practices may not necessarily result in *large* gains in terms of pupils' attainment, but the very fact that changes to practices are made was significant to the participants involved. This was in part, because making changes to existing practices breaks the chain of recurring repetitious practices. New ideas and resources acted to provide variation and intellectual rejuvenation, and this had a positive impact on participants' sense of professional fulfilment and satisfaction.

CPD can have idiosyncratic and individual impacts on the participants' practices. A key finding from this study is the recognition of affective and emotional impacts of CPD. The benefits of engaging with CPD are more complex than the acquisition of new ideas of knowledge (Davies and Preston, 2002). Data from this study supported the notion that CPD was important to participants for building their own confidence, self-esteem, and feelings of agency.

Participants felt very positive about the CPD experience as a whole. However, the 'very positive' feelings do not necessarily transpose on to feelings that CPD was 'very useful' at changing teaching practice, or 'very effective' at enhancing student engagement with science. I would suggest that there are many other factors that account for teachers feeling very satisfied than just pupil outcomes alone – as important as these are. Emerging from the interview data is evidence of participants' feelings of increased professional satisfaction in association with their

own professional learning, and feelings of greater professional fulfilment. This is illustrated in extracts taken from transcripts of interviews with Participant A and C, highlighted below:

“I often find that I don’t get a lot of intellectual stimulation from the kids, every day, you know, you’re teaching them the same thing every day, or you teach the same topic over and over again, and sometimes that can be quite boring, and I find that’s a really important way to interest myself, to go home and research different ways of teaching things and to try and change a lesson up makes it again interesting for me and I think that helps the way I deliver it because if I’ve taught that lesson ten times in the last year I’m going to be bored when I teach it but if it’s going to be innovative and new I’m interested as well and I think that enthusiasm sparks off on the kids, and they respond well to it, so I think that really is important” (Participant A).

Participant C expressed similar views:

“It’s boring to stay the same If you just teach every day and you just it’s mind numbingly dull, I need something to keep myself stimulated and also I want to get better at what I do because that’s something I, I just can’t see the point of doing something if you don’t want to do it properly or better . I think it makes your job more interesting, it’s just boring if you stay the same, you need something else, it’s not enough to just stand there and teach day in day out the same thing over and over because that could be soul destroying”. (Participant C).

Each transcript provides a very clear message of the strength of the intellectual drive to access new ideas and new resources. Inspiration to find ways of avoiding repetitious practices emerges as a strong motivator to implement changes to practice.

Approaches such as those promoted through the CPD workshops; such as aims of supporting teachers' autonomy to develop new ideas and teaching strategies, and to embed these new ideas in their classrooms are valued by teachers because:

'Approaches such as these mark a significant shift in the light of several decades of policies that worked to de-professionalise teachers by taking agency away from them and replacing it with prescriptive curricula and limiting and sometimes oppressive regimes of testing, inspection and bureaucratic forms of accountability. The (re)turn to teacher agency not only gives explicit permission to teachers to exert higher degrees of professional judgement and discretion within the contexts in which they work but also sees their agency as a key dimension of teachers' professionalism (Priestley et al, 2015, p1).

The benefits are also noted by Teacher B:

"It's important to find better more interesting and effective ways of teaching, and so this is very important to me, I feel *if I am interested* then they are going to be more interested" (Teacher B).

In addition, as well as the sense of increased pupil engagement, and professional fulfilment, the notion that engagement with CPD leading to promotion within the workplace was identified. As illustrated within the following extracts taken from interviews with Participants B and A:

“I think it’s important to teach to the best of your ability and be aware of developments in the subject and learn more about teaching effectively, and getting more ideas for teaching well. I think that is what the pupils need, but I also think if you can do these things well, like being an outstanding teacher and ensure pupils are learning then you are more likely to be promoted, or there will be opportunities for promotion” (Participant B).

These notions were also expressed by Participant A:

“I think the two go hand in hand [improved Practice and Promotion] though. I think the better you are at teaching the more likely you are to be promoted, and the better it would be for the kids, so I think that it is both. Um I don’t know which one would be stronger. I don’t know which one drives me more. Both definitely both [Laughter]” (Participant A).

However, the influences of CPD workshops on perceptions of job security and possibilities for promotion could be more nuanced, as was the case with Participant D who discussed a link between the CPD and an increase in pupils’ attainment, and stated that as a result of the increase in exam scores the head teacher ‘was pleased’ with his results.

Subject specific CPD is not just professional development, but personal professional development. Teachers’ individualities and individual priorities should be important considerations within the process. This is noted by Day (2004), ‘Professional development must extend beyond classroom practice, such that support for the personal and long-term needs of the teacher as artists, connoisseur, craftsperson and technician are legitimated’. (Day, 2004).

In considering the nature of the impact of CPD it is important to consider the wide-ranging benefits (Davies and Preston, 2002). These extend beyond the immediate classroom environment into teachers' psychologies and feelings of intellectual stimulation and professional satisfaction. It is perhaps unsurprising that questionnaire data revealed that 35% of the CPD participants had gained an additional management responsibility since attending the CPD workshop. As discussed in Chapter 4, this may indicate that short subject specific CPD can make a difference to participants' internalised extrinsic rewards such as perceptions that CPD can enhance future prospects of promotion. The apparent potential increases in personal and professional satisfaction following CPD are important particularly in light of current educational policy:

'The new policy paradigm and the market form in particular constitutes a new moral environment for both consumers and producers, that is, a form of 'commercial civilisation'. Within this new moral environment schools, colleges and universities are being inducted into self-interest. Self-interest is manifest in terms of survivalism - and increased, often predominant, orientation towards the internal well-being of the institution and its members and a shift away from concern with more general social and educational issues within 'the community' (Ball, 2013, p. 53).

However, 'there is an emerging tendency in the United Kingdom and elsewhere to acknowledge the importance of teachers' agency, that is, of their active contribution to shaping their work and conditions' (Priestley et al., 2015, p. 1). Findings from this study would suggest even short CPD workshops can contribute towards a greater sense of personal professional fulfilment of teachers, by providing support, inspiration and resources, to trigger change.

5.5 Possessing expert knowledge of ‘current’ and ‘new’ practices

Participants within this sample were already making use of a wide range of practices. The mean score based on the questionnaire Likert scale 1 (lowest) - 5 (highest), along with the qualitative score can be seen in the table below.

Table 37: Current classroom practices/activity (n = 110)

Participants’ Classroom Activity: (Ranked)	Mean	Qualitative Score
Encourage dialogue between teacher and student	4.65	A Lot
Encourage discussion between students	4.39	Quite a Lot
Link science to the everyday lives of pupils	4.30	Quite a Lot
Use questions requiring explanations and understanding	4.24	Quite a Lot
Use questions based on application of knowledge and understanding	4.11	Quite a Lot
Link science topic together	4.00	Quite a Lot
Encourage use of ICT resources	3.92	Quite a Lot
Link science with other subjects	3.87	Quite a Lot
Differentiate work for able, gifted and talented students	3.81	Quite a Lot
Link science to global / social challenges	3.79	Quite a Lot
Use non-technical language and analogies where possible	3.69	Quite a Lot
Link science with careers	3.69	Quite a Lot
Encourage reflection time in your classes	3.57	Quite a Lot
Use gender-neutral illustrations and examples	3.04	Partly
Differentiate work for girls and boys	1.81	A Little

Even before attending a subject specific CPD workshop, participants already report that their existing teaching practice is highly varied, and contains high levels of the 'good practices', such as using question based on the application of knowledge, encouraging dialogue between pupils and teacher, and linking science to pupils everyday lives.

To some extent, this data was at first, somewhat surprising. In that, it was not immediately clear when studying this data alone why participants had chosen to attend the CPD. Participants were reporting widespread use of a variety of practices. Outside of a couple of lower scoring items, there was little obvious deficit in their current professional practices.

However, open-ended questionnaire responses within the questionnaire were more revealing. As discussed within Chapter 4, expectations of the CPD, and revealed impacts often related to refinement and improvement of existing practices, supporting the notion that the teachers within this sample were motivated to continue developing as more effective practitioners through subtle change to practices, as opposed to more large scale transformative change. Interview data supported the notion that teachers, within the CPD process are active agents, selecting, and using their professional judgement to consider the value of new ideas and resources. This is exemplified in the interview extract below:

“The whole point of CPD is to bring things to your attention you don’t necessarily have to use them . It’s brought it onto your radar then you can adapt it or you can not use that, or you can use a different one, or you can pick and choose, it’s about giving you a toolkit isn’t it, so that there are different tools at your disposal which you can choose to use or not. But then again it’s class by class, year by year, subject by subject, somethings work so much better in some subjects and absolutely don’t work at all in others so you have to use your judgement on that as well. But I think bringing ideas to people’s attention, as long as they’re not sort of “you will do it” putting your own spin on it is important and you have to feel like you can do” (Participant C).

What I think is particularly significant within this interview extract is that professional judgement and expertise is essential for conditioning changes to practice. Selecting and adapting resources to fit and work effectively for the individual pupils, is a process that requires expert knowledge. It is also essential that the teacher *feels* that they have a degree of autonomy in which to exercise their professional judgement. That is to say, those feelings of autonomy are important conditions from making changes to teaching practices.

However, for teachers to be able to work autonomously to bring about change, evidence emerged to suggest this needs to be coupled with a detailed expert understanding of teaching practices in the first instance. This is exemplified within the interview extract of teacher A:

“I almost had too much autonomy... I didn’t know what was in [the topic], I didn’t know what that entailed. I didn’t know what the best way to teach things were, sometimes a bit of guidance is useful” (Teacher A).

Teacher A went on to explain that without knowing the current curriculum in sufficient detail she was unable to position the ‘new’ practices explored through the CPD workshop against the current curriculum, and so as a result did not have the necessary knowledge, or sufficient professional expertise, to see the value of, or make the necessary change. As a result changes to existing teaching practices, did not occur. This is in contrast to the reflections of Participant C, who communicated a good grasp of the current curriculum area, and by drawing upon professional judgement was able to select and implement changes to practice:

“I think there are some initiatives that I just can’t see the point ... I’m not all for trying it just for the sake of it ... It’s got to be something where I can see a benefit” (Participant C).

Therefore, participants’ detailed understanding of the curriculum, having good curriculum and subject pedagogical knowledge, is an important part of the change process. When participants see that potential new approaches are different to those existing practices, they need to draw upon their subject knowledge and professional experience to judge the likely value of the new suggested approaches. Without a good knowledge of the curriculum and subject pedagogy, making value judgements becomes more difficult. In this way, good curriculum and subject pedagogical knowledge help to facilitate the more autonomous behaviours, which can lead to changes to practices, and teacher development.

The opportunity for action planning also emerged from the study, as a process that can help to facilitate change. Action planning can serve as an opportunity for

teachers to formalise their plans for the changes they will introduce – it acts as a bridge between the CPD and their teaching practice. Within the questionnaire data, moderate effects were observed in terms of changes to practice, student engagement, and confidence in sustainability of change, and teachers had the freedom to write their own action plans.

5.6 Self-assurance in personal capacity to influence change

On the process of bringing about change Dadds (1997) notes that ‘Fortitude and courage are needed. Receiving facts and information is nothing in comparison.’ (Dadds, 1997). A particularly strong theme to emerge from the data was the reported high degree of teacher efficacy expressed by participants. In addition, participants were engaged with a range of practices supported by theory and empirical evidence, and they agreed that their science teaching was generally ‘effective’. Participants also reported that they tended to actively seek opportunities to enhance the quality of their teaching.

Teacher efficacy is described by Hoy as ‘teachers’ confidence in their ability to promote students’ learning’ (Hoy, 2000). The questionnaire data highlighted in the table below gives an indication of participants’ perceptions of their efficacy. In other words, it provides an indication of teachers’ sense of competence (Protheroe, 2008).

Table 38 provides the mean score calculated from the questionnaire ranging from 1 (low) to 5 (high), and provides the questionnaire's qualitative score corresponding to the mean score.

Table 38: Participants perceptions of efficacy at supporting pupils learning

Teacher Efficacy: Ranked	Mean	Score
I usually welcome student questions	4.47	Agree
I am typically able to answer students science questions	4.28	Agree
I will usually be able to help a student understand a concept	4.27	Agree
I can explain to students why experiments work	4.22	Agree
I will generally teach science effectively	4.21	Agree
I consider that I have the necessary skills to teach science	4.20	Agree
I am continually finding better ways to teach science	4.17	Agree
I understand concepts well enough to be effective in teaching science	4.14	Agree
I know the steps necessary to teach science effectively	3.93	Agree
I am effective at monitoring science experiments	3.9	Agree
I know how to turn students on to science	3.8	Agree
I would generally be happy to invite the HT to evaluate my teaching	3.61	Agree
I generally teach science as well as I'd like	3.07	Uncertain

This table provides an interesting insight. It is notable that participants report on their confidence in their skills to teach science and that they have a range of knowledge and skills to support pupils' learning. I have highlighted several statements within the table, for the reason that they seem to present something of

a paradox. Participants agree that they generally teach science effectively, and that they are continually finding better ways to teach science. Yet, in spite of this, they are less likely to consider that they teach science as well as they would like to. I would suggest that this perhaps provides some evidence of the notion of ‘cruel optimism’ (Moore and Clarke, 2016). Teachers within this sample would appear to be continually striving for the even ‘better’ lesson, or the *ideal* lesson – something which will never be achieved. This notion of cruel optimism is captured in the interview extract below:

“I would say that the kids opinion of me is quite positive, and I do think they often say ‘Oh yeah we’ve got science today’ which isn’t always the case across the department, which is quite nice. But I don’t know whether that’s necessarily because of my, the way I [Teach]” (Participant A).

What the participant has revealed here is that pupils enjoy *her* science lessons. It could be argued that this must, in part, be due to the quality of her teaching. Yet she appears to have little conviction that this is the case. This view is seemingly representative of those other participants who revealed their ‘uncertainty’ about whether they teach science as well as they would like to. I will return to this issue and its implications, in Chapter 6, where I will discuss the influences of Socio-Political factors more fully.

Participants report continually finding *better* ways to teach science. However, as has been discussed within an earlier section, establishing opportunities to make beneficial changes to practices requires a certain level of subject and pedagogical knowledge on the participants’ behalf, so that through their professional judgement

participants' can appraise the value of potential changes to practices. The knowledge which helps to support participants to bring about change is formed in part by participants' knowledge of the subject, as well as that that knowledge gained from their teaching experience. The importance of subject content knowledge and professional teaching experience is highlighted within the interview extract below:

"Biology that's my strongest area it's probably the one I can be the most innovative". (Participant A) and:

"I think because I'd taught the biology all year that helped me as well so I had a better understanding of where the kids slipped up more, and which were the difficult topics, how I could see it working in my classroom" (Participant A).

When participants teach outside of their subject specialisms and lack the specific content and curriculum knowledge, they are less likely to have the same level of self-assurance to implement *better* changes to practices. This is illustrated in the interview extract below:

"There was no information on how this fits directly with the curriculum . It was very much a case of trying out the various activities, so not being a physicist meant that I couldn't directly link these to specific areas of the curriculum [emphasis added] , without having to go away and look at detail and then try to work out where these might fit. Some notes to take away on how this could be done would have been really useful for this... I haven't ever used any of those practical since , because I didn't have the knowledge of the physics curriculum to have more autonomy" (Participant B).

It is acknowledged within this statement, that had the CPD participant been provided with notes or instructions on where the new activities and resources could be connected directly to the curriculum then she could have made some informed (albeit somebody else's) changes to practices. However, even then, without the related subject pedagogical content knowledge (Shulman, 1986), any changes would likely have been 'mechanical' transpositions of workshop ideas into practice, at least in the first instance.

Capacity to bring about change is therefore conditioned, in part, by participants who have a certain level of self-assurance, and subject and pedagogical content knowledge can help to provide this. Participant C considered that teachers' personal capacities to implement adaptations and refinements to existing teaching practices would be enhanced through the interaction of teaching experience with a good level of subject pedagogical content knowledge. This is illustrated in the interview extract below:

"When... not so experienced ... they [Teachers] don't have that confidence, or the competence because they haven't had the practice, so it's harder for them to think on the spot or suddenly they have to plan much more... so I think the more competent you become the easier it is to be autonomous because there is a whole bank of things that you have used before, you know what works, and you've got all the little techniques but also you know your subject really well . Knowing your subject really well actually makes it much easier to put these things in place, to use different tasks because you can think of all the different ways of explaining it or you can think of other different ways of approaching it or doing it but you have to really understand the subject really well to do it... Other people might need full suggestions or example... They need you to say you could use it here, here and here but that comes with experience" (Participant C).

Evidence within the sample suggested that when participants were teaching outside of their own subject specialism, they could exhibit perceptions of lower levels of confidence and competencies, in terms of ability to make changes to practices. Participant C outlined the effect of this particular issue:

“It’s like because they literally couldn’t think of where they would do it [Implement Change]. They couldn’t make that connection” (Participant C).

Nevertheless, the majority of participants within this sample were working within their specialist areas, and reported high levels of teacher self-efficacy. Zimmerman (2000) reports that self-efficacy provides learners (teachers, in this instance) with agency, intrinsic motivation and feelings of self-concept and perceived control, as well as acting as a predictor of effort and persistence.

To an extent, the study supports the view that self-efficacy leads to use of self-regulatory behaviours and process such as goal setting, self-monitoring and self-evaluation. Despite a wide range of professional profiles, the vast majority (95%) of teachers considered themselves to be at least quite capable of teaching science. With only a small minority of teachers feeling uncomfortable – and potential reasons for this have been discussed. Subject pedagogical knowledge and teaching experience support participants’ self-assurances that they can implement effective practices to support pupils’ learning.

5.6.1 Participants' reflections on colleagues more resistant to change.

Not all teachers engage so enthusiastically with CPD. The attitudes and perceptions of participants within this study may not necessarily be representative of those within the wider teaching profession. Participants' reported during interviews that their colleagues do not always engage so enthusiastically with CPD opportunities. The lack of available time to engage with CPD and implement changes was given as one such reason: "Some people in science were saying I haven't got time to do that, but it was like it's literally a three minute task" (Participant E).

However, I think what is indicated in the extract above is a question, by Participants E, to whether the reported lack of time, is really the prime reason for colleagues unwillingness to be involved implementing changes to practices. Participant D gave further reasons for colleagues' unwillingness to engage with a change process:

"a lot of the staff would say ... that won't work with my kids, that couldn't work with my kids, so it's like that, it's a fear of trying new things with possibly a group of children that they don't trust and kids that don't trust their teacher. That's the key thing about teaching, being able to take some risks and being able to try something new, but I think you've got some staff who just didn't have that and they would just blame things : 'oh it takes too much time, I can't do it, it doesn't fit with this, it doesn't go with that'; but ultimately I think it's about the teacher trusting the kids to have a go at it" (Participant D).

The reported limitations of time emerge again, as a reason cited for maintaining the status quo. However, within this interview extract there is explicit reference to a

'fear of trying new things'. Put another way, a lack of teacher self-assurance, could limit the nature and extent of change. On this occasion, it was contextual factors, uncertainty of how pupils would respond to change, which were considered to undermine teachers' self-assurances.

Challenges to teachers' autonomy, was also considered another inhibitor of instigating change, "There are some people who get their backs up straight away as soon as they're told to do anything... It's just people being automatically defensive. And maybe there are reasons for that". (Participant C).

What is indicated at the end of this statement is a suggestion that other 'reasons', other than a challenge to teachers' autonomy, are likely to have a negative influence on the nature and extent of change. But I think it is significant that Participant C links negative reactions from colleagues who have been 'told to do something'. I would suggest that this provides a very clear message of the importance of supporting teachers' autonomy within any change process. Being 'told to do something' is not an autonomy supportive action.

5.6.2 Professional histories

Evidence gained through interview transcripts also pointed to the importance of participants' personal professional histories, in supporting participants' self-assurance to engage with the CPD process. The transcript extract below highlights the importance of how Participants C's employment history as a professional

scientist, helped condition the embedding of the ideas and resources gained through the CPD:

“I think I can always relate something that we’re doing to something that I’ve done, and I think I can then sort of explain to them real life examples, and even when I’m teaching chemistry and physics I can often link in things that I’ve done, and I was mainly a biologist obviously but it just about thinking of those things and thinking of the connections” (Participant C).

And also:

“It’s interesting for them to hear about it from someone who has done it [worked a scientist], I think rather than just telling them about how it happens. I think they appreciate it from first-hand” (Participant C).

Earlier, I discussed that overall participants held perceptions of high levels of teacher efficacy, as measured by the questionnaire items. There were, however, some interesting variations in the levels of participants’ perceptions of their teacher efficacy. Paradoxically, those with a leadership responsibility reported lower levels of teacher efficacy, overall. It can be seen in the Table 39 that participants *without* leadership responsibility scored higher mean scores in questionnaire items. This may be due to the additional competing accountability pressures that science leaders may face within their roles. This is an area to be discussed more fully later within Chapter 6.

Table 39: Perceptions of teacher efficacy for teachers and leaders

Teacher Efficacy Score	Teachers	%	Science Leaders	%
(low) 1	0	0.00	0	0.00
2	0	0.00	0	0.00
3	0	0.00	16	22.22
4	18	54.55	48	66.67
(high) 5	15	45.45	8	11.11
<i>Total</i>	33		72	

The questionnaire data revealed that 100% of classroom teachers scored a mean teacher efficacy score of 4 or above, whilst only 78% of science leaders rated themselves as highly.

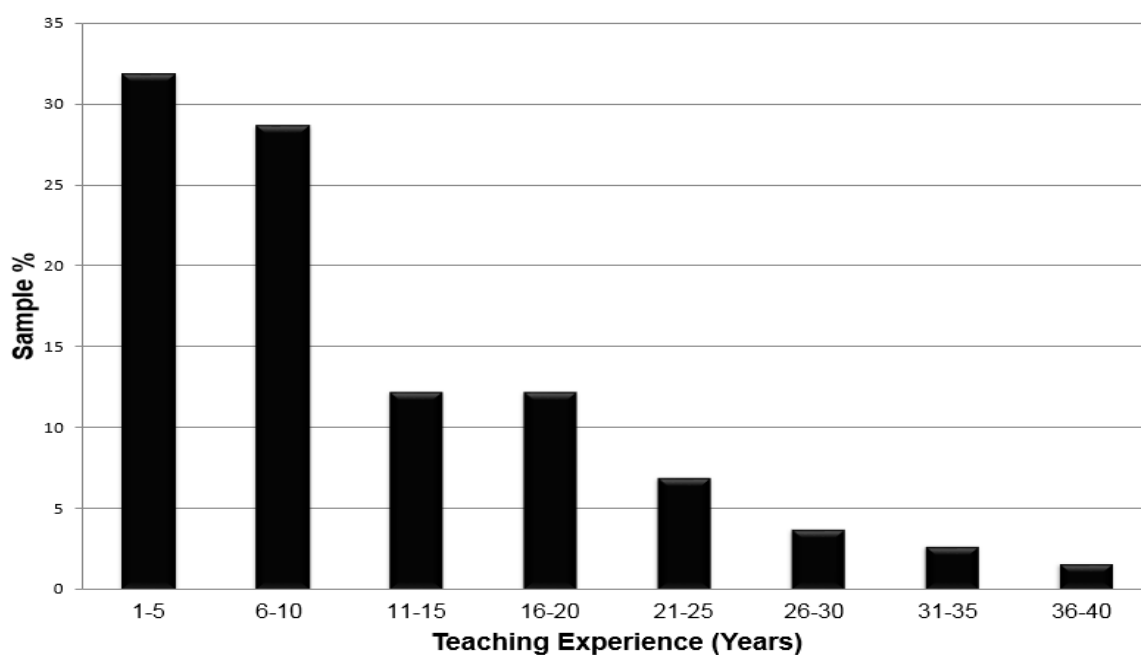
Other variations in perceptions of overall levels of teacher efficacy occurred within the length of teaching experience, and the level of academic qualifications of the participants. In both instances, greater teaching experience, and higher academic qualifications were associated with perceptions of higher degrees of perceptions of teacher efficacy. The associations between teaching experience and perceptions of teacher efficacy can be observed in Table 40.

Table 40: Perceptions of teacher efficacy for teachers of more than and less than five years' experience

Teacher Efficacy Score	Length of Teaching Experience			
	<=5 Years	%	>5 Years	%
(low) 1	0	0.00	0	0.00
2	0	0.00	0	0.00
3	8	20.00	8	11.59
4	26	65.00	44	63.77
(high) 5	6	15.00	17	24.64
<i>Total</i>	40		69	

It could be suggested that perceptions of lower levels of teacher efficacy may act as strong driving forces for participants to attend the CPD in the first instance. In this way interest in engaging subject specific CPD may decline with time. On this note, there is a very a clear pattern within the questionnaire data that shows an inverse relationship between attendance at the CPD and length of teaching experience. This can be seen in the figure below.

Figure 17: Teaching experience of sample



In addition, further questionnaire data would suggest an association between attendance at CPD and levels of teacher efficacy. Participants who had previously attended science specific CPD, specifically within the last two years, reported higher levels of teacher efficacy overall. These associations can be observed in the Table 41.

Table 41: Perceptions of teacher efficacy for participants who had, or had not attended previous science specific CPD

Teacher Efficacy Score	Previous attendance at subject specific CPD?			
	No	%	Yes	%
(low) 1	0	0.00	0	0.00
2	0	0.00	0	0.00
3	11	21.57	5	8.62
4	33	64.71	37	63.79
(high) 5	7	13.73	16	27.59
<i>Total</i>	51		58	

In the population of participants who had attended similar CPD in the past, 91% reported a mean teacher-efficacy score of 4 or above, whilst this figure was 78% in those who had not attended similar CPD. This could suggest, that the CPD has had an impact on building participants' perceptions of their teacher-efficacy, and therefore a series of short-CPD workshops may have a cumulative effect in terms of enhancing participants' capacities within a process of change.

5.7 Teacher autonomy

Interview findings suggest that participants felt that having a degree of freedom, or autonomy, to make selected changes to their own practices was a particularly significant factor in influencing changes to practices. This is illustrated within the two contrasting statements below. In the first, Participant A felt that she was unable to make changes to her teaching practices, within the Key Stage 3 Curriculum, in the school. “[Teaching] was very much prescribed; “this is what you’re doing, this is why you’re doing it, this is the PowerPoint you are going to use, whether you like it or not”. (Participant A).

Individual autonomy within the workplace is of course balanced against organisational expectations and requirements. It is a careful balance, which can be nudged, towards perceptions of greater autonomy, as Participant C notes: “Obviously you’re restricted by the curriculum, so there’s certain content you’ve got to cover but how you deliver that content is up to you”. (Participant C)

However, Participant D indicated that he had a high degree of freedom to make his desired changes to teaching practices. However, what emerges within this extract below is a clear link between a level of autonomy to make changes to practices, and the *authority* to make those changes actually happen:

“It was basically up to me. I made the decisions really, and I knew that there were skills shortages with some of our students. My biggest concern was that students were coming to study their GCSEs and they didn’t have the right kind of learning skills ready to take them on, so that they could be successful in science at GCSE, so that was why, yeah basically I had

complete autonomy to do what I wanted to do because it was my scheme of work. And the head was very supportive". (Participant D).

Leadership responsibility in the extract above is clearly related to perceptions of increased autonomy. This link may therefore explain a finding within the questionnaire data that suggests an association between leadership authority and increased perceptions of the CPD's usefulness to practice. In addition, perceptions of increases in pupils' engagement, and likelihood of the sustainability of CPD over time, are linked to leadership authority in a similar way. These associations can be observed in the following tables.

Table 42: Teachers' and leaders' perceptions of CPD's usefulness to practice

CPD: Usefulness to Practice	Teacher	%	Leader	%
Very	13	38.24	26	56.52
Quite	17	50.00	20	43.48
Not Very	4	11.76	0	0.00
Not at all	0	0.00	0	0.00
Total	34		46	

This table gives an indication that a leadership responsibility is associated with participants' perceptions of increased usefulness of the CPD to practice.

Table 43: Teachers' and leaders' perceptions of benefit of CPD to pupils' engagement

CPD: Pupils' Engagement Increase	Teacher	%	Leader	%
Very Effective	6	17.65	19	41.30
Quite Effective	22	64.71	21	45.65
Neither	4	11.76	6	13.04
Not Very Effective	1	2.94	0	0.00
Not at all Effective	1	2.94%	0	0.00%
Total	34		46	

This table gives an indication that a leadership responsibility is associated with participants' perceptions of increased pupil engagement.

Table 44: Teachers' and leaders' perceptions of the likely sustainability of CPD

CPD: Sustainability	Teacher	%	Leader	%
Certainly	16	47.06	31	67.39
Probably	15	44.12	13	28.26
Possibly	1	2.94	2	4.35
Not at all	2	5.88	0	0.00
Total	34		46	

This table gives an indication that a leadership responsibility is associated with participants' perceptions of increased likelihood of sustainability of CPD practices.

The significance of the need for participants' autonomous behaviours to be supported within the CPD process was explicitly communicated by Participant C, as can be observed in the interview extract below:

"I mean it was useful to have the time to talk about the different ways of doing it [On the day of CPD] but then .. it was a bit like you were shoehorning it in a little bit because you'd been told to do it rather than it feeling natural, like a natural thing to do. Getting the ideas was good but then you should have the flexibility to apply them a little bit, because everyone has got their own style ... some judgement has to be there, and some choice needs to be there". (Participant C)

Participant A, a class teacher, highlighted how autonomy can be influenced by other external factors, and when teacher autonomy is not supported, change may be impeded: "With practical based things, they have to be run past the technician, and that [reduced] my autonomy... So things like the whole class dissection I won't be able to do, because I was told "no"". (Participant A).

Supporting teachers' autonomy is clearly important to accommodate individual teaching styles, choice, and selection of the ways in which changes are implemented in practice. However, the importance of professional freedom and autonomy functions with a fine balance. An interesting point was raised by Participant A, who discussed having 'too much' autonomy, when she felt she did not have sufficient pedagogical content knowledge to support the innovation. In this way, autonomy, authority, and competence to bring about changes to practices are closely related.

5.7.1 Authority to Influence Colleagues.

Findings from this study indicate that CPD participants are highly likely to share ideas and resources with colleagues on their return to school. Opportunities for sharing new ideas and approaches with a wider population is likely to influence the extent of change. However, interview data revealed the importance of a leadership or management responsibility in supporting more wide scale change.

The extract below is taken from an interview with an experienced teacher who at the time of the interview did not have a current leadership or management responsibility:

“People [Colleagues] sometimes say I don’t know how to do that, and that’s absolutely fine, but when you have actually produced and shared something [New Ideas and Approaches] that could address that, but people are using something that’s worse” (Participant C).

This gives some insight into the teacher’s frustration; having shared ideas and resources – which she considered valuable and worth sharing, were not adopted by colleagues. Participant B also identified the issues experienced when collaboration and sharing of ideas is not reciprocal:

“We don’t really work particularly effectively as a department, there is no opportunity to share ideas and share resources, if that did happen then my physics teaching would be more effective, and I could get more feedback on what I do”. (Participant B)

This is in contrast to an interview with Participant D with management responsibility who reported widespread changes to colleagues practices. Although the participants did make the point that his influence on colleagues practices, was in part due to their belief in the value of the new CPD approach, and a trust in him: “So they [Teachers] had to have that belief in it [CPD] I think, and that possibly comes back to a trust in me” (Participant D).

It is interesting to note that although teachers within the sample reported that they actively sought ‘better’ ways to teach science, the interview data revealed that on return to school, colleagues’ perceptions of ‘better’ ideas and resources may be more favourably received from somebody with a management or leadership responsibility.

5.8 Motivations to become a ‘better’ teacher.

Participants’ views of their current teacher identity and the sort of teacher they would like to become emerged as a strong conditioner of change, in that participants within this sample sought to reduce the discrepancy between these two identities. That is to say, evidence emerged that participants wanted to make their teaching ‘better’ – they wanted to become more effective teachers. This was supported in questionnaire data, by teachers reporting a desire to make lessons ‘*more*’ engaging, to make use of ‘*better*’ resources, to ‘*improve*’ teaching, to challenge pupils ‘*more effectively*’. These drives were highlighted within the interview data too. What is remarkable within the short extract below – a teacher’s

answer to their reasons for attending the CPD - is the frequency of the word 'better':

"I think it [motivation for attending CPD] was to get **better** at my job and to know the job **better**, and be able to lead a **better** department, and get **better** outcomes for the kids ultimately". (Participant D).

Every teacher interviewed discussed similar sentiments, a desire to become a better teacher:

1. "It's important to find **better** more interesting and effective ways of teaching". (Participant B)
2. "I want to get **better** at what I do because that's something I, I just can't see the point of doing something if you don't want to do it properly or **better**". (Participant C).

Participant B also highlighted the point: "The kids round here really need good teaching and that is really important so I do feel a real sense of obligation that my lessons are as good as they can be that is really important to me" (Participant B).

Many participants considered that they do not always teach science as well as they would like to. Participants in the sample were evidently active in the process of refining and developing their own practices; as one of the highest scoring items reported in the questionnaire data was that participants were 'Continually finding better ways to teach science'. However, issues of participants' perceived

successes were amongst the lowest scoring items. For instance, 'I generally teach science as well as I'd like' was the lowest scoring item on the efficacy scale. Clearly, the determination to achieve *betterness* is a strong driver for implementing changes to existing teaching practices.

A related conditioner for change emerged as the extent to which the new approaches and ideas explored within the CPD workshops challenged participants' current teaching practices. The following table gives an indication of the extent to which participants considered the CPD challenged the way they currently taught.

Table 45: Extent to which CPD challenged existing teaching practice (n=80)

To what extent did the CPD challenge the way you teach?	%
Very much	27.85
To some extent	64.56
Not much at all	6.33
Not at all	1.27

Although 92% of teachers considered the CPD challenged the way they teach to at least 'some extent', it was teachers who felt CPD had challenged their teaching 'very much' who reported more extensive changes to their teaching practices, to pupils' engagement, and also to the likelihood of the sustainability of the implemented changes. The details of these associations can be seen in the following tables.

Table 46: Association between the extent to which CPD challenged teaching, and its perceived usefulness to practice

CPD: Usefulness to Practice	Extent to which CPD challenged Existing Practices					
	Very Much	%	Quite a lot	%	Not Much at all	%
Very	17	77.27%	20	39.22%	1	20.00%
Quite	5	22.73%	29	56.86%	2	40.00%
Not Very	0	0.00%	2	3.92%	2	40.00%
Not at all	0	0.00%	0	0.00%	0	0.00%
Total	22		51		5	

This table indicates an association between the extent to which CPD challenges participants' current teaching approaches, and participants' perceptions of the usefulness of the CPD to practice. For instance, greater challenge is associated with increased usefulness.

Table 47: Association between the extent to which CPD challenged teaching, and perceived increases in pupils' engagement

Pupil Engagement Increase	Extent to which CPD challenged Existing Practices					
	Very Much	%	Quite a lot	%	Not Much at all	%
Very Effective	11	50.00%	11	21.57%	1	20.00%
Quite Effective	10	45.45%	30	58.82%	3	60.00%
Neither	1	4.55%	9	17.65%	0	0.00%
Not Very Effective	0	0.00%	1	1.96%	0	0.00%
Not at all Effective	0	0.00%	0	0.00%	1	20.00%
Total	22		51		5	

This table indicates an association between the extent to which CPD challenges participants' current teaching approaches, and participants' perceptions of the effectiveness of the CPD at increasing pupils' engagement. For instance, greater challenge is associated with increased effectiveness.

Table 48: Association between the extent to which CPD challenged teaching, and its perceived sustainability

Sustainability of Changes to Practices	Extent to which CPD challenged Existing Practices					
	Very Much	%	Quite a lot	%	Not Much at all	%
Certainly	18	81.82%	25	49.02%	2	40.00%
Probably	3	13.64%	23	45.10%	2	40.00%
Possibly	1	4.55%	2	3.92%	0	0.00%
Not at all	0	0.00%	1	1.96%	1	20.00%
Total	22		51		5	

Table 48 indicates an association between the extent to which CPD challenges participants' current teaching approaches, and participants' perceptions of the likely sustainability of new practices. For instance, greater challenge is associated with increased confidence in sustainability.

Motivations to become a 'better' teacher, and to implement practices that are 'better' than existing ones, emerged as a very strong theme. Whilst these reflect the personal drives of the individual participants', such dispositions are influenced heavily by the socio-political environment. These issues will be discussed more fully in Chapter 6.

5.9 Seeking reassurance

Participants within this study reported overall high levels of teacher efficacy, as rated within questionnaire responses. This is noteworthy in terms of developing an understanding to changes in classroom practices following CPD. Zimmerman (2000) reports that self-efficacy plays a key role in future function, outcome expectations and motivation to perform new actions. It can act as a predictor for motivation and learning.

A major issue with concentrating on self-efficacy alone, however, is that it focuses on task specific performance capabilities and expectations, rather than personal qualities or psychological characteristics (Zimmerman, 2000). The interview extract below is taken from a highly effective (as judged by peer review and through performance management arrangements) subject specialist teacher who had attended a CPD workshop within her own science specialism:

“Maybe it’s a confidence thing, just to boost my confidence just for me to believe that maybe I am doing the right thing, but also just to guarantee it”.
(Participant A).

This statement highlights the importance of the need for reassurance. Particularly in relation to the success or otherwise of the enactment of teaching approaches. It would appear though from what is said that personal professional development is not always self-regulatory. The ‘self’ is not always sufficient to sustain this iterative process of enactment and reflection.

Interview data revealed the importance of the role of CPD at addressing some areas of low confidence expressed by some participants. Why the role of the external CPD should be so significant in building participants' confidence, particularly when taking into account the high degrees of teacher-efficacy, and reported effectiveness of existing practices, is not easily explained, although the reflections of Participant A who considers that 'external' CPD can provide access to support and feedback which is less 'biased'. Participant C also alludes to this, and states that 'peer' support and feedback is more neutral than management feedback and 'often makes you feel more competent' (Participant C).

Evidently, not all support is considered equally valuable. Interview data suggested that for support to be meaningful, the support should be as unbiased and objective as possible. The desire for objectivity, within the CPD process, is illustrated in the interview extract of Participant C:

"Lesson observations you know they are used to judge and they are used for lots of negative reasons as well, so when you want to use them for positive reasons it can be like, it can be hard to turn that around. It's often performance management, its Ofsted". (Participant C).

What I consider is being said here is that support and feedback can be politicised, can be related to Ofsted judgements, performance management arrangements and accountability measures. These external pressures are often the drivers for

much observation and support, as opposed to the support provided as part of participants' development and professional growth. In addition, what is also suggested is that something which could be useful developmental support, such as lesson observation and the associated feedback, is in some respects tarnished and viewed with suspicion, set against more political motives and agendas. This is illustrated when Participant C goes on to state that "I think there is a fear with some [Teachers] that they are scared I think, of change, and also of being watched" (Participant C). In this statement, 'being watched' is a very emotive phrase, with Orwellian connotations. It is linked with Ofsted and performance management. This is juxtaposed with the importance of bench marking oneself against peers, as can be seen in the interview extract below:

"Putting yourself into the situation where you are with people who are other teachers is actually probably good because you often think you're not as good as you are. It's only when you put yourself out there you think 'oh actually I'm alright" (Participant C).

And also:

"I think if you do that and you take part [In CPD] and you come up with ideas then, and people go 'oh that's a good idea', that makes you think 'oh I must know what I'm talking, about a bit' . Nobody has yet gone 'oh that's stupid'. So if it makes you feel a bit more confident and therefore you're more likely to suggest things – if you get a good reception, and I think that boosts your confidence more and makes you more likely to try things as well because you think 'well I do sort of know what I'm doing" (Participant C).

These have been very interesting, and perhaps unexpected, findings from the data to emerge within this study. Participants within the sample are highly qualified practitioners; yet still remain uncertain that they teach science as well as they would like to, and discuss the need for reassurance. It is not entirely clear why these participants, who report high degrees of efficacy, do not have more of an internalised confidence or trust in their own professional 'internal voice' (Dadds, 1997). This is an issue that will be revisited in Chapter 6, when I consider the influence of the socio-political environment on participants' practices.

5.10 Self-Determination Theory (SDT) as a construct for explaining participant engagement with CPD workshops, and subsequent changes to practices.

Findings from this study would suggest that, participants actively seek CPD to improve practice, to enhance pupil engagement, and also to seek greater professional fulfilment, and also to influence other teaching professionals.

However, although competent and self-efficacious, the participants were not always confident in their abilities – even when they received positive feedback from the pupils they teach, or from colleagues they work with. This seems something of a paradox, although I suspect can be explained to some extent by Craft (1997) who makes the point that:

‘Change can help people feel vital and motivated as their skill increases, but that at a certain point there is a ‘change dip’ when confidence and motivation can fall and need to be supported’ (Goddard and Leask, 1992).

This notion of a dip in confidence and motivation resonates very closely with the reported need in participants for ‘reassurance’. However, there are other significant factors at play. A point summed up by Dadds (1997):

‘Major educational reform initiatives in England since 1988 have been based on a technicist view of curriculum and teaching which assumes that change can be ‘delivered’ in a linear way from the ‘centre’ to teachers for implementation in classrooms. Expertise in judgement and decision-making is seen to reside outside schools, to be conferred in a hierarchical way to those inside schools. There is no account in such models of teachers’ own expertise, understanding and judgement’. (Dadds, 1997).

What is clear from the emerging findings is that a technician view of teaching is wholly insufficient for understanding teachers and classroom change. Teachers are the mediators of classroom change, they are directly and inextricably linked to the process of enactment and reflection of new, or refined practices.

It has been discussed (Chapter 4) that short episodes of subject specific CPD can often, in the first instance, lead to 'mechanical' or 'routine' change, but over time these changes can become adapted and more refined, most probably becoming more and more effective.

Within this chapter, I have discussed how a number of personal influences can help condition changes to classroom practices. These include:

- Participants' motivations to become a 'better' teachers
- Participants' needs to seek reassurance
- Participants seeking Intellectual Rejuvenation
- The importance of participants addressing their 'own' personal professional needs within the CPD process
- Participants possessing sufficient subject and pedagogical knowledge of current and 'new' practices
- Participants' confidence in personal capacity to bring about change
- Participants' views of CPD as a worthwhile process, and expectations that new ideas and resources will be of value.

Of significance, is that participants benefit from CPD workshops when they already have an existing level of expertise, and have a professional interest within the CPD area. On one level, it may seem ironic that high levels of expertise are

required for successful engagement and interaction with the CPD process. If CPD workshops are to contribute to teachers' development and classroom change, they must dovetail with teachers' existing capabilities.

Short episodes of CPD are widely considered to be insufficient to bring about meaningful changes to classroom practices. However, I would argue that based on the findings of this study this depends on the levels of the teachers' self-determination to bring about such changes to practices. 'The more a person takes responsibility and ownership of the changes, the more likely those behaviours will continue so that classroom strategies influence student achievement' (Grove et al., 2009). This is supported too by Dadds:

'Such a disposition [willingness of teachers to study and question their work closely and in-depth] provides the crucial inner conditions for growth and for professional development which changes the world in small but significant ways for children' (Dadds, 1997).

And Dadds goes on to state that:

'Such learning also, usually, needs time and does not come simply as a result of awareness-raising of new content... The surface moments of insight usually mask deeper stages of maturing thinking which have been incubating over time.' (Dadds, 1997).

Teaching science can often involve teaching across all three subject disciplines, which inevitably can bring a range of challenges, for a teacher who is academically

well-qualified in only one subject area. The motivation for teachers to seek out opportunities for appropriate subject specific CPD was considered by participants to be as an important source of professional and pedagogical knowledge, as illustrated in the following interview extract:

“The good thing about the course was that we discussed lots of different things from different subject angles... as a biologist it was important to get the spin from chemists and physicists because I knew I was going to have to teach chemistry and physics... When you’re not a subject specialist I think that really helped, but also when we were just throwing out ideas it’s when it kind of came to me that I started to think of the sorts of things that I could do, I think that helped me”. (Participant B)

In explaining classroom change participants’ confidence and expertise to enact those changes, as well as their autonomy and authority to do so are important conditions, but so too are issues of how participants relate to colleagues. Participants’ psychological needs of autonomy, competence, and relatedness have an important position in explaining the nature and extent of classroom change following their attendance and engagement at a CPD workshop.

The longer-term use of implemented strategies was very much bound up with the extent to which the CPD met teachers’ expectations, and the extent to which it challenged their current practices. There is a clear message of the importance of utilising professional judgement and ongoing reflection to ensure that new practices are in fact more effective, in the face of pressures to follow ‘new-fangled fashions’ (Teacher C) or whatever the current educational trends might be. It takes

courage to subvert any ill-informed new initiatives. Participants' confidence and high levels of pedagogical knowledge and expertise are required to judge likely effectiveness of new practices.

Clarke and Hollingsworth (2002) make the case for the value of their model supporting analysis and understanding the influences on change processes. The interconnection between the domains can help assist in developing an understanding of the Nature and Extent of change and therefore is useful to this section of work. As it is individual participants who are the mediators of change, the processes of enactment and reflection are to some extent within the participants' control. The cycles of enactment and reflection can take time to complete, and a key strength of this study is that data were collected, on average, almost 3 years after the CPD workshop. It is reasonable to assume that this could provide sufficient time for a number of cycles of enactment and reflection to occur, and therefore findings provide a useful insight into the ways in which the different domains highlighted by Clarke and Hollingsworth (2002) interact.

The influences of the change environment will be explored more fully in Chapter 6. However, the findings discussed within this chapter have illustrated the importance of conditions within the 'Personal Domain' of the teacher in understanding psychological processes leading to change. The external domain has been considered by teachers as an important source of 'new ideas' and an important source of information to help become 'better' teachers. However, findings from this study suggest the significance of the role of participants' motivations and their

professional needs and desires in mediating those changes. Participants' reported the need to utilise their own professional judgement within a CPD process.

Changes to practice are more likely to occur if participants have a good understanding of the subject and curriculum area. The salient outcomes of short subject specific CPD workshops include participants' access to new resources and ideas that will likely benefit pupils' learning. In addition, participants may be motivated to engage with subject specific CPD to support their own feelings of personal professional fulfilment.

Short CPD workshops, are often associated with 'deficit' models of CPD, in which CPD is something 'done to teachers'. In this view, participants are considered to be 'passive recipients', as the workshop itself does not provide time for enacting change or reflecting upon it. Yet, findings from this study would suggest that participants of such workshops could be far from 'passive recipients'. They can be actively involved in contextualising their learning, and draw upon their professional judgement to consider the relative merits of new ideas and resources. Participants also attend the CPD with very clear expectations of what they would like to achieve from it. And, importantly when there is a range of subject specific CPD on offer, and the CPD meets participants' expectations, and provides a level of challenge, positive impacts on teaching practices and pupils' learning are reported.

The self-determination of the participants within the CPD process as a key concept with which to make sense of the nature and extent of change. The idiosyncratic nature of participants' circumstances and their school settings requires them to be

active agents within this process of introducing new ideas and approaches into existing practices. Findings from this study would suggest that the 'quality of CPD', cannot be judged by the length of the course alone, as this neglects important considerations such as how participants interact with the CPD, and how the domain of consequence (Clarke and Hollingsworth, 2002) can act as an important motivator and driver.

Gains in participants' feelings of satisfaction and professional fulfilment were reported within the sample. Participants reported that short subject specific CPD workshops can refresh practices and make their role more intellectually stimulating. Very rarely are these explicitly defined outcomes of a CPD workshop, but they have emerged from this study as important unintended consequences. These findings align with the view of Schön (1983) that in terms of professional growth the motive for learning and engagement with CPD can arise from the need for feelings of greater personal and professional fulfilment. Short subject CPD workshops can provide the stimulus for enhancing participants' perceptions of professional fulfilment. Significantly, the personal professional 'self' is a central component of the CPD process.

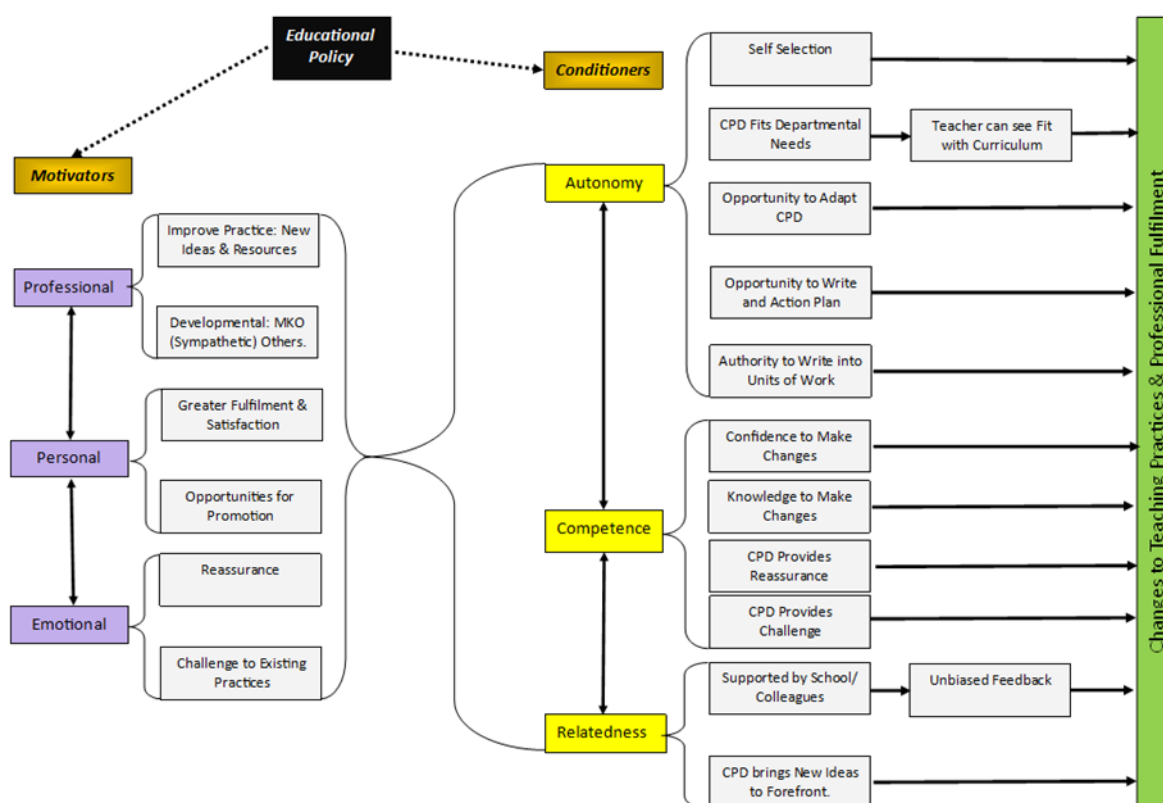
5.11 Development of a model, to understand processes leading to change.

Participants' self-determination has emerged as an important construct in understanding the processes leading to classroom change. Analysis and interpretation of the data generated through this mixed-methods study has shown that an understanding of participants' autonomy, competence, and relatedness to

colleagues, plays an important role in contributing to an understanding of the change process.

The key findings and the key themes to emerge from this mixed-methods study synthesised, and draw together to present the model presented in Figure 18.

Figure 18: The role of SDT (Autonomy, Competence and Relatedness) in conditioning change



The model represents each of the key themes to have emerged from the study (indicated with a grey-shaded box). These themes have been identified as being important, for facilitating change. Within this model, the themes have been arranged depending on whether they are likely to motivate participants to engage

with the CPD in first instance, or on whether they are likely to help support the change process, once participants have actually engaged with the CPD. The model suggests that there are likely to be a range of personal, professional, and emotional motivations for participants to engage with the CPD. It suggests that there are a range of autonomy supportive, competence supportive, and relatedness supportive actions that are likely to help support the change process. Although various motivators and ‘conditioners’ are likely to be interrelated, the model posits that if any one of the conditions listed in the model are satisfied, then there is an increased likelihood that changes to teaching practices will occur. For instance, if a participant is able to initiate attendance at a CPD workshop of *their* choice, then changes to classroom practices are more likely to occur. The model also posits that changes are likely to manifest as changes to teaching practices as well as in levels of feelings of enhanced professional fulfilment.

The black-box highlighted on the model indicates the influence of educational policy across all aspects of the model. The influence of the socio-political environment will be discussed within Chapter 6.

5.12 SDT interplay and the extent of change

Autonomy, competence, and relatedness supportive actions have emerged as an important part of the process of facilitating change. When teachers act, or feel they are able to act in a more autonomous way, as indicated in Figure 18, it is much more likely that changes to classroom practice will occur. This finding is very much in line with findings outlined by Grove (2008). When teachers feel they have a

strong sense of efficacy and have pre-existing subject and curriculum knowledge, then classroom change is more likely. Change is also likely when teachers view CPD as a way of enhancing and adding value to their existing knowledge by providing new ideas and resources, and that they have confidence they will be able to implement the new practices, and add value to them. This again, is in line with findings of Grove (2008). When teachers feel that the CPD relates to their own professional needs and meet their expectations, and that colleagues can act as a 'more sympathetic other' to share or help develop and refine ideas for new practices, then again changes to classroom practice are more likely to occur. The importance of these internal motivational factors are also recognised by Grove (2008) and Grove et al (2009).

Most significantly, it can be noted from analysis of the questionnaire data, and analysis of the interview findings that when the three psychological needs of autonomy, competence and relatedness, are supported *in combination*, change in practice, but also long term change, and teacher growth, is much more likely. It is their interplay which leads to an understanding of the extent of impact. This emerged when findings from this study revealed some of the various connections between feelings of autonomy, competence, and relatedness. Neatly summarised by one of the participants, when discussing the impact of the CPD (My annotations are highlighted):

“I think bringing ideas to people’s attention (**relatedness**) , as long as they’re not sort of “you will do it” (**need for autonomy**) putting your own spin on it is important (**autonomy & competence**) and you have to feel like you can do it (**competence**)”. (Participant C)

The phase 3 Interviews were particularly significant in providing a further layer of detail, notably the ways in which autonomy, competence and relatedness can affect and influence each other. Analysis and interpretation of these interview transcripts was instrumental in explaining how these constructs can impact upon each other. For instance, the link between relatedness to colleagues and issues of autonomy and competence was evident in the extract below:

“It’s not easy to work in this department (**absence of relatedness**), it would be so much easier to be, to develop as a teacher (**competence & autonomy**) if it was a more friendly environment to work in”. (Participant A)

In addition, the interview extract below provides further insight into the impact of relatedness on competence:

“I think sometimes children say what they think you want to hear, ‘oh I love your lessons’. Can I actually trust that? And also sometimes they might like your lessons for the wrong reasons, so I think it’s important to have an external point of view , just completely independent, no bias at all (**issues of relatedness**), and just say it exactly as it is, that would help. Just a, maybe it’s a confidence thing, just to boost my confidence just for me to believe that maybe I am doing the right thing (**issues of competence**), but also just to guarantee it” (Participant B).

However, competence and relatedness can also impact on autonomy, as highlighted in the following quotation, taken from a teacher who has previously worked as a research scientist:

“I think they [pupils] like it when I tell them stories, of what I used to do (**autonomy**). If we are covering something I will say, I used to use this (**competence**) and then I will give them an example of where I used to use it, and how I used to use it, and the people I used to work with sometimes who are known for certain things . They like it when you can say I used to know him, that gives them, they enjoy that the sort of connection to actual science (**relatedness**) rather than it being sort of distant. I'll say we actually did this, I spent two years doing this” (Participant D).

SDT has clearly emerged as an important framework for explaining the impact of CPD workshops. But it is evident that relationships between various constructs are complex and sometimes unpredictable. The key overall findings are summarised below:

An individual's **autonomy** within the change / growth process is:

- Restricted by the curriculum and the degree of prescription in schemes of work.
- Restricted by power, politics and authority, and own ability to influence others.
- Restricted by their own competences e.g. whether they are subject specialists, whether they see themselves as subject specialists.
- Restricted by relatedness to colleagues and receptivity of support and new ideas.
- Restricted by confidence to make change, to take the risk, to 'put themselves out there'.

An individual's **competence** within the change / growth process is:

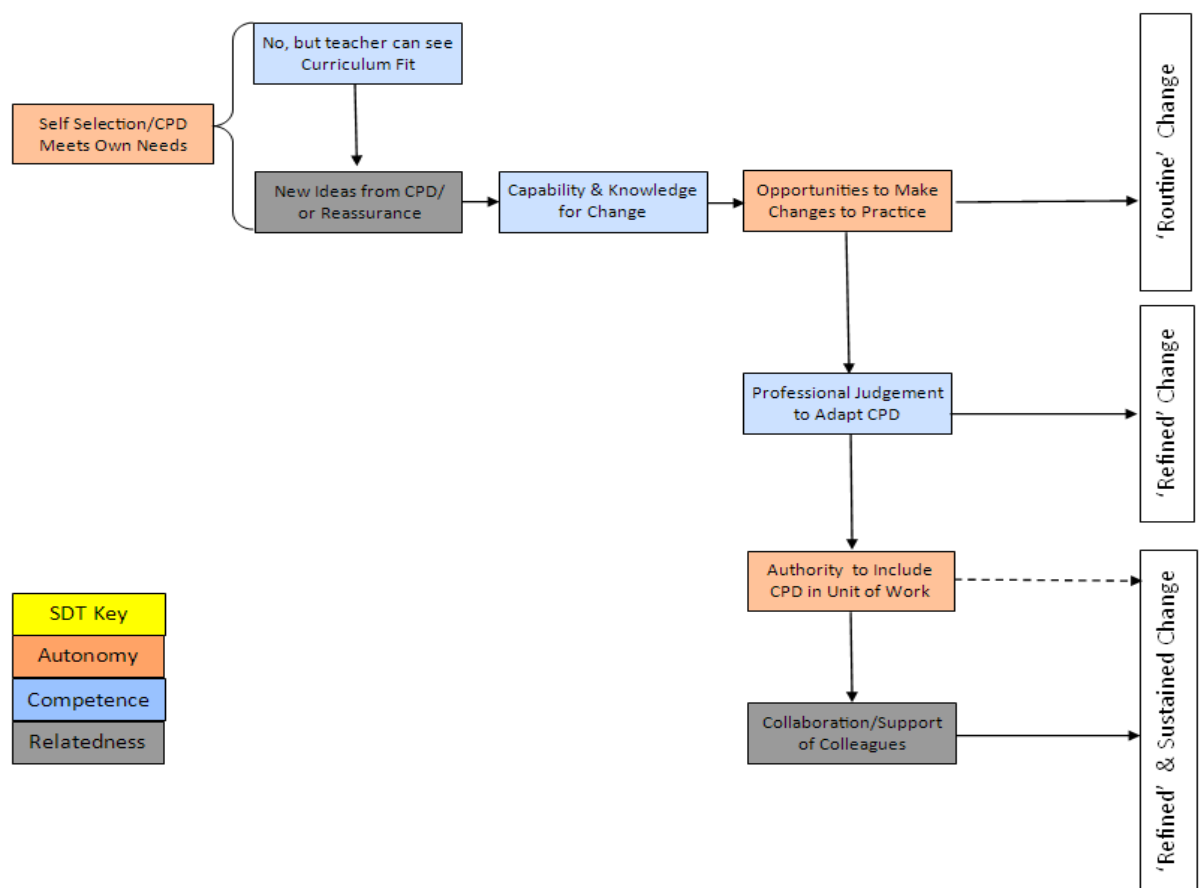
- Restricted by science qualifications.
- Restricted by level of teaching experience.
- Restricted by relatedness to pupils, and knowing what they need.
- Restricted by relatedness to colleagues, quality of support and feedback.
- Restricted by confidence to 'give change a go'. Successes build feelings of competence.

An individual's **relatedness** within the change / growth process is:

- Restricted by levels of confidence to share ideas and ask for or share feedback.
- Restricted by levels of competence which impact on confidence to share ideas.
- Confined by feelings of fairness and parity e.g. reciprocity of sharing of resources and support.
- Restricted by levels of authority and power, and ability to influence others.
- Restricted by culture of change within the department or school.
- Restricted by issues of motivation.

The significance of the interplay between participants' perceptions of autonomy, competence and relatedness, in terms of influencing changes to practices, is summarised in the model Figure 19.

Figure 19: The role of the interplay between SDT components in influencing change



When interpreting the model, the reader should begin from the orange box on the left hand side. Each step provides details of the links in the key sequences, which have emerged from the study as leading to impacts on teaching practices. The extent to which each of the criteria can be satisfied provides an indication of the extent of the change that is likely to be observed.

The extent to which the basic psychological needs of autonomy, competence, and relatedness, can be satisfied within a professional development process, is likely to influence the extent of impacts on teaching practices. Supporting a participant's self-determination is likely to support change. In terms of a participants' professional growth, the CPD process – even short subject specific workshops, may have a particularly important role to play, as CPD can act as a grindstone on which the basic psychological needs of autonomy, competence, and relatedness, can be promoted and supported. As such, participants gain more from the process than acquiring a list of new ideas and resources. CPD workshops can also support feelings of professional satisfaction and fulfilment. The ways in which components of self-determination are satisfied are therefore key to understanding the professional development process.

Engagement in personal and professional development is an effortful process and can require significant investments in time, and implementing changes to classroom practices often takes more time than expected (Fullan, 1993; Guskey, 2002). A participant's self-determination to implement changes can provide the motivation and momentum within this change process. A participant's emotional

investment in the CPD is a key part of the change process, as Dadds makes the point:

‘Professional learning is not simply a matter of “reading off” others’ expert theories and “reading them in” unproblematically to practice (Hamilton, 1994)... The journey of professional growth into new and better practices is often unpredictable; often non-linear; often emotional as well as cerebral. It demands capacity and strength to ask questions; to analyse and interpret feedback; to discipline the emotions generated by self-study; to challenge established practices in the light of new understanding; to remain interested and professionally curious’ (Dadds, 1997).

The significance of SDT as a theoretical framework emerged through analysis and interpretation of all three stages of the study. The elements of SDT are important for ensuring high degrees of intrinsic motivation which impact on the extent of change following professional development. Supporting all three elements of teachers’ self-determination is important for ensuring impact on teacher growth, as not only will the absence of any one of the supporting elements impede impact on changes to practices but will also impact on the extent to which other elements can be supported. Elements of SDT interconnect and support the other. SDT is an important lens through which to view the professional development process. The need for a theoretical framework is made by Eun:

‘Recognizing the importance of professional development, many attempts have been made to identify the elements that contribute to its effectiveness (Joyce and Showers 1980). However, most of these studies have investigated the effects of professional development programs empirically in a post-factum approach (Eun, 2008). Lacking a general theoretical framework in which to ground professional development (Eun, 2008, Eun

and Heining-Boynton, 2007) these studies do not allow for predictions to be made or offer an explanation regarding why professional development leads to teacher learning or what factors may lead to enhancing this process' (Eun, 2010).

In line with Eun, Self-Determination Theory is suggested as one such framework, as it provides a predictive capacity, to some extent, to view teacher growth and classroom change following engagement with CPD. It has emerged as an important framework to consider how the professional development process is influenced by participants' perceptions of autonomy (choice), competence (expertise), and relatedness (collegiality and connectedness).

5.13 Summary

Findings from this study have suggested the importance of SDT in understanding participants' engagement with this CPD process. This framework provides insight into the personal, emotional, and motivational factors influencing how participants engage with the CPD process.

Emerging from this study is the notion that SDT is an important psychological theory, for understanding teachers' professional growth. An external CPD workshop is likely to provide ideas, resources, and strategies to a broad spectrum of participants in attendance, from a variety of school backgrounds. The professional development acts very much as a starting point, or a trigger for change. But, it is the participants at the CPD workshop who are then required to

implement, and eventually adapt or refine practices based on their own expertise and professional judgement. Individual participants have to internalise and mediate the change process. Change requires time, effort, and persistence on the participants' part as they actively engage the enactment and subsequent reflection of new practices.

Eun makes the point that although SDT can be a useful framework in which to understand the impacts of professional development, it must be noted that:

'This is only one piece of the bigger picture. Many theories of human development exist, and in order to decide which one is in greatest alignment with professional development, practices must inform theories. This may lead to further validating the usefulness of certain theories or it may focus the need to establish new theories to specifically address teachers' developmental paths.' (Eun, 2010)

This certainly holds true with findings from this study. The SDT framework provides a useful way, to some extent, of explaining the nature and extent of change. Nevertheless, this particular framework says little of the 'environmental' socio-political factors that may influence the extent to which participants engage within the effortful processes of bringing about change. The next chapter will seek to explore the importance of socio-cultural and political influences on the Personal psychological domain of a teacher, and the impact this can have on the change process.

Chapter 6: Findings and Discussion 3: The Significance of Socio-Political Factors in Influencing Changes to Teaching Practices.

6.1 Introduction

This chapter will focus on the social, cultural and political factors influencing changes to teachers' practices. As with the previous findings and discussion chapters, data will be drawn from the questionnaire and interview data. This chapter will build upon an understanding of the findings discussed within the previous two chapters.

Within the previous chapter, findings were presented and discussed in relation to the salient personal factors which can influence changes to participants' practices. A model was posited to highlight how an individual's level of self-determination can influence the change process. However, teachers do not work in isolation; they work in busy and complex social and political environments which impact on their personal and professional motivations and capabilities. The social and political, or 'environmental' conditions have an important part to play in accounting for the nature and extent of change to participants' practices following their engagement with a CPD workshop.

The purpose of this chapter is to discuss how the local and wider educational environment affects the parameters within which teachers' can affect change. It will build on the work of the previous chapter by providing a more holistic view of the ways in which the interactions between participants and the environments

within which they work influence the processes of implementing and embedding change.

The discussion within this chapter is very much in line with Murchan et al's. (2007) point that:

'What is also required is sensitivity to the interconnections between the individual practitioner, the school as an organisational entity and the wider systemic context in which it is located, and how in turn these too are also effected either as direct or indirect consequence of a programme of professional development' (Murchan et al., 2007).

Within any model of teacher change, consideration must be given to how teachers negotiate and mediate the change process within a complex socio-political environment. As such, this chapter will explore such interactions.

As discussed in Chapter 5, a range of 'internal' conditions: personal professional drivers, motivations, emotional factors, and competencies, can have a bearing on the way a change process is mediated by the teacher. However, teachers' knowledge, beliefs and attitudes will be effected by social and political factors. The significance of the interactions between the personal domain of the teacher and their work environment emerged earlier within this study. These interactions have a significant influence on the nature and extent of change following participants'

engagement with CPD. This chapter will discuss two key themes to have emerged from this mixed-methods study:

Key Theme	Page
The influences of the socio-political environment on participants' motivation to change practices (6.2)	302
How the socio-political environment influences participants' self-determination within the CPD process (6.3)	327
Critical Events and Zones of Enactment (6.4)	353

6.2 The influences of the socio-political environment on participants' motivation to change practices

The teachers' working environment presents conditions that have an influence upon an individual's capacity to affect changes to practices. Educational policy requires teachers to become 'better' teachers, to 'take responsibility' for their CPD, and to ensure pupil outcomes are continually enhanced. However, the pupil outcomes considered of most value are often confined to academic attainment only – particularly test scores and examination performance. Whilst of course these outcomes are highly important, there is a danger of marginalising other outcomes that teachers may justifiably consider important, such as pupils' affective outcomes, including pupils interests, attitudes, aspirations, and science capital.

Clearly, the socio-political environment impacts significantly on the extent to which teachers can implement changes to their practices, if these new practices are not

directly aligned with current policy. The environment is likely to place strict parameters on the scope of professional innovation, or place limits on teachers' zone of enactment (Spillane, 1999). On one hand, teachers are expected to take responsibility for change, but at the same time policy can restrict the nature and extent of the change which teachers' can reasonably apply. This section will comprise four parts:

Key Theme	Page
The significance of educational policy: Past and present	302
The drive to become a 'better' teacher: Issues of Professionalism	317
Criticality within the CPD Process	323
The 'expectation' that teachers <i>will</i> engage with CPD	325

6.2.1 The significance of educational policy: Past and present (1979-present)

Educational policy influences the extent to which teachers have capacity to bring about change (Whitty, 2008). This can be seen more recently with the (2010) White Paper 'The Importance of Teaching' where the economy was placed before community, and schools expected to behave more like businesses (Ball, 2013). Education has become marketised. Market-driven forces become drivers for classroom change.

This shift in policy alters the discourse and language used by teachers, and this in effect could change the way teachers think. Willmott (1993, p. 522) makes the point that teachers are:

‘simultaneously required, individually and collectively, to recognise and *take responsibility* for the relationship between the security of their employment and their contribution to the competitiveness of the goods and services they produce’. New administrative procedures are generated that ‘make individuals’ “want” what the system needs in order to perform well (Lyotard, 1984). We are encouraged to see our own ‘development’ as linked to and provided for by the ‘growth’ of our institution (Willmott, 1993, p. 522).

Educational Policy alters language and discourse. A 2012 study by the TES discovered that the term ‘standards’ was used several times more frequently than ‘curriculum’ in policy documents. In effect, ‘standards’ had replaced ‘curriculum’. Nick Gibb’s appointment as Minister of State for Schools Standards is likely to see this emphasis continue. This is significant. Particularly when interpreting the responses of CPD participants within this study. With ‘curriculum’ being knocked from professional discourse and a current top-down approach to curriculum innovation, it is hardly surprising that when teachers try to take a more central and crucial role in curriculum development – even within a local context, their own classrooms – they face some significant challenges and resistance. This may explain to some extent why teachers within this study, who reported change, tend to report high levels of teacher efficacy and articulate the importance of their self-determination within the change process.

The challenges that teachers can face when choosing to make their own, more intendent, changes to practices and drawing upon their own professional judgement is highlighted by Sahlberg and Biesta:

‘By positioning the teacher as a curriculum deliverer and producer of performance statistics, rather than as a curriculum developer, a responsible professional and agent of change, they stand in tension with professional discourse in education’ (Sahlberg, 2010, Biesta, 2010).

Priestley (2015) asks the question, and a valid one for this research study too, as to whether or not teachers still have the capacity (by which he means the will, determination and ability) to make changes based on their own professional judgement. Findings from this study would indicate that the teachers, within this study, certainly had the desire and expertise to enact change, but changes to practices could be ‘held up’ by the environment within which they worked. Eventually, changes to practices were more than likely to take place, which was highly likely due to the participants’ determination. These findings sit alongside those of Helsby (2000) who ‘suggested that teachers with high confidence in their own capacity and authority were able to act with a high degree of agency in the face of performativity, noting also that collegiality boosted such capacity, but that performativity eroded it’ (cited in Priestley et al., 2015, p. 125).

Teachers are faced with ‘an educational dilemma: how to deal with external productivity demands on the one hand, while simultaneously teaching for the knowledge society with moral purpose’ (Sahlberg, 2010, p. 48). They are caught

between a rock and a hard place' (Reeves, 2008) and as a result their agency is potentially limited (Priestley et al, 2015, p125).

The consideration of the backdrop of the current neoliberal model of education is one that helps to explain one of the most challenging findings to emerge from this study. That is that teachers on the one hand reported high levels of confidence and teacher-efficacy (questionnaire data), yet on the other could discuss a lack of confidence, and the need for reassurance. At first, this is something of a paradox. However, if considering that this is a lack of confidence in what the 'system' wants, then that is perhaps a little more unsurprising.

The professional development of teachers, no matter how current and contemporary the new ideas and resources might be, is entangled within educational policy, therefore within the context of this study it is essential to consider the impacts of the neoliberal policy undertones, to understand the work of, as Watson (2016) put it, the 'neoliberal arsonists'

A particularly interesting finding to emerge from Phase 2 questionnaire data is that only one fifth of teachers felt the need for clarification of policy. This is surprising considering that, as Ball makes the point:

'Policies are contested, interpreted and enacted in a variety of arenas of practice and the rhetoric, texts and meanings of policy makers do not always translate directly and obviously into institutional practices (Ball, 1994). They are inflected, mediated, resisted and misunderstood, or in some cases simply prove unworkable. It is also important not to overestimate the logical rationality

of policy. Policy strategies, Acts, and guidelines and initiatives are often messy, contradictory, confused and unclear... In a sense, education policy has always been about education reform, about doing things differently about change and improvement. Policy is an enlightenment concept, it is about progress, it is about moving from the inadequacies of the present to some future state of perfection where everything works well and works as it should. However, since the 1970s education policy has been about 'radical' change, about changing the principles on which education functions, for example unsettling of the welfare state 'settlement' of which comprehensive education was a part. Reform in this period is not just about changing the way things are organised or done; it's about changing teachers and learning, and educational institutions and their relations to the economy, and to international competitiveness.' (Ball, 2013, p. 9).

Although participants within this study did not explicitly discuss the influence of specific education policy, they did refer to how the nature and extent of classroom change, can be influenced by the context in which they work, which is of course, heavily influenced by education policy.

Current education policy is considered to be neoliberal (Davies, 2016, Harvey, 2007). Moreover, it is understood to position performance over personal enrichment, and is linked to a centrally imposed national curriculum. Neoliberalism emphasises the importance of market forces in facilitating freedom and choice, and places the burden of responsibility of performance on schools and individual teachers.

Moore and Clarke (2016) categorise teachers into three main stances on education policy:

- Teachers who are broadly supportive of central education policy at the present time.
- Teachers who substantially reject or resist key aspects of central policy, and who actively seek out opportunities within practice in which alternative pedagogies can flourish without detriment to students.
- Teachers who are unhappy with key aspects of central policy but feel they have no other option to go along with it (resulting in reluctant compliance).
(Moore and Clarke, 2016, p. 667)

There were certain indications within the study's findings to suggest that participants within this sample did actively seek out opportunities for alternative pedagogies, but at the same time had an acceptance that there was little option but to move along with central policy, particularly in terms of responding to the demands and constraints of the National Curriculum, and to rise to the demands of performance measures. Participants within the sample appeared to be pushing at the boundaries of what is possible in terms of the constraints of the curriculum, but at the same time still trying out new ways of providing interesting and engaging teaching contexts.

Of key significance in explaining the nature and extent of change is an understanding of the relationship between the individual self and the 'external' structures in which the individual acts and makes choices, 'of how the individual's psyche 'enters' the external world of policy and how the external world of policy enters and establishes itself in the individual psyche' (Moore and Clarke, 2016, p. 668). In addition, it is important to recognise the interplay between the past policies and future demands and expectations:

‘Although [teacher] agency is involved with the past and the future, it can only ever be ‘acted out’ in the present, which is precisely what is expressed in the *practical-evaluative* dimension... Judgements are both practical – shaped by the affordances and constraints of the context – and evaluative – for example, judgements of risk in any given situation.’ (Priestley et al, 2015, p25).

‘According to Emirbayer and Mische (1998), such contexts are primarily to be understood as *social* contexts in that agency is ‘always a dialogical process by and through which actors immersed in temporal passage engage with others within collectively organised contexts of action’ (Priestley et al, 2015, p25).

The individual CPD participant has a crucial role in shaping changes to teaching practices following attendance at a CPD workshop. Analysis of interview and questionnaire data indicates that participants who express higher levels of self-determination are likely to bring about more sustained change. However, even those teachers exhibiting higher levels of self-determination and capacities to implement change, are constrained by the school environment. This is because teachers must work *through*, rather than merely work *in*, their school environment to bring about change (Priestley et al, 2015).

The way in which the work environment shapes and conditions change is highlighted in the extract of the interview transcript below:

“Then I have to try and make sure that my department believe me and are coming with me, without that, without them being on board it [Change to Practice] wouldn’t have happened in lessons on a day to day basis. So they had to have that belief in it [the change to teaching practices] I think, and that possibly comes back to a trust in me” (Participant D).

Participant D is a teacher with leadership responsibility, but it is clear that his 'agency' to bring about changes to teaching practice is not something he necessarily has, but is a phenomenon that emerges from the interplay between his capacities and with the social elements of the school environment (Priestley et al, 2015). Which in this case includes not just school structures, but cultures too – particularly one of trust, with both the teachers he manages and also the Head teacher. The reasons for a low trust culture (Ball, 2013), will be explored more fully in a later section of this chapter.

Interestingly, the participants within this study overwhelmingly reported that the 'performance' of their school was 'medium' attaining (90%). It is highly likely that this did not reflect the actual range of schools represented within the sample, as in reality there was significant variation in school 'performance'. Yet, I suspect this speaks more of the teachers' belief that schools 'could be doing better'.

However, when seeking to implement changes to practices participants reported that they could experience, resistance from colleagues, time constraints, and difficulty in influencing others. The context and social environment in which teachers work is also recognised by Dadds as being very significant within the CPD process:

'The effectiveness of CPD experiences can thus, be in great part a consequence of the learning context, be it that of the culture of a CPD

course of the learning culture of the school and professional reference group. The values, attitudes, interactive practices within the learning context can have as great an influence on the learning teacher as his or her own inner qualities and professional drives. This development of inner expertise cannot be divorced from the nature of outer context' (Dadds, 1997).

This statement represents and reflects some of the key findings from the study. Participants within the interview sample often discussed the challenges of the culture that existed amongst colleagues within the school. Yet, they nevertheless persevered with making changes to practices to some extent, in spite of this.

In Chapter 4, within the discussion of findings in relation to the nature and extent of change, it was noticeable that a number of common themes emerged. The nature of change usually concerns use of new ideas, resources or strategies. There is also evidence to suggest that change to classroom practices is sustainable over time, but the new changes are likely to go through a process of refinement and renewal. Both the embedding of new ideas and sustaining these over time can present challenges from the school's political, structural, cultural and material environment.

In a study by Harland and Kinder (1997), they note that although 'CPD input was fairly standard in the way it was provided for teachers across different schools, the effects on and consequences for different teachers were disparate and individualistic.' (Harland & Kinder, 1997).

In this study, the disparate and individualistic differences have been by-and-large due to the differences in the participants' interactions with the 'change environment'. That is to say, the way participants respond to the different combinations of opportunities and pressures in schools can account for differences in the nature and extent of change. Clarke and Hollingsworth's (2002) model recognises the situated practice, which can constrain and afford such individual variation.

The classroom, school and political environment (the change environment) has a substantial impact on teacher growth, and influences every stage of the CPD process. The change environment impacts on the opportunities of access to CPD; and constrains or supports participants on their return to school; it encourages or discourages participants to experiment with new professional practices, and can provide administrative restrictions or support.

Therefore, in a sense, the socio-political environment of the school applies a selective pressure on any potential change to teaching practices. Findings from this study suggest that individual perceptions of levels of self-determination will affect the extent of change and of professional growth. It was established within this study's findings that participants experienced only little restriction as a consequence of 'material' resources when implementing their selected changes to practices. However, social structures and cultures were much more likely to explain the nature and extent of change. When teachers expressed concerns about implementing change there were statistically significant differences in the

nature and extent of change. The cause of these concerns related to a number of social and cultural factors. Some of the key concerns highlighted within the questionnaire data are highlighted below:

- “Resistance in department”.
 - “Resistance within the department to new things”.
 - “Tried to get middle leader and pupils involved but time constraints a problem”.
 - “Changing whole school planning was a large undertaking Lack of profile of science with school priorities”.
 - “Lack of time”.
 - “Worried that what I wanted to do might not fit into the schools long / med plan”.
 - “Uncertainty surrounding what OFSTED expect to see”.
- (CIQ Questionnaire)

The majority of issues relate to the pressures of colleagues, management, or Ofsted. These views are also reflected too in the Phase 3 interview findings.

The recurring issue of reported lack of time to implement changes fully, is perhaps no surprise considering the multiple and competing demands placed on teachers’ time. This is an issue that has been identified with the research literature for some time:

‘Time is one of the greatest constraints to any change process, whether at the individual, classroom, or school level...’Every analysis of the problems of change efforts that we have seen in the last decade of research and practice has concluded that time is the most salient issue’ (Fullan and Miles, 1992).

Within the professional development process, time is important for a number of reasons. Effective enactment of intended practices and the subsequent reflection upon these requires time. Time is required to collect and judge the evidence of impact of new practices, and to consider how practices may be adapted or refined. In addition, working with, supporting or receiving support, from colleagues requires extra time commitments.

As discussed in Chapter 5, the issue of a need for participants to receive professional reassurance emerged within the study's findings. Participants reported that they do not always receive the reassurance they require. Even highly experienced teachers reported the need for reassurance. It became very clear that objective unbiased feedback is considered to be particularly valuable. Within the interview data (Phase 3) a number of participants raised questions over the agenda or motives of the sources of support and feedback on their teaching practices.

On the issue of professional collaboration Dadds (1997) makes the point that:

'Learning is a social experience, so professional growth is usually fostered through exchange, critique, exploration and formulation of new ideas... With the help of sympathetic others, the open-minded teacher-learner can scaffold his or her way to new states of knowing, feeling and acting in the interest of pupils. Talk is often the medium through which this multiple growth takes place... Practice seems to develop best, for example, when collaborative talk in the workplace or CPD course focuses upon pupil learning rather than extraneous matters' (Dadds, 1997).

However, findings from this study would suggest that the ‘extraneous matters’ act in a very significant way in dominating teachers’ interactions and behaviours. Suspicions over the bias of colleagues feedback offered as part of enactment-reflection loop is articulated by Participant A, although valuing collaboration, as part of the professional development process, valued ‘external people, by which she meant those working outside of the immediate school environment, and therefore, as she saw it, they were independent of it. Priestley et al (2015) makes the point that teachers’ relationships with other professionals as well as people within the wider communities in which they work ‘have the potential to impact significantly on their wider professional agency’ (Priestley et al, 2015, p85).

Participant E suggests that some colleagues may have a fear of making changes to practices and also may have a fear of ‘being watched’, in light of her wider comments it is clear that this is not about the fear of change itself, but about the fear of their interactions with the social environment being judged or ‘marked’:

Participant C makes the point that, professional development processes can be a way of receiving some well-needed reassurance. However, what is evident in views expressed in the interview extract below is that the process of engaging with CPD may be considered to be a high-stakes, risky process:

“Sometimes it’s a bit of reassurance [engaging with CPD] and I think it’s a shame for people who don’t go to those things because they don’t know that, and if they never put themselves out they’ll never get good feedback. They think that if they put themselves out they’re going to get criticism but

actually unless you put yourself out there you never get the good feedback either” (Participant C).

The point that, in Participant C’s view, teachers expect to get a degree of criticism as part of a professional development process is somewhat startling. Clearly, change to teaching practices can involve a degree of risk particularly when positioned in a high stakes culture of performativity. However, it would appear that there is a perception that the educational system can be very unforgiving.

A particularly perplexing issue is why CPD participants within the study, many of whom, express such high degrees of professionalism should feel the need for reassurance from colleagues, external to the school, or otherwise. I suspect that this may say something of the lack of sufficient feedback currently. Ball (2013) makes the point that some teachers ‘find their professional commitments and personal well-being at odds with the demands of performance’ (Ball, S.J., 2013 p59). Hence, participant requests for independent and objective support with “no bias at all” (Participant A).

It can be seen that for CPD endeavours that require changes to classroom practices ‘it is problematic to expect that teachers become agentic, when in their practical contexts they are unable to do so. It is one thing for policy to demand that teachers have agency; it is quite another for this to occur in practice (Priestley et al, 2015, p127). This is recognised to some extent by the OECD:

The quality of teaching is determined not just by the 'quality' of the teachers – although that is clearly critical – but also by the environment in which they work. Able teachers are not necessarily going to reach their potential in settings that do not provide appropriate support of sufficient challenge and reward (OECD, 2005, p. 9).

Findings from this study support Priestley's ecological understanding of teacher agency (Priestley et al, 2015, p3). In that CPD participants draw upon a range of their own individual capacities in order to implement changes to practices, but significantly it is the 'interplay' between a teacher's capacities and the school's social-political environment through which changes to practices emerge.

This should be an important consideration for policy makers, who insist that teachers 'take responsibility' (DfE, 2016) for their own professional development. Ownership and agency are not the same thing. Eun (2000) acknowledges the challenges faced by teachers when implementing changes to practices as a result of engaging with CPD:

'As many educational researchers have noted (for example, Fullan 1982, 2007, Guskey 2000, 2002, 2003), the real challenges of professional development become apparent only after the implementation process has begun' (Eun, 2010).

The school environment has a well-documented influence on affecting potential changes to practice, especially when policy and teachers' new practices (evidenced based or otherwise) do not align. As Grove et al (2009) make the point, 'if the teacher feels that the changes are not appreciated and/or supported by

peers or administration, there may be little motivation to put the changes to thinking and planning to practice' (Grove et al 2009).

Emerging from these study findings is that neoliberal selective-pressures of high-stakes accountability are associated with questions over issues of trust, bias, and objectivity. The school environment will not necessarily provide room for CPD participants' own professional judgement, and therefore will limit the extent to which teachers can take ownership of their CPD.

6.2.2 Becoming a 'better' teacher: Issues of professionalism

Reverberations of New Labour's remodelling agenda and that 'Maintaining the status-quo is not an option' was a very clear theme to emerge within findings of this study; CPD participants expressed strong interests in gaining new insights and implementing 'new' resources.

An overwhelming reason given by CPD participants, within this study, to engage with professional development in the first instance, and then to go on to implement changes to teaching practices was to make teaching 'better'. Participants wanted their future teaching practices to be different to their current practices.

Teachers' perceptions of what the future may hold are bound up with and influence their motivations and agency to bring about change. Emirbayer's and Mische's (1998) make the point that 'Agency is in some way 'motivated', that is

linked to the intention to bring about a future that is different from the present and past (Priestley et al, 2015, p24). The point is that educational policy requires future practices that look 'different'. The constant drive for better or different teaching is evidence of Moore and Clarkes (2016) 'Cruel Optimism', in which teachers are continually seeking the perfect or 'ideal' lesson, which remains just out of reach. Teachers within this study reported that by making use of new resources, they expected that pupils' learning would benefit as a result. However, the retrospective impact questionnaires reported modest gains on pupils' attainment.

Issues of Performativity

Embedded firmly in the current educational climate are processes of performance management:

'Performativity is a culture or a system of "terror". It is a regime of accountability that employs judgements, comparisons and displays as means of control, attrition and change. The performances of individual subjects or organisations serve as measures of productivity or output, or displays of 'quality', or 'moments' of promotion or inspection. These performances stand for, encapsulate or represent worth, quality or value of an individual or organisation within the field of judgement. Clearly, the issue of who controls the field of judgement and what is judged, what criteria of measurement are used or benchmarks or targets set is crucial. The setting, monitoring and reviewing of performance and rewarding of performance achievements, are all critical and effective tools of management – hence 'performance management' as a method to achieve a constant state of 'activation' within organisations. One consequence of this is new kinds of 'professional dominance', that is, the logics of accountants, lawyers and managers are made more powerful over those against the judgements of teachers, doctors and social workers, and so on.' (Ball, S.J., 2013 p56).

The pervasiveness and impact of regimes of performance management was discussed explicitly by teachers Teacher C & E during the phase 3 interviews, who

each suggested that some of their teacher colleagues could be reluctant to participate in CPD endeavours for fear of being ‘judged’, ‘watched’ or ‘marked’. The effects of performance management are felt widely, and may have far-reaching and unintended consequences. Individuals have to mediate the effects of performativity, and may find their values challenged or displaced by these demands (Ball, S.J., 2013 p59). It is individual teachers who have to manage the pervasiveness and influences of educational policy. Findings from this study suggest that even for teachers motivated to engage with CPD workshops, and to then bring about changes to their teaching practices, they can find themselves constrained by other teaching colleagues who were less enthusiastic about working collaboratively. This is illustrated within interview extracts below:

“I feel like if I could work better with the people in my department that it would be easier to share good practice, and to ask questions, and to learn from each other, and that’s not happening, and I can’t see that happening in the foreseeable future. It’s not easy to work in this department, it would be so much easier to be, to develop as a teacher if it was a more friendly environment to work in”. (Participant A)

These sentiments were reflected also by Participant E who reported that some colleagues are “not as confident to share” (Participant E).

Participants discussed how the lack of collaboration between colleagues is likely to limit the development of their own practices, and captures Ball’s point about that ‘together, management, the market and performativity have effects of various sorts

on interpersonal and role relationships (vertical and horizontal) within schools.’
(Ball, S.J., 2013 p60).

Even positive performance management judgements and outcomes can have unintended consequences: “The last three of my performance management lesson observations have been outstanding, which is a bit of a curse more than a blessing” (Participant C). Participant C went onto explain how this led to pressure for her to lead in-school CPD – not a venture for which she would naturally volunteer.

There is a dilemma, whilst on one hand education policy may drive teachers to implement new alternative practices; this is also a high-stakes endeavour. As evidenced in the account of Participant D, who reported on the significance of the Head teacher’s satisfaction with the new approach, due to enhanced pupils’ attainment. Helsby (2000), outlines that a culture of performativity can undermine a teacher’s agency. It can be suggested that the end justifies the means: discourse associated with curriculum development takes a back seat in relation to performance results. Participant D was able to report on positive impacts, but had these new practices not achieved an immediate desired impact, then Participant D would likely be held to account. Ball (2013) recognises this duality of praise and blame:

‘The dualities of freedom and control which run through the methods of reform, both a ‘giving away’ and a ‘taking away’ of professional judgement

and teacher autonomy. It is also important to recognise that the assertion of reform also rests upon another duality, that of praise and blame.’ (Ball, S.J., 2013 p106).

Within the interpretation of the findings from this study, a culture of performativity has emerged as being significant. It is a ‘phenomenon that has major implications for teachers and their agency’. (Priestley et al, 2015, p107). Within the CPD process, participants are required to position themselves as curriculum developers, rather than curriculum deliverers. This shift requires teachers to act as a more autonomous agent of change, and as a result ‘they stand in tension with accountability practices, and the current discourse in education (Sahlberg 2011; Biesta 2010).

Subject specific CPD workshops, will encourage and support teachers, to ‘have a go’ to try out new practices, and possibly to exercise higher degrees of teacher agency than they already might. Findings from this study align with the views of Nieveen and Kuiper (2012); Kuiper and Berkvens (2013); Leat, Livingston and Priestly (2013), Biesta (2004), who argue that the pervasiveness of output regulation or outcomes steering is eroding teacher autonomy, and teacher-agency to implement such changes. CPD teacher participants are immersed in a culture of performativity which:

‘in practical terms, rests on databases, appraisal meetings, and annual reviews; report writing, quality assurance visits, the regular publication of results, inspections, and peer reviews. The teacher, researcher and academic are subject to a myriad of judgements, measures, comparisons, and targets... Within all this, there is a sense of being constantly judged in

different ways, by different means, according to different criteria, through different agents and agencies. There is a flow of changing demands, expectations and indicators that makes one continuously accountable and recorded. And yet it is not always clear what is expected' (Ball, S.J., 2013 p58).

The findings of this study would support the notion of the fear of being judged by Ofsted or through performance management arrangements can influence the nature and extent of changes to teaching practices. Participants C & E explain how collaborative lesson observation and feedback, a recognised and valuable part of the CPD process (Day, 2000) is viewed with suspicion by a number of teachers within their school environment. The high stakes demands of performance management, and the judgemental culture of Ofsted inspection regimes are seen to undermine the value of lesson observations as part of any ongoing CPD process. Teacher E reports of resistance from colleagues to engage voluntarily in any such activity, thereby limiting their own professional discussion and support with subsequent classroom change. Teachers wanting to implement change which draws upon their own professional judgement are faced with 'an educational dilemma: how to deal with external productivity demands on the one hand, while simultaneously teaching for the knowledge society with moral purpose' (Sahlberg 2010, p.48). 'They are caught between a rock and a hard place' (Reeves 2008), and as a result their agency is potentially limited. (Priestley et al, 2015, p124).

However, emerging from the study findings is that in spite of demands a pervasive culture of performativity, the CPD participants will inevitably make changes to their

practices, and will implement ideas and resources gained through CPD workshops. Whilst this may in part be explained by Helsby's (1999) point that teachers with higher degrees of confidence in their own capacities to implement changes are more likely to do so in the face of performativity. Findings from phase 3 interviews also reported a strong drive by teachers to implement changes, in part, for purposes of making their own job more interesting – presumably a reaction against some of the more prescriptive accepted practices that have become inherent with a culture of performativity.

In the complex socio-political world of the educational environment it seems to be the case that the significant emphasis on performativity produces what Lyotard (1984) calls the 'law of contradiction'. The actual creative and productive activities are side-lined for those time-consuming activities that report on and make claims of effectiveness (Priestley, 2015)

6.2.3 Criticality within the CPD process.

Another significant finding to emerge from this study is that teacher agency, can lead to moderation or resistance to change, as much as it can lead to the implementation of change. That is teacher agency draws upon teachers' professional judgement so that new practices are not implemented unthinkingly. This is illustrated in the interview extract below:

"I think there are some initiatives that I just can't see the point of because for me if its, there's fashion isn't there as well, a bit of a trend as well, as bit

of a fashion you know that, you're in this area. Sometimes as a teacher you just can't see the point in them, because if you tried that in the classroom it doesn't seem to add anything. So I'm not all for trying it just for the sake of it, to me if I try it and I don't see an improvement then I don't want to use it". (Participant C).

This is very much in line with findings of Osborn et al (1997) and Gleeson and Shain (Shain and Gleeson, 1999). These authors noted the varied responses of teachers to performative demands; not merely a simple binary of resistance/compliance but more nuanced forms of mediation of policy to reflect differing perspectives and positioning (Gewirtz, 2002). I would suggest that the criticality and professional judgement evident in the interview extract above, is a vital part of any professional CPD process.

This study has reported on a range of impacts as a result of short episodes of subject specific CPD. It is clear that these changes are largely a result of individual teachers' capacity and drive for change, as opposed to more cultural or structural capacity to support teachers in making meaningful changes to their practices. Ensuring the production of outcomes which can be measured through performance management arrangements, or maintaining the current *policy* status quo (Sarason, 1990, p. 35) is likely to occupy a larger part of teachers' working arrangements. A number of participants within this study have demonstrated a capacity to challenge the pervasive policy status quo, and ensure that their own professional judgement and expressions of agency are a key part of the CPD process. In that sense, pupils' interests, motivations, and aspirations within the subject area are as important as attainment. In some respects though, they may be seen as policy nonconformists.

6.2.4 Expectations to engage with CPD – and bring about change

Teachers may have their own personal motivations for engaging with CPD.

However, the expectation to engage with CPD to bring about classroom change is also a political one. The newly introduced DfE ‘Standard for Teachers’ Professional Development’ (DfE, 2016) exemplifies this.

Although the letter from the PD expert group does make the case that professional development should be seen as a developmental process. The introductory section of the DfE Standard for Teachers’ Professional Development document begins with a quotation from Dylan Wiliam:

*‘Every teacher needs to improve, not because they are not good enough, but because *they can be even better*’* (emphasis added) (DfE, 2016, p. 3).

A case for the importance of CPD could be made by acknowledging that this can provide the opportunity for teachers to learn about new and emerging research or new ideas leading to improved practices, resulting in enhanced student outcomes. Instead, in this selected quotation, it is teachers *themselves* who it is said need to improve and become ‘better’. In Nick Gibb’s response to the letter from the expert group, he notes the importance of CPD ‘to build the professionalism of teachers and improve teaching’ (Gibb, 2016).

- demonstrate knowledge and understanding of how pupils learn and how this has an impact on teaching;
- have a secure knowledge of the relevant subject(s) and curriculum areas;
- reflect systematically on the effectiveness of lessons and approaches to teaching; and
- know and understand how to assess the relevant subject and curriculum areas' (DfE, 2016).

Teachers are expected to 'take responsibility', and improve practices, and improve pupils' outcomes. This political environment clearly provides a very significant driver for classroom change.

The individual teacher interprets policy, within their own context, and mediates classroom change. The earlier chapter highlighted the importance of a teachers' self-determination in bringing about changes to teaching practices. The next section will consider how the current political environment supports a teachers' self-determination to bring about change - within the professional development process.

6.3 How the socio-political environment influences participants' self-determination within the CPD process.

Within Chapter 5, it was suggested that the nature and extent of change can be influenced by participants' levels of self-determination to bring about changes to teaching practices. This final section will discuss how the participants' environment can impact specifically upon a teachers' feelings of self-determination, within the change process.

This section will comprise of three parts:

Theme	Page
Environmental influences on teacher Autonomy	328
Environmental influences on feelings of Competence	339
Environmental influences on Relatedness	347

6.3.1 Environmental influences on teacher autonomy

Although teachers are required to take ‘responsibly’ for their own professional development (DfE, 2016), doing so requires access to financial resources and permission from the head teacher. With a shift from ‘Occupational’ to ‘Organisational’ professionalism (Evetts, 2011), there is an important question as to how the needs of the teacher will be balanced with the needs of the organisation. Whilst teachers and schools are of course closely related, there are subtle differences in needs.

Financial restrictions limit the extent to which teachers can ‘take responsibility’ for their own professional development. Teachers within the sample have expressed high degrees of satisfaction with externally provided professional development, with teachers expressing their preference for this over other internally provided CPD. But, this requires access to financial resource, not directly within a teachers’ reach, and so will limit a teachers’ autonomy to engage with the full range of professional development on offer. In addition, on return to school changes to

practice may require a material resource investment, which again lies outside the teachers direct control.

Embedding changes to teaching practices was also shown to be highly reliant on finding a link to a direct curriculum fit. The changes bolt on to existing curricula; changes to practice require existing curriculum structures. Again, these centrally imposed, and organisational imposed structures can have a significant impact on a teachers' agency to implement changes following engagement with professional development.

However, an unintended consequence of such central or externally imposed control, over the curriculum and stipulation of what teachers should teach was that this was the very thing some participants would work against to support their own feelings of autonomy. Participants within the sample discussed how they would seek to try out effective new ideas and resources, raising their own interest levels, which both directly and indirectly impact upon pupils. Current educational policy, however, does not make direct reference to the need to raising teachers own intellectual curiosity, yet teachers within the sample were actively seeking this.

There are also competing and opposing forces acting upon teachers – to maintain the policy status quo and stick with 'what works' in terms of recognised practices, but also to introduce changes in a drive to become 'better' teachers. Enhancing pupils 'outcomes' is a key driving force, and the ultimate outcome of CPD

(Guskey, 2000, DfE, 2016). Yet, some outcomes are prioritised over others.

Attainment outcomes (as measured in test scores) are likely to be prioritised over pupils' interests, or enhancing their 'capital' within the subject. Pupils can achieve well in tests and examinations, but still have little inclination to progress within the subject beyond the compulsory curriculum (Archer et al, 2016). Teachers can try to seek to address this, but raising interest within the subject cannot come at the cost of effecting measures of performativity.

Pressures to maintain the schools test scores will inhibit the extent to which a teacher can 'take risks' to embed new approaches, regardless of whether these are 'evidence based' or not. The idiosyncratic and contextual factors of each classroom environment requires interactive cycles of enactment and reflection of new ideas and approaches to be trialled, in order to ensure that these become effective – but by the very nature of an iterative process, this can take time. It is individual teachers who mediate these changes, and remain directly accountable for these, so any drop in pupils' performance (as measured in assessment scores), even within the interactive / formative stage of the change process, can add pressure for teachers to abandon such approaches, and hence limit both the nature and the extent of change.

A key issue is that teachers and school systems may have different views as to which combinations of pupil 'outcomes' are most important. Because of measures of accountability and performance management processes, and fears of job security, it is always likely that the outcomes that the 'system' considers most

important will be given precedence. Teachers are expected to 'take responsibility' for what the system wants, and to draw upon evidenced-based professional development which boosts the outcomes that the system wants. It could be seen that expecting teachers to engage with professional development, and requiring them to take responsibility for this is not sufficient to support their autonomy within the change process. There is little room for 'Building Professionalism' (Gibb, 2016), if room for teachers' professional judgement is limited and teachers' views of salient outcomes are different to those advocated by the system more generally.

The interaction between educational policy and individual teacher has horizontal impacts on teacher colleagues also. Interview data revealed a determination on the teachers' part to implement new ideas or approaches to make teaching 'better'. CPD teacher participants spoke of the importance of not blindly following 'new-fangled' trends, but instead drawing upon their own expertise to mediate and internalise change, processes utilising and drawing upon their own professional judgement. When CPD participants returned to school and shared ideas of new approaches with colleagues, and faced resistance from them, this resistance was viewed with some suspicion and considered to be due to a possible lack of confidence or trust. This says something of the pervasiveness of the view that teachers need to be seen, by managers and colleagues, to be actively trying to make their teaching 'better'. Autonomous behaviours which manifest as a resistance to any form of change are not supported by the system. Teacher change, in some form, whether for reasons of performativity, or wider educational outcomes, seems to be viewed as none negotiable.

Educational policy changes language and discourse, to become a 'better' teacher, to 'build professionalism' means change. However, within the confines of the outcomes favoured by a system based on performativity, there are clear parameters as to what counts for acceptable change. Nevertheless, teacher participants within this study recognised the importance of the need to draw upon their own professional judgement, interests, and expertise when affecting change, and considered the value of a wide range of educational outcomes.

Promotion

Teachers reported, within the interview process, that engagement with professional development, could lead to 'better' teaching, and in turn lead to an increased chance of promotion. Questionnaire data also revealed that one third of teachers had been promoted since engaging with the professional development. In that sense the current environment could be seen to provide autonomy supportive structures, in that teachers feel they know how to increase chances of internalised extrinsic rewards such as promotion.

This is illustrated within two interview extracts below:

"I think it's important to teach to the best of your ability and be aware of developments in the subject and learn more about teaching effectively, and getting more ideas for teaching well. I think that is what the pupils need, but I also think if you can do these things well, like being an outstanding teacher and ensure pupils are learning then you are more likely to be promoted, or there will be opportunities for promotion" (Participant B).

And also:

“I think the better you are at teaching the more likely you are to be promoted, and the better it would be for the kids” (Participant A).

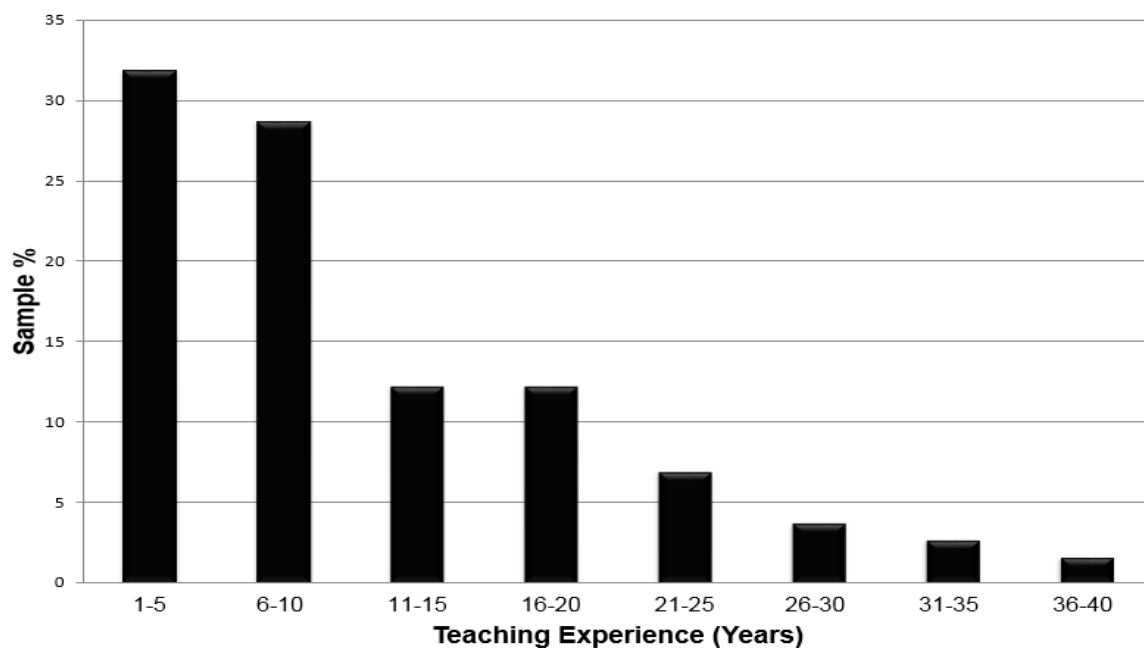
Participant A also discusses how her motivations to attend CPD workshops and to make subsequent changes to teaching practices are likely formed from an equal balance of desires to improve pupils’ learning, but also to enhance her own prospects of promotion.

Both Participant A and B are in the early stages of their careers, and possibly represent similar views of the other early career teachers attending the subject specific CPD.

Differentiated Engagement

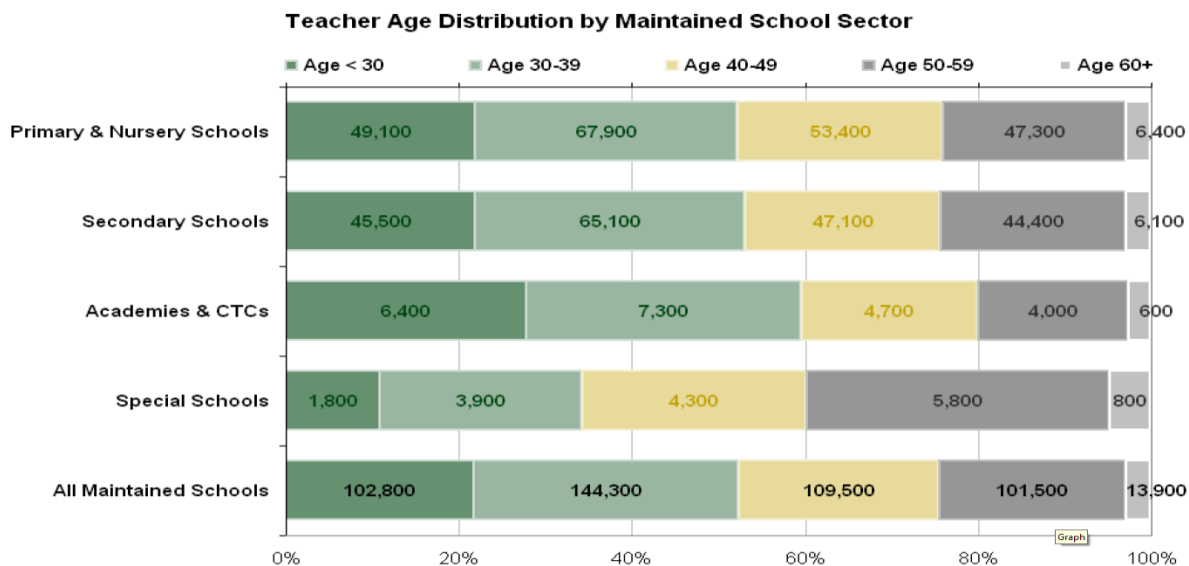
Across the sample of participants within this study, there was a significant range in the length of teaching experience. Some teachers were still in their NQT year, whilst others had almost 40 years of classroom experience. However, on analysis of the questionnaire data a clear pattern emerged. Over a third (37%) of participants were within their first 5 years of their careers. Participant numbers decreased with increasing teaching experience. This relationship can be observed in Figure 21.

Figure 21: Teaching experience of sample



This pattern is particularly interesting considering the age distribution of the teaching workforce, which is represented in the following chart.

Figure 22: Teacher age distribution by maintained sector



(DfE, Teaching Work Force Census, 2010)

Although these two charts do not compare like with like: Fig 21 indicates the length of teaching experience, whilst Fig 22 represents the age distribution of the teaching workforce, when considered alongside analysis from the Good Teacher Guide (TES, 2010) that reports that the majority of teachers entering the teaching profession are under 25 years of age. It could be suggested that as teachers progress through their careers they are less likely to engage with subject specific CPD workshops. This of course could be due to a number of reasons. However, results from this study would indicate that it is *not* a case that more experienced teachers feel more comfortable with their science teaching, and they are *no* more likely to report that they teach science as well as they would like too. There were no significant differences between teaching experience and perceptions of teaching efficacy. Therefore, it is likely to be other 'external' reasons that teachers with more teaching experience are less likely to attend subject specific CPD later in careers.

Regardless of teaching experience, there is still a perceived need for science CPD: as one of the lowest scoring points of teacher efficacy scale was that teachers did not teach *science* as well as they would like to. The link between subject CPD and teaching effectiveness is highlighted in Ofsted's most recent subject report for Science (Ofsted, 2013):

The effectiveness of science in both the primary and secondary schools visited was much more likely to be outstanding when teachers and subject leaders had received science-specific training. However, most of the primary teachers had not received such training, and most of the science

leaders in both phases had not received leadership training that was specific to science (Ofsted, 2013).

It could be suggested that many participants within the sample are active at seeking subject specific CPD, as almost half of them had attended subject CPD previously. This is particularly notable considering the proportion of participants (37%) who were still in early stages of their careers.

Participants within the sample reported high degrees of competence within the subject area; over half (51%) of teachers considered themselves specialists in science, with 95% of the sample considering themselves to be at least 'quite capable' of teaching science and also reporting highly on efficacy scales for having the necessary skills to teach science. Participants were most likely to consider existing practice to be 'quite good' overall, and pupils to be learning 'quite effectively' overall.

There was evidence to suggest that participants within this sample were working as 'extended professionals' (Hoyle, 1980), seeking ways to engage with educational developments and CPD to support pupils' learning. Participant A alludes to this:

"It [students' progress] makes me stressed every day. I feel very responsible for them and their outcomes, and their lifelong achievements because of the outcomes they get in my classroom. Definitely I feel a huge

responsibility for that... anything that can improve the learning of a pupil in my class is important to me” (Participant A).

Again, evidence of the extended professional, and reflective practitioner can be observed within questionnaire and interview data: For instance, Participant C reported that “If I don’t see an improvement [in a new practice] then I don’t want to use it...[sometimes] you sort of think well actually I don’t think that brings anything new to the table” (Participant C). The concept of the reflective practitioner is key to teacher professional identity ‘Looking inwards is not egocentric. It is an essential act of professional responsibility, done in the cause of considering children’s educational needs and rights’. (Dadds, 1997). It is evident from interview and questionnaire data that participants were reflecting upon the efficacy, and likely efficacy, of new practices. However, the socio-political environment had a strong influence on raising participants’ concerns about their individual capabilities to implement change. When participants reported concerns about implementing changes to practices, this was associated with reduced likelihood of increases in pupils’ engagement and reduced likelihood of the sustainability of the new practices over time. The detail of these associations can be observed in the following three tables:

Table 49: Association between participants’ feelings of ‘concern’ or no concern’ in relation to CPD implementation, and perceptions of extent of usefulness to practice

Usefulness to Practice	No Concerns	%	Concerns	%
Very	38	54.29	1	10.00
Quite	29	41.43	8	80.00
Not Very	3	4.29	1	10.00
Not at all	0	0.00	0	0.00
Total	70		10	

This table indicates an association between participants' 'concerns' raised over their capacities to implement changes to practice, and perceptions of the extent to which new ideas and resources are useful to practice. There is an association between participants' concerns raised, and perceptions that new ideas and resources have more limited usefulness.

Table 50: Association between participants' feelings of 'concern' or no concern' in relation to CPD implementation, and perceptions of extent of increases in pupils' engagement

Pupils' Engagement Increase	No Concerns	%	Concerns	%
Very Effective	24	34.29	1	10.00
Quite Effective	39	55.71	5	50.00
Neither	7	10.00	3	30.00
Not Very Effective	0	0.00	0	0.00
Not at all Effective	0	0.00	1	10.00
Total	70		10	

This table indicates an association between participants' 'concerns' raised over their capacities to implement changes to practice, and perceptions of increases in pupils' engagement. There is an association between participants' concerns raised, and perceptions of reduced impacts on pupils' engagement.

Table 51: Association between participants' feelings of 'concern' or no concern' in relation to CPD implementation, and perceptions of likely sustainability

Sustainability	No Concerns	%	Concerns	%
Certainly	44	62.86	3	30.00
Probably	23	32.86	5	50.00
Possibly	2	2.86	1	10.00
Not at all	1	1.43	1	10.00
Total	70		10	

This table indicates an association between participants' 'concerns' raised over their capacities to implement changes to practice, and perceptions of likely sustainability of new practices. There is an association between participants' concerns raised, and perceptions of reduced likelihood of sustainability of new practices.

What is particularly significant within these findings is that the 'concerns' raised by participants often relate to resistance within socio-political structures within the participants' school environment. Alongside interview data, it can be seen how the participants' environment can have a strong influence on their perceptions of autonomy and capacities to implement changes to practices.

6.3.2 Environmental influences on feelings of competence

The findings from this study indicate that teachers within the sample are active in seeking 'better' ways to teach science. Even though participants within the study report drawing upon a range of evidence based teaching approaches and

exercising a range of teaching practices, one of the lowest scoring items on the teacher-efficacy scale was their confidence at teaching science as well as they would like to. Many reported that they were seeking ways of enhancing their teaching, making it better or more effective.

It is not difficult to see how current educational policy can impact upon teachers' feelings of competence. Teachers are reminded that it is important to 'build' professionalism (Gibb, 2016), and that 'they can be even better' (William, 2016). With such educational policy effecting educational discourse it is no surprise that teachers report the perceptions that – *they* do not teach science as effectively as they could.

In that respect, it could be suggested that current educational policy has the effect of undermining teachers' feelings of competence. This can manifest in teachers need for reassurance that they are 'doing the right thing' – in spite of the fact that they are already reporting a range of positive pupil outcomes. Even when participants receive positive feedback this can be viewed with suspicion. This is exemplified by Participant A reporting that pupils' claim that they enjoy her science lessons. However, she then goes on to question whether they like her lessons for the 'right reasons'. Continual adjustments to policies, new initiatives and 'fads', can impact on teachers' views of their own 'effectiveness'. It is hardly surprising that the need for 'reassurance' from 'independent' sources emerged from the interview findings.

One of the most significant impacts of the influence of educational policy is the extent to which it can moderate or even undermine, the iterative cycles of enacting new practices and reflecting upon them, as participants try out new teaching approaches within their classrooms. This is because the ‘salient outcomes’ are determined ‘externally’, and ‘professional experimentation’ must not impact on measures of teacher performance.

This is significant in terms of findings of this study. The table below illustrates the changes to pupils’ learning following participants’ engagement with professional development.

Table 52: CPD impact on pupils’ learning: Ranked (n = 80)

Impact on Pupils’ Learning: Ranked	Mean	Score
Pupils are more willing to discuss science	3.81	Quite A Lot
Pupils are showing a greater interest in science	3.76	Quite A Lot
Pupils are more engaged in practical activities	3.71	Quite A Lot
The attitudes of pupils to science has improved	3.67	Quite A Lot
Pupils show a greater motivation to succeed in science	3.67	Quite A Lot
Pupils attainment has improved	3.33	Partly

Pupils’ attainment outcomes have changed the least compared to the other outcomes, but attainment is the outcome most likely valued within performance management measures.

The External Other: What has happened to the 'Expert Within'?

Provision of professional development outside of the immediate school environment was considered by a number of participants to provide less bias, and provide an important source of inspiration and reassurance.

It is interesting to consider why teachers should place such a value on external CPD. This resonates closely with work of Dadds 1997 who identifies the perceived high status value of an external CPD provider. The value of the external other could be seen to be important in clarifying key ideas and supporting developments and refinements to practice, particularly before teachers engage with the active process of enactment and reflection, and begin to adopt and embed and refine successful practices within their own classrooms. The well-informed or 'more knowledgeable' *external* other appears as a key part of the CPD process.

The value placed on the role of the 'external' other needs careful interpretation. The findings from this study clearly indicate that participants within the sample bring with them, to the CPD process, a range of ideas, experiences, and expertise, and have high degrees of confidence that they can connect with pupils and influence pupils' learning. Yet the need for reassurance emerges strongly. This is a finding which resonates very strongly with the work of Dadds (1997):

Tragically... many come [to CPD] with a convincing feeling that what is inside them is not valid because it is 'only personal' to them. Somewhere

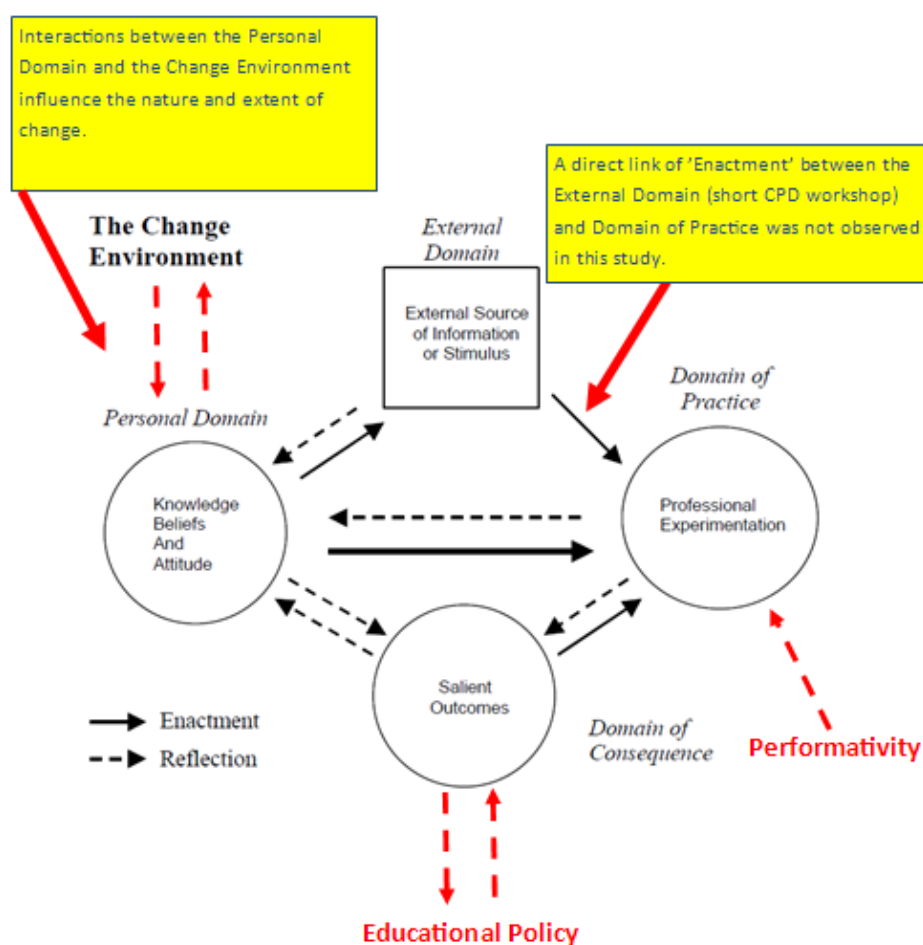
along the line, many have learnt to feel that others' visions and experiences are much better than their own. They have learnt to seek the 'expert' outside but deny that there may be a potential 'expert' within. Somewhere, somehow, they have been taught to devalue their inner voice, their own experience, their own hard-earned insights about children and classrooms. (Dadds, 1997).

I would suggest that this is a case where it could be argued that 'the combined influence of at least two decades of intrusive input and output regulation may well have to a large extent eroded teachers' capacity for agency and have taken away important resources and opportunities for the achievement of agency from their practice.' (Priestley et al, 2015, p125).

ITT providers and schools are required to assess how teachers' standards have been met by individual teachers. Satisfactory judgement is required for graduation from teacher training programmes. The standards also provide a framework for new appraisal processes within schools. With this era of the 'new professionalism' (Nixon, 1997, Patrick, 2003) there is a top-down requirement that teachers will engage with ongoing professional development: '[teachers *will* (emphasis added)] take responsibility for improving teaching through appropriate professional development, *responding to advice and feedback from colleagues* (emphasis added)' (DfE, 2012). Paradoxically, this says little of the importance of an individual's 'inner voice' or professional judgement and highlights the significance of the wider environment in influencing teacher agency.

Findings to emerge from this mixed-methods study would suggest that Clarke and Hollingsworth's (2002) model could be further exemplified, to highlight the particular influences of Education Policy, and of Performativity on any process of teacher change.

Figure 23: This study's findings transposed onto Clarke and Hollingsworth's (2002) model.



Through interpretation of interview findings and questionnaire data, it can be seen that short episodes of subject specific CPD can in the first instance lead to low-level mechanical and routine change. However, there is also reason to believe that

this can become an important part of more refined and meaningful change and teacher growth. Particularly when taking into account the ambitions and motivations of teachers within the study. It remains unsurprising then that the conditioning of basic psychological needs are important facilitators of ongoing impact. 'The more a person takes responsibility and ownership of the changes, the more likely those behaviours will continue so that classroom strategies influence student achievement.' (Grove et al 2009). This is supported by Dadds also, who argues that 'such a disposition [willingness of teachers to study and question their work closely and in-depth] provides the crucial inner conditions for growth and for professional development which changes the world in small but significant ways for children (Dadds, 1997). She continues to state that, 'such learning also, usually, needs time and does not come simply as a result of awareness-raising of new content... The surface moments of insight usually mask deeper stages of maturing thinking which have been incubating over time.' (Dadds, 1997).

Teachers within the study clearly demonstrate the attributes of studying their work closely and in depth: important conditions for professional growth. However, the socio-political environment can heavily influence the extent to which teachers can truly take ownership and responsibility for those changes.

Based on questionnaires responses and interview findings, participants within this sample did not appear to express a deficit in skills or knowledge, as might be assumed by earlier models of CPD. Instead, they were engaging with CPD as part

of ongoing development, and enhancing existing practices. However, it could be suggested that there were perhaps issues of confidence in their own capacities to sustain the enactment-reflection loop and their own development. The reliance on an external other was surprising, and Dadds (1997) point, particularly relevant: 'the inner voice must be cultivated; personal theories must be evolved; belief in, and responsibility for the professional self-seen as crucial and indispensable.' (Dadds, 1997).

The CPD workshops could be seen to provide new ideas and resources, but what is more uncertain is to what extent it cultivates confidence in the 'inner voice' or 'expert within'. Teacher efficacy did not appear as an issue of concern, but the need for teacher reassurance did. I would suggest, a key factor in the need for reassurance can be in part due to the differences in internal and external accountability (Bishop and Denleg, 2006), in that participants can have confidence in their own abilities to influence pupils' learning outcomes, but are less certain that they are effecting what the 'system' requires.

Heightening the value of teachers' internal personal professional voice and judgement is likely to be an important precursor for meaningful change in any professional development process. Vygotskian theory, in which a 'more competent other' can provide guidance and support learning, posits social primacy in all developmental processes (Vygotsky, 1980). However, interview findings suggest that the 'more competent other' should be 'independent' of external accountability measures.

6.3.3 Environmental influences on relatedness

Current educational policy, and much of the literature purporting characteristics of effective CPD, support the virtues of teachers working collaboratively as part of the CPD process. Findings from this study also indicate that participants have strong views on the value of collaboration. Effective collaboration is associated with enhanced learning opportunities for participants, a reciprocal opportunity to share ideas, and to discuss and overcome pertinent issues.

Findings from this study would indicate that collaborative working does not always occur as frequently or as effectively as it might. The fear of 'judgement' emerges as a key reason for avoiding collaboration. Factors such as a lack of trust, and the desire to avoid perceived bias, can affect the degree of collaboration. Moreover, the authority of the person suggesting the changes to practice matters. Findings from the study would appear to further support a shift from 'occupational' professionalism to 'organisational' professionalism, as those in authority will more likely have their suggested changes enacted.

Teaching science can often involve teaching across all three science subject disciplines. The willingness and ability of teachers to collaborate with colleagues from other subject disciplines was viewed as a real advantage in terms of developing potential ideas for changes to practices. The collegiality of colleagues within school contexts also emerged as a key factor in terms of its influence on a

teacher's perceptions of her own competence, perhaps best summarised in the following interview extract:

"I feel like if I could work better with the people in my department that it would be easier to share good practice, and to ask questions, and to learn from each other, and that's not happening, and I can't see that happening in the foreseeable future. It's not easy to work in this department; **it would be so much easier to be, to develop as a teacher if it was a more friendly environment to work in (emphasis added)**". (Participant A).

This is significant as it was reported in all but one of the interview findings that 'density' (Daly et al., 2010) of interactions with colleagues was low, and as a result, teachers discussed how this had the effect of limiting developments of classroom practices.

Some of the most significant challenges in terms of making changes to classroom practices within the school context emerged as time factors, or a lack of support from colleagues. Teachers obviously have many competing professional priorities and so high demands on their time and effort are highly likely. This goes some way to explaining why changes to practice noted within this study tended to be subtle, but could accumulate, and become refined over time.

Collaboration is effected by socio-political pressures. When resistance from colleagues does occur the negative impact on any change event is highly significant. Participants within the study reported desires for more productive and

supportive dialogues with their peers. Even, apparent apathy from colleagues to share ideas or expertise was considered to have an impact on the extent of change even for teachers exhibiting high levels of self-efficacy and self-determination. This raises the question as to why some teachers are content to collaborate, whilst others are less enthusiastic. Collaboration can involve teachers putting themselves 'out there', and opening themselves to judgement, which was considered a risky process in the current educational climate.

Desires to teach science more effectively emerge strongly, but so too do other personal factors such as wanting to reach greater levels of professional fulfilment, and seeking opportunities for promotion. The environment impacts heavily on the extent of an individual's self-determination and ability to make changes happen, 'effective professional development demands both individual, organisational, managerial and cultural change. To bring about change in one requires change in another'. (Loxley et al, 2007).

It was clear from teachers within the sample that colleagues at all levels can either consciously and even unconsciously subvert change. In addition, participants in the interview sample discussed feelings of lack of direction and reassurance in the quality of feedback that informs the enactment-reflection- feedback loop. It was apparent that there is a lack of conviction or confidence in what makes good feedback (Participant E, C and Participant A). Ball makes reference to the teacher-head teacher relationship in his point:

‘The Coalition abolished the GTC, and in April 2012 it was replaced by the Teaching Agency, an executive agency of the DfE responsible for the regulation of the teaching profession – a small but significant change that underlines the lack of autonomy of the teaching profession. Within these reforms the internal school relations between teachers and head teachers have also changed.’ (Ball, S.J., 2013 p161).’

It is obvious that teachers do not work in isolation. Schools are shaped by structures and cultures which influence and act upon teachers’ work. Teachers’ agency to develop and implement new practices and to make changes to the curriculum, even at a local classroom level, is heavily influenced by current school climates.

Collaborative lesson observation and feedback - a recognised and valuable part of the CPD process (Day, 2000) was seen by participants within this study to be viewed with suspicion by some teachers. The high stakes demands of performance management and the judgemental culture of Ofsted inspection regimes are seen to undermine the value of lesson observations, and collaboration as part of any ongoing CPD process. These sentiments were echoed by Participant C in the interview sample when reflecting on the reluctance of some colleagues to engage in processes of collaborating and sharing ideas (Participant C). The teacher goes on to make the point that:

“[unless you put yourself out there] you never get the good feedback either, you don’t get any feedback, so you just churn it over in your head ‘oh, I’m rubbish, I’m not working, this is not working, and you have this idea where you become very self-critical, and then you doubt yourself and then you have this fear that everyone is going to look at you and think you’re rubbish and I think that sometimes just spirals out of control and people get into that closed mindset where they just think ‘everyone’s looking at me’, but it’s their

own fault, they're doing it to themselves, if only they would just say something then" (Participant C).

Two things are very striking about this statement. Firstly, is the notion (as discussed in Chapter 5) that teachers naturally expect to receive criticism as part of a change process, and that they would need to work through this criticism to reach feedback that is more positive. This goes some way to explaining the defensiveness and reluctance to partake in such activity, with the inevitable spiral of depreciating self-efficacy obvious for those teachers who fail to engage with such a process. Secondly, and perhaps even more striking is the notion that not wanting to 'stick their head above the parapet', is somehow the teacher's own fault.

It has been found within this study that participants engaged with CPD and implemented changes to teaching practices, for reasons of institutional performativity, but also for their own professional fulfilment – in reality a nuanced combination of these two aims. However, not all teachers engage so enthusiastically with CPD workshops.

One of the most intriguing points was made by Participant D, when suggesting why some colleagues may be so reluctant to engage with CPD:

"In some respects it was almost on overconfidence that they thought they knew what would work with their pupils' best. They weren't willing to try new things it's an arrogance in a way, isn't it?" (Participant D).

What is noticeable with this statement is the scepticism expressed by a practising teacher and active participant of CPD that other teachers are not in a position to know which pedagogies are best for the pupils they teach. The resistance of teachers to change or to influences of CPD is seen as a negative attribute. Even their peers can perceive a teacher's conviction in their own practices as arrogance.

In the context of complex social-political school environments, this does raise the question over whose knowledge and whose values and structures are given authority and precedence. 'Literature focusing on the power of conflict (De Lima, 2001) and dissonance (Imants, 2002), and pointing to the dangers of groupthink (Watson, 2014), would appear to be less common place than writing extolling the merits of shared values and compromise'. Stoll et al. (2006) highlight the importance of external agents to interrupt habitual forms of practice (Imants, 2002) and 'habits of mind' (Vescio et al., 2008, p. 85). This is necessary if teachers are to expand 'horizons of observation' (ibid., p.89), and collaboratively work together to ensure the development of effective practices (Lieberman and Grolnick, 1996).

However, findings from the study would indicate there are many challenges within the current education environment, particularly in relation to issues of low trust, which inhibit true collaboration, or collegiately, which can limit perceptions of relatedness.

6.4 Critical events and zones of enactment.

Subject specific personal professional development is likely to be intrinsically motivating for subject specialist teachers due to a focus on the subject content. Even short subject specific CPD workshops can be sufficient to trigger change. The focus on the subject content can support a teacher's self-determination to implement changes to practices.

Teachers do not work in a vacuum, and as much as they might be encouraged to take ownership of their personal professional development, subsequent changes to practices do not necessarily lie within their control. The initiation of change relies not just on the teacher's determination to make the change, but also on a niche being available within the classroom-school environment for such change to be applied and to take hold. It is these interactions between a teacher's determination and with the opportunities in environment that act as the 'critical events' in the change process. This is true not just in respect of the implementation of initial changes to practices, but also for any subsequent adaptations or refinements to those practices. Critical events are the product of teacher-school interactions, and are crucial for understanding the occurrences of changes to practices.

However, the pervasive culture in schools is one of external accountability and low trust and this has a moderating impact on the extent to which teachers can

influence change. Teachers' zones of enactment (Spillane, 1999) are limited as a result. In this environment control is exercised over teachers' work practices through managerialist techniques that privilege performativity at the expense of professional responsibility and autonomy (Ball, 2001). Patrick et al. (2003), in their persuasive article that challenges the new professionalism, argue that the culture in schools needs to shift to replace the dominance of managerialism with teachers' own personal commitment to professional learning. Bringing about change in teacher practice is therefore a problem of teacher learning, not one of management (Ingvarson, 1998).

Educational policy emphasises teacher competence and taking responsibility for own professional development, but there is rarely mention of subject knowledge or subject focused pedagogy. Instead the CPD agenda is dominated by government-imposed reforms, leaving little room for individual-based professional development (Furlong, 2005, Bolam, 2000). Bishop and Denleg, (2006) suggest that 'the key to personal professional development comes from a commitment to professional learning, and that in turn is achieved when professional learning includes a substantial component that focuses on the teaching of the subject matter' (Bishop and Denleg, 2006).

Bizarrely, the current culture of continuing professional development is set within a context of appraisal and performance management (Gleeson & Husbands, 2003), the very mechanisms that breed teacher cynicism and confirm the existence of a culture of low trust (Bottery, 2003).

Findings from this study would suggest that science teachers find that support for subject-focused CPD at the institutional level is somewhat constrained. However, personal professional development that meets individual needs can also meet the needs of the institution. Yet, subject specific CPD is not always prioritised at the school-level. Issues of low trust emerged at many levels within this mixed-methods data. To shift towards a culture of high trust, 'schools will need to be confident in their support of science teachers by sharing in the belief that the goals of the science teacher can be coincident with the goals of the institution' (Bishop and Denleg, 2006).

Even short workshops of subject specific CPD, can promote 'internal accountability' (Olssen, 2004) and support teachers' self-determination which must be necessary to move towards establishing a high-trust pro-CPD culture within schools (CST, 2000). However, trust develops *between* individuals, and develops within a framework of professional accountability (Eraut, 1994), and moral agency, as opposed to one of just external accountability. This requires that school leaders have confidence to take the risk (Avis, 2003), as opposed to the full responsibility of risk being placed on the shoulders of individual teachers.

The findings from this study demonstrate the significance of individual-institution interactions in determining 'critical events' within the CPD process. Similarly,

individual-institution interactions determine the extent of the ‘zones of enactment’ of new practices.

6.5 Chapter summary

The discussion within the chapter built on Chapter 5, in which the significance of teacher’s own personal resources; knowledge and expertise, and their motivations and determination, within the process of implementing changes to practices, was discussed. In this chapter, I discussed how teachers can be influenced by the socio-political educational environment, in which they operate. The interactions of the teacher with their school environment influences the nature and extent of classroom change. Current educational policy requires teachers to believe that *they* want what the *organisation* (school) wants, which can limit scope for autonomy and professional judgement on the part of the teacher. Maintaining ‘standards’ and upholding performance targets, are key driving forces for schools, and this can have an adverse effect on individual teachers view of their own feelings of self-determination to bring about change. It could therefore be suggested that paradoxically current education policy is undermining one of the key responsibilities it claims to promote – that of teachers taking ‘ownership’ of their own professional development.

Nevertheless, CPD participants within this study have reported a number of small, but significant benefits to pupils and to themselves, because of their engagement

with short subject specific CPD workshops. The wider implications for this will be discussed within the next chapter – the Conclusion.

Chapter 7: Conclusion

7.1 Summary

In carrying out this study, I set out to explore the long-term impacts, and conditions influencing the impacts, of short episodes of subject specific CPD on teaching practices. The study took place against a backdrop of 'universal condemnation in the research literature on professional development for the one-shot 'INSET day' as a method of bringing about any real change in teaching practice'. (Adey, 2004, p. 161). Before beginning to explore potential impacts, I chose to wait at least six months following participants' engagement with the CPD, to avoid the limitations of a number of earlier studies that have searched for effects too soon.

The specific research aims, as originally outlined included were to explore the extent to which a one-day subject specific CPD course impacts on teachers' practices (Research Question 1), and to explore the conditions that can influence the nature and extent of change (Research Question 2).

7.1.1 The Nature and Extent of Change of Participants' Practices

Findings from the study suggest that participants' engagement with a short episode of subject specific CPD can provide the stimulus to trigger changes to teaching practices. Wide ranges of beneficial impacts were reported by teachers, both to their own teaching practices, and to pupils' learning experiences.

Some of the most significant changes to participants' practices following engagement with the CPD workshops were reported to include: enhanced knowledge of resources and ideas to use in teaching; enhanced knowledge of resources and ideas to help support teacher colleagues; increased confidence in participants' own ability to make the most of resources and increased confidence in participants' own ability to acquire interesting resources to use in teaching.

The impact on pupils' learning experiences as a result of changes to teaching practices were reported to be: Pupils more willing to discuss science; pupils showing a greater interest in science; pupils being more engaged in practical activities; an improvement in pupils' attitudes to science; and pupils showing a greater motivation to succeed in science.

However, despite the reported changes in some of the more affective outcomes such as pupils' motivations, interests, and engagement with science, their attainment was not reported increasing to the same extent – nevertheless, gains in attainment were reported.

In addition to acquiring new resources and ideas and making changes to their teaching practices, participants also reported enhanced feelings of professional satisfaction. Cognition and emotion are interlinked: the enactment of new practices had benefits for pupils, but also benefited the participants too. Not only did participants report feelings of general satisfaction with the CPD, but effects on

their feelings of professional fulfilment were also reported. In fact, the desire to try something *new*, was also given as a motivation for attending the CPD in the first instance. This suggests that, seeking positive gains in pupils' learning is *an* ultimate desired outcome of engagement with CPD, but it is not always *the* ultimate outcome. That is to say, teachers within this study expressed motivations to utilise new ideas, new approaches, new resources, to enhance their practices, but also sought impacts at a more emotional level - to enhance their level of personal professional interests, which as a result also influenced pupils' learning experiences.

Support and development of teachers' personal affective outcomes emerged as an important quality of the CPD process. Supporting teachers to access, to engage with and use their professional judgement; to try out new ideas and resources helps to support perceptions of autonomy. This is likely to be an important consideration in the extent to which teachers are motivated to take 'ownership' of their own CPD. Subject specific CPD is likely to have an important place in teachers' professional learning:

'Much CPD is directed towards achieving institutional targets determined by external authorities, thus privileging generic curriculum and assessment professional development over individual professional development centring on subject matter. As a consequence teachers' perceptions of ownership are diminished as little value or significance is placed on their personal professional needs'. (Bishop and Denleg, 2006 p86).

Findings from the study suggest that an accumulation of small changes can lead to impacts that are more significant. This can be explained through the framework of Clarke and Hollingsworth's (2002) model of teacher change. Small changes, which are triggered because of active engagement with short subject episodes of CPD, are enacted by teachers and then reflected upon. Through this iterative process, cycles of enactment and reflection may continue over time, and can lead initial changes to be adapted and refined in response to feedback and reflection. In a sense, initial changes may therefore evolve in response to positive reinforcement or consequences provided by the wider classroom and school environment.

In this way, specific practices or resources gained as a result of the initial CPD, can change form - will become adapted - and so will not always remain as easily recognisable when compared to the original ideas and resources that were introduced within the CPD workshop. This evolution of practices and resources is perhaps inevitable in complex socio-political environments, and can make the process of identifying the impact of specific CPD resources and practices difficult to unpick once they enter the dynamic classroom environment. This presents an important case for the value of teachers' professional judgement and their informed views and perceptions of the impacts of the CPD.

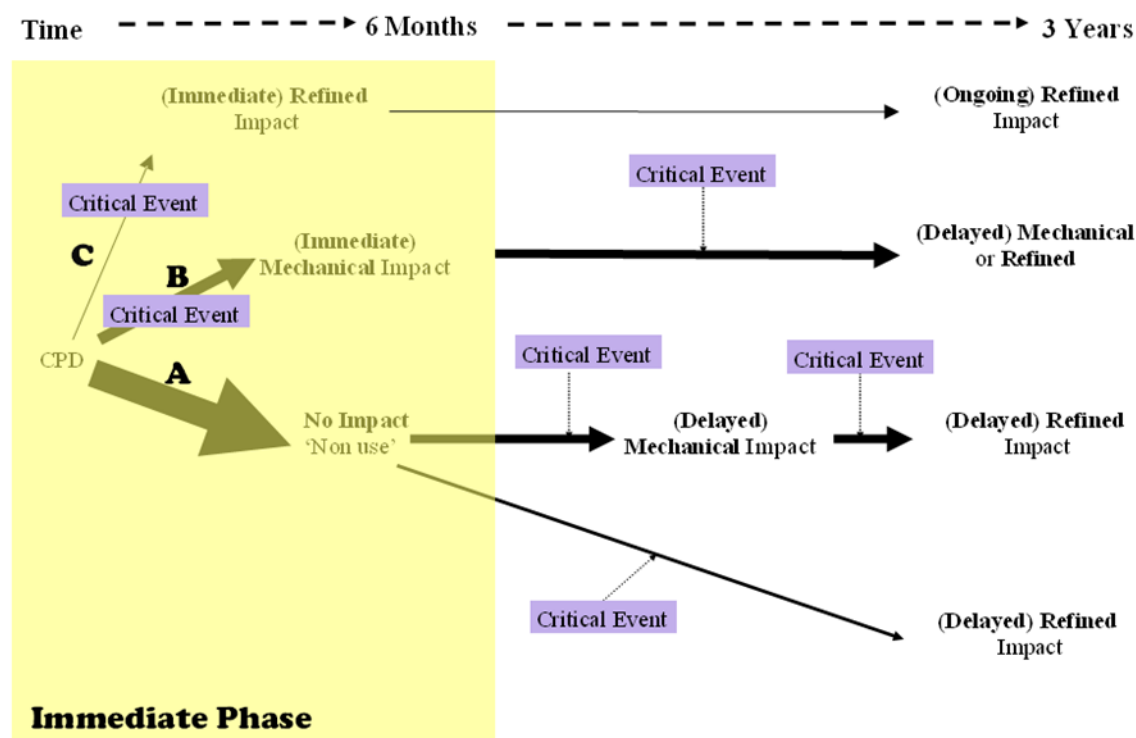
Participants within this study tended to underestimate the time it would take to find the opportunity to introduce new resources and ideas, or to make initial changes to their teaching practices. Only one third of the initial changes to practice occurred

immediately. The majority of initial reported changes occurred later in the school term, or even later during the academic year. This biggest determinant of time until initial implementation was the occurrence of an appropriate fit between the content of the curriculum, and the new CPD resources or practices.

Once the initial changes to practice had been made, teachers reported that these changes to practice were highly likely to be sustained over time, albeit highly likely to evolve. Moreover, the passage of time provides further opportunity for the cycles of enactment and reflection, which can lead to refinement and adaptation of resources and practices. The introduction or adaptation of practices is hastened by exposure to 'critical events', which can include a change in curriculum, a change in teachers' leadership or management responsibility or position of authority within the school, or teachers own evaluation of the effectiveness of those initial practices.

The model outlined in Fig. 24 has been posited to explain the significance of 'critical event' in terms of accounting for the nature and extent of change. The specific routes, A, B, and C, are explained more fully within Chapter 5 of this thesis.

Figure 24: The significance of 'critical events' in influencing change



7.1.2 Conditions Influencing Changes to Teaching Practices.

Individual teachers mediate changes within their classroom environments. The teacher is the active agent driving the cycles of enactment and reflection, and will have a personalised response to 'critical events'. Findings from the study suggest that the extent to which teachers' perceptions of autonomy, competence and relatedness are supported, within the CPD process, have a bearing on the nature and extent of change. Generally, feelings of greater autonomy, competence and relatedness will provide a higher degree of confidence that changes to classroom practice *can* occur. All three constructs interact to influence participants' self-determination and capacity to bring about change. Absence of one may undermine others. For instance, findings from the study suggest, that participants' feelings of

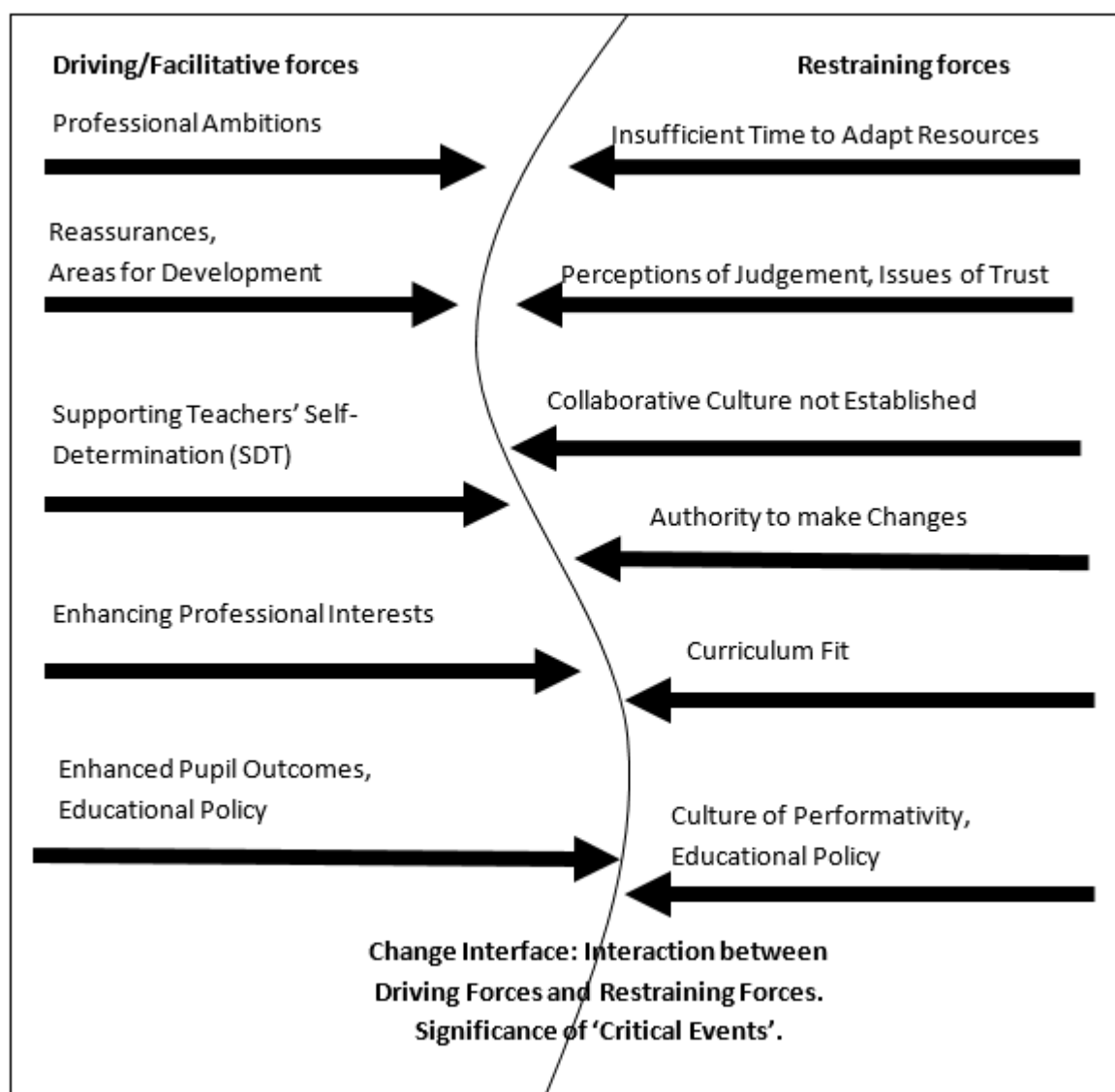
their level of competence (e.g. their confidence and expertise utilising subject or curriculum knowledge) may undermine their feelings of their autonomy to bring about change. Perceptions of a lack of relatedness in terms of collaboration with colleagues could undermine feelings of competence, when such lack of collaboration prevents the sharing of resources and knowledge.

Findings from this study suggest that challenges to a teacher's perceptions of his/her competence can help drive his/her determination to engage with CPD and make changes to classroom practices. For instance, teachers who feel the need for reassurance that they 'are doing the right things' may actively seek opportunities for CPD and collaboration, and be more determined to make changes to practices. Although ironically, the engagement with CPD and subsequent changes to practice seems to require a threshold level of confidence in one's abilities. Equally, teachers' feelings of their *own* desire to make their teaching 'better' can be an important driver for implementing changes to practice.

Interview findings indicated the school environment has a significant bearing on teachers' self-determination within the CPD process. In particular, teachers' perceptions of their autonomy may be undermined by overly prescriptive regimes, which can reduce the scope for the nature and extent of changes to practices. The school environment may effect teachers' perceptions of their competence by providing feedback through frameworks based on cultures of performativity. Which also influence perceptions of relatedness when the criteria for effectiveness is not always clear. In summary the Force Field analysis (Lewin, 1951) below provides a

brief overview of some of the conditions which can influence the process of implementing changes to practices.

Figure 25: Force-field analysis for changes to teachers' practices



Equally, teachers' desire for 'intellectual rejuvenation' emerged as an important driver for change. This was not just a case of making teaching 'better', but also engaging with different practices and exerting choice and autonomy about how these practices should be implemented. Teachers' own professional judgements

are essential. Engagement with CPD with a clear focus on improving pupil outcomes is highly important. However, so too, is providing space for teachers to mediate the intended changes to practices and adapt these within their own pedagogies and own classroom contexts. Teachers' feelings of self-determination need to be supported as part of the CPD process, in order to implement refined and sustainable classroom change.

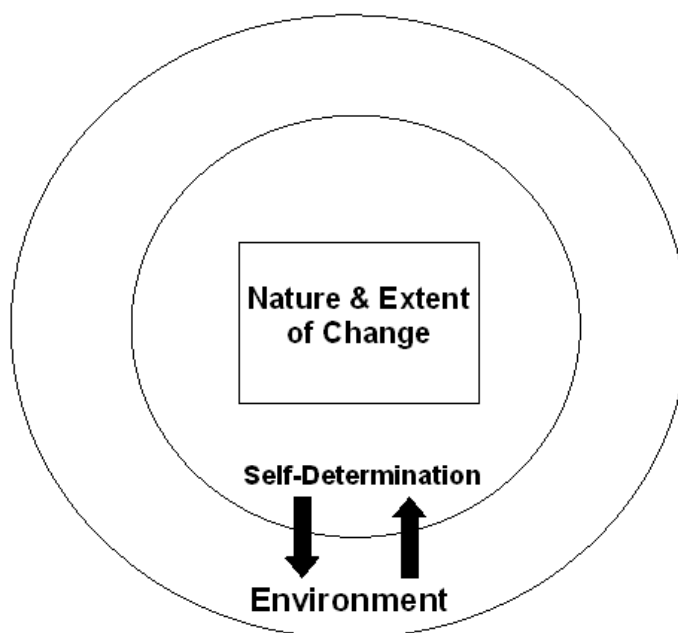
However, making changes to teaching practices requires capacity and agency, and the environment in which teachers work has a significant impact on their ability to bring about change:

'There is also the question of the extent to which teachers can actually achieve agency in highly performative cultures, which is a question about capacity and about resources and opportunities. Here it could be argued that the combined influence of at least two decades of intrusive input and output regulation may well have to a large extent eroded teachers' capacity for agency and have taken away important resources and opportunities for the achievement of agency from their practice.' (Priestley et al, 2015, p125).

These study findings support the view that the socio-political school environment affects teachers' capacity to bring about change – even those who report higher levels of teacher efficacy.

The nature and extent of change to teaching practices, following a short CPD workshop is influenced by the interaction of participants' self-determination, and the socio-political environment.

Figure 26: Influences on nature and extent of change



The teachers' school environment can provide important conditions for influencing the change process. Educational policy requires teachers to become 'better' teachers, to 'take responsibility' for their CPD, and to ensure pupils' outcomes are enhanced. However, the pupil outcomes considered of most value are often confined to test scores and exam performance. Whilst of course these outcomes are important, there is a danger of marginalising other outcomes that teachers may justifiably consider important, such as pupils' affective outcomes, including pupils' interests, attitudes, aspirations, and their science capital.

The result is that the socio-political environment impacts significantly on the extent to which teachers can be self-determined to implement changes, and opportunities to support teachers' professional judgement limited as a result.

On one hand, teachers are expected to take responsibility for change, but at the same time policy can restrict the nature and extent of the change which teachers' can reasonably apply. Priestley highlights the influences of neoliberalism:

'The neoliberal reconstruction of the professional role has thus impacted radically on the possibilities of agency. It has rendered teachers' repertoires for manoeuvre in response to problematic situations more limited. It has, at the same time, undermined professionals' ability to take responsibility for their work, that is, to act on the basis of informed and negotiated professional judgement. While standards are important elements of good professional work, they run the risk of becoming counterproductive when they turn into forms of standardization that may rule out judgement, for example, in favour of so-called 'evidence-based' practices (see Biesta 2007b). The same can be said for accountability when the emphasis on achieving performance targets begins to overshadow the work. In those cases, the diminished opportunities for professional agency lead to forms of action that are increasingly a-responsible and potentially irresponsible (Solbrekke and Sugrue, 2011, Keddle et al., 2011). In both situations, it is the users of the services who stand to lose the most.' (Priestley et al, 2015, p126).

Evidence was also presented that participants' can in turn influence the socio-political environment, albeit in subtle ways. For instance, through a strong desire to share new ideas and resources with colleagues, which might in turn influence their practices. However, this is arguably a small push back, and wider uptake of

new practices was dependent on the participants' managerial authority within the school.

Teacher participants within this study considered that short episodes of subject specific CPD can help trigger beneficial changes to teaching practices and learning, and can contribute to enhanced pupil outcomes. Participants' determination, to engage with CPD in the first instance, and then to apply changes to practice, is a determinant in explaining the nature and extent of change.

However, whilst teachers' self-determination is an important part of the change process, the cultural and political environment can have a heavy moderating impact on teachers' perceptions of autonomy, competence, and relatedness.

'In an environment focused on external accountability, the prevailing culture is essentially low-trust and outcomes-focused (Cochran-Smith, 2001) where hierarchical lines of management are used to obtain compliance through managerialist techniques of monitoring and reporting. By contrast, a culture of high trust is one that fosters a commitment culture of high moral agency and delegated professional responsibility. Shifting to a culture of high trust, however, requires...a culture characterised by mutual understanding, where school leaders have confidence to take the risk (Avis, 2003) that the professional development goals at both teacher and department levels are ones that will also serve the interests of the school'. (Bishop and Denleg, 2006 p 99)

As a result, the environmental influences on teachers can have a significant bearing on the scope of the nature and extent of change, as it is the capacities of individual teachers who mediate changes to practices.

7.2 Recommendations for the importance of subject specific CPD provision

Findings from this study would suggest that within a process of CPD aimed at enhancing pupils' outcomes, a teacher's perceptions of autonomy, competence, and relatedness should be supported too. This may be achieved by ensuring that the range of CPD available can support teachers' personal professional interests. Access to a wide choice of subject specific CPD is likely to play an important role. Participants within the sample were very clear about the importance of accessing CPD which connected with their *own* needs. For science teachers the National STEM Learning Centre is likely to be a significant provider of their CPD needs and interests. On return to school, teachers should be provided with autonomy supportive actions, such as sufficient intellectual space and time, so that they can develop capacity, to adapt and refine the new approaches and ideas to fit within their own individual classroom and departmental or school contexts. Competence and Relatedness supportive behaviours including providing lesson observation and feedback that is not just focused on what the teacher can do for the school, but what the school can do for the teacher.

The newly formed Chartered College of Teaching may have an important role to play. Collaboration is often suggested to be an essential part of any CPD process. However, there is nothing particularly virtuous about collaboration, unless all teachers feel comfortable to share knowledge and practices and contribute meaningfully. In a sense a clearer understanding of the value of collaboration as opposed to cooperation - which can often be 'a management tool for getting

decisions implemented' (Lofthouse and Thomas, 2017, p. 51) will likely be helpful. Even when collaboration is not possible, teachers with sufficient levels of determination and support can begin a perpetuating cycle of enactment and reflection of change practices. However, equitable collaborative practices in which teachers share professional aims and goals is likely to enhance the CPD process.

Connecting with teachers' affective and emotional attributes is an essential part of the CPD process. Teachers will face barriers, challenges, and pressures but if the teacher values the process, then he/she may be more likely to persevere with change, in spite of challenges. CPD should aim to build on teachers' existing competences as well as their interests. A wide choice of quality CPD provision is likely to support this, and the education system should support and value teacher autonomy and professional judgement.

Judgements made about the potential effectiveness of CPD should not be made based on the length of the course alone. Short subject specific CPD workshops are valued by teachers and have a role to play in triggering change:

'The key to personal professional development comes from a commitment to professional learning, and that in turn is achieved when professional learning includes a substantial component that focuses on the teaching of the subject matter. This was a point reinforced by the House of Lords' Select Committee on Science and Technology review into what science teachers value, which recommended that for CPD to be effective a commitment of resources to fund subject-specific development was required (House of Lords, 2001).' (Bishop and Denleg, 2006 p86)

7.3 Predictions and a comment about the future of subject specific CPD

A drive for teachers becoming 'better' teachers by narrowly focusing on enhancing pupil attainment outcomes alone will not achieve that aim. CPD must be of interest to teachers and the educational system must support and allow room for teachers to take risks and experiment with new approaches. However, as long as teachers feel pressures of performativity teachers will be restricted in terms of the sorts of CPD they engage with and the likely impacts as a result.

Guskey (2000) makes the point that 'If the practices are not new to the teachers involved, there is no real change, no innovation, and, consequently, no reason to expect improvements in student learning outcomes.' (Guskey, 2000). However, an important corollary here is that newness of practices by themselves may not necessarily lead to improvements in pupils' learning. Teacher's professional judgement needs to be supported too. This can also have the, indirect, impact of supporting teachers' positive views of the CPD process.

The newly formed Chartered College of Teaching may become increasingly important in terms of negotiating and mediating the language and discourse within current Educational Policy. '[Teacher agency] may be shaped and enhanced by externally defined policies that specifies goals and processes, enhancing the capability of teachers to manoeuvre between repertoires, make decisions and frame future actions' (Priestley et al, 2015, p142).

Whilst important to consider the intended nature of the impact of CPD in terms of pupils' attainment outcomes, teachers' affective outcomes should also be important considerations: both in terms of the effects of the CPD on teachers' motivations to attend the CPD in the first instance but also in terms of their affective and emotional outcomes in response to the satisfaction of implementing and adapting selected practices. The potential for CPD to enhance perceptions of professional satisfaction may possibly be a contributing factor to the associations between attendance at CPD and teacher retention (Allen and Sims, 2017). 'In the absence of a considered approach to changing both teacher and managerial perceptions and establishing a truly professional culture, a reversal in trends from where [A high proportion] of science teachers leave teaching after only five years is unlikely'. (Bishop and Denleg, 2006 p100). High teacher turnover damages pupil attainment (Ronfeldt et al., 2013, Atteberry et al., 2017). Access to subject specific CPD may therefore, directly and indirectly, influence pupils' attainment.

It is essential to consider the significance of the interactions of teacher with their socio-political environment:

[On teachers as the most important 'factor'] This has potential that teachers are not seen as 'thinking, judging and acting professionals. 'To think of the teacher as a 'factor' also reveals an underlying conception of education as a 'quasi-casual' process, (Beista 2015), where teaching is seen as 'input' and student performance as 'output'; rather than that teaching is understood as a complex interactive process of communication, interpretation and joint meaning making where teacher judgement and decision-making are crucial.' (Priestley et al, 2015, p4).

'Finally, the upshot of identifying the teacher as the most important 'factor' in the production of certain educational 'outcomes' is a situation where

teachers are being blamed – if not punished- if their activities have not managed to make a reasonable difference to the achievement of their students. Rather than enhancing and promoting teacher agency, this particular way of approaching the idea that teachers ‘matter’ tends to work in the opposite direction, limiting and confining teachers’ space for professional judgement and action’ (Priestley et al, 2015, p4).

A culture of performativity can drive CPD for better pupils’ attainment outcomes but such a narrow focus can neglect the importance of teachers’ feelings of their own professional fulfilment. That is to say although necessary to have part of the focus of CPD on enhanced pupil attainment outcomes, it may not be desirable to have this as the sole focus. It must also be acknowledged that new strategies may lead to marginal gains in pupils’ attainment outcomes, but can provide opportunities for teachers to exercise professional judgement that can have notable impacts on teachers’ feelings of professional satisfaction and raise interests within their role, and possibly support retention. This is a crucial part of initiating change, but also vital for the sustainability of these changes, and their subsequent refinements and adjustments over time.

In line with Priestley:

‘Any attempt to enhance teacher agency should not just focus on the capacities of individuals - for example, through programmes of professional learning and development – but should at the very same time pay attention to the factors and dimensions that shape the ecologies of teachers’ work.’ (Priestley et al, 2015, p3).

The recently published TALIS report (Sims, 2017) reports that teachers’ sense of job satisfaction in England is below that of other comparable TALIS nations

including Australia, New Zealand, USA, and Alberta (Canada) (*ibid*). In the same report, effective professional development is demonstrated as having a positive impact on job satisfaction.

CPD provision should be wide-ranging and varied in order to support the individual idiosyncratic and individual interests and need of teachers. CPD providers could explicitly draw reference both in planning and design to the likely impact of the CPD on teachers' affective outcomes, in addition to likely pupil outcomes. In addition, it is likely to be important that CPD participants are given the opportunity to plan for implementation, as well as having the opportunity to discuss and address any concerns they may have about the new ideas, approaches or resources before they return to the classroom.

Teachers make an emotional investment within the CPD process. Teachers should, quite rightly, be encouraged to 'take ownership' of their CPD, but for this to happen it is important that their own professional judgement and autonomy are supported more fully.

Choice of a wider CPD provision that could lead to an increase in a range of benefits to pupils. Barriers including financial constraints and concerns that participants have, in relation to issues of accountability, as a result of absence from teaching commitments, in order to be able to attend CPD workshops, need to be considered.

Policy makers and educational researchers discuss the value of collaboration, but when the system invites high stakes feedback, and judgement based on performance, a meaningful and democratic collaborative culture may be undermined, in part due to fear of bias, and a lack of trust:

‘And the key issue is to acknowledge that teachers are stakeholders as well and not just deliverers of other people’s agendas, not least because they possess unique professional expertise and experience of the everyday realities of education. The language of teacher agency seeks to position teachers as active agents within their wider complex, where professional voice and their professional judgement matter.’ (Priestley et al, 2015, p4-5).

It is important to build truly collaborative professional cultures, and support equitable teacher cooperation in environments imbued with trust, so that teachers can see their own personal and professional interest served. Building social capital may increase teachers’ job satisfaction, but also to enhanced pupil outcomes.

Even short episodes of subject focused professional development could raise teacher aspirations and increase intrinsic motivation, which could help promote an emphasis on internal professional accountability. A school’s CPD self-assessment tools should identify and value both the competing and the collective institutional and individual teachers’ needs (Powell, 2000), so that (re) professionalism of teachers can be supported.

7.4 Study limitations

The study has a number of limitations, and so of course, it is important to recognise these.

The study explored the views of teachers who were engaged with, or who had engaged with, science specific CPD. Arguably, this is a self-selecting group. Wider analysis of views of teachers who do not engage, or have not recently engaged with similar subject specific CPD, would add valuable information to the study's findings.

Within the study, I have acknowledged the challenges of identifying planned changes, and actual changes to teaching practices and pupils' learning. Hence, the value placed on participants' accounts of such changes. Which as self-reported accounts are open to criticism of a potential lack of objectivity. However, teaching practices that become adapted and refined over time will look different to those introduced during the original CPD workshop. For this reason participant interviews and questionnaire responses were considered appropriate and effective ways of gathering teachers' professional reports of the nature and extent of change. However, future work could seek to detect more objective accounts, and further details of longitudinal impacts on practices for individual teachers, and to establish further understanding of the unfolding interactions between CPD participants and their school environment over time.

Finally, the study focused on the nature and extent change, and the conditions influencing this change had, following teachers' engagement with a short subject specific CPD course. Impacts on practices, and conditions influencing impacts on practices, are likely to be different for teachers attending longer more extended courses, or even for similar length CPD workshops, which are non-subject specific.

7.5 Future research into short subject specific CPD workshops

Wengraf (2000) makes the point that the role of the researcher is to give voice to people who are not usually heard. Not to suggest that participant voices are 'unheard' but findings emerging from this study may be of interest within the professional development community, and contribute to the educational discussion on the value and effectiveness of short subject specific CPD courses. There is likely to be value in future research studies exploring how teachers' autonomy, competence, and relatedness can be supported as effectively as possible within an educational system with a culture of high-stakes performativity arrangements.

In addition, the ways in which teachers, who express different levels of self-determination within the change process, interact with their socio-political environment, and the extent to which CPD processes can be tailored to support all teachers working in a range of school contexts, will likely be an important area of study. So too, would longitudinal studies of the impacts of CPD workshops, to provide further detail of the interaction of the environment on evolving practices.

7.6 Concluding statement

This study has demonstrated that short subject specific CPD workshops can have a range of beneficial cognitive and affective impacts on teachers and on their teaching practices. However, the extent to which participants can influence change, their 'zones of enactment' (Spillane, 1999), is influenced heavily by their socio-political environment. In order to enhance teachers' capacities and agency, special attention should be given to the ways in which educational policy can support teachers' perceptions of enhanced autonomy, competence, and relatedness.

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Appendices

Appendix 1: Ethical considerations

Information Sheet and Consent Form for Participants:

Thank you for considering taking part in this research. If you have any questions please ask researcher before you decide whether to take part. You will be given a copy of this Consent Form to keep and refer to at any time.

Research Title: Examining the impact of CPD: What are the long term impacts of short courses?

Information about the Research:

- 1. Invitation to Participate and Description of the Project.** You are being asked to participate in a research project that aims to further understanding of *the long term impacts of short courses*. Your participation in the research study is voluntary. Before agreeing to be part of this study, please read and/or listen to the following information carefully. Feel free to ask questions if you do not understand something.
- 2. Why have I been asked to take part in this study?** Because you are a teacher having engaged in subject specific CPD, you will have thoughts, feelings, perception and ideas that are very relevant to this research. The research also aims to achieve a good mix of men and women; who between them have attended a range of different subject specific courses, and who have a range of educational backgrounds. You have not been singled out for any other reason or characteristic.
- 3. What will I be asked to do?** If you participate in this study, you will be asked to participate in an audio recorded 'intensive' interview. The interview will be conducted with the named researcher at a location agreeable to you. The interview is expected to last approximately one hour and will be conducted using an interview guide. It is called an 'intensive' interview because those taking part have been selected for the relevant experiences they have in the research topic and as such will probably permit the interview to be more in depth and 'intensive' on the research topic than if the participant did not have the relevant experience.

Once the interview has been transcribed by the researcher, the transcript, and the researcher's summary of key themes, will be emailed to you and may ask for clarification or more depth on specific points. If absolutely necessary, the researcher may ask you to support with a further interview.

4. **Are there any risks and/or inconveniences?** There is a possibility that some of the questions in the interviews may make you feel uncomfortable. If this happens you can do any of the following; you can choose not to answer certain questions, return to the subject later in the interview, or you can choose to stop the interview. If you wish you can call Mike Cole to talk about your feelings following the interview.
5. **Are there any benefits to my taking part in this research?** Although this study was not designed to benefit you directly, there is some possibility that it may impact on educational provision in the future. The aim of this study is to illuminate impact and educational value of subject specific CPD. In addition, what we learn from the study may help us to better understand the factors influencing the impact of CPD.
6. **Will my taking part in this study be confidential?** Any and all information obtained from you during the study will remain confidential. Your privacy will be protected at all times by the use of coding and security procedures. You will not be identified individually in any way as a result of your participation in this research.
7. **How will my confidentiality be preserved and the data stored?** The consent form that you sign (if you chose to take part in this research) will be stored in a locked filing cabinet in a secured office. This will be the only 'hardcopy' record as all other data will be digital. The interview will be digitally recorded then transcribed (word-processed) by the researcher. These files will then be assigned a numerical code and stored on the researcher's university based U drive which is password protected. A list of your contact details with the identifying numerical code will be stored on a database on a separate password protected drive. This will ensure that your interview and transcript will not be connected to your identification details. The data collected however, will be used as part of a thesis for doctoral study, publications and papers related to pedagogy and professional training programmes. Any quotes from your interview will be anonymised

and in addition those quotes will be reviewed to ensure that they do not inadvertently suggest who the person quoted might be.

There may arise a situation where you might choose to waive your right to anonymity during the dissemination process; if this is something you decide you want to do then please let Mike Cole know.

The researcher will be the main person to have access to your data. In unusual circumstances, it may be necessary for the Principle Supervisor to access the data to check accuracy but permission for this will be sought if the situation arises.

Your data (consent form, interview audio file, interview transcript and database with contact information) will be stored and retained for the duration of completion of the thesis plus five years, then destroyed.

What is voluntary participation? We are seeking your agreement to take part in this study, but to ensure it is not taking advantage of you or putting you in a difficult or uncomfortable situation, that agreement must be voluntary. Your participation in this study is entirely voluntary meaning that you should not feel coerced, pressured, obliged or required to take part. You may refuse to participate in this research. Such refusal will not have any negative consequences for you. If you begin to participate in the research, you may at any time, for any reason, discontinue your participation without any negative consequences.

8. **Who has authorised this study?** This study and the collected data will contribute towards a thesis in part submission for a PhD in Education. The research proposal has been moderated and confirmed by the Principal Supervisor, and the process of data collection has been reviewed by an Ethics Committee.
9. **Other considerations and questions.** Please feel free to ask any questions about anything that seems unclear to you and to consider this research and the consent form questions carefully before you sign.

Appendix 2: Example of initial coding

Transcript	Initial Coding
<p><i>What impact has the course had on your practice?</i></p> <p>The course has had an effect; the style of teaching within scenarios fits in well with a number of topics; keeping healthy (which is a core course) and life care (part of applied science). I've used [the CPD approaches] with a number groups over the years and pupils really enjoy working on the real life scenario, it makes the learning seem a little more important and real for them.</p> <p>[The CPD approach] can work well with KS3 groups, and this style of teaching fits quite nicely with the new KS3 curriculum big picture, and working within themes. The scenario provides a good way of working in a theme, there is the obvious biology side, but also ultrasound and imaging techniques could be covered in some detail. What</p>	<p>CPD approach fits well with a number of KS4 topics.</p> <p>CPD approaches have been used over a number of years.</p> <p>Pupils enjoy the approach.</p> <p>CPD approach fits well with KS3 curriculum.</p> <p>Connection with subject and real life.</p> <p>CPD could have provided further approaches – linked to the curriculum.</p>

would have been better is if we could have been given a number of scenarios rather than just one that could fit in with a scheme of work.

Which aspects of the course were the most useful?

At the time it was a really good day, although getting out of school now is much more difficult. We spent time looking at the resources, [and then spoke to professionals]. It was all very interesting and informative and a good balance, but now I wouldn't be allowed out on a course like this because our KS4 results are good, and so there school would see no need in attending any other CPD.

You mentioned that it would have been useful if on the day of the course you were given a number of other scenarios to fit in with schemes of work. I'm also aware that the approach may have required some tailoring to the needs of your schemes of work and students; did

Getting out of school is difficult.

Opportunity to meet subject professionals.

CPD interesting and informative.

A good balance of content and meeting professionals.

Now that KS4 results are good teacher would not be allowed on CPD course.

<p><i>you have time at school to be able to do this?</i></p> <p>Time is of the essence, and while the course was useful and provided some useful ideas there wasn't any time at school to tailor these or develop any further, any spare time would be spent on anti-bullying policies, strategies, marking books and keeping on top of all of the schools priorities, they all take most of my spare time.</p> <p><i>How long did it take to change your practice following the course?</i></p> <p>I used the resource straight away and have used it every year. In fact it's probably more useful now than it has been. It's really helped preparing pupils for case studies [assessment as part of the new curriculum] and it certainly has potential within the new KS3 curriculum and moving to thematic approaches.</p> <p><i>What has been the impact on practice that has helped students to prepare for</i></p>	<p>No time at school to tailor CPD resources.</p> <p>Time at school spent on whole school policies.</p> <p>CPD approach used straight away, and used since.</p> <p>CPD approach has benefited pupils in KS4 assessment.</p> <p>CPD approach fits with KS3 curriculum.</p> <p>CPD approaches focus on real life</p>
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<p><i>case studies.</i></p> <p>The approach focuses on real life scenarios and encourages students to think for themselves, they need to come up with their own ideas and work collaboratively within groups. Using the approach helps students to develop much more independent learning skills, seeking out information for themselves and analysing that against the problem. This is exactly the sort of approach that is important with the case study, and I think students who have worked through the approach are in a much better position to tackle the case study.</p> <p>In addition to case studies I've also found that the general idea of introducing a problem to students is a good way of introducing a topic, and have used this with most groups, pupils respond well to this as it gets them thinking from lesson one.</p> <p><i>Is this something you've shared with</i></p>	<p>scenarios.</p> <p>Pupils encouraged to think, and become more independent.</p> <p>Pupils encouraged to work collaboratively.</p> <p>CPD approach fits well with assessment approach, and befits pupils.</p> <p>CPD approach used more widely with other groups of pupils.</p> <p>Shared CPD ideas with other teachers.</p>
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<p><i>other teachers within your department?</i></p> <p>I've shared these ideas with others on the department. I'd like to say this has been done successfully, but it's very difficult to say. We've had our fair share of staff turn over and any time we have together as a department is spent on anti-bullying, assessment for learning, and literacy strategies, and anything else that is considered important by the school at the time, so anything like this doesn't always receive the time it should. However by incorporating some of these ideas into schemes of work has helped to ensure teachers are using them. Our KS3 curriculum is currently under review, and current KS3 results are a significant concern for the school and I can see that this is an approach that might be important with addressing that.</p> <p><i>What evidence do you think would best document any changes to practice and student learning?</i></p>	<p>AST role important.</p> <p>Staff turnover diminishes confidence in success of dissemination.</p> <p>Subject CPD not necessarily a school priority.</p> <p>CPD ideas incorporated into schemes of work.</p> <p>Low KS3 results likely to be a driver in adopting CPD approach.</p>
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<p>Our GCSE results have improved year on year, and although this isn't just down to the CPD, this sort of approach will have had a part to play. In 2005 our results were below 40% 5- A* to C grades, but now are over 80%. This sort of approach has helped to engage more students in science and will have contributed to this increase, particularly with helping to prepare for course work. Schemes of work will show that starter activities are geared around that approach - presenting a scenario for pupils to think about [particularly at beginning of topics] and has been incorporated into my schemes of work in both the keeping healthy and life care topics and provides good preparation for the case studies.</p>	<p>CPD approach may have part to play in rising KS4 attainment results.</p> <p>CPD approach has helped to engage more pupils in science.</p> <p>Incorporated into schemes of work.</p> <p>CPD approach provided good preparation for case studies.</p>
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Appendix 3: Example of focused coding

Initial Coding	Focused Coding: Category Formation
<p>Pupils enjoy the approach.</p> <p>CPD interesting and informative.</p> <p>CPD approach has benefited pupils in KS4 assessment.</p> <p>Pupils encouraged to think, and become more independent, as a result.</p> <p>Pupils now encouraged to work collaboratively.</p> <p>CPD approach used more widely with other groups of pupils.</p> <p>CPD approach provided good preparation for case studies (assessment).</p> <p>CPD approach may have part to play in rising KS4 attainment results.</p> <p>CPD approach has helped to engage more pupils in science.</p> <p>Helped with curriculum decision making.</p> <p>Clarification of assessment requirements, definitions, and terminology, useful.</p> <p>Ideas for assessment, useful.</p> <p>Student attitudes and aspirations in science have improved.</p> <p>Head teacher pleased with new results.</p>	<p><i>Category 1:</i></p> <p>Participants' engagement with, and outcomes of, CPD involve affective and cognitive outcomes.</p>
<p>A good balance of content and networking with professionals.</p> <p>Opportunity to meet subject professionals, useful.</p>	<p><i>Category 2:</i></p> <p>The levels of knowledge and experience of people within the CPD process (both the participants</p>

<p>Shared CPD ideas with other teachers. AST role important.</p> <p>Staff turnover diminishes confidence in success of dissemination.</p> <p>Useful to network with colleagues.</p> <p>Knowledgeable tutors provided credible ideas.</p> <p>Lead teacher, drawing on personal experience, helped to reassure staff.</p> <p>Professional background of the teacher aided credibility amongst colleagues.</p>	<p>attending, and those providing the CPD), influences the outcomes of the CPD.</p>
<p>CPD approach fits well with KS3 curriculum.</p> <p>CPD approach fits well with a number of KS4 topics.</p> <p>Connection with subject and real life.</p> <p>CPD could have provided further approaches – linked to the curriculum.</p> <p>CPD approach fits with KS3 curriculum - CPD approach used straight away, and used since.</p> <p>CPD approaches focus on real life scenarios.</p> <p>CPD approach fits well with assessment approach, and befits pupils.</p> <p>Examples of assessment, useful</p> <p>Case studies were useful aspect of the course.</p>	<p><i>Category 3:</i></p> <p>Exemplification of practice and the degree of the curriculum fit of the CPD approaches is a key determinant of potential impact.</p>
<p>No time at school to tailor CPD resources.</p> <p>Time at school spent on whole school</p>	<p><i>Category 4:</i></p> <p>A lack of time, and competing</p>

<p>policies.</p> <p>Lack of time at school diminished opportunity for developing ideas & approaches.</p> <p>More time would have likely improved quality of implementation.</p> <p>Teaching a full timetable – little/no space for adapting CPD approaches.</p>	<p>demands on the participant diminishes the quality of the innovation and implementation of changes to practices.</p>
<p>Getting out of school is difficult.</p> <p>Now that KS4 results are good teacher would not be allowed on CPD course.</p> <p>Subject CPD not necessarily a school priority.</p> <p>Low KS3 results likely to be a driver in adopting CPD approach.</p> <p>CPD ideas incorporated into schemes of work.</p> <p>Incorporate into schemes of work.</p> <p>Pressures of performativity and pressures of accountability (e.g. marking books), were the priority.</p> <p>Low attainment results provided opportunity to implement new CPD practices.</p> <p>Initial impact delayed by 3 years. Move to a new school significant in explaining this latent impact.</p> <p>CPD implementation not a school priority.</p> <p>Colleagues resistant, to a new curriculum. Impacted on approaches associated with this.</p>	<p><i>Category 5:</i></p> <p>School cultures and structures have a significant bearing on the manifestation of CPD outcomes.</p>

Facilitated by a supportive department.	
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Appendix 4: Example of narrative summary

In this case the participants' own view of the utility of the CPD approach, and the constraints of the curriculum, and issues of time, can influence how the CPD approaches are implemented.

My Narrative Summary of Teacher 2's Transcript.

Teacher 2 could see the value of the aims of the CPD, particularly the emphasis on linking to real life applications and links to careers. Implementing these changes of practice in the classroom has contributed to increased attainment, through preparation for coursework case studies, and a general sharper focus on current issues. The approach has been used at KS4 and is planned to be used with KS3 curriculum developments.

Implementation has been gradual largely due to organisational structures, namely shortage of time and staff turnover, school priorities also appear not to be overly concerned with new approaches like this, but more with government priorities.

Over time as opportunities have arisen the [CPD] approach has been used more widely, particularly with KS4 case studies, and has incorporated these into schemes of work. Overtime [the CPD approach] has fitted in where appropriate and opportunities taken to ensure this gets written into scheme of work. However, the shortage of time has ensured that only one of the [CPD approach] has been used as this was perceived to have a direct curriculum fit. The other scenario was less appropriate for a direct fit and the teacher had little time to tailor this. Recently however the teacher has recognised that within the new KS3 curriculum there are opportunities for both.

Appendix 5: TEEQ

Exploring Professional Development Impact

Teacher Expectations Questionnaire (TEEQ) CPD Questionnaire

As part of our ongoing evaluative work, we are very keen to ensure that our courses achieve the impact intended. We would be very grateful if you could take a few minutes, over coffee, to complete this questionnaire as fully as you can.

Course Details

Title? *Date*

Summary**Outcomes**

Participants will be able to:

Your Details

Your Name	
School Name	
Contact No.	
Email	

[Teacher Background]

1. Are you female or male?

- Female ☐
- Male ☐

2. Which of the following degrees or diplomas do you hold? (tick all that apply)

- a. B.A. or equivalent ☐_a
- b. B.Sc. or equivalent ☐_b
- c. B.Ed or equivalent ☐_c
- d. PGCE ☐_d
- e. Master degree in education ☐_e
- f. Master of science degree ☐_f
- g. Master degree in another subject ☐_g
- h. Ph.D. or equivalent ☐_h
- i. Other degree or diploma ☐_i
- j. No degree or diploma ☐_j

3. If you hold a B.Sc. degree or higher degree in Science, in which subject(s) did you major or concentrate? (tick all that apply)

- a. All subjects (e.g. in primary) ☐_a
- b. All sciences ☐_b
- c. Physics ☐_c
- d. Chemistry ☐_d
- e. Biology ☐_e
- f. Other (*please specify*): ☐_f

4. In the past two years, have you completed any in-service, professional development, or other courses dealing with the teaching of science?

- Yes ☐
- No ☐

If 'yes' could you list the course names or type of courses in the box below;

5. Counting this year, how many years of teaching experience do you have in total?

6. Counting this year, how many years of teaching experience do you have in your current school?

7. How many schools have you taught at?

8. What is your responsibility in science teaching at the current time (select the closest description from the list)?

- | | |
|---|---------------------------------------|
| a. Classroom teacher | <input type="checkbox"/> _a |
| b. Subject responsibility (e.g., "Head of Science or Physics") | <input type="checkbox"/> _b |
| c. Key stage responsibility (e.g. Science or a subject in KS3, KS4, etc.) | <input type="checkbox"/> _c |
| d. Science Coordinator (e.g., for a primary school) | <input type="checkbox"/> _d |
| e. Not applicable | <input type="checkbox"/> _e |

9. Which of the following statements best describes your comfort level in teaching science?

- a. I consider myself a specialist and prefer to teach mainly in this area ☐_a
- b. I consider myself quite capable of teaching science, but would prefer to teach other subjects ☐_b
- c. I am not particularly comfortable with science, but teach it when necessary ☐_c
- d. I will teach science only as a last resort ☐_d

10. Who initiated your attendance at the CPD course?

- a. Head teacher ☐_a
- b. Head of Department / Science Coordinator ☐_b
- c. Self ☐_c
- d. Other (please specify): ☐_d

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11. A number of things influence teachers' choice of CPD. How important was each of the following in choosing this course?

	Very important	Quite important	Not very important	Not important
a. Suggested by a senior colleague (e.g. Head, Deputy, Head of Department/Key Stage)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
b. To address CPD needs identified by me	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
c. Fits the school's development plan	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
d. Recommended by a colleague/friend	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
e. To help other teachers in my Department/Key Stage	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
f. To help change policy on what the school department does	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

12. During your usual teaching practices, how likely are you to;

	Highly	Quite a lot	Partly	A little	Not at all
a. Encourage dialogue between teacher and student?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
b. Differentiate work for able, gifted and talented student?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
c. Differentiate work for girls and boys?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
d. Use gender-neutral illustrations and examples?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
e. Use non-technical language and analogies where possible?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
f. Link science with careers?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
g. Link science topics together?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
h. Link science with other subjects?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
i. Link science to the everyday lives of pupils?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
j. Link science to global/social challenges?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
k. Encourage discussion between students	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
l. Encourage reflection time in your classes	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
m. Encourage use of ICT resources	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
n. Use questions based on application of knowledge and understanding	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
o. Use questions requiring explanations and understanding	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

13. During your usual teaching practices, how likely are students to;

	Highly	Quite a lot	Partly	A little	Not at all
a. Observe natural phenomena and describe what they see	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
b. Observe demonstrations of an experiment or investigation	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
c. Design or plan experiments or investigations	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
d. Conduct experiments or investigations	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
e. Analyse scientific data	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
f. Work together in small groups on experiments or investigations	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
g. Memorize facts and principles	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
h. Use scientific information and knowledge to solve problems	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
i. Give explanations about something they are studying	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
j. Relate what they are learning in science to their daily lives	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
k. Engage in discussions based on a scientific issue	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
l. Ask questions relating to scientific issues	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

14. To what extent do the following to limit or restrict how you teach your science classes?

	Highly	Quite a lot	Partly	A little	Not at all
a. The range of student abilities in the class	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
b. The range of differences in students' backgrounds (e.g., <i>economic, language</i>)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
c. The presence of students with special needs	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
d. Uninterested students	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
e. Disruptive students	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
f. Pressure from parents	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
g. Shortage of computer hardware or software	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
h. Shortage of materials or equipment	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
i. Inadequate physical facilities	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
j. Large class size	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
k. Low morale in the school	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
l. Concerns with personal safety or safety of students	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
m. Inadequate resource material for lesson planning	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
n. External examinations or standard tests	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
o. Limits in my own background in the subject	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
p. Inadequate curriculum design	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

[Teacher Efficacy]

15. Please complete the following table;

	Strongly Agree	Agree	Uncertain	Disagree	Strongly Disagree
a. I am continually finding better ways to teach Science	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
b. Even if I try very hard, I do not teach Science as well as I'd like	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
c. I know the steps necessary to teach Science concepts effectively	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
d. I am not very effective at monitoring Science experiments	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
e. I will generally teach science ineffectively	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
f. I understand concepts well enough to be effective in teaching Science	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
g. I find it difficult to explain to students why experiments work	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
h. I am typically able to answer students' Science questions	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
i. I wonder if I have the necessary skills to teach Science	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
j. Given a choice, I would not invite the Head teacher to evaluate my Science teaching	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
k. When a student has difficulty understanding a concept, I will usually be at a loss as to how to help the student understand it better	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
l. I usually welcome student questions.	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
m. I do not know what to do to turn students onto	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

Science					
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[Participants Learning - Expectations]

16. What outcomes do you hope to achieve from attending this course (please tick all that apply)?

- a. Knowledge of teaching strategies ☐_a
- b. Subject knowledge ☐_b
- c. Networking with other teachers ☐_c
- d. Resources or activities to use in my teaching ☐_d
- e. Resources or ideas to help your colleague(s) ☐_e
- f. Clarification about policy, curriculum, or practice ☐_f
- g. Assessment (Clarification or Ideas) ☐_g
- h. Other (*please specify*): ☐_h

[Teacher Practice - Expectations]

17. What is it that you would like to change as a result of attending this course?

18. When, if at all, do you expect to use the resources, materials, ideas from this course?

- a. Used straight away ☐_a
- b. Used within a few weeks or in the next topic ☐_b
- c. Used later in the school year ☐_c
- d. Used several years after the course ☐_d
- e. Will never be used ☐_e
- f. Other (*please specify*): ☐_f

[Impact on Student Learning - Expectations]

19. As a result of your CPD course, do you expect pupils at your school to show;

	Yes	No	Not sure
a. An improvement in their science skills (e.g. measurement, graphing, planning investigations)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. An improvement in general skills (e.g. thinking skills, collaborative working, communication, problem solving)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. An improved understanding of science concepts?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Improved attitudes towards science?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

[School Structures and Organisation - Expectations]

20. Apart from pupils and yourself, who else do you expect to benefit from your CPD?

- a. Nobody else ☐_a
- b. One or a few other teachers ☐_b
- c. The whole Department or Key Stage team ☐_c
- d. The whole school ☐_d
- e. Teachers in other departments ☐_e
- f. Teachers in other schools ☐_f
- g. Student teachers ☐_g
- h. Other (*please specify*): ☐_h

--

21.How much do you expect to share ideas with other teachers?

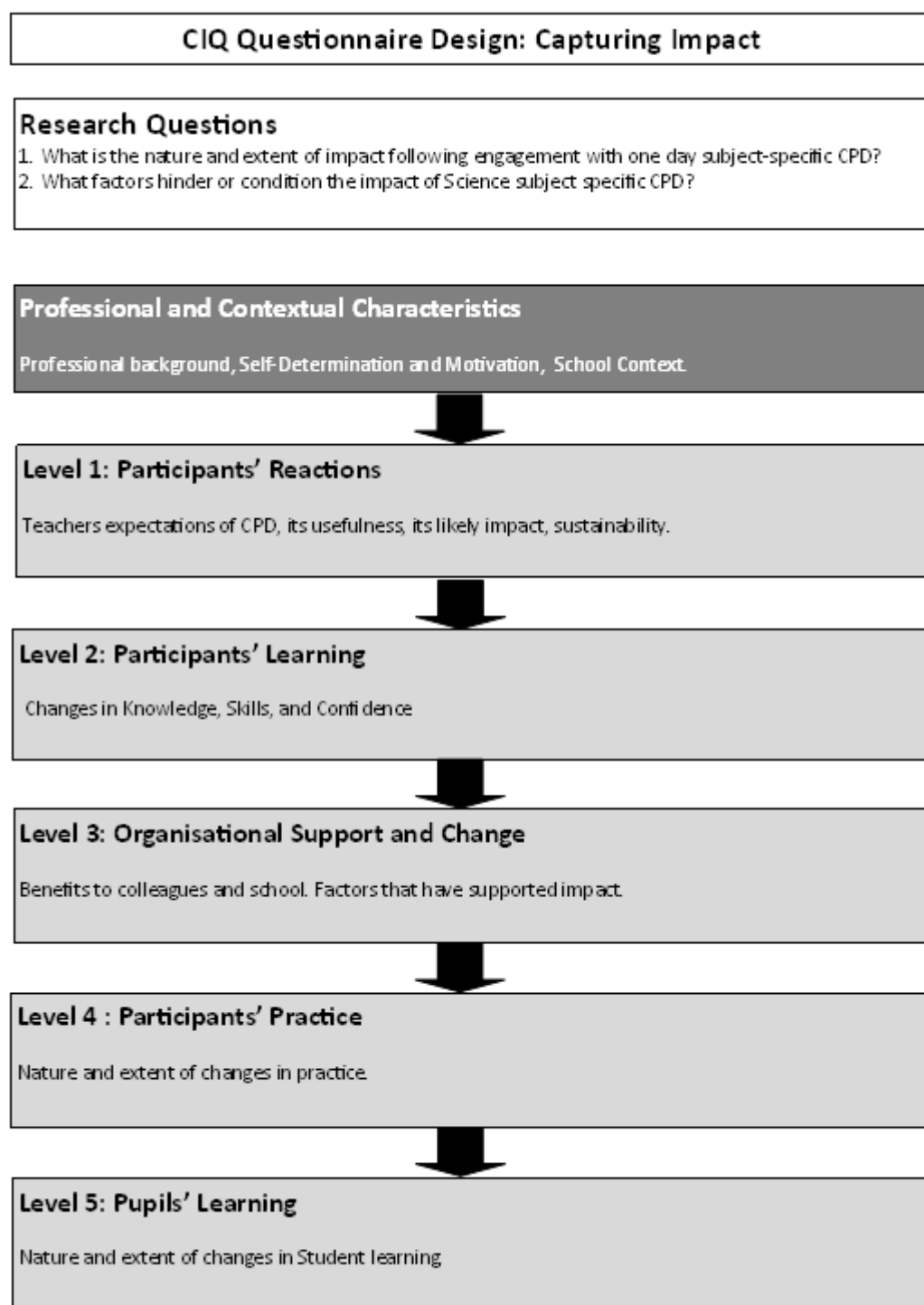
- a. A lot ☐
- b. A little ☐
- c. None ☐

22. What do you expect to happen in school after the CPD to spread ideas and approaches *(select all that apply)*?

- a. Whole school or department training event ☐_a
- b. Meeting with colleagues in department or Key Stage ☐_b
- c. Chat with one or more other teacher(s) ☐_c
- d. Putting teacher resources onto school's VLE/portal/intranet ☐_d
- e. Production of new training materials ☐_e
- f. Nothing ☐_f
- g. Other (please specify): ☐_g

Thank you for taking the time to complete this questionnaire!

Appendix 6: CIQ questionnaire design



The figure above indicates the various levels of contextual and impact data gathered through the CIQ.

Appendix 7: CIQ

Professional Development Impact Questionnaire

Course Questionnaire

As part of our on-going evaluative work, we are investigating the **longitudinal** impact of Science Learning Centre North East courses. We would like to ask you some questions relating to the course you attended previously with us, details outlined below.

We would be very grateful if you could take the time to complete this questionnaire, which should take approximately 20 minutes.

Course Details

How Science Works: Data and Enquiry

Intended Learning Outcomes:

You will:

- Develop an awareness of opportunities for HSW in the new science curriculum.
- Develop a repertoire of appropriate teaching and learning approaches.
- Develop confidence to support students in engaging effectively with HSW.

Your Details

Your Name	
School Name	
Contact No.	
Email	

[Teacher Background]

20. Are you female or male?

- Male ☐₁
- Female ☐₂

21. What was your responsibility in science teaching at the time of your CPD (select the closest description from the list)?

- f. Classroom teacher ☐₁
- g. Subject responsibility (e.g., "Head of Physics") ☐₂
- h. Key stage responsibility (e.g. Science or a subject in KS3, KS4, etc.) ☐₃
- i. Science Coordinator (e.g., for a primary school) ☐₄
- j. Not applicable ☐₅

22. What would you consider the profile of your school (the school you were working at the time of the course) to be? Please circle as appropriate for *Type*, *Attainment* and *Size*.

Type	Attainment	Size
Primary	Low	Small
Middle	Medium	Medium
Secondary	High	Large

23. Have you moved schools since attending the course in []?

- Yes ☐
- No ☐

24. Since attending the course in [] have you taken on any additional responsibility within your role?

- Yes ☐
- No ☐

If 'yes' to either question 4 or 5 , please could you indicate the dates and changes below?

	Date	If 'Yes' to Question 4 New School Profile: (please circle as appropriate)			If 'Yes' to Question 5 New Responsibility: (please circle as appropriate)
		Type	Attainment	Size	
Change 1		Primary Middle Secondary	Low Medium High	Small Medium Large	Subject Responsibility Key Stage Responsibility Science Coordinator Other _____
Change 2		Primary Middle Secondary	Low Medium High	Small Medium Large	Subject Responsibility Key Stage Responsibility Science Coordinator Other _____
Change 3		Primary Middle Secondary	Low Medium High	Small Medium Large	Subject Responsibility Key Stage Responsibility Science Coordinator Other _____

25. Counting this year, how many years of teaching experience do you have in total?

26. Counting this year, how many years of teaching experience do you have in your current school?

27. How many schools have you taught at?

28. Which of the following degrees or diplomas do you hold? (tick all that apply)

- | | |
|-------------------------------------|---------------------------------------|
| k. B.A. or equivalent | <input type="checkbox"/> _a |
| l. B.Sc. or equivalent | <input type="checkbox"/> _b |
| m. B.Ed or equivalent | <input type="checkbox"/> _c |
| n. PGCE | <input type="checkbox"/> _d |
| o. Master degree in education | <input type="checkbox"/> _e |
| p. Master of science degree | <input type="checkbox"/> _f |
| q. Master degree in another subject | <input type="checkbox"/> _g |
| r. Ph.D. or equivalent | <input type="checkbox"/> _h |
| s. Other degree or diploma | <input type="checkbox"/> _i |
| t. No degree or diploma | <input type="checkbox"/> _j |

29. If you hold a B.Sc. degree or higher degree in Science, in which subject(s) did you major or concentrate? (tick all that apply)

- | | |
|-------------------------------------|---------------------------------------|
| g. All subjects (e.g. in primary | <input type="checkbox"/> ₁ |
| h. All sciences | <input type="checkbox"/> ₂ |
| i. Physics | <input type="checkbox"/> ₃ |
| j. Chemistry | <input type="checkbox"/> ₄ |
| k. Biology | <input type="checkbox"/> ₅ |
| l. Other (<i>please specify</i>): | <input type="checkbox"/> ₆ |

--

30. Which of the following statements best describes your comfort level in teaching science?

- | | |
|--|---------------------------------------|
| e. I consider myself a specialist and prefer to teach mainly in this area | <input type="checkbox"/> ₁ |
| f. I consider myself quite capable of teaching science, but would prefer to teach other subjects | <input type="checkbox"/> ₂ |
| g. I am not particularly comfortable with science, but teach it when necessary | <input type="checkbox"/> ₃ |
| h. I will teach science only as a last resort | <input type="checkbox"/> ₄ |

31. Who initiated your attendance at the CPD course?

- e. Head teacher ☐₁
- f. Head of Department / Science Coordinator ☐₂
- g. Self ☐₃
- h. Other (please specify): ☐₄

32. A number of things can influence teachers' choice of CPD. How important was each of the following in choosing your CPD?

	Not important	Not very important	Quite important	Very important
a. Suggested by a senior colleague (e.g. Head, Deputy, Head of Department/Key Stage)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
b. To address CPD needs identified by me	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
c. Fits the schools development plan	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
d. Recommended by a colleague/friend	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
e. To help other teachers in my Department/Key Stage	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
f. To help change policy on what the school department does	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

33. What did you expect to get from your CPD (please *tick all that apply*)?

- i. Knowledge of teaching strategies ☐_a
- j. Subject knowledge ☐_b
- k. Networking with other teachers ☐_c
- l. Resources or activities to use in my teaching ☐_d
- m. Resources or ideas to help your colleague(s) ☐_e
- n. Clarification about policy, curriculum, or practice ☐_f
- o. Assessment (Clarification or Ideas) ☐_g
- p. Other (*please specify*): ☐_h

Your views

These questions should be answered thinking about what you gained from the CPD and what happened in your school as a result.

[Reactions to CPD]

34. How well did the CPD match what you expected to get from it?

- g. Very good match ☐₁
- h. Good match ☐₂
- i. Poor match ☐₃
- j. Very poor match ☐₄

35. To what extent did the CPD challenge what you teach?

- a. Very much ☐₁
- b. To some extent ☐₂
- c. Not much ☐₃
- d. Not at all ☐₄

36. What is your general feeling about taking part in the professional development programme?

- a. Very positive ☐₁
- b. Positive ☐₂
- c. Neutral ☐₃
- d. Negative ☐₄
- e. Very Negative ☐₅

37. How useful did you find professional development in terms of improving classroom practice?

- a. Very useful ☐₁
- b. Quite useful ☐₂
- c. Not very useful ☐₃
- d. Not at all useful ☐₄

Please explain;

38. How effective do you feel your participation in the professional development programme has been in increasing your students' engagement in science?

- a. Very effective ☐₁
- b. Quite effective ☐₂
- c. Effective nor ineffective ☐₃
- d. Not very effective ☐₄
- e. Not at all effective ☐₅
- f. Not sure ☐₆

39. How likely is the impact of your CPD course to be sustainable in the long term?

- a. Certainly ☐₁
- b. Probably ☐₂
- c. Possibly ☐₃
- d. Not at all ☐₄

Please explain;

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[Participants Learning]

40. How have the following changed since you engaged with the professional development?

	Not at all	A little	Partly	Quite a lot	Highly
a. Your subject knowledge	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
b. Your knowledge of teaching strategies	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
c. Your knowledge of resources or activities to use in your teaching	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
d. Your knowledge of curriculum or policy	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
e. Your knowledge of ideas or activities to help your colleagues	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
f. Your knowledge of support networks	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
g. Your confidence in your ability to boost students' confidence in science	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
h. Your confidence in your ability to sufficiently challenge able students in science	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
i. Your confidence in your ability to increase students' awareness of careers/futures in science	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
j. Your confidence in your ability to acquire interesting resources	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
k. Your confidence in your ability to make the most of resources	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
l. Your confidence in being able to make abstract science more 'visible' for students	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
m. Your confidence in teaching "cutting edge" science	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
n. Your confidence in	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

teaching “wow!” science					
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[Impact on Teacher’s Practice]

41. Following the course did you have any concerns about implementing changes to your teaching practice?

- Yes ☐
- No ☐

Please specify briefly:

42. Did you formulate an action plan following the CPD course?

- Yes ☐
- No ☐

b. If yes, did you write your own action plan?

- Yes ☐
- No ☐

c. If yes, did you integrate it into the departmental / school scheme of work?

- Yes ☐
- No ☐
- ☐

43. Has your attendance at the course improved your teaching style and strategies?

- a. Highly ☐₁
- b. Quite a lot ☐₂
- c. Partly ☐₃
- d. A little ☐₄
- e. Not at all ☐₅

If ‘not at all’ what do you think the reasons are for this (tick all that apply)?

- a. Not enough time to implement changes ☐_a
- b. Lack of curriculum fit ☐_b
- c. School unwilling to support changes ☐_c
- d. Other (please specify): ☐_d

44. When, if at all, did you use the resources, materials, ideas from the CPD?

- a. Used straight away ☐₁
- b. Used within a few weeks or in the next topic ☐₂
- c. Used later in the school year ☐₃
- d. Used several years after the course ☐₄
- e. Will never be used ☐₅
- f. Other (*please specify*): ☐₆

Could you briefly outline the reasons for your response to Q24?

45. Please complete the following table, with reference to your **teaching practice** *Before* (B) and *After* (A) the course. How likely were / are you to;

		Not at all	A little	Partly	Quite a lot	Highly
p. Encourage dialogue between teacher and student?	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
q. Differentiate work for able, gifted and talented student?	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
r. Differentiate work for girls and boys?	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
s. Use gender-neutral illustrations and examples?	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
t. Use non-technical language and analogies where possible?	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
u. Link science with careers?	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
v. Link science topics together?	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
w. Link science with other subjects?	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
x. Link science to the everyday lives of pupils?	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
y. Link science to global/social challenges?	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
z. Encourage discussion between students	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
aa. Encourage reflection time in your classes	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
bb. Encourage use of ICT resources	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
cc. Use questions based on application of knowledge and understanding	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
dd. Use questions requiring explanations and understanding	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

46. Please complete the table, with reference to **student activity Before (B)** and **After (A)** the course. How likely were / are students to;

		Not at all	A little	Partly	Quite a lot	Highly
m. Observe natural phenomena and describe what they see	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
n. Observe demonstrations of an experiment or investigation	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
o. Design or plan experiments or investigations	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
p. Conduct experiments or investigations	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
q. Analyse scientific data	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
r. Work together in small groups on experiments or investigations	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
s. Memorize facts and principles	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
t. Use scientific information and knowledge to solve problems	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
u. Give explanations about something they are studying	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
v. Relate what they are learning in science to their daily lives	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
w. Engage in discussions based on a scientific issue	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
x. Ask questions relating to scientific issues	B	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
	A	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

47. In addition to your answers above, what has changed in your practice as a result of your engagement with the professional development?

[Impact on Student Learning]

48. As a result of your CPD course, did pupils at your school to show;

	Yes	No	Not sure
e. An improvement in their science skills (e.g. measurement, graphing, planning investigations)?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
f. An improvement in general skills (e.g. thinking skills, collaborative working, communication, problem solving)?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
g. An improved understanding of science concepts?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃
h. Improved attitudes towards science?	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃

49. Please rank the following statements about the impact of your CPD course on pupils

	Not at all	A little	Partly	Quite a lot	Highly
a. The attitude of pupils to science has improved	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
b. Pupils are showing a greater interest in science	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
c. Pupils are more willing to discuss science	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
d. Pupils are more engaged in practical activities	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
e. Pupils are showing a greater motivation to succeed in science	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅
f. Pupils' attainment has improved	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄	<input type="checkbox"/> ₅

[School Structures and Organisation]

50. Apart from pupils and yourself, who else has benefited from your CPD?

- a. Nobody else ☐_a
- b. One or two other teachers ☐_b
- c. The whole Department or Key Stage team ☐_c
- d. The whole school ☐_d
- e. Teachers in other departments ☐_e
- f. Teachers in other schools ☐_f
- g. Student teachers ☐_g
- h. Other (*please specify*): ☐_h

51. How much do you share ideas with other teachers?

- A lot ☐₁
- A little ☐₂
- None ☐₃

52. What happened in school after the CPD to spread ideas and approaches (*select all that apply*)?

- a. Whole school or department training event ☐_a
- b. Meeting with colleagues in department or Key Stage ☐_b
- c. Chat with another teacher ☐_c
- d. Putting teacher resources onto school's VLE/portal/intranet ☐_d
- e. Production of new training materials ☐_e
- f. Nothing ☐_f
- g. Other (*please specify*): ☐_g

53. To what extent did the following limit or restrict the impact of the professional development?

	Rarely or never	A few times a month	A few times a week	Almost every class
q. The range of student abilities in the class	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
r. The range of differences in students' backgrounds (e.g., <i>economic, language</i>)	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
s. The presence of students with special needs	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
t. Uninterested students	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
u. Disruptive students	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
v. Pressure from parents	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
w. Shortage of computer hardware or software	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
x. Shortage of materials or equipment	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
y. Inadequate physical facilities	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
z. Large class size	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
aa. Low morale in the school	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
bb. Concerns with personal safety or safety of students	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
cc. Inadequate resource material for lesson planning	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
dd. External examinations or standard tests	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
ee. Limits in my own background in the subject	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄
ff. Inadequate curriculum design	<input type="checkbox"/> ₁	<input type="checkbox"/> ₂	<input type="checkbox"/> ₃	<input type="checkbox"/> ₄

Thank you for taking the time to complete this questionnaire.

Appendix 8: Pilot testing framework (adapted from Iraossi, 2006)

Questions that were considered in pilot testing:

- Do they (the participants) understand the objective of the questionnaire?
- Do they (the participants) feel comfortable answering the questions?
- Is the wording of the questionnaire clear?
- Is the time reference clear to the participants?
- Are the answer choices compatible with the respondents' experience in the matter?
- Do any of the items require them to think too long or hard before responding? If so, which ones?
- Which items produce irritation, embarrassment, or confusion?
- Do any of the questions generate response bias? If so, which ones?
- Do the answers collected reflect what you want in regards to the purpose of the questionnaire?
- Is there enough diversity in the answers received?
- Is the questionnaire too long?
- According to your test audience, have any other important issues been overlooked?

Appendix 9: An example of initial, and axial coding.

P3: I think there are some initiatives that I just can't see the point of because for me if its, there's fashion isn't there as well, a bit of a trend as well, as bit of a fashion you know that, you're in this area. Sometimes as a teacher you just can't see the point in them, because if you tried that in the classroom it doesn't seem to add anything. So I'm not all for trying it just for the sake of it, to me if I try it and I don't see an improvement then I don't want to use it. It's got to be something where I can see a benefit, it's got to be something when I use it I can see it actually engages the students more and it actually does help. Sometimes some of these suggestions, you sort of thing well actually I don't think that brings anything new to the table or I think we already do that but we just don't call it that.

Reluctance to follow fashions and trends in CPD (autonomy) has to be something which is considered to have a genuine impact on student learning (increase competence – but also requires competence to consider what this would be e.g. avoiding blind adherence to new fangled initiatives).

MC: So that professional informed view that you have is important in judging the value of CPD?

P3: Yes some things might be too structured I'd rather have it a bit looser, but I think that, the whole point of CPD is to bring things to your attention you don't necessarily have to use them. It's brought it onto your radar then you can adapt it or you can not use that, or you can use a different one, or you can pick and choose, it's about giving you a toolkit isn't it, so that there are different tools at your disposal which you can choose to use or not. But then again it's class by class, year by year, subject by subject, some things work so much better in some subjects and absolutely don't work at all in others so you have to use your judgement on that as well. But I think bringing ideas to people's attention, as long as they're not sort of "you will do it" putting your own spin on it is important and you have to feel like you can do it normally and natural and it not a big task for you to do you know it's not something extra but it sort of adds to what you already do.

A very clear link from collaboration to autonomy to competence!

MC: How do you feel when it's imposed on you, so you're told you're going to do AfL in this way?

P3: I would prefer to be shown things that are possible and then choose what I would like to do myself rather than say right this year we're going to do this this and this, and this was a bit of that in that group cooperative learning thing. I'm not adverse to cooperative learning, but it was that idea of you will do it and you will do it with one task and we will, it was a bit, it felt a bit too prescribed, a bit like you were forcing it, and then also they had everybody in the school doing that with the kids in every lesson, so then it becomes, the kids would be like, on not this again because they were doing it in every lesson it just seemed a bit too much or a bit too concentrated. I think and it's just my feeling that it was a little bit too much all at once and it was in all subject so it seemed a bit like the kids would go 'oh God' we're doing this in every lesson. And the whole point I think of those techniques is that they should be like an assortment of techniques rather than everybody doing the same thing all of the time.

Cooperation does not mean collaboration. The teachers own feelings of autonomy are an important part of, and influence her motivation, to engage with the process of change. 'Cooperation' that does not support a teacher's perceptions of autonomy, is likely to be less effective in terms of bringing about change.

Commented [W42]: Barriers: trends and fashions in education

Commented [W43]: Reflection on quality of Impact Important for sustainability of CPD.

Commented [W44]: Innovation important for CPD

Commented [W45]: CPD: to bring things to your attention

Commented [W46]: SDT: a clear link to theory here.

Commented [W47]: Added value – not extra work

Commented [W48]: Choice Important for Impact

Commented [W49]: Prescription a negative factor