THE INTEGRATION OF INFORMATION AND COMMUNICATIONS TECHNOLOGY (ICT) INTO TEACHERS' PROFESSIONAL PRACTICE: THE CULTURAL DYNAMICS OF CHANGE.

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PhD

ABSTRACT

A number of policy initiatives have emerged from the UK government in recent years which have been designed to integrate the use of Information and Communication Technologies (ICTs) within the professional practice of teachers. This thesis investigates the implementation of these policies. Taking account of previous research that points to the complexity of translating policy statements into embedded classroom practice, the thesis examines factors and processes at the local level that serve to enhance or inhibit the implementation of the policies. Specifically the investigation covers the period 1997–2003 and focuses on teachers' experiences of implementing the ICT policies. Following a grounded theory approach the research involved a multi-site case study of 12 schools across 5 LEAS and 113 teachers. Questionnaires, interviews and observational techniques were combined to produce both qualitative and quantitative data.

Findings from this research point to the importance of the social/informal dimension of teachers' professional development as a vital factor influencing the success/failure of policy implementation in the school context. In particular, the research highlights the significance of teachers' communities of practice and specific aspects of school culture (leadership, vision, shared ethos, training, ICT infrastructure) as critical to the integration of ICT. The research also identifies key factors that account for *variations* in the extent of integration between teachers and departments within the *same* school and across *different* schools.

The thesis concludes that the process of embedding educational innovations and policy initiatives owes much to the existence of departmental communities of practice – professional groupings that are not dependent on the curriculum subject, but on a collegial culture. Ways to stimulate, encourage and sustain communities of practice are considered as constructive proposals to facilitate the implementation of educational policies linked to the professional practice of teachers in schools.

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PREFACE

My interest in doing the PhD stemmed from my background as a practitioner, as a teacher for eight years in secondary schools and ten years at university. Teaching for me was inspired most prominently by the team of teachers I first worked with, who were innovative and creative in pushing the boundaries of what constituted engaging lessons as we planned long into the nights together and team taught. I was amazed as students became alive through ideas and activities and I saw that winning hearts and minds was both achievable with difficult and challenging students and was paramount to effective learning.

The courage and vision of those teachers has stayed with me as I saw how, as practitioners we had to adapt to situational demands alongside changing educational policy. My commitment to ensuring students engaged with learning in a meaningful way kept me keen to constantly developing my practice. What I experienced as a teacher with the introduction of ICT into education was a fracture: a space, an opportunity for us as teachers to open up our preferred practices and engage with new ways of teaching. My professional experiences illustrated how learning within a community of practice can change our knowledge and understanding and how technology can be a catalyst for stimulating the active process of transforming pedagogy.

I also became aware that there were major differences between teachers and schools regarding the ways in which technologies were appropriated. I wanted to conduct research that could explore the process of implementing ICT and from which I could make recommendations to policy makers, school leaders and teachers in the technological change facing schools and which could contribute to meaningful learning: particularly for teachers to re-engage with their practice in re-generative ways.

CHAPTER 1
INTRODUCTION

In the context of technological change in the area of information and communications technology (ICT), government polices have sought to promote the integration of ICT in education. The thesis investigates the implementation of ICT in relation to *teachers' professional practice* in schools, for teaching, learning and administration. The investigation, mindful that policy implementation is a complex procedure not a direct mapping process, focuses on factors at the local level of the school that serve to enhance or inhibit ICT uptake by teachers. Specifically the research examined teachers' experiences of implementing ICT policies during the period 1997– 2003.

The purpose of the Labour government's policy drive on integrating ICT in schools was two fold: first, ICT would aid the government's core education agenda to 'raise standards' and second, would equip the future workforce with ICT skills that would ensure the competitiveness of the UK in an increasingly globalised high–tech economy (Brown and Lauder, 1997). Since 1997, the government has dedicated significant sums, £3.54 billion to develop the use of ICT in schools (Doughty, 2006). Funding was targeted to equip schools with ICT resources; specifically hardware, software, connectivity to the internet, ICT training for teachers and online educational content via the National Grid for Learning (NGfL) and New Opportunities Fund (NOF); the flagship ICT initiatives of the Labour government from 1997, culminating in the U.K's first national ICT strategy.

Changes in education ICT policy and concomitant financial investment from government have culminated in mounting political pressure on teachers to use ICT in schools (Leask and Pachler, 1999). However, from research on policy implementation and technological innovation in education, it is well known that change is either very slow or tends to fail (Agalianos *et al.,* 2001; Fullan, 1991). Policy implementation is neither straight forward nor an unfaltering mapping of changes from government documents to practice; localised factors affect take up.

The research was undertaken in a time of transition and change with respect to government policy on ICT in schools. The national ICT strategy intended to stimulate change in education, which was transforming schools and teachers' professional practices to incorporate ICT. The pressure for change towards integrating ICT did not take place in isolation, but in parallel with competing educational priorities, creating tensions for teachers and schools.

Working within a framework that acknowledges teachers' professional practices as situated within the socio-cultural contexts of schools, it was necessary to attend to the differing levels of influence; from macro, meso and micro concerning respectively, government policy, LEA strategies and individual school management initiatives, whilst attending to the complex and dynamic ways in which teachers negotiate understandings about priorities for their professional practice.

The aim of the research was to examine the processes of policy implementation with respect to ICT in schools from 1997-2003, a period that encompassed Labour's seminal national ICT strategy, with NGfL and NOF. The research was undertaken to clarify: *What factors influence the implementation of government ICT policies in schools and aid the integration of ICT into teachers' professional practice?* This necessitated the identification of local factors that were influential in schools and entailed exploring teachers' experiences of implementing ICT and identifying the issues pertaining to integration and concomitant changes, if any, in teachers' professional practice. The research was concerned with teachers as professional grouping, not as individuals, and focused not on the psychological factors of attitudes and motivation, but rather the attendant socio-cultural influences that affected teachers' engagement with ICT. This was because schools are complex, social settings and provide the context through which teachers enact policy; hence the cultural dynamics of the school context were fore grounded in the investigation.

Empirical research was conducted over four years from 1999-2003, which involved both qualitative and quantitative methods. In total, 113 teachers across 5 LEAs and 11 schools, plus 1 study support centre were used; forming a multi-site case study. The research was conducted in three distinct phases. The first phase was exploratory; the second phase employed detailed qualitative methods of interviews, observations and documentary analysis. The third phase involved participant validation of the research findings.

The research identified the factors that contributed to the effectiveness of ICT policy implementation. It also identified those factors that had limiting effects, such as current curriculum and assessment formats and the varying effectiveness of school leadership, quality of ICT training, amount of technical support, access to ICT resources and the robustness of the school's ICT infrastructure.

The research confirmed there is no simple translation of government ICT policy into teachers' professional practice. Findings from this research point to the importance of communities of practice; the social dimension of teachers' professional development and specific aspects of school culture (leadership, vision, shared ethos, ICT training, technological infrastructure) as critical to the integration of ICT. The research also indicates which factors accounted for *variations* in the extent of integration between teachers and departments within the *same* school and across *different* schools, which were used to explain *inter* and *intra*-school variation in ICT policy implementation. And, on a positive note, the findings point to constructive aspects of policy implementation, when an awareness of the complexity of the implementation process is maintained by school leaders and ICT is developed on multiple fronts: materially and culturally.

The thesis concludes that embedding the government's national ICT strategy in teachers' professional practice in secondary schools may depend on departmental communities of practice, which are not dependent on the curriculum subject, but a collegial culture. It is suggested that schools may consider ways to stimulate, encourage and sustain communities of practice, which allows teachers to actively engage in the creation of new knowledge about ICT for professional practice.

This research contributes to new knowledge in two ways:

- The *significance of communities of practice* as professional groupings of teachers, which form the locus of change regarding ICT policy implementation; a description of *situated* communities of practice in the particular locations and time frames of the multi-site case study; identifying *distributed* communities of practice as enabling school leaders to develop ICT.

- Developing an understanding regarding the *complexity* and *multidimensionality* of implementing ICT policy in schools, which facilitates managing change at the local level, enabling schools to become more ICT integrative. This extends the current understanding of ICT maturity in schools with hierarchical, static levels of descriptors (Becta, 2005), which fail to outline progression. This new understanding outlines *how* schools can *progress* by attending to the multidimensionality of both the material and cultural aspects of policy implementation.

Structure of the thesis

The following chapters present the rationale, methodology, findings and analysis of the research. Chapter two introduces the background context to the research by describing the development of ICT in U.K schools and provides a historical overview of government ICT initiatives. Chapter three provides a review of the literature relevant to the investigation in the following fields: innovation and policy change in education, teachers' professional development and factors affecting teachers' uses of ICT. In chapter four, the methodology employed to collect and analyse data is detailed. Chapter five summarises the findings from the three phases of research and presents evidence to support and illustrate themes, or categories (Strauss and Corbin, 1998) arising from the data, which are discussed and analysed in chapter six and seven. Chapter eight offers conclusions which propose that a) communities of practice are significant in relation to government polices and the integration of ICT into teachers' professional practice and, b) a framework for understanding how schools may become more ICT integrative, which attends to the multidimensional, dynamic nature of managing change as a complex interaction between material and cultural factors. The chapter also discusses the contribution of the research to new knowledge in the field of ICT and education and suggests questions for further enquiry. The chapter also outlines recommendations to policy makers, school leaders and practising teachers.

Research Rationale

The broad research question was concerned with 'how ICT policy in education becomes embedded into practice?' and surmised that ultimately the success of policy must depend on translation into practice at the delivery end, with schools and teachers. Given that schools are complex, social settings, the take up of ICT within them depends upon schools' complex cultural dynamics. However, there is a research omission here, because there are very few studies on the cultural processes of ICT implementation in schools. Existing studies are either, large scale, quantitative and statistical (Pelgrum, 2001), measuring the extent of ICT in schools (DfES, 2001; Ofsted 2001), or, small scale, qualitative studies, examining individual teacher perceptions of ICT (Dawes, 2001; Loveless, 2001; Veen 1993). This research addresses the middle ground between the macro, large scale and micro, individual teacher, by exploring the cultural dynamics of schools through which policy becomes enacted by teachers. This research contributes to our understanding by looking at the cultural dynamics of change, how social and material factors interact at the level of the school and affect the take up of ICT by teachers, as professional groupings.

The research focuses on the cultural dynamics of implementing ICT in schools, because this is both an omission in prior research and there is the need to examine the reasons for school level *variation* in the embedding of ICT, as identified by government reports (DfES, 2001, 2002; Ofsted, 2001, 2002, 2004), which is discussed in detail in the next chapter.

CHAPTER 2

GOVERNMENT POLICY ON ICT IN EDUCATION: U.K NATIONAL CONTEXT

2.0 INTRODUCTION

> The introduction of ICT into schools represents one of the largest and most complex curriculum innovations that has ever been attempted. (Scrimshaw, 2003, p85)

This chapter examines the history of ICT development in schools, from the introduction of the first computers in the 1980s, with the Microelectronics Education Programme (MEP) and Technical and Vocational Education Initiatives (TVEI), to the launching of the NGfL and NOF training under the new Labour government of 1997 and how such an ambitious national ICT strategy came about.

Following the decade of the Conservative government's original ICT initiatives in schools, the first national assessment of the impact of ICT was conducted in 1993. The ImpacT report highlighted in particular teachers' need for in-service training with ICT, as well as a number of other problems, which were reiterated by the McKinsey and Stevenson reports of 1997. Both these independent inquires into the 'issues and opportunities' with ICT damningly concluded that the state of ICT in UK schools was primitive and it was a public priority to increase the use of ICT. Having identified no coordinated strategy to develop ICT in schools the Stevenson report urged government to develop a cohesive national strategy. Consequently, the new Labour government of 1997 launched the NGfL and NOF initiatives and has since invested £ 3.54 billion in ICT (Doughty, 2006).

Prior to the NGfL, an analysis of the key ICT reports above revealed four recurring issues regarding ICT development. First, there was the problem of ICT resourcing, which was judged to be in urgent need of upgrading due to the obsolete technology found in schools. Second, teachers required specialist ICT training in order to be proficient with technology. Third, school managers needed to take responsibility for developing a whole school policy for ICT and strategies for its implementation. Fourth, schools needed to address the curriculum application of ICT; since this was prior to Curriculum 2000, which introduced statutory orders for the integration of ICT across subjects. Arguably the inconsistencies found across schools in the curriculum use of ICT helped formulate the need for Curriculum 2000.

Following the identification of these problems the new Labour government clearly focused on prioritising ICT in schools and developed the most ambitious and far-reaching plans for a national strategy for ICT. In 1997, the government announced its intention of encouraging the widespread use of ICT in maintained schools. The main element of this programme, the National Grid for Learning (NGfL), provided a network of information and learning materials, and funding for schools via the Standards Fund (DfEE, 1997).

A supporting national programme of in-service training for teachers and school librarians was funded by the National Lottery's New Opportunities Fund (NOF) (TTA, 1998). These programmes have been key components of the government's national ICT strategy for schools. Their implementation has been the responsibility of the Department for Education and Skills (DfES). In 2003, the combined initiatives were relaunched as the 'ICT in Schools' programme (ICTiS), with continued earmarked funding for schools to purchase ICT hardware (DfES, 2003-06).

However, despite such significant investment in government ICT *initiatives* (with the NGfL and NOF), and government *policy intervention* (with Curriculum 2000 and statutory ICT orders), there was an identifiable *gap* between the legislative requirements *and* the reality of what was happening in schools: a gap identified by government inspection agencies and academic researchers alike (DfES 2001-2, 2005; Loveless, 2005; Ofsted 2001-02, 2004; Opie and Fukuyo, 2000 and SCAA, 1997). This highlighted the problems of government policy implementation and how the process was not a direct translation from policy to practice. In particular, an analysis of the evaluation reports listed above, identified five key areas that were seen as problematic regarding implementation: the *multi-agency* nature of the initiatives and their *management*; disparities of *funding*; technology resourcing and *procurement*; ICT *training* for teachers and impact on *pedagogy*. These issues of implementation affected the national roll out of the government's ICT strategy at the local level.

Overall this chapter explores the history of ICT development in schools and how government policy has attempted to enhance the use of ICT since the 1980s through a variety of technology initiatives. Analysis of UK ICT evaluation reports has identified specific problems with developing ICT, due to the complexity involved in an area that demands management of multiple factors simultaneously; from securing ICT funding for technology procurement, resourcing and training to curriculum and pedagogical application. Further analysis has revealed that implementing government policy on ICT in education is a complicated process, which is multi-faceted and far from a singular, straightforward translation from policy to practice. This research explores teachers' experiences of implementing ICT. First it is necessary to examine the development of ICT initiatives in education to provide the background context to the research.

2.1 BACKGROUND: EDUCATIONAL POLICIES ON ICT

The introduction of ICT into education has been a key component of government policy from around 1980 (Abbott 2000; Dawes 1999), and Somekh (2000) traces Blair's commitment back to Kenneth Baker and Lord Young in the mid 1980s. Most significantly though has been the ambition of Ministers for what ICT could achieve: in 1995 Michael Heseltine launched the Superhighways initiative stating it 'would help with the vital task of keeping Britain competitive in the 21st century' (Somekh, 2000, p20). In 1997, at the launch of the NGfL, Blair argued similarly:

> Technology has revolutionalised the way we work and is now set to transform education. Standards, literacy, numeracy, subject knowledge will be enhanced by the grid and the support it will give to our programme for school improvement. (NGfL launch, March 1998)

Offering such a panacea of hope, ICT has been cast as the solution to no less than the fundamental problems of education. If the achievements do not match the dream, then it is necessary to assess to what extent that is a failure of government policy (regarding the problems and complexity of implementation) and the extent to which policy makers made ICT such a seductively anodyne 'cure all' to the public that it could never live up to the dream.

As Somekh (2000, p20) argues;

> I believe it is not fanciful to say that politicians have taken possession of the new technology image and offered it to the electorate as a talisman...something by which extraordinary results are achieved...Since educational achievement is linked to economic success, the ambition has gone beyond school itself to encompass the future economic well being of the country.

Whilst priority was given to ICT development in the UK *partly* because research evidence indicated the increasing importance of computer literacy in the *employment market*, the drive to increase ICT use in schools was also to be an *act of faith:*

> ...analogous to realising in the aftermath of its invention that electricity would be applied across all aspects of society. (Stevenson, 1997, p6)

The policy drive on ICT in education in Labour's first term thus had a visionary, futuristic quality. This may address the speculation of *why* the government invested so heavily in ICT in schools from 1997, *before* the evidence of ICT's impact on learning was known (beyond a previous small scale evidence base). An estimated £1 billion was spent before ImapCT2 was published in 2002. The above analysis points in part to an underlying *economic rationale* regarding ministers' commitment to ICT in education (Brown and Lauder, 1997; Cole, 1998).

The focus on ICT has continued to be a priority for education policy from the 1980s, but particularly so for the consecutive three terms of the Labour government. The focus of the analysis predominantly lies in the period of Labour's first term of office from 1997-2002, as this represents a seminal time in the history of ICT in schools, with the launch of the NGfL and NOF; the most pioneering and ambitious ICT initiatives yet developed for schools.

Consequently, Labour government policies on ICT have put an enormous amount of *political pressure* on teachers to integrate ICT into their professional practice (Leask and Pachler, 1999). In particular, the key government initiatives that predominantly exerted this pressure were the NGfL and NOF ICT Training for teachers. However, it is necessary to analyse the background and national context to these policy developments prior to the Labour government's introduction of them.

The development of government ICT policies, implementation strategies and infrastructures was contextually framed by ministers' political aspirations with their utopian vision of ICT and their attendant urgency to raise standards in education, in order to be seen as an effective government. In the first term of the new Labour government 1997-2002, the major policy initiatives for schools have been

- The Education Departments' Superhighways Initiative (EDSI, 1996-98), £10 million of sponsorship from industry and a funded evaluation; although commissioned by the previous Conservative government, the project was operational when Labour took office and became the first major report that heralded a new era in education with ICT. This era was to be marked by the development of the Internet and potential educational opportunities this technology afforded. It was also the first time policy makers, ICT providers, researchers and practitioners were brought together to examine ICT across every sector; primary, secondary and higher education.
- Multimedia laptops for teachers; pilot project (1996-98), £4 million to supply 1,400 teachers; main phase 1998, £23 million to supply 10,000 teachers and heads.
- The National Grid for Learning; phase one 1998-99, £100 million for hardware, software and Internet connectivity for 8,000 schools; between 1998 and 2002, £657 million of grant funding was made available to schools in England through the Standards Fund to help develop ICT provision (infrastructure, services and content); a further £710 million of expenditure was allocated between 2002 and 2004.
- ICT Training for teachers and school librarians; from April 1999 to December 2003, £230 million from the New Opportunities Fund across the U.K (£180 million in England – equivalent to around £450 for each teacher being trained).

The government has continued to prioritise ICT in education with the development of further key ICT initiatives. In 2003 a DfES report notified that policy direction had taken a subtle turn; whereas the period 1997- 02 concentrated on 'ICT infrastructure, connectivity, professional development' (p7), the period 2003-06, would be concerned with 'ICT pedagogy and whole school improvement' (DfES, 2003, p7).

Consequently the government's seminal NGfL and NOF initiatives were relaunched as the 'ICT in Schools programme' (ICTiS), which has continued funding for schools to purchase ICT hardware (DfES, 2003). Other significant projects and funding schemes have included: Strategic Leadership in ICT (SLICT) – a programme of in-service training for senior school staff; Curriculum Online – a learning materials scheme with approved software and funding, and the Test Bed Project, evaluating use in ICT rich schools (Becta 2006).

In the interests of clarity and the timeline of this research, the policy period 1997-2002 was the most pertinent, as this signaled the most fundamental changes in education regarding ICT, with respect to the funding and scope of the initiatives; 'in excess of £1.65 billion' (Stevenson, 2006, p45) and by 'the end of 2006-7, £3.54 billion' (Doughty, 2006, p1). However, successive UK governments have been developing ICT in education since the early 1980s and a brief exposition of these developments will be discussed.

2.2 HISTORY OF GOVERNMENT ICT INITIATIVES IN SCHOOLS (1981-1997)

First, it is necessary to provide definitions of key terms that are routinely used in the field of ICT and education. There are the terms IT and ICT; the use of the words 'integration' and 'embedding' with respect to the use of ICT; and the difference between government ICT 'initiatives' and 'policies'.

To start, it is important to clarify terminology with respect to technology: IT (Information Technology) and ICT, which adds 'C' for 'Communications' to the acronym. Interestingly, it was the Stevenson Report that first added the C in order to stress this emergent and potentially powerful aspect of the internet.

> It is the communications aspect of ICT which is broadening educational horizons and providing so many benefits. Resources... need no longer be contained within the school walls. (Becta, 1998b, p6)

This additional dimension of educational technology *extended* what it meant to be *computer literate* to being *network literate*, which required the ability to use computers to communicate, access and create electronic resources (Scrimshaw, 1997). Kennewell, Parkinson and Tanner (2000) assert that the term information and communications technology 'refers to the set of tools used to process and communicate information' (p1) and, ICT is defined for curriculum purposes as, 'the range of tools and techniques relating to computer-based hardware and software' (QCA, 1999, p.184), which defines usage in an educational context.

Second, it is necessary to define what is meant by the terms 'integration', 'embedded' and 'innovative', which are often referred to as different ways of using ICT in the literature. However, the same literature rarely defines the terms. In fact, such terms are used casually and rather loosely, hence the need to offer an articulation of what the terms mean in this research. It is not even the case that the terms are contested; rather they are employed, but rarely defined. Also, interestingly, the terms 'integration' and 'embedded' are often used interchangeably in the literature, but in this research they are taken to mean the following: integrated use refers to the incorporation of ICT into practice; the use of ICT is *included* in practice, perhaps each week, but it may not be routinely used, for example, very lesson. However, 'embedded' use of ICT refers to habitual use. Importantly this type of use is routinely and regularly part of teachers' practice and refers to the integral use of ICT for teaching. For integral users, the use of ICT is not a 'bolt-on' activity, but part of every day practice.

McCormick and Scrimshaw (2001) argue that government policy requires the use of ICT in order to increase the *efficiency* of teaching, hence if teachers in this research are using ICT at the efficiency level, then the teachers can be said to have *integrated* use; that is, when teachers are using or including ICT in their practice.

'Innovative' use of ICT is taken to mean there is a transformative element (McCormick and Scrimshaw, 2001). However, this needs further qualification: the ICT itself maybe innovative and new, and/or the pedagogy maybe innovative, though it is possible to do transformative pedagogical activities with 'old', established ICT. Pedagogy is briefly defined as 'any conscious activity by one person designed to enhance learning in another' (Watkins and Mortimore, 1999, p17, cited in Loveless, 2001, p17).

The above definitions are not to be taken as essentialist; neither are they prescriptive or measurable, rather they are an articulation to help understand the varying *degrees* of use made by teachers of ICT in this research.

Third, it is worth clarifying political terminology with respect to what constitutes the difference between a political *initiative* with ICT in education and educational ICT *policy.*

It is only the latter that contains a mandatory requirement; the use of ICT across all subjects became a statutory obligation of all teachers with the introduction of National Curriculum orders for ICT in 2000. Initiatives, however, do not contain the differential element of compulsion. For example, the NGfL and NOF initiatives provided ICT resourcing and training, with the hope that teachers would, as a result, implement ICT use in the classroom. With initiatives there is the *desire* to enable change, through teachers responding to the initiatives in the ways the government intended, but this is not a legislative requirement.

Initial Government ICT initiatives: 1981 – 1997

Firstly it is necessary to examine, albeit briefly, the historical development of ICT in schools, in order to identify which government initiatives have been pivotal. It was possible to identify a number of emergent themes from government reports pertaining to: ICT resourcing, ICT training, school management and curriculum application, which are now well known markers on the historical landscape of ICT development.

In the 1980s, consecutive Conservative governments were committed to developing IT in their recognition of its economic significance.

> The Government fully recognises the importance of information technology for the future industrial and commercial success of the United Kingdom and the central role that the Government must play in promoting its development and application. (Prime Minister Margaret Thatcher, Hansard, 2 July 1981)

In the early 1980s, Information Technology, in the form of computers, was first introduced into UK schools. A brief outline of the historical development of computers will provide a context from which subsequent developments can be understood.

In 1981 Kenneth Baker, the newly-appointed Conservative Minister for Information Technology, launched the 'Micros in Schools' scheme with an emphasis on the vocational aspect of IT in education.

> I want to ensure that the kids of today are trained with the skills that gave their fathers and grandfathers jobs...And that is the reason why we've pushed ahead with computers in schools. I want youngsters leaving school at sixteen, to actually be able to operate a computer. (Quoted in Scaife and Wellington, 1993, p15)

The Department of Trade and Industry (DTI) provided £16 million to subsidise the purchase of British computers in schools. The Department of Education and Science (DES) provided £23 million to launch the Microelectronics Education Programme (MEP), which ran until 1986. British companies Research Machines and Acorn, and to a lesser extent Sinclair, competed with the American and Japanese manufacturers (such as IBM, Apple, Atari, Commodore) to equip schools (Scaife and Wellington, 1993, pp15–20).

To increase national awareness of IT, 1982 was designated 'Information Technology Year' by the Government. Consequently the 'BBC Computer Literacy' project was launched; this involved a book (60,000 copies sold), a TV programme (that reached 300, 000 people), a course on the programming language BASIC, and BBC computers (12 000 machines sold) (Hawkridge, 1983, p57).

This was followed by another major IT initiative launched by the Conservatives in the early 1980s, entitled the Technical and Vocational Initiative (TVEI), which provided further financial aid for schools to purchase computers. However, it transpired that TVEI schools on average had almost *twice* as many computers as non-TVEI schools (Scaife and Wellington, 1993, p. 16). This highlights an emerging disparity of funding between schools for technology procurement: a theme that will continue to re-emerge throughout the following two decades. Also, importantly, TVEI triggered a major political shift in the balance of power in UK education. TVEI was an initiative that radically altered the locus of control in education; being imposed by central government without consultation with the Local Education Authorities or the teaching profession (Leask, 1987).

In 1986, the Modem Scheme (DTI) put £1 million into enabling schools to buy a modem to link up their micros. The Microelectronics Support Unit (MESU) was set up with £3 million funding to carry on the work of the MEP. The White Paper 'Working Together - Education and Training' announced national expenditure of £90 million over ten years to extend the TVEI programme. The Conservative government's commitment to TVEI clearly indicated the importance of IT in education. In 1987, Kenneth Baker announced Educational Support Grants of £19 million for the expansion of IT in schools.

However, Bowles (1999, p31) argued that since 1984, when TVEI first bought computers into secondary schools, 'teachers have struggled with the new concepts and skills'. The Trotter Report of 1989 identified three specific skills relating to the use of IT that an experienced teacher might be expected to have: (1) practical IT capability, (2) capability to relate IT to the curriculum area, and (3) the ability to manage and evaluate IT use.

In fact, there has been rather variable progress in actually developing the skills identified by Trotter (Bowles, 1999). When researchers asked 'what went wrong in the 80's?' the answer was an immediate identification of a key obstacle to developing IT in education: teachers.

> This complex chemistry of teacher attitudes has probably been the major barrier to success. (Scaife and Wellington 1993, p19)

In the 1990s, the National Council for Educational Technology published an information sheet, 'Teacher Education and IT', which highlighted how IT's potential to harness education had been largely unrealised, again, due to teachers' lack of capability of employing IT in the classroom.

> The learning potential of IT is far from being realised. There remain large numbers of teachers, in all phases of education, who are not familiar with IT and are therefore not using it in their teaching. (NCET, 1997, p5)

The notion of teacher resistance emerged as a significant concept in the literature, hindering the development of ICT in education and will be examined in detail in subsequent sections.

Following the development of major ICT initiatives across the three terms of Conservative office (1979-1997), the government commissioned a seminal national assessment of the impact of ICT in schools: the ImpacT Report (1993). Conducted by Watson, this was the first major evaluation, which notified government that: (1) the use of ICT-based work is primarily dependent on individual teacher's initiatives; (2) in-service provision was a major concern as many teachers felt they needed an on-going programme of in-service training and, (3) knowledge and awareness of software was not in itself *sufficient* for effective implementation: instead issues of management, teaching styles and the need for on-going support were identified as critically important.

It was the seminal Education Department Superhighways Initiative (EDSI) Synoptic report of 1997 that first explored the educational opportunities afforded by the internet that rightly drew attention to

> ...the considerable managerial and organisational demands placed on those introducing technology of this complexity... (Scrimshaw, 1997, p11)

The EDSI report highlighted the multi-dimensional nature of change and showed that *many conditions* had to be met in order to utilise the educational potential of ICT, one of which was: 'the immediate obviousness to teachers of the educational potential' (DfEE, 1997b, p29). It was clearly evident from this report that teachers would be instrumental in unlocking the educational potential of ICT.

Similarly, the School's Curriculum and Assessment Agency report on ICT (SCAA, 1997) identified the *training of teachers* as the most significant component for 'future work', alongside 'the need for a *long term strategy*' (SCAA, 1997, p.12):

> IT training should be a fundamental requirement in initial teacher training and form part of qualified teacher status. There needs to be a strategy for the continuing professional development of all teachers. (SCAA, 1997, p14)

Here the origins of and NOF ICT training for serving teachers and the TTA Circular 4/98 that made ICT mandatory to trainee teachers can be found. As Robin Squire, Parliamentary Under-Secretary of State for Education and Employment, asserted in his keynote address at the SCAA conference;

> ...answers can only be produced if teachers themselves become knowledgeable about the technologies and their uses, and confident in their ability to shape them for curricular use. (SCAA, 1997, p5)

However, most significantly, the SCAA report also identified that 'there is often a gap between the rhetoric of schools' IT policies and classroom reality' (SCAA, 1997, p3).

Common Concerns for ICT from Government Reports

There are a number of common threads that run throughout the reports considered above. Although the balance of emphasis differs between them, all the reports raise four key issues: ICT training; ICT resourcing; school management and the curriculum application of ICT. First, teachers needed specialist training to be proficient with ICT. Second, the problem with ICT resourcing was the urgent need to replace obsolete machines. Third, school managers needed to take responsibility for developing a whole school policy for ICT. Fourth, schools needed to address the curriculum application of ICT. The issues were:

- *ICT Training* - specifically, the need for: thorough training in ICT for all trainee teachers and serving teachers that is clearly targeted by phase, curriculum area and previous experience; the reports recommended that this training should cover not just the use of software, but its application to curriculum areas, ICT pedagogy and classroom management.

- *ICT Resourcing* - specifically, the need for: more up-to-date hardware, software, more broadband connections to external networks and cheaper connection charges, improved access to computers by pupils and teachers; also, more human resources in the form of technical staff and teachers with expertise and training in leading ICT as a major curriculum area.
- *School Management* - specifically, the need for: senior managers to take responsibility for developing a whole-school policy for ICT and the strategy for its implementation; setting realistic budgets for purchasing ICT hardware and consumables; training staff and clearly establishing support for ICT use at management level, giving ICT a high profile.
- *Curriculum application* - specifically, the need for: schools to get a balance between direct teaching of ICT skills and their application across subject areas; teachers to evaluate their use of ICT and to share good practice; to review how access to networks can help both teachers and learners.

Whilst these four issues were reiterated across all the reports, there were also elements that occurred in some reports, but not in others, for example, raising standards of achievement was referred to explicitly in the documents that originated from government agencies, like Ofsted, but were an implicit sub-text in other reports. All the reports discussed the need for change, to make *more use of ICT* and the benefits of making that change, but one issue that seems to have been either ignored or disregarded is 'the nature of the change that the use of ICT will have on a teacher's work in his or her classroom' (Bowles, 1999, p24). This was to become imperative with the election of a new Labour government in May 1997, which made statutory the use of ICT across all subjects.

2.3 NEW LABOUR GOVERNMENT 1997: PRIORITISING ICT

It was the 1997 Labour government's adoption of a post Fordist economic policy that specifies particular requirements for the education system, not least a policy drive for generic skills with technology at the core, hence the push for ICT across the curriculum (Brown and Lauder, 1997; Younie, 2002a). Technology is pivotal in the global reorganisation of capitalism, which entails shifting to post fordist production practices, with flexible specialisation requiring technologically skilled workers. Post fordism forefronts technology as part of the solution to economic restructuring, which requires workers to be technological literate and multi skilled (Murray, 1989; Piore, 1986; Sabel, 1982).

With the resurgence of the British Labour party, Brown and Lauder (1997) identified the 'left modernisers' adopting a post fordist perspective that provides an economic and vocational rationale for fore fronting technology in education. In fact Loveless (2001) identifies four distinctive rationales for the educational use of ICT, which also includes a social rationale, as our culture subsumes ICT in increasingly integral ways; a pedagogic rationale that supports and extends existing teaching practices and a catalytic rationale, where ICT significantly changes teaching and learning. Arguably the economic rationale was the most politically persuasive regarding the unprecedented financial investment made by the Treasury in ICT and education.

Two independent ICT reports, McKinsey and Stevenson, both published in 1997, clearly indicated an economic imperative, which in turn justified an educational rationale and were critical in influencing government policy on ICT.

Firstly, McKinsey signified an international trend, when in 1993 its American practice reviewed IT in the USA for President Clinton's NII (National Information Infrastructure) Commission, which culminated in Clinton's $2 billion technology initiative to connect all US classrooms to the Internet by 2000. Brown and Lauder (1997) argued the American rational for the policy drive on ICT in education was also predominantly economic: school leavers needed ICT skills to be productive in the emerging new knowledge economy. The international development of ICT in education, across leading nations, provides a global context to the developments in the UK. For example, in Europe, Member states of the European Union had begun joint action to strengthen national, regional and local developments in ICT in schools (Scrimshaw, 2003) - with a strong emphasis on the 'paramount importance' of the role of the teacher.

> The use of computers and related services in school is never an end in itself. The teacher is at the focal point of the process. Increasingly, his or her role will be to guide the pupils... (European Commission, 1997, Section 7)

In the UK, however, McKinsey (1997) had identified *no coordinated strategy* to support teachers in the integration of technology into professional practice. In 1996, Tony Blair (then leader of the opposition) and David Blunkett (shadow education secretary) commissioned Sir Dennis Stevenson (Chairman of Pearson) to assess role and status of ICT. The resultant Stevenson Report (1997) was influential in its reiteration of previous findings from the McKinsey and EDSI reports (1997) and highlighted the involvement of *teachers* as 'crucially important' to ICT innovation.

> If we wish to ensure that our children and our country reap the benefits of ICT we must cherish our teachers and do everything we can to help them to take it on board. (Stevenson, 1997, p22)

Proclaiming that 'addressing the issue of ICT' was to be one of new Labour's 'top priorities' the main elements in any new strategy were identified as needing to: 'increase the time given to ICT in both initial and in-service training; make computers available to teachers and develop curriculum-related software' (Stevenson, 1997, p7-8).

Stevenson powerfully concluded that the government would disadvantage the UK in terms of global competitiveness, if steps were not taken to integrate ICT into education. The two fundamental conclusions of the Stevenson Report that alerted government to develop a seminal cohesive strategy for ICT were:

> The state of ICT in our schools is primitive and not improving.
> It is a national priority to increase the use of ICT in UK schools.
> (Stevenson, 1997, p6)

These recommendations clearly paved the way for Labour's policy drive on ICT and the advance of the NGfL and NOF as major initiatives, which marked the first *coordinated national strategy* for the development of ICT in schools.

The First Coordinated National ICT Strategy

On October 8th 1997, the newly elected Labour government from May launched its consultation document 'Connecting the Learning Society' (DfEE, 1997a). This detailed the proposals for the National Grid for Learning, the core of which was

> The creation of a Virtual Teacher Centre... a forum for creative ideas in the use of ICT in teaching, professional development and administration. (DfEE, 1997a, p17)

The Prime Minister Tony Blair asserted in his Foreword to the above how the 'Stevenson report had identified two main problems - the need to train teachers and to create a market for high quality British Educational software'. The government therefore committed £1.3 billion in finance and consulted on numerous levels. In fact, there were 'over 900' responses to 'Connecting the Learning Society', and in these its content was 'enthusiastically welcomed'.

> The main messages from the consultation were... very strong endorsement for building up the expertise and confidence of teachers... (DfEE, 1998, p5)

The support of the teaching profession was thus recognised to be essential if the NGfL aims were to be realised. Consequently, the DfEE document (1998) 'Open for Learning, Open for Business' set the government's ICT proposals in motion.

> The NGfL Programme is the Government's key initiative for improving ICT provision in schools, developing a wide range of digital resources for teaching and learning and equipping teachers to be effective users of ICT... Providing teachers with appropriate training opportunities so that they are able to incorporate the use of these technologies and resources into their everyday teaching. (DfES, 2001, p3)

The government's NGfL and NOF proposals were ambitious, however, as initiatives these were only intended to provide ICT training and resourcing, with the *hope* that teachers would, as a result, implement ICT use in the classroom. In order to ensure the latter, the government would have to introduce an ICT policy that had a statuary requirement for teachers to use ICT. Consequently the differential between government *initiatives* and *policy* can be seen in the introduction of Curriculum 2000, which outlined *statutory orders* for the integration of ICT across all subjects.

Implemented in September 2000, Curriculum 2000 contained an integral ICT component for all subject areas, which meant that Ofsted inspections of mandatory orders would ensure ICT's uptake by teachers. These, then,

> ...were strong indicators that a determined government would allow no choice. The NGfL was designed to ensure that teachers would use technology to deliver the curriculum. However, implementing change is rarely so straightforward. (Dawes, 2001, p8)

Government ICT Initiatives: Launching the National Grid for Learning (NGfL)

In 1997, the Government's White Paper on 'Excellence in Schools', made recommendations for ICT based substantially on the work done by McKinsey and Stevenson (1997). In turn, the broad brushstrokes in the White Paper were converted into clear objectives and strategies in the National Grid for Learning documents (DfEE, 1997a; DfEE, 1998a, 1998b).

Varying, though complementary definitions of the NGfL were identified in these documents, which indicated the NGfL's intended function: 'the delivery of ICT infrastructure, services, support and training'(DfEE, 1998a, p24); 'a framework for a learning community designed to raise standards and improve Britain's competitiveness'(DfEE,1998b, p4).

A summary of the proposals for the NGfL clearly indicates the breadth, extensiveness and ambitiousness of the government's ICT initiatives. The NGfL aimed to: 'link learning institutions, provide networks, develop ICT skills of teachers, promote industry partnerships, and develop high quality content and software' (Connecting the Learning Society, DfEE, 1997a, p24).

A core aim of the NGfL was to harness technology in order to raise educational standards. To make this possible, public/private partnerships were envisaged, and commercial companies were encouraged to develop a range of managed ICT services for schools. Economies of scale and competition were predicted to keep down the costs; however, DfES evaluations (2001, 2002) found costs of managed services to schools often remained prohibitive, despite initial intentions otherwise.

These far reaching proposals of the NGfL represented perhaps the most ambitious ICT innovation envisaged for UK schools. The emphasis was on ensuring that at a national level the ICT infrastructure of every school was upgraded and managed. Specific proposals for teachers focused on training: 'The Grid must be useful. It must lead to the improvement of the skills and confidence of teachers' (DfEE, 1997a, p14).

In 1998, the task of coordinating content for the NGfL fell to Becta, previously NCET (National Council for Educational Technology). Becta were also set the task of evaluating the roll out of the government's national ICT strategy. Becta are currently responsible for ensuring the implementation of the DfES e-Strategy Harnessing Technology (2005). Although Becta are also charged with conducting research, arguably this is largely reactive, in as much as government initiatives are evaluated by asking if they work *after* they have been set up. Perhaps it may be better to ask what works, conducting research then launching initiatives.

With respect to the NGfL unprecedented levels of finance were committed, a programme of £657m for the period 1998 - 2002 was invested in the infrastructure, services and content, and another £50m was available for the digitisation of content for the Grid. To date Labour has invested £3.54 billion in ICT in schools (Doughty, 2006). 'This was a high-profile initiative the success of which could contribute to perceptions of the efficacy of the Labour government' (Dawes, 2001, p13).

Launching the New Opportunity Fund ICT Training Initiative (NOF)

> The prime importance of developing teacher skills and confidence in the use of ICT is now widely recognized... (DfEE, 1997, p8)

Alongside addressing inadequate and obsolete ICT provision, policy makers identified the need to improve teacher competence (op. cit., pp 8-14). David Blunkett announced that the NOF training initiative was to be delivered through Approved Training Providers (ATPs). These were independent training organisations, approved by NOF and quality assured in England by the TTA. LEAs were directly involved; over 75% were either accredited training providers in their own right or were receiving direct funding for supporting providers. LEAs received direct funding of £20 million to support the programme. In England, 96% of eligible teachers signed up for the programme and this far exceeded the target of 80% (Ofsted, 2004, p3); in total 394,000 teachers and 99.6% of schools took part (TTA, 2002, p ii).

Compulsory training for trainee teachers in ICT was introduced with effect from September 1998 (DfEE Circular 4/98: Initial Teacher Training National Curriculum for the use of ICT in Subject Teaching), the aim of which was 'to equip every qualified teacher with the knowledge, skills and understanding to make sound decisions about **when, when not, and how to use ICT effectively in teaching particular subjects'** (DfEE 1998, p17; bold in original). Ofsted (2001) reported favourably on how this policy was impacting on the teaching profession.

> Newly qualified teachers with good levels of ICT skill are beginning to be deployed in schools of all types, and they often provide a good source of stimulus and support for established colleagues. (Ofsted, 2001, p10)

However, the situation with serving teachers was more complex. Firstly,

> The learning curve for many teachers is very steep, but the challenge of changing practice must be faced... (Leask and Pachler, 1999, pxviii)

As Lord Putnam noted, teachers are at the heart of successful policy implementation:

> ICT has the potential to radically alter the way teachers teach. Building the confidence of teachers in the useful possibilities of ICT is one of the greatest challenges facing this country. No matter how well schools are equipped with up-to-the-minute hardware and software, our teachers remain far and away the most precious element of our education system. (Putnam, Foreword, Leask and Pachler, 1999)

Whilst acknowledging the significance of teachers, which is important, by simply focusing on teachers and training in a rather one-dimensional, reductionist way, this negates the complexity of the cultural context regarding ICT in schools, which actually was, at best complex and, at worst confusing. How to deliver ICT in schools was an issue that was fraught with ambiguity and lacked clarity and coherence. Furthermore Loveless (2001) identified how government documents referring to 'ICT capability' also failed to prescribe clearly what the term meant for schools attempting to interpret ICT initiatives.

Bowles (1999) argued that a background of continuous change with many aspects of ICT in schools had led to much uncertainty, about what ICT to deliver, and on how and where to deliver it.

> The introduction of the National Curriculum in 1991, which included IT, caused much confusion. As in other subjects, different sets of requirements were imposed at least twice; but ICT presented a particular problem. The initial clear link between IT and Technology in the original Orders was broken, being replaced first by nothing and then by stand-alone orders for IT, but with a very vague Programme of Study at Key Stage 4. (Bowles, 1999, p10)

In particular, there was a 'tension between the delivery of IT - as a discrete subject - against cross-curricular delivery via a number of other core and foundation subjects, which has remained since that time' (ibid.).

Consequently, Curriculum 2000 brought clarification to an area where previously there had been much confusion regarding ICT in the curriculum. This uncertainty had been identified by McKinsey, who reported 'the lack of clarity over educational objectives for IT itself' (1997, p2). This tension was solved, at least at a legislative level, by the implementation of ICT national curriculum orders for all subjects across the curriculum. Most importantly, ICT as a discrete subject was awarded *core subject status* and the *integration of ICT into other subject areas* was made *statutory.*

Prior to Curriculum 2000, there was the lack of a clearly articulated strategy for delivering ICT, which had left schools in a variety of positions on how to deliver it and 'convinced many teachers that delaying their involvement with something apparently so ill-defined was the only sensible course to follow' (Bowles, 1999, p12). Bowles highlighted that the cultural context in schools was one that lacked lucidity and coherence with respect to ICT in the curriculum.

Summary: Labour Government ICT Initiatives

The development of the Labour government's ICT initiatives was contextually framed by ministers' political aspirations and panoptic vision of ICT as an anodyne solution to 'raise standards' and prepare school leavers for the new knowledge economy (Brown and Lauder, 1997; Younie 2002a). Yet, despite heavily funded government ICT initiatives (NGfL and NOF) and government policy intervention, (Curriculum 2000 statutory ICT orders), there was a *gap* between the legislative requirements *and* the reality of what was happening in schools. Evidence indicated that the implementation of the national ICT strategy across schools was inconsistent, fragmented and 'patchy' (Becta, 2005; DfES 2001-2; Loveless, 2005; Ofsted 2001-2, 2004; Opie and Fukuyo, 2000 and SCAA, 1997). This highlights the problems and complexity of implementation and how the process is not a direct translation from policy to practice, which is explored further in the next section.

2.4 AN EVALUATION OF THE NATIONAL ICT STRATEGY: PROBLEMS WITH IMPLEMENTATION

Given that the implementation process is neither straight forward nor an unfaltering mapping of changes from government policy to practice; this section investigates lessons learnt from the roll out of the national ICT strategy. From research on reform in education, it is well known that change is either very slow or tends to fail (Fullan, 1991). Evidence from government reports suggests ICT initiatives were not being embedded consistently or fully across schools (DfES, 2001-2; Ofsted, 2001-2, 2004). However, given the government's aspirations for ICT to seriously modernise education, analysis requires an identification of the specific problems.

Given that policy implementation is a complex procedure, this research examined the factors that affect policy uptake at the local level of the school. The documentary analysis of national ICT evaluation reports provides a *framework* for understanding the implementation process, which exemplifies the structural procedures involved. Government policy has to be filtered through *macro, meso* and *micro* levels, as policy is mediated through national agencies (macro: Department for Education and Skills (DfES), regional agencies (meso: Local Education Authorities (LEAs) down to individual schools and teachers at the micro level. Younie (2006) is a published version of this analysis.

An Evaluation of Government ICT Initiatives

The government commissioned research to evaluate the national roll out of the NGfL through Becta; NOF was evaluated via the TTA quality assurance process, also the school inspection programme (Ofsted) provided data on the impact of ICT initiatives in schools. From these macro government agencies a number of evaluation reports were produced, which became significant in the appraisal of the implementation of the government's national ICT strategy. These were primarily the Becta Pathfinder Series (2001-02; Nos 1-10) and Ofsted Reports (2001-02, 2004).

The analysis focuses specifically on the documents above as they represent key findings and are the chief documents around which others coalesce. Other research reports have offered further substantiation as they have tended to refer to the same or similar themes, alongside additional findings, which are in accordance with their focus. For example, ImpaCT2 (2002) examined the impact of ICT on pupil attainment; TTA (2002) and Preston (2004) evaluated teachers' experiences of NOF.

National ICT Evaluation Reports: evidence base

The evidence base from which the evaluation of the initiatives was assessed was nationally representative. From the launch of the NGfL in April 1998, Ofsted's inspection of the impact of government ICT initiatives began in June 1999, with reports published in May 2001, April 2002 and May 2004. Evidence was drawn mainly from visits to schools, local education authorities (LEAs) and regional broadband consortia (RBCs) by Her Majesty's Inspectors (HMI) and Additional Inspectors (AIs) recruited by Ofsted. Other evidence came from Ofsted's regular section 10 programme of school inspections and from LEA inspections (Ofsted, 2004, p1).

A series of evaluation reports from Becta was commissioned by the government to provide feedback on the national roll out of the NGfL, entitled 'ICT in Schools Research and Evaluation Series'. Along with ImpaCT2, NGfL Pathfinders was an important strand of the NGfL evaluation strategy. It focused on the implementation of the NGfL programme in schools in ten Local Education Authorities (LEAs).

The first series of evaluation reports from Becta (Nos 1-10) became available from 2001 onwards. However, the first pathfinders' report qualified the short time span from initial roll out to the report's publication, with the statement that although too soon for a full evaluation, the report could yield interim findings 'and raise key questions to guide future developments in the implementation of ICT in schools' (DfES, 2001, p.4). However, it must be remembered that

> The implementation of such a major innovation – one involving procurement and installation of high-cost infrastructure and hardware, and significant changes in management and teaching practices – takes time. (DfES, 2001, p4)

The evaluation findings from Becta were emerging at exactly the same time as the empirical fieldwork was being undertaken with teachers in schools for this research, which made them extremely pertinent to the investigation. Since then other significant reports have been published, which have gone on to substantiate the earlier initial problems identified in the evaluation reports. In particular, Becta have continued to produce reports in their evaluation series, which have continued to assess the impact of government ICT initiatives. (See appendix A for a complete list of Becta's Evaluation Reports Nos 1-10, which covered Labour's first term in office, published 2001-2).

Multi-Agency ICT Initiatives and Leadership

The most discernible factor regarding the government's ICT strategy was the number of different agencies involved. As Ofsted (2001, p.1) reported, the DfEE (Department for Education and Employment) was given the role of formulating the ICT policy for education and steering the implementation of most aspects of the national strategy. This involved working with the ICT supply industry, LEAs (meso), the TTA and Becta (macro). The responsibility for Lottery-funded ICT training for teachers was given to NOF, a non-departmental public body, sponsored by the Department of Culture, Media and Sport (DCMS), via policy directions drawn up in consultation with the DfEE and the TTA. By 2002 the National College for School Leadership (NCSL) had become involved and the DfEE had become the DfES (Department for Education and Skills).

This signaled an unprecedented national ICT initiative that drew together both emergent and established sectors together for the first time.

The process of implementing the government's ICT strategy was clearly complex, requiring either preliminary or extended collaboration across different sectors: from national (macro) governmental agencies (DfES, TTA, Becta) to regional (meso) level organizations (LEAs and commercial ICT companies) down to individual schools and teachers at the micro level.

This was a multi-agency approach to implementing a nationwide ICT initiative that was unprecedented in its scope and vision of cross-organisational management. Given the unparalleled nature of the initiatives, it was perhaps not surprising that operational relationships between agencies were found wanting; with no prior histories of dialogues across agencies regarding implementing ICT on such a grand scale. The initiatives were exceptional in scale, challenging and complicated, requiring expertise of personnel that largely wasn't there.

> Where senior officers failed to give a strong lead, ICT staff often worked in isolation, and this held back both planning and implementation of NGfL-related provision...a few LEAs lacked the professional expertise to inform decision-making, while others failed to consult schools adequately. (Ofsted, 2001, p13)

What was required was effective consultation by the LEA with its schools, with other Local Authority services and with suppliers of telecommunications services. Not all of these agencies had the necessary understanding of schools and their particular ICT needs. It was '...rare to find LEA officers with a good overview of current ICT developments in their schools or sufficient understanding of whole-school issues relating to ICT' (ibid.).

This highlighted the need for coordinated leadership that required agencies to interact and develop coherent plans for implementing ICT. However, the extent and newness clearly challenged the sectors operational relations. For example, an examination of relationships between LEAs and schools revealed that 'the levels of LEA support for ICT ... are often too low to meet the full range of schools' needs; have often underestimated the level of funding required... guidance unsatisfactory' (Ofsted, 2001, p3).

The management of the implementation of the government's ICT initiatives – even within the one locale, i.e. schools, were multi-faceted, and required an understanding of the relationships between procuring a technology infrastructure, teachers' ICT training, and curriculum and assessment demands. As a major innovation in education the government's ICT strategy necessitated change on multiple fronts; not surprisingly

> ...schools' ICT development plans too often fail to make explicit the links between intended improvements in curriculum, resources and staff development. (ibid.)

More complex still for school leaders, the government's multi-agency ICT initiatives were introduced alongside other (multiple) educational initiatives. For example, 'the NGfL Programme had links with several initiatives including Excellence in Cities (EICs), Education Action Zones (EAZs), Technology Colleges (TCTs) and the Information Management Strategy (IMS)' (DfES, 2001, p3).

Hence, not only was the government's ICT initiative to be operationalised across multiple-agencies; there were also other (non-ICT) initiatives that were simultaneously implemented, which, whilst sometimes linked, were nonetheless often in competition. Although the focus of all the initiatives was arguably always reductionist in attempting to 'raise standards', the emergence of competing priorities between all these initiatives made for a multifarious and complex landscape of change for schools to manage, with leaders not necessarily in possession of ICT expertise, or in a position to know or be able to locate this knowledge elsewhere.

Managing Implementation: a lack of ICT expertise

In the analysis it probably yields no surprise, particularly with hindsight, to find that at the time of the NGfL roll-out there was a discernible lack of ICT expertise in the education profession; schools and LEAs simply did not have the necessary level of ICT proficiency among existing senior leaders: a point identified by both Ofsted and Becta evaluations. Not confined to schools, this was found across the multiple agencies implementing the government's ICT initiatives.

> The Pathfinder LEAs, having had no experience of implementing similar large-scale technology initiatives, did not have personnel in leadership roles at the outset with the prior experience needed to lead the NGfL initiative. (DfES, 2001, p5)

Indeed, the pathfinders' evaluation concluded that the need to develop key personnel and use them effectively has remained problematic. With the initial roll-out, there was not enough leadership experience and ICT expertise across the educational and commercial sectors; the latter had little prior experience of working with schools, and did not always fully understand the needs of the education sector. This led to a fragmented approach, for example:

> ...using the commercial market to give schools a choice of training provider; and, in allowing schools to use a variety of funding sources to improve ICT facilities. Too much flexibility, coupled with considerable competition among ATPs [Approved Training Providers], however, has contributed to a fragmentation of effort, with training organisations, LEAs and schools independently seeking solutions to the same problems. This is in stark contrast with the more uniform approach of the NNS [National Numeracy Strategy] and NLS [National Literacy Strategy]. (Ofsted, 2001. p4)

The crucial issue regarding the implementation of ICT was the need for coordinated leadership. In an already complex field this deficiency could be seen as highly detrimental to schools that lacked ICT expertise (internally) and guidance (externally) from LEAs. Again, this was in a context where other educational initiatives were being introduced simultaneously (the NLS/NNS in primaries and EAZs, etc. in secondaries), which made the cultural context of schools complex.

Also, in the case of ICT, it wasn't always or simply a lack of leadership and ICT expertise: in some cases, for example in the case of NOF training, it was not having enough basic knowledge to choose an ATP, since 'the list of Approved Training Providers given to head teachers included little accompanying information from which to make informed choices' (Ofsted, 2001. p4).

School leaders lacked adequate information on which to base a decision, consequently ICT 'decisions (were) taken by schools on the basis of poor or partial advice' (op. cit. p13). Ofsted (2001) identified that

> ...there are few national support networks to share and develop teachers' professional competence in ICT. In consequence, there are too few opportunities to pool expertise to take forward the national initiatives. There is also a danger that the shortage of well informed, commercially neutral and educationally sound advice could be costly at a time of fast-changing technologies. (Ofsted, 2001, p5)

The multi-faceted nature of implementing ICT even just within the school context, leaving aside the dynamics of multi-agency operational relations, raised particular challenges for school leadership regarding the management of the different elements. Consequently,

> There is too little quality assurance of the implementation of schools' ICT development plans to ensure that initiatives are achieving their purpose...long-term planning of ICT developments at both senior and middle management levels is not good enough. For example, schools have insufficiently developed strategic plans to link developments in the curriculum to staff competence or to replace out-of-date hardware. (Ofsted, 2001, p5)

School leadership needed to attend to monitoring and evaluating ICT developments, however, within schools this was judged to be 'very weak' (Ofsted, 2001, p15). Not only was school leadership found wanting, leadership at regional and national levels, between education and commercial ICT sectors, were insufficiently 'joined-up'. There was a lack of ICT expertise and leadership to facilitate multi-agency cohesion required by the government's national strategy. In addition to differing levels of ICT knowledge and leadership ability, also other disparities emerged, most notably funding.

Disparities of Funding for ICT

> The roll-out of the NGfL Programme has been the largest and most costly single initiative ever to be undertaken by Local Authorities in the UK. (DfES, 2001, p19)

Funding the government's national ICT strategy has represented the most significant level of investment ever in education and technology in the history of UK schooling, £3.54 billion to date (Doughty, 2006). Government funding began in April 1998 and amounted to £657 million over four years. This was distributed to Local Authorities via the government's Standards Fund (SF). In addition, the Government announced that, from April 1999 until December 2003, £230 million of Lottery funds would be available from NOF (Ofsted, 2001, p1). Also 'a further £710 million of expenditure was allocated between 2002 and 2004' (DfES, 2001, p3). In 2004, Ofsted reported that DfES funding for ICT in schools had increased substantially since 1998: in one year (2002–03) it totaled £510 million, compared with £657 million over the four years prior, from 1998 to 2002.

However, such significant funding was not uniformly allocated and an analysis yielded discrepancies, which 'varied widely among schools...This situation was exacerbated by the differing patterns of support in LEAs' (Ofsted, 2001, p4). Each LEA had to provide matched funding to the DfES Standards Fund and seek support, where possible, from commercial partners. However, some LEAs were identified as Pathfinders (to enable them to explore the value of particular patterns of networked provision) and 'these were funded more generously than most LEAs' (ibid). Also, 'further differences arose in those schools that benefited from their involvement in other well-funded initiatives, such as Education Action Zones' (Ofsted, 2001, p5).

Consequently different levels of funding led to disparities between schools and 'variation in provision means that teachers and pupils in different schools/LEAs are working under very different conditions' (DfES, 2001, p9), which 'raises issues of fairness and social justice' (DfES, 2002, p3).

The identification of funding discrepancies revealed, at best inconsistencies and, at worst, ethically unacceptable inequality; again this highlighted a multi-faceted initiative that was fragmented with material disparities that would problematise implementation.

Also the issue of ICT sustainability arose, where it was identified that sustainability plans would need to cover consumables as well as maintenance and technical support. Moreover, 'problems have arisen due to inadequate prior experience or training for LEA personnel and head teachers in procurement, financial and contractual arrangements' (DfES, 2002, p3); alongside the fact that leaders lacked the necessary expertise, 'it is difficult to plan for sustainability when funding is awarded on a year-on-year basis.' This clearly limited long term planning for ICT.

> This evaluation has not found evidence of Pathfinder LEAs planning for long-term replacement of hardware or the recurring costs of consumables...(also) it is not clear whether responsibility for long-term sustainability rests with LEAs, central Government or indeed, individual schools. (DfES, 2001, p6)

The point on long-term funding remains unresolved and highlights the multi-faceted nature of ICT implementation, which is not only a matter of finance, but also multi-agency leadership, and the complexity involved in the procurement of financial contracts to install ICT provision in schools. Managing the financial aspect of implementation directly relates to another factor that greatly differs between schools regarding levels of resourcing.

Technology Resourcing: procurement, installation and sustainability

In this analysis, the complexity of the government's ICT initiatives have been identified with respect to both the financial and managerial aspects of implementation and, both of these affect ICT procurement and resultant levels of technology in schools.

Firstly the disparity of funding clearly impacts on schools' ability to upgrade and increase the quality and quantity of their ICT. Hence, although NGfL funding has raised levels of ICT resources in all types of school, it was the case that 'in many schools, the quality, age and accessibility of ICT resources pose continuing problems. There also remain significant differences among schools' (Ofsted, 2001, p18).

Second, whilst funding increased overall ICT provision there were specific problems concerning greater demand for ICT now across all subjects and a consequent lack of parity of access across the curriculum.

> ... there remains a growing demand for access to ICT equipment from many subject departments and more often than not it outstrips supply. As a result, the general lack of access to ICT resources for subject areas frequently limits the development of ICT across the curriculum. (Ofsted, 2001, p18)

Third, there were also specific technical issues that continued to be problematic concerning, reliability, connectivity and technical support; the latter involved securing ICT technicians and a stable network (DfES, 2002, p3).

Overall, long term planning has been identified as problematic with respect to annualised funding allocations and the need to plan ahead only remains more pertinent with respect to managing sustainability, when 'schools become increasingly ICT active [and] the need for network support provided at industrial standards of reliability will grow. Technical support for schools is a key issue' (DfES, 2001, p17).

Consequently, 'there is a need to understand that decisions on technical matters such as hardware and infrastructure have a direct impact on teaching and learning in schools' (op. cit., p18). This reveals the dynamic inter-relatedness (multidimensionality) between the differing factors regarding finance, procurement, reliability, technical support and teachers' access and use of ICT.

Implementation requires the management of diverse factors *within* schools and *beyond* schools, with the need to secure operational relations across agencies, for example, with ICT Training Providers. Again, school leaders needed sufficient knowledge to be able to select a training provider from an approved range. Different providers offered different models of training and it was important to select one that would meet individual school and teacher needs. However, the NOF training programme was not without it problems.

NOF: the impact of training programmes on teachers

With respect to NOF, significant features in the evaluation reports referred to 'teachers' acknowledgement of their need for training [and] the importance they attach to it as the route to increased confidence and improved practice' (DfES, 2001, p20).

The positive evaluations regarding NOF referred to teachers' raised awareness and following training teachers' ICT skills were enhanced (Ofsted, 2001, p11). However, serious criticisms also emerged as evidence indicated that 'many teachers across the Pathfinder LEAs are dissatisfied with the NOF training' (DfES, 2001, p20).

The continuing problem of a multi-agency approach was also apparent with the NOF initiative and further exacerbated by an open market strategy regarding Training providers. There was evidence that NOF training was not consistent across providers; whereby a delayed and fragmented approach also meant that 'the lack of information about the range of training programmes from which to choose has hindered progress' (Ofsted, 2001, p4). Consequently, 'many teachers reported dissatisfaction on the grounds that it was disorganised, lacking focus and too fragmented and text based. Criticisms were made of both distance courses and face-to face provision' (DfES, 2001, p13).

A key factor in the successful implementation of the training initiative occurred at the local level of the school and signifies the need to contextualise the national strategy to localised needs. Teachers reported NOF was

> ...over-prescriptive and insensitive to the needs of their own school. This suggests that to optimise the effectiveness of NOF training, schools need to have the opportunity to select training that is customised to the needs of their particular staff. (ibid.)

If implementation was to meet with success, national initiatives needed to be locally modified. Evaluations demonstrated that schools had differing expectations about the purpose of NOF training. Analysis highlights the importance of attending to contextualising factors operating at the micro level of schools and their specific needs with respect to implementing the national NOF training strategy. For example, school leadership emerged as a critical factor. Where school leaders endorsed NOF it was more likely to be successful (TTA 2002, Preston, 2004).

Factors at the local level emerged as key to the implementation process. They were as likely to influence the success or otherwise of government initiatives with ICT. Also, whilst overall, the NOF training initiative has contributed to an increase in teachers' confidence with computers, this has been 'only rarely to the pedagogic expertise to help them make the most effective use of ICT in their lessons' (Ofsted, 2001, p4). A recurrent problem throughout was that despite upgrading teachers' ICT skills, the pedagogical application of ICT in the classroom was disappointing and inconsistent across subjects. Consequently, 'practice, remains patchy... [with] less successful use of ICT in core subject teaching' (Ofsted, 2001, p12). Clearly, whilst 'providing on-line materials is only the first step; what is even more important is the development of pedagogic models to guide teachers' (DfES, 2001, p17).

Pedagogy: the impact of ICT initiatives on teaching

The impact of ICT initiatives on teachers' classroom use of ICT has remained problematic and has been less dramatic than politicians had envisaged, with the DfES decrying that 'the massive resources pumped into infrastructure and teacher development have yet to bring about a transformation of teaching and learning (DfES, 2001, p18). And, 'while effective use of ICT in teaching subjects across the curriculum is increasing, good practice remains uncommon...and progress is slow' (Ofsted, 2001, p3 and p10).

The impact on pedagogy was found to be: minimal, progressing inconsistently, even in well resourced schools and a disparity of use between subjects was identified (DfES, 2001, p18). The use of ICT in subject teaching was found to be limited (DfES, 2001, p10), often constrained by insufficient resources, or unreliable technology. Consequently, 'the lack of access by teachers in other subjects frequently limits developments in the use of ICT in those subjects' (Ofsted, 2001, p16).

> Across subjects there remain significant weaknesses in teaching using ICT. Only a minority of teachers are capable of managing ICT resources and organising the classroom to ensure that effective subject learning is taking place. Many teachers still have difficulty in deciding when and when not, to use computers, while others are reluctant to use them at all. Teachers who have had experiences of faulty technology are often skeptical about the capacity of ICT to help raise standards. (Ofsted, 2001, p13)

Clearly the process of implementing ICT into teachers' classroom practice is a multi-dimensional process that appears to depend on a number of factors that are inter-related, namely: the development of a technology infrastructure that is stable and reliable, which enables parity of access across all curriculum subjects; teachers' ICT training having received support from school managers; a school leadership team with sufficient ICT expertise and understanding of implementing multi-agency initiatives with respect to the financial and contractual obligations inherent in the design of the government's national ICT strategy.

Whilst recognising that the government's ICT initiatives are multifarious and the most ambitious and expensive changes ever to be implemented in the history of British schooling, this analysis raises the question of how such initiatives become translated into teachers' everyday practice. Particularly considering that

> The complexities of ICT...are substantial, so the managerial and organisational demands made on all those introducing them will be considerable. Establishing a national development programme will undoubtedly be extremely challenging. (Scrimshaw, 1997, p11)

Recognising the Complexity of Implementation

A key issue, which emerged from analysing the evaluation reports, concerned the complexity of the implementation process. Analysis revealed that factors at the local level served to enhance or inhibit uptake, since the factors influencing uptake predominantly occurred at the level of the *school.* However, even *within* schools, as *one* stratum of the implementation process (as opposed to all the strata – macro, meso and micro), the factors involved in implementing ICT were multi-dimensional. For example,

> Decisions about where resources are located and the construction of the timetable have a major impact on the kind of use of ICT which is possible, but these are routinely made in relation to specific constraints such as available space, curriculum specifications and patterns of assessment. (DfES, 2001, p15)

There are complex connections and inter-dependencies between technology procurement and levels of resourcing, location of ICT within schools, quality of training and externally imposed curriculum and assessment patterns.

Beyond recognising the complexity of the government's ICT strategy and how it is operationalised at the local level of the school, it is important to identify what has worked and enabled implementation. Where 'joined-up' thinking and planning across agencies was achieved this enabled a coherent and coordinated programme of implementation (Ofsted, 2001, p14).

Clearly leadership and cross-organisational support were identified as crucial to managing such a complex government initiative.

> Local Authority guidance for school development planning in ICT was, in the best cases, thorough... This led to a productive professional dialogue with schools and, where appropriate, to more careful consideration by the schools of how developments in resources, training and curriculum *related to each other.* (Ofsted, 2001, p14) (Emphasis added)

The Problems of Implementation: a multifarious national strategy

From 1998-2002 the government's ICT national strategy focused primarily on developing schools' ICT infrastructure and training. As the first level of intervention, the NGfL initiatives focused predominantly on ICT procurement, dovetailing with the NOF initiative for ICT inset for serving teachers. Consequently improvements and progress were evident regarding ICT in schools:

> As a result of NGfL, improvements can be clearly identified in the levels and quality of ICT resources in schools... [and] the increase in teachers' use of computers is a clear benefit emerging from the Government's ICT initiatives. (Ofsted, 2001. p4-5)

However, despite these positive outcomes, these were more limited than expected and the overall impact of the initiatives was less penetrating than desired; whilst best practice with ICT in schools could be identified, it continued to remain in 'pockets', rather than the national roll out intended (Becta/Pittard, 2005). The implementation of national initiatives is not a direct translation from government documents to practice, as the evidence has clearly indicated. From the evaluation reports five specific problems regarding implementation were identified: the management and multi-agency nature of the initiatives; funding disparities; technology procurement and sustainability; ICT training and impact on pedagogy.

There was a discernible lack of ICT expertise and cohesive, 'joined-up' thinking across different strata and agencies, and even within schools, as one stratum. For example, just within schools, leaders had to juggle the difficulties and demands of financial contracts, technology procurement alongside timetabling, spacing requirements, ICT training for teachers and, curriculum and assessment demands; not surprisingly, schools ICT development plans were often found to be weak with respect to coordinating all these aspects coherently. Further more, operational relationships between schools and LEAs were also found to be wanting (Ofsted, 2001). Regarding LEAs, there was the need to 'provide more support for schools in their ICT development planning; increase support for ICT leaders in schools in co-ordinating staff and curriculum developments' (Ofsted, 2001, p6), and schools needed to 'formulate long-term resource and professional development plans' for ICT (ibid.).

To summarise, the NGfL initiative 'has given teachers access to a wider range of more reliable hardware to support their teaching. This access, together with INSET, has led to a greater focus on ICT in teaching' (Ofsted, 2001, p11). However, most importantly, 'there is scope for further improvements in the development and implementation of the Government's ICT initiatives' (op. cit., p5).

Evaluating the national ICT strategy

This section has focused specifically on identifying the problems of government ICT implementation as understood from national UK evaluation reports. In particular five key areas emerged as problematic and the specific outcomes of these were:

1. insufficient leadership and ICT expertise across the multiple agencies,
2. disparities of funding, leading to
3. differing levels of ICT provision,
4. inequable quality of ICT training and
5. the limited impact on pedagogy.

The multi-agency approach inevitably fractured the roll out of the national strategy, however, this was exacerbated in those cases where ICT expertise and leadership within and between agencies was absence or underdeveloped. The strategy required implementing relations and commercial contracts between macro, meso and micro level organisations – an unprecedented and ambitious plan that in reality was deeply fragmented.

Reference to evaluation reports (DfES, 2001-2; Ofsted, 2001-2, 2004) reveals a useful analysis of policy in which it is necessary to assess the lessons learnt. First, the national strategy was ambitious and it was implemented at a time when there were not the necessary procedures in place for managing such a multifarious and complex initiative across macro, meso and micro agencies. Second, there were insufficient levels of ICT expertise and leadership within the education profession and commercial companies to orchestrate the strategy. This was by leaders struggling to manage the cross-organisational operations inherent in the multi-agency initiative; perhaps a more cohesive or streamlined approach may have been more beneficial. One lesson was that the open market approach to developing an infrastructure from commercial ICT companies and selecting training providers, needed ICT expertise and contractual experience more characteristic of private enterprise than public sector education or, at least, more experience than most school leaders had.

As a result, at the time of the national roll out there was not enough ICT expertise in the profession; what knowledge existed was held perhaps by only a few (DfES, 2001; Ofsted, 2001). Consequently, in response to the question, how is it possible to get new knowledge into a profession, the answer is to network, distribute and extend existing knowledge. The key lesson learnt is the need to build communication networks in order to manage both the cross-organisational aspect of the strategy, and to share and develop ICT expertise. Such encouragement for networking can develop communities of practice across multiple agencies and within schools for ICT.

> There has been little or no systematic networking of leading teachers and schools to ensure a sound basis for supporting the development of effective subject pedagogy using ICT. As a consequence, teachers with particular interests and expertise too often operate in isolation and lack the stimulus of professional dialogue. (Ofsted, 2001, p21)

A second outcome was recognising the disparities of funding, which meant that some schools were significantly richer and that led to differing levels of ICT provision between schools (DfES, 2001, 2002; Ofsted, 2001). The subsequent outcome of that was varying provision affected access for pupils and teachers. A digital divide between schools ICT resourcing has emerged that urgently needs addressing (Leask and Younie, 2001).

With training, despite improvements in teachers' confidence with ICT, which positively emanated from the NOF initiative, there were a number of problems regarding implementation, which were (1) the general lack of ICT expertise within school leadership teams, Local Authorities and ATPs and consequent lack of joined-up thinking and (2) the limited impact on pedagogy and classroom practice. Significantly the quality of training provision between providers varied and factors at the local level affected the outcomes. For example, the levels of access to ICT and the extent to which school leaders supported the training played an important role (Preston, 2004). One key lesson learnt concerned the need to *contextualise* the national strategy to meet local needs of specific schools and teachers who maybe operating in very different conditions. That is, ICT rich or poor, depending on the varying levels of finance, provision and leadership expertise in each given school. This highlights the need to attend to the cultural context of schools as the space of dynamic inter-relations and multidimensionality through which policy is implemented and enacted upon by teachers.

A serious outcome regarding the lessons learnt concerns the extent to which each of the factors (finance, technology provision, training, leadership) combine to affect teachers' use of ICT in the classroom. All of the factors identified need to be in place; materially with respect to resources and training and culturally, with respect to ICT being valued by leaders, in order to facilitate the development of effective subject pedagogy using ICT: in short, the cultural context of schools.

Overall, the embedding of networked ICT into schools and teachers practice has progressed unevenly, which is largely due to a fragmented and fractured roll out that, with hindsight may have been partially inevitable, given the magnitude and complexity of such a multifarious national strategy. Perhaps the main lesson learnt is the need to systematically develop networks, communities of practice, between teachers, school leaders and other key stakeholders (trainers, commercial companies, regional and government agency personnel), to ensure a sound basis of communication and knowledge building for supporting effective practice using ICT. Also to develop a better understanding of the cultural dynamics of schools that forms the context through which policy is enacted by teachers. This would enable an understanding of the interplay between the material and social factors that affect policy implementation.

2.5 SUMMARY: EVALUATING GOVERNMENT POLICY ON ICT IN EDUCATION

This chapter has examined lessons learnt from national evaluation studies of ICT in schools in the UK. From research on policy reform in education, it is well known that change is either very slow or tends to fail (Fullan, 1991). Policy implementation is a complex procedure, whereby factors at the local level serve to enhance or inhibit uptake. The process is neither straight forward nor an unfaltering mapping of changes from government policy to practice.

Documentary analysis of national ICT reports has provided a framework for understanding the implementation process, which exemplifies the structural procedures involved. Government policy has to be filtered through macro, meso and micro levels, as policy is mediated through national agencies (macro), regional agencies (meso) down to individual schools and teachers at the micro level.

The research focus concerns Government policy on ICT in schools, because of the historically unprecedented wave of government initiatives designed to embed ICT use within the organisation and curriculum of schools from 1997.

The research problem concerns the difficulties and complexities of implementing ICT policy in schools. This is because existing evidence suggests ICT policies are not being embedded consistently or fully across schools (government reports: DfES, 2001-2; Ofsted, 2001-2, 2004).

The research addresses the above problem in order to enhance our understanding of why embedding ICT policy has been inconsistent, fragmented and 'patchy' (Becta, 2005). Given that schools are complex, social settings through which policy becomes enacted, the research needs to examine the complex cultural dynamics through which schools mediate government initiatives and translate policy into practice at the delivery end.

The research does not attempt to measure outcomes, or extent of ICT use using standardised evaluation techniques (Becta/DfES), nor examine individual teacher psychological motivation and perceptions of ICT (Dawes, 2001; Loveless, 2001; Veen, 1993). The research instead examines the cultural processes through which policy becomes enacted at the school level, through an examination of the social and material factors that affect teachers' take up of ICT. What's more, there is a dearth of studies on the cultural context of ICT implementation in schools. This research will examine the organisational factors (cultural, social, material) in schools that affect teachers' implementation of ICT and explore teachers' uses and experiences of ICT.

The research issues are as follows:

Research Issues [broad issues narrowing down to specific issues]

1. The *embedding* of government policies on ICT in education in the professional practice of teachers.
2. *Factors at the local level* (school/teachers) enhancing or inhibiting the embedding of ICT policies in education.
3. The *relationship* between factors operating at the local level.
4. The role of *teachers' experience* in the process of ICT policy implementation.

Main Research Questions

How do government ICT policies for schools become embedded in the professional practice of teachers?

How do government ICT policies become implemented more extensively in some schools than others?

Are there factors operating at the local level that enhance or inhibit the implementation of national policies relating to ICT and teachers' professional practice?

In what ways do factors operating at the school level interact? Is there a relationship between these factors and how do they influence the impact of national policies at the local level?

General propositions

1. The implementation of policy changes involves dynamic and complex social processes.
2. The prospects of embedding policy changes are enhanced or inhibited by material and cultural factors affecting those who implement the new policy.
3. Evidence from teachers involved with implementing policy change can be used constructively to understand and evaluate the process of ICT policy implementation.

The following literature review chapter considers prior research on the implementation of ICT into education with a view to analysing what is known to be influential and important in this field and what is not known with respect to identifying possible areas of omission in research to date.

CHAPTER 3

THE DYNAMICS OF EDUCATIONAL CHANGE

3.0 INTRODUCTION

This chapter provides a review of the literature relevant to this research and considers previous findings of studies that relate to innovation and change in education; teachers' continuing professional development and factors affecting teachers' uses of ICT. The latter involves a detailed examination of prior research on the factors found to support and hinder teachers' integration of ICT, which in turn requires a consideration of what is known from research in technology-rich and support-rich contexts. Two additional areas that, to date, have received much less attention in relation to ICT are; the role of subject cultures in the integration of ICT and school leadership as a factor affecting integration. However, even more significant, is the lack of research on the school context that forms the space through which government policy is implemented and enacted by teachers, who negotiate that space as part of the performative dynamics of their daily professional practice.

However, first, it is necessary to consider how government policy reforms have envisaged the process of change with respect to ICT and teaching. Arguably early government initiatives with ICT worked with a simplistic supposition that on the one hand there is the technology and, on the other there are the teachers, and it is simply a case of giving teachers computers and training and change will automatically occur. However, this is a flawed assumption as it underestimates the complexity involved:

> ...meaningful change requires... deep understanding. This is particularly true for the introduction of computers to schools because of the magnitude of the change required. (Casey, 1996, p13)

The idea of 'dropping computers into classrooms and dipping teachers into training' (Hoffman, 1996, p43), was too reductionist a view of how teachers change practice. As Norton and Sprague (1996) argue, integrating ICT into the classroom involves more than simply installing hardware. It also involves a shift in the way teachers teach and thus is a multifaceted process.

> One of the many lessons learned from the last two decades of using computers in American schools is that dropping computers into classrooms and dipping teachers in technology training courses is simply not an effective way to get teachers using technology for teaching and learning. Dropping and dipping doesn't do it. (Hoffman, 1996, p43)

As Willis confirms,

> By itself dumping more computers and software into the classroom is not likely to produce any important changes in education. (Willis, 1996, p5)

As teachers' practice and approaches to using ICT evolves over time, it is more complicated and significant than simply the degree of computer 'take up' by schools, which many statistical studies were concerned with (Kerr, 1991; Pelgrum, 2001; also successive DfES reports on ICT statistics in schools). Hence, the crude, quantitative measures of the number of computers installed in schools over simplifies a complex picture concerning teachers' evolving pedagogy and professional practice with ICT.

Hennessy, Ruthven and Brindley, (2002) argue that approaches that construe computer technology as an innovation to be administrated 'from above' and then adopted by teachers *assume* that ICTs are 'merely new educational tools waiting to be picked up and used' (Kerr, 1991, p121). However,

> Technologies do not follow some pre-determined and inevitable course... and technologies used in schools are no exception. Rather, technologies and their use in the classroom are socially constructed; technologies are inserted in a context where they remain both the object and subject of struggles over meaning. Technologies are often appropriated in ways unanticipated by their developers, locking into institutional arrangements and reflecting elements of the prevailing *social relations in and around the particular context(s) of application.* (Agalianos, Noss and Whitty, 2001 p479) (Emphasis added)

This is why it is important that research attends to the cultural context into which ICT is to be implemented if one is to understand how technology comes to be used by teachers in ways that sustain meaningful change. The reductionist assumption that schools simply had to install hardware was erroneous.

> Those early visions were naïve, and they overlooked the fact that integrating computers into classrooms is a complex process that involves personal, group, organisational, institutional, and even cultural change. (Willis, 1996, p5)

As Loveless, DeVoogd and Bohlin (2001) pointedly observed

> The mere presence of technology will not be a catalyst for radical change in our education system. It is more likely that it will be used in unexpected ways over a period of trying to make it fit into the old system. (Loveless, DeVoogd and Bohlin 2001, p63)

By 1997, the government had recognised that technology alone was not sufficient to engender change and there was the need to go beyond 'dropping and dipping'. This resulted in the combined NGfL and NOF initiatives, in which government acknowledged the complexity of the situation, partly, because this was highlighted by nationally significant research reports (EDSI, 1997) and partly, because of the failure of previous policy initiatives to substantiate change in teachers' practice. Thus the NOF ICT initiative was a step beyond just giving hardware, but arguably there was a similar degree of faith in a 'global' solution to a complex and situated problem. The 'multiple providers' was in part an attempt to solve this, but it if anything made it more difficult for schools faced with a bewildering choice and little or no guidance. So NOF training ended up as perhaps a rather blunt instrument.

Arguably, the implementation of ICT poses a much larger challenge than most previous school innovations (Casey, 1996), because ICT affects all three dimensions of educational change identified by Fullan (1991): a change in attitude, classroom practice, and in the knowledge base possessed by teachers. ICT innovation is therefore unlike other innovations in that so many dimensions require change. Hence, innovation, which involves change, requires a definition:

> Innovation is defined as any activity or practice which involves human beings in changes to established routines. It is always embedded in a unique, multi level context. (Somekh, 1996, p115)

3.1 INNOVATION AND CHANGE IN EDUCATION

It is an important observation regarding teaching that teachers generally are not involved in policy changes, neither national policies, nor school policies unless in a senior management position, and only then at the latter (micro) level. Hence, if teachers are not party to decisions made on their behalf, like ICT implementation, they may find it difficult to be enthusiastic about proposed change.

It is well noted in the literature that the views of teachers about prospective changes go largely unheard (Lortie, 1975; Hargreaves, 1992). Hence, change is the imposition of the ideas of others; teachers dealing with the immediate pragmatics of the classroom have often found that the ideas of those external to the classroom can be impractical (Casey, 1996; Hargreaves and Fullan, 1992; Huberman, 1993; Moore, Edwards, Halpin and George, 2002). Indeed Stronach, McNamara, Stark, and Warne's (2002) research with teachers testifies that

> The most influential aspect... seemed to be the crucible of classroom experience. It was there that innovations seem to have been tested, adapted, resisted, embraced, or ignored. *It was there that things had to work.* (p17) (Emphasis added)

Importantly the seminal work on the diffusion of innovations by Rogers and Shoemaker (1971) and Rogers (1983) offers a stage model of change at the level of the institution, whereby innovation goes through three stages: implementation, embedding and institutionalisation. The final stage refers to the habitual nature of use, whereby the innovation has become totally embedded into routinised practice. This provides a useful guide for analysing any variation in schools' development of ICT, whereby schools may differentiate between stages.

According to Hoyle (1975) the root of the problem facing would-be innovators lies in the inertia inherent in social systems like schooling. Hoyle envisaged planned change depending on changes to the organisational character of the school, its internal organisation. The most important characteristic of a school's internal organisation is considered to be the relationships between teachers. Thus teachers contribute towards the creative changing of schools, and are themselves changed (McCormick and James, 1983, p31). Hence, *teachers* are held to be essential in the process of innovation as the key change agents involved in the implementation of new professional practices with ICT.

The following section examines the research on change in educational settings, in particular the ways that change happens, or does not happen, in schools.

Despite the continual effort of educational change during the last hundred years, less than 10% of the reported research on innovation has come from education (Rogers, 1983). Despite significant focus on schools by policy makers and researchers, 'there still has been little research attention to the *process* of educational innovation' (Casey, 1996, p18); with the notable exception of Acker, 1990; Fullan, 1991; House, 1979. However, much has been written about the *management* of change in schools, particularly since the 1990's with the school improvement agenda (Hopkins, 1987; Gray, Hopkins, Reynolds, Wilcox, Farrell and Jenson, 1999).

Jones (2004) found that much of the literature investigating barriers to ICT use referred to the professions' inherent resistance to change, which 'need not only be attributable to teachers', but also the 'school as an institution [which] may in itself be resistance to the kinds of change needed for the successful integration of ICT' (p17). The organisation of the school, with it's strict timetabling and departmental boundaries 'considerably reduces the cross-fertilisation of ideas within and between departments' (ibid.). Consequently Jones (2004) rightly identifies how school culture can be a barrier to ICT integration, also supported by Cuban, Kirkpatrick, and Peck's (2001) research in America.

It is important to acknowledge that the 'meaningful system of beliefs and practices,' which is culture (Lubeck, 1985, p14), varies from school to school. Each school has its own culture, it is only by attending to the *differences* between schools that can account for the *variation* in take up of ICT. Hence the present research necessitates an examination of school specific factors. For example, the head teacher's vision and management is frequently cited in the literature as a critical source of variation from one school to another (Acker, 1990). Hence a school's 'organisational culture' (Nias, Southworth and Yeomans, 1989) or 'institutional bias' (Pollard, 1985), may be seen to hold explanatory value that may account for differences between schools' implementation of ICT.

Fullan (1982, 1991, 1993, and 1999), Huberman and Miles (1984) and Nias *et al.*, (1989), illustrated how the *culture* of the school determines the response to change in practicing teachers. Schools are organic, social organisations that affect the work of the teacher, and the ability or inclination of the teacher to accept change. Schools 'are complex organisations and ...changing them is a complicated, non-linear, sometimes messy endeavour' (Miller and Lieberman, 1988, p7).

Also change in schools needs to be understood as a *process* rather than an event (Hord 1987). Schools are complex and dynamic in their organisation, and as such they have what Dawes termed *'dynamic inertia'*: they change constantly, but remain essentially the same (2001, p27). Fullan (1991, 1993) perceptively grasps this apparent paradox of educational reform, which requires continual structural change, yet nothing really changes, since: *'to re-structure is not to re-culture'* (Fullan, 1993, p49). This highlights the need to examine the surrounding cultural context of the school in which teachers work. However, it is important not to underestimate the extent to which school culture is normative and consequently can be resilient to change; as Fullan's observation attests to the relative ease of re-structuring and the inordinately more difficult process of re-culturing.

The pervasiveness of mainstream school culture to absorb innovations and change is testament to its normative maintenance of the status quo. As Agalianos, Noss and Whitty's (2001) research demonstrated: the one major factor that can mute the radical potential of ICT as an innovation is the power of the traditional organisational culture of mainstream schools (p484).

> An institution like school likes things as they are and will resist...when a foreign body comes along it wants to keep it out. Because it upsets the way the curriculum is organised, the way the hierarchy is organised... (Agalianos *et al.*, 2001, p484)

Agalianos *et al.*, (2001) concluded that beyond the few committed enthusiasts (innovators in Rogers' 1983 model), Logo was taken up *unevenly;* it depended 'significantly on the views of individual teachers as well as the culture of the specific school environment' (p485).

Similarly, Papert (1980) had argued that Logo was *not compatible* with the *organisational culture of mainstream schools.* Agalianos *et al.*, (2001) argue that a classic strategy for neutralising the 'transformative potential' of innovations in schools, is to shunt fundamental reform (like Logo) to the 'periphery' of the regular school (p.493). Nias *et al.*, (1989) argue that achieving a genuine understanding of the more subtle factors involved in the adoption or otherwise of an innovation requires a more thorough and sensitive examination of schools. This clearly provides a rationale for the research. Schools form the context and space through which teachers implement change and are complex social settings framing teachers' practice. This requires a much more detailed understanding of the processes and organisational and material factors that affect teaching, in short a better understanding is needed of the *operational cultural dynamics* of schools that shape teachers' practice.

The Management of Change in Schools and Teacher Resistance

The successful introduction of any change relies on various factors, many of which involve the values and beliefs of the teachers concerned, which as norms governing behaviour, could be seen as constituting a culture among teachers, as a professional grouping. Fink (cited in Bowles, 1999) examined the psychology of change and argued that substantial change involves a series of reactive stages: shock, withdrawal, acknowledgment and adaptation. Individuals move through these stages at different rates and in different ways, making the management of the process complex. Schon's (1971) concept of 'zones of uncertainty' adds further insight into the impact of change by recognising that change involves risks in shifting from the familiar to the unfamiliar. A common sequence of feelings is: first, loss - of long standing beliefs, ideas and behaviour patterns, and of confidence or self-esteem; which may cause; second, anxiety - about new knowledge and skills, what the future will be like and about coping in the future; followed by struggle - to survive, to acquire new competencies and to gain respect and recognition.

However, Fink's individuated process of change fails to account for the influence of social and contextual factors that affect teachers. Whilst change does have an internal, psychological component, it is overly reductionist to examine only this element, since other significant, external factors can clearly affect how teachers manage change, like levels of support from school leaders. There is the need to attend to the cultures of schools as influences shaping how teachers experience change, for example, the degree to which teachers experience school management and culture as supportive or punitive.

Although only part of the picture of change management, with respect to the psychological insights offered earlier by Schon's (1971) 'zones of uncertainty', Coulson (1985) helpfully expands on these and provides guidance for managers in schools. Coulson argues that on one level teachers will always resist change - resistance is a mechanism for self-protection and survival. The way that teachers come to operate at work is through a long process of establishing an identity in relation to meeting the demands and expectations with a minimum of uncertainty and anxiety. Suggesting teachers' change the way they do things, implies inadequacy in their performance, which may seem threatening and invite a defence of current practice. Managers too often see this defensiveness as opposition to new ideas and see their task as one of overcoming perceived *resistance*, which may damage the professional relationships that are vital to the success of the innovation.

The literature repeatedly emphasises what Hargreaves and Hopkins (1991) describe as a 'familiar phenomenon': the notion of teacher resistance to change; see Barber, 1997; Casey, 1996; Leask and Pachler, 1999; Papert, 1993; Whiteside, 1978. Studies of change in education have largely concluded that teachers are conservative, resisting change, and adept at neutralising what is perceived to be 'bandwagon' initiatives and ideas, which seem impracticable (Hargreaves and Fullan, 1992). As Desforges (1995, p391) claims,

> Teachers have ways of ignoring or absorbing them (*different types of information encouraging innovative change*) without recourse to restructuring their conceptions of teaching. Small wonder that teachers' practices are conservative. (Desforges, 1995, p391)

Hargreaves (1994) examines why teachers are perceived to be resistant to change, and noted 'the powerful conditions that sustain the culture of teaching'. Hargreaves encourages teachers to confront existing power relations, since 'the teacher can all too easily become the scapegoat of unfulfilled change' (Hargreaves, 1994, p168), and as Fullan observed, 'if it fails, they get most of the blame' (1982, p107).

Cuban (1986) also identified in his analysis of the history of technological innovation in education that the lack of change is often ascribed to teachers: 'Teacher bashing [...] produced a series of sharp critiques blaming intransigent teachers for blocking improvements through modern technology' (Cuban, 1986, p5). Teachers are seen as the 'nuisance factor', creating a stumbling block to reform and re-organisation: a barrier to progress (Brosnan, 1997). Whilst teacher resistance is identified as a barrier to change in the literature this does need to be contested.

As Dawes (2001) argued, the label of 'resistance' describes reluctance to change, but fails to describe the reasons creating reluctance, which may well be sound.

> Changes which are designed without involving the teacher may be impractical, overly time consuming, and at worst educationally ineffective. Implementing change may require the sort of shift in beliefs that demands of the innovator and practitioner a dialogue based on mutual trust and joint purpose. This is not easily achieved, since one of the components of such interaction is the acceptance that these things take time. (Dawes, 2001, p33)

Dawes' (2001) insightful critique of 'teacher resistance' reveals that it is an over used concept, and consequently, use of the term may reveal more a laziness or inadequacy of interpretation and failure to understand the true nature of teachers' work, in which it is reasonable for teachers to question the *practicality* of implementing ICT, before investing the time required to change. Since

> ...innovation and adaptation are costly in terms of the time needed to develop and establish new practices. (Hennessy *et al.*, 2002, p4)

The view that teachers need time has received extensive support in previous research on ICT (Sheingold, Kane and Endreweit, 1983; Somekh, 1989; Plomp, Pelgrum and Steerneman,1990, Plomp and Pelgrum, 1991; Hadley and Sheingold, 1993), and refers to the 'practicality ethic' that rightly affects teachers' implementation of change (Doyle and Ponder, 1977). As Ruddock (1990, p28) argues, it is possible that schools are 'properly conservative' in their effective rejection of whimsical or faddish suggestions'.

> It is entirely reasonable that many teachers should be skeptical in the absence of sound evidence that (ICT) is of proven value, or clear guidance as to what that value is. (McFarlane, 1997, p 6)

However, as Agalianos *et al.,* (2001) argue, teachers' failure to engage with an innovation must be understood in terms of the *wider context* within which teachers work.

> Faulting teachers for refusing to change assumes that most teachers are free to adopt changes, if they merely choose to. It assumes that when they do not do so it is because they are stubborn or fearful of classroom consequences. Attributing to teachers the personal power to halt or divert change is the corollary of the common tendency to locate explanations for events in individual action rather than assessing the potent influence of the situational contexts or blend of many influences. (Agalianos *et al.,* 2001, p489)

Consequently the research must attend to the effect of the situational context in which teachers find themselves working, namely the cultural dynamics of schools as the context through which teachers come to engage with change.

Teachers and Innovation: the change process

Ruddock (1990) and Nias *et al.,* (1989) both argue that real change in schools is only possible if teachers are consulted: that is, if teachers consider that prospective change has good purpose and they have control over what happens to themselves and their classrooms.

Crook (1994) highlights the importance of the teacher when it comes to implementing ICT. Using theories of cultural psychology, Crook analyses the effective use of computers:

> Computer work must become a topic of classroom discourse such that the experience can be interpreted and blended into the shared understanding of the participants. This is a more demanding and perhaps more intrusive role for the teacher than has otherwise been identified. (Crook, 1994, p87)

Teachers' disposition to change, that is their hopes and fears when confronted with ICT, will be partly influenced by the way their teaching careers have developed. To understand how teachers approach, for example ICT, it is important to consider *their perception of their professional lives* (career identities) as they find themselves interacting with this innovation.

Huberman (1993) details the range of career trajectories that teachers may experience: from painful or easy beginnings, through self-doubt or stabilisation, to loss of enthusiasm or positive focusing and experimentation/renewal. Huberman's research identified that there were a number of paths to negative, 'bitter focusing' and disenchantment with teaching as a career, some of which involve the imposition of change. It is important to recognise and acknowledge that the integration of ICT may be regarded by some teachers as such an imposition. However, change is not necessarily a negative factor for teachers. Teachers that emerge with a positive, 'serene focus' have a willingness towards experimentation and involvement with change, leading to renewal and resolution (Huberman, 1993).

Huberman (1993) attentively outlines the process that can be provoked in teachers experiencing change (p59):

> The new ideas, new vision, new attitude towards schoolwork: then the shock of reality and the feeling of self-delusion. This can be contrasted with the satisfaction of involvement with reform which enables the individual teacher to realise hopes, and favourably alter educational practice. A justification of caution in experienced teachers was that they held that too many reforms were based on untested theories, rather than proven effectiveness. (Huberman, 1993, p59)

This scenario has implications for teachers facing the integration of ICT into classroom practice, as a *government led reform.* In short, changes that are seen as 'add on' to teachers normal working practices, or are the ideas of management alone, may be hard to implement, and so may be abandoned by teachers. As Hargreaves argues,

> Even the most well intentioned change devices which try to respect teachers' discretionary judgments, promote their professional growth and support their efforts to build a professional community are often self-defeating, because they are squeezed in to mechanistic models. (Hargreaves, 1994, p3)

Promoting Successful Change in Education

People are always wanting teachers to change. (Hargreaves, 1994, p5)

The most extensive work conducted on understanding educational change is found in the work of Fullan (1982; 1985; 1991; 1993; 1999). In 1982 Fullan provided criteria with which teachers assess proposed change: 1) Does the change potentially address a need? 2) How clear is the change in terms of what the teacher will have to do? 3) How will it affect the teacher personally in terms of time, energy, new skills, and interference with existing priorities?

In 1985, Fullan developed the list to include: characteristics at the school level (including actions of the Head and the relationships between teachers), which can be identified as micro; characteristics at the LEA level (including history of innovation attempts, timeline and monitoring, training for Heads, community support, and 'overload'), which can be identified as meso, and the role of Government, which is macro. Fullan also identified two other important factors: 1) teachers' colleagues as a preferred source of knowledge and 2) the influential support of the wider community.

Fullan's criteria are complemented by Ridgeway and Passey's (1995, pp. 65-66) evaluation of change, which rightly asks: What change is likely to succeed in education? And, what change is likely to fail? Ridgeway and Passey (1995) conclude that change is likely to succeed in education when the following occurs (see table 3.1 below). The researcher has applied Ridgeway and Passey's (1995) analysis specifically to ICT.

Table 3.1 Criteria for Evaluating Change in Education

Change is likely to *succeed* when:

	Ridgeway and Passey (1995)	Examples of researcher's application to ICT
1.	It lets one achieve goals which are hard to achieve in other ways	ICT lets teachers conduct classroom activities that are hard to achieve in other ways e.g. Data logging, where experimental data can be collected in real time and the results immediately plotted on graphs for analysis. Also interactive CD ROMS of

		science experiments that are either too dangerous or too time consuming.
2.	It makes life more fun	ICT e.g. interactive quizzes and games on electronic whiteboard
3.	It makes life easier	ICT e.g. multiple choice self-assessment tests for revision ICT e.g. database of pupil assessments for monitoring, evaluating and target setting
4.	It is seen to be desirable by the community at large	ICT e.g. electronic registers for attendance, enabling more effective monitoring of absences and truancy

However, equally change is likely to *fail* when:

	Ridgeway and Passey (1995)	**Examples of researcher's application to ICT**
5.	Challenge fundamental values and practices	ICT challenges central role of the teacher as expert (move from 'sage on the stage' to 'guide on the side', Selinger, 1999), or ICT will make teachers redundant
6.	Are associated with over ambitious claims	ICT e.g. computers will make teachers redundant, or will radically revolutionise teaching (e.g. ILS: Integrated Learning Systems)
7.	Underestimate the practical constraints of resources e.g. time and support	ICT e.g. practical constraints of time and support needed for ICT training, sufficient numbers of ICT technicians, access to ICT equipment - constraints of resourcing; timetabling
8.	Ignore starting point of individuals involved	ICT e.g. teachers at different levels of ICT skills and pedagogic understanding regarding the use of ICT in their subject area
9.	Fail to monitor progress and adapt the programme appropriately	ICT e.g. some teachers report that NOF provision failed to adapt the programme appropriately to their curriculum subject needs; lack of in-school monitoring of teacher progress/engagement

Examining the research on innovation and change in education reveals that change is multi-dimensional and complex, requiring an analysis of change that is dynamic and attentive to the interplay between key factors; namely how teachers come to negotiate, understand and implement change in relation to the occupational norms shaping cultures of teaching and the specific cultural context of schools.

Given the significance of the cultural context in which teachers work when it comes to understanding how teachers negotiate and manage change, it is important to consider these factors when examining how teachers implement ICT.

To conclude, Agalianos *et al's.,* (2001, p497) analysis of Logo, as an example of technological change in education, demonstrated that,

> ...beyond the question of access to technology, a number of factors determine the success or failure of such educational innovation; matters well beyond the technical, and even well beyond the classroom. The fact that a particular technology is available in the classroom does not automatically mean it will be used at all, or that it will be used in a particular way. [...] schools and classrooms are social organisations that both influence the ways in which an innovation will be adopted...[Consequently] Logo was variously embraced and resisted, normalised and institutionalised, marginalised and altered by the various players in the life of the school, in their daily struggle for meaning and power within the classroom arena. (Agalianos *et al.,* 2001, p497)

It is important therefore to attend to the social and organisational influences with regards to managing change, because these are cultural factors that shape change. This leads to the following research question: what factors regarding the cultures of teaching are significant in affecting teachers' use of ICT for professional practice?

School Culture: categorising schools' ICT use

Accounting for varying levels of integration between schools, researchers have attempted to categorise schools. A brief history of this device reveals a range of types or categories, with the most recent emerging from Becta, with a maturity model approach to categorising schools.

The NFER/DfES (2001) referred to schools on an innovative continuum, while an earlier model from NCET (1995) had borrowed from MIT's (Massachusetts Institute of Technology) model of ICT integration into businesses. This model identified five levels of ICT development that could be transferred 'successfully into educational contexts' (p8), ranging from the most innovative, to embedded, transformative, and coordinated down to localised. The latter two were considered to be in the 'evolutionary stage' of change, with a 'transition stage' in the middle, followed by a revolutionary stage for the top two levels. Such typologies of ICT use have been applied to teachers as well as schools (see latter discussion of teacher ICT typologies).

More recently, Lawson and Comber (1999, 2004) have referred to the 'integrative' school, 'where ICT is used to promote learning across all curriculum areas in a seamless way' (2004, p145). An ICT integrative school possessed key components that were a collegial approach and willingness to innovate, an enhanced role for the ICT coordinator and effective leadership. Whilst this represents the most ICT embedded schools, Comber and Hingley (2004) categorised other types of schools' use of ICT: as *pre-emergent, emergent, established* and *advanced,* which was developed out of their analysis of the SLICT programme.

Clearly schools can be categorised in relation to how much they use ICT and that schools may have a general ICT *ethos*, which can be seen to be shaped, at least in part, by the headteacher's approach to ICT. For this research, it was therefore important to have a range of schools from emergent to advanced to investigate the significance (or otherwise) of school culture on ICT implementation.

3.2 TEACHERS' CONTINUING PROFESSIONAL DEVELOPMENT (CPD)

This section examines the contemporary conditions shaping teachers' professional practice with respect to the rise of an audit culture and the pressure this exerts on teachers and how this may impact on the implementation of ICT. In light of contextual conditions, how teachers may develop their practice is explored through an analysis of teachers' continuing professional development (CPD), with a specific examination of models of ICT CPD.

Contemporary Contextual and Political Pressures Shaping Teachers' Practice

The conditions currently shaping the teaching profession concern public accountability, which prioritise external performance measures, for example, national league tables of schools' examination results. Increased regimes of accountability and audit are meant to improve public trust in education, which are co-extensive with other contemporary public sector reforms (Sachs, 2003) and are implemented through standards regimes. Consequently, under the structures of an audit culture 'surveillance and inspection go hand in hand. Regulation, enforcement and sanctions are required to ensure its compliance. Of its professionals it requires self-ordering...based upon meeting externally applied edicts and commands' (Sachs, 2003, p7). These political conditions confronting teaching are becoming universal and succinctly exposed by Sach's observation:

> The strong and sustained push for accountability required by governments ...ensures the external control of the teaching profession. Regulatory frameworks serve to constrain teachers' practices and to emphasise a conservative and reactive form of teacher professionalism. (Sachs, 2003, p9)

Contemporary political pressures of public accountability have affected teachers' professional identities and positionings (Jones, 2004; Moore, Edwards, Halpin and George, 2002; Sachs, 2003; Stronach, McNamara, Stark, and Warne, 2002). It is therefore necessary to examine teacher positionings under the current conditions that are shaping the profession, in order to understand the contextual situating of teachers and implementation of ICT.

Significantly it was the research of Moore, Edwards, Halpin and George (2002) that discovered that teachers 'reposition' themselves in the face of rapid and extensive *educational change*. Moore *et al's.,* (2002) interviews with teachers indicated that responses to public policy were prompting teachers to become increasingly pragmatic in their practice. Two distinct forms of pragmatism were identified: 'principled pragmatism', in which teachers who were positive to recent reforms felt able to strengthen and affirm their pedagogic practice; and 'contingent pragmatism', adopted by teachers in 'oppositional orientation to reform' (p. 551). The latter groups of teachers' reactions to policy change take on the function of a survival strategy.

Moore *et al.,* (2002) propose a *practical definition of professional pragmatism.* In drawing a distinction between being *proactive*, feeling free to make choices, and, *reactive* on the other hand, feeling forced into making decisions, by being overly constrained (by government) to introduce 'reform' or change into professional practice. Some teachers might be severely restricted in their choice of identifications or positionings by increased government control, through the introduction of statutory educational policy, such as ICT.

Moore *et al.,* (2002) argue that previous categorisations of teachers as 'compliant' and 'resistant' in relation to educational change, as though on a continuum, actually masked a wide and complex variety of professional positionings. In relation to ICT, teacher positionings have not been adequately researched. In any analysis, it is necessary to attend to the dynamic nature of teacher 'positionings': the latter term is preferred by the researcher as it highlights fluidity, as opposed to the term 'teacher identities' or 'attitudes' or 'perceptions' that is characteristic of much research in this area, which suggest relative permanence and closure.

Coldron and Smith (1999) do acknowledge the dynamic element of teacher 'positionings' by arguing that these are 'partly given and partly achieved' by 'active location in social space' (p711). Social space is defined as 'an array of possible relations that one person can have to others' (ibid.). Some of these relations, Coldron and Smith argue, are conferred by 'inherited social structures and categorisations', while others are 'chosen or created by the individual', which interact (ibid.).

Whilst accounting for the fluidity of teacher positionings, Coldron and Smith (1999) also account for the effect of policies on teachers that 'impose greater degrees of uniformity and conformity' (such as the National Curriculum, assessment criteria and OFSTED), which 'threaten to impoverish the notion of active location, restricting the number of potential positions the teacher might assume' (p 711). This highlights how teachers may feel restricted in their positionings by increased government control, again through statutory reform. This needs to be explored in relation to the implementation of ICT.

Teachers may feel constrained to incorporate alien elements into an enduring 'preferred practice'. Marris (1975, p16) argues 'change threatens to invalidate their previous experience, robbing them of the skills they have learned and confusing their purposes, upsetting the subtle rationalisations and compensations by which they previously reconciled the different aspects of their situation'. To what extent this is the case with teachers' experiences of ICT implementation, is important to explore.

Stronach, McNamara, Stark, and Warne, (2002) also examine the nature of contemporary professional identities and positionings, in particular the ways in which 'discursive dynamics' come to re-write the professional teacher as split and plural, wherein the teacher is located in a complicated nexus between policy and practice. Epistemologically, Stronach *et al.,* offer a deconstruction of professional identities that criticises the reductive typologies and characterisations of current professionalism. Whilst these theorists offer an explicitly self-conscious post-structuralist reading of teachers' professionalism, from empirical interviews with teachers, the researcher notes that in fact their findings are no different to those of Moore *et al.,* (2002), with respect to identifying the fluidity of teacher postionings in the context of current reforms and educational change.

Stronach *et al's.,* (2002) analysis claims to create different possibilities for 'professionalism', ones that resist the increasing universalist, essentialist, reductionist accounts that seem to appeal to governments (p8). Rather, Stronach *et al.,* prefer to read the professional as 'mobilising a complex of occasional identifications in response to shifting contexts' (p9). Teacher narratives should not be stabilised as essential identities, stages or types, since instead, they depict dynamic and ambivalent aspects of situated performance. Following this, the researcher acknowledges that the notion of 'professional teacher' is an indefensibly unitary concept. Instead, it is necessary to conceptualise teacher positionings as non-unitary, unstable, fragmented and shifting.

Hence, it is very importance to keep tensions and movements in play, particularly between *external pressures* (government policy reform), *local contextual pressures* (school culture) and *teachers' preferred practice*. For example, Stronach *et al's.,* sample of professionals acknowledged a plurality of roles, or 'typical engagements' and 'uneasy allocations of priority'. In the fluidity of positionings, a 'growing professional uncertainty' was identified, 'as teachers tried to come to terms with a welter of recent innovations, the pressures of their respective audit cultures, threats to their preferred professional styles and external impositions' (p11). Such 'juggling' was expressed as a 'reworking of individual professional commitments' (ibid.). This leads one to consider how teachers come to rework their professional commitments with the implementation of ICT as an external pressure that may impact on their preferred practice.

Emerging Universalism: an audit culture of professional competencies

Stronach *et al.*, (2002) rightly acknowledge that whilst trying to preserve difference, movement and particularity, it is important to also acknowledge that these pointers to 'locality' are by no means unconnected to the global and universal.

The tendency towards universalism can be found at a national *and* international level, where definitive lists of competencies for teachers are published, for example, in the UK by the TDA. This indicates the greater degree to which the work of professionals is 'managed' by an external specification of competencies, which are measured by the 'language of indicators' (Strathern, 2000, p314). External indicators of educational performance are league tables of GCSE results, SATs levels, OFSTED ratings and the public ranking of schools against such performance criteria. Arguably this drive towards universalism is led by policy makers rather than teacher professionals and the value and merit of such measurability remains open to question. For example, teachers and heads professional organisations and unions routinely call for an end to, or relaxing of such regimes.

The 'coalescing registers' of performance measures can be identified as aspects of an 'audit culture', which have been externally imposed by government on the profession. Stronach *et al.*, (2002), refer uniquely to such quantitative performance measures as an *'economy of performance'*, which require universal criteria in order that standardised comparisons can be made locally and nationally, or even internationally. This supports the research of Day, Fernandez, Hauge and Moller (2000, p116), who identified an 'emerging international consensus' concerning the nature of professionalism.

Consequently the 'audit culture' or 'economy of performance' for professionals gives expression to 'universal' rather than 'local' models of good practice, which are based on 'measurement', 'effectiveness' and 'improvement'. However, these pressures were discovered by Stronach *et al.,* (2002) to be in tension with teachers' 'ecologies of practice'. That is teachers' preferred practice that has arisen from individual and collective experiences of teaching, through which teachers lay claim to being 'professional' and concern convictions about what constituted 'good practice'. 'Locating 'professional' experiences betwixt and between these affiliations' (p15) created a tension for professionals, with its contradictions, dilemmas and compromises.

In short, the tension between external pressures of an 'audit culture' and teachers' preferred practice (or Stronach *et al's.,* 'ecologies of practice') undermine the stable, unitary notion of the 'professional'. Hence it is important to attend to these tensions and to keep contradictions, compromises and movements in play. The identification of this situation led Moore *et al.,* (2002) to signify an emerging teacher pragmatism in relation to contemporary educational policy changes.

Stronach *et al's.,* (2002) post-structuralist account offers a deconstruction of the term 'professional', since definitions are rejected on the grounds that any such attempt to pin down terms, is to stabilise, or make static an identification, positioning, or situation that is inherently unstable due to shifting contexts and tensions. Therefore the researcher argues accounts must keep in mind the dynamic nature of teacher positionings, due to the fluidity of teachers' situated performance, which attends to the compromises of teachers' preferred practice alongside changing educational policy such as the implementation of ICT.

The conditions currently shaping the teachers' practice prioritise external performance measures, due to the publicly accountability of published league tables. This may pressurise teachers to focus on curriculum content and assessment (audit culture), rather than giving time and space to experiment with ICT. The latter maybe perceived to involve risk in a culture where failure to meet performance targets has consequences (Ofsted school closure), which may compromise a teacher's willingness and inclination to experiment with ICT for pedagogic use.

Clearly there is the need to examine the extent to which an audit culture exerts pressure to meet external measures of effectiveness, through exam results, and the extent to which this affects (promotes or inhibits) teachers' take up of ICT. The research will therefore examine how government ICT initiatives interact with existing priorities concerning the national curriculum and assessment.

Having outlined the contemporary political pressures shaping teachers' practice, specifically the demands of an audit culture that prioritise public performance indicators of exams and inspections, this provides a background context from which to explore how teachers develop professionally. The next section examines teachers' continuing professional development.

Teachers' Professional Development

Research on educational change shows that for change to have a significant impact it requires shared ownership of plans, which start with 'experimenting in small ways and then expand on success, and for teachers to work out their own meanings, over a realistic time frame' (Hennessy *et al.,* 2002, p23). Kirk and MacDonald (2001) highlighted the complex obstacles which teachers face in experiencing ownership of educational change. According to Wright (2001), *relearning* is at the heart of cultural - rather than cosmetic - change. As Bell and Gilbert (1994) argue

> Teacher development can be viewed as teachers learning, rather than others getting teachers to change. In learning, the teachers were developing their beliefs and ideas, developing their classroom practice... (Bell and Gilbert, 1994, p493)

This emphasises the link between proposed change and the learning or professional development of teachers. As Fullan (1982) pointedly argues,

> Educational change involves learning how to do something new. It is for this reason that if any single factor is crucial to change, it is *professional development.* (Fullan, 1982, p256)

Defining Professional Development

Part of being a profession means that individuals engage in professional *development.* The Institute of Management (1995) defines professional development as 'the process of planned, continuing development of individuals throughout their career', which needs to include 'elements of professional and personal development, the acquisition of knowledge and the enhancement of skills' (p5). However, the extent to which teaching can be considered a profession is contested.

Hoyle and John (1995) conducted an extensive review of the fluctuations in thinking about the professional status of teachers since 1915, finally arriving at a general definition:

> The term 'profession' can refer to any occupation... hav[ing] distinguishing characteristics on which there is a high degree of consensus, including knowledge base, autonomy and responsibility. (Hoyle and John, 1995, p16)

In the interests of space, the intricacies of the debate cannot be examined. Suffice to say that teaching may be accepted to be at least semi-professional.

However, Stronach *et al's.,* (2002) review perceptively examines how teacher 'professionalism' is currently conceptualised, noting that 'professionals' are systematically categorised in terms of *different types of knowledge* (Eraut, 1994), *stages of development* (Huberman, 1993), and *typologies of role*, such as 'extended' versus 'restricted' (Hoyle, 1980; Woods, 1997). Similarly Stronach *et al.,* (2002, p4) argue that professionals are 'regularly consigned to, threatened with, or rescued from, *'proletarianisation'* (Hargreaves, 1994), *'bureaucratisation'* (Murphy, 1990), *'intensification'* (Galton *et al.,* 1999) and *'deprofessionalisation'* (Parkin, 1995). Hence,

> Current theories of professionalism are guilty of highly reductive characterization. (Stronach *et al.,* 2002, p18)

Writers on teacher development and professionalism have tended to focus on the following range of issues: teacher reflectivity, introspection, self-analysis and inquiry (Fullan and Hargreaves, 1992; Miller and Silvernail, 1994; Schon, 1987; Stenhouse, 1985).

Yet, there are problems with defining teacher development and it is only recently that *teacher development* has emerged as an identifiable area of study (Fullan & Hargreaves, 1992; Hargreaves & Fullan, 1992; Darling-Hammond, 1994; Day, 1999), in which it is categorised as part of teacher professionalism. Consequently, the newness of the field means that

> Definitions of teacher development are almost entirely absent from the literature: even leading writers in the field do not define precisely what they mean by the term. (Evans, 2002, p124)

Hence, 'the concept of teacher development is unclear' and 'relatively unexplored' (ibid.), and Evans (2002) pointedly argues that the major theorists 'all fail to offer definitions of teacher professional development' (ibid.). Fullan & Hargreaves (1992) also observe ' how little systematic attention has been devoted to understanding the topic' (p1) and consequently Fullan & Hargreaves 'overarching conclusion is that teacher development must be conceptualised much more than it has been' (ibid.).

Evans (2002) argues that since teacher development may mean different things to different people, threats to construct validity would be reduced if researchers defined the term. Evans (2002) own definition of professional development is

> ...an ideologically-, attitudinally-, intellectually-, and epistemologically-based stance on the part of the individual, in relation to the practice of the profession to which s/he belongs, and which influences her/his professional practice. (op. cit., p130)

However, arguably Evans' definition is rather a 'catch all' and looks only at teachers as *individuals* and not as part of a *community of practice* (Lave and Wenger, 1991). So Evans' notion is more of an individuated epistemology, as opposed to a socially constructed knowledge of professionalism as embedded in a community of shared practices. Though there is an implicit reference to the latter in Evans' article, it is not developed any more substantially than this sentence in the entire article.

Whereas McCormick and Scrimshaw (2001) critically expose the 'ICT research community' for not keeping up to date with recent theories of knowledge that acknowledge the social dimension of learning, the researcher would also criticise Evans for failing to do so with respect to professional development.

Evans (2002, p131) continues to define teacher development as *'the process whereby teachers' professionality and/or professionalism maybe considered to be enhanced'.* The researcher agrees and stresses that teacher development is a *process* and in need of further research to gain an understanding of this process in relation to ICT.

Evans (2002) argues that even of the 'most analytical of teacher development-related literature and the work of the most prominent in this area', there is the *lack of conceptual clarity*, which 'underscores the need for clearer definition of what is meant by teacher development' (p127). Since Evans (2002) argues that the 'knowledge base in the field of teacher development is still underdeveloped and inadequate compared to other more established areas and, therefore, needs supplementing' (p128), and given that 'there is still much to be discovered about the teacher development process' (ibid.) this research aims to address this omission, in specific relation to ICT.

Fullan (1993) also noted such an omission and argues there is an 'inadequately defined knowledge base about teaching' (p112), which is a key obstacle in the evolution of teaching as a profession. This omission has at last been recognised by the TDA and is currently being addressed by the development of a knowledge base for teaching, set up as part of the TTRB (Teachers Training Resource Bank, 2006; part of the 'Evidence and Effectiveness' unit of the TDA). However, this does not address *how* teachers professionally develop with ICT; the processes by which teachers experience and engage with change with ICT, such that ICT becomes embedded into practice.

Summary: teacher development

First, the *knowledge base* in the field of teacher development is underdeveloped and needs supplementing (specifically with respect to ICT), since there is still much to be discovered about the *process* of teacher development, as argued by Evans (2002) and Fullan (1993), which is an omission this research aims to address. Since,

> The teacher development *process* - the understanding of precisely what we need to do if we want to develop teachers - remains unclear. (Evans, 2002, p133)

Second, the researcher's analysis concludes that the field of teacher professional development has been largely understood in terms of an *individuated epistemology*, which fails to adequately deal with more recent theories regarding the social dimension of learning and professional development. There is insufficient attention given to the way teachers learn to construct new knowledge through participation in a 'community of practice' as a joint venture, in education generally and, specifically with ICT.

National Government Initiatives for Teacher Development

In the 1980s teachers' in-service training radically altered (Acker, 1990). One major change was 'the end of arrangements that guaranteed a supply of funds for LEAs to pay for teachers on long award-bearing courses such as MEd degrees' (Acker, 1990, p258). This marks the move from *individuated teacher development,* where teachers autonomously selected a course of their choice, to *whole-school development*, wherein development had to be tailored to meet the needs of the *school's priorities*, as opposed to a teacher's self-determined priorities.

Since 1994, when OFSTED inspections and teacher appraisal became compulsory via legislation, all schools were compelled to consider staff development *in relation to* school improvement. Previous legislation, notably the 1988 Education Reform Act, also focused attention on the need for staff development, in relation to the introduction of the National Curriculum, Local Management of Schools (LMS), and the policy directives for 'school improvement' and 'raising standards'. Consequently schools were required to take greater responsibility for the development of their staff, wherein teachers' experience and expertise became recognised as the most significant resource, and managing 'staff development and training' has become part of the overall resource management of a school.

The government's responsibility for the 'continuing professional development' of teachers was part of the then Teacher Training Agency's (TTA) remit. The main focus of the 1996 TTA report to the Secretary of State, was the development of *national standards for the teaching profession*, including a framework for four distinct groups: Newly Qualified Teachers (NQT), Teacher, Expert teacher and Head teacher. Clear expectations and training opportunities needed to support each group were established, which enable progression from one to the other. For NQTs: upon completion of an Initial Teacher Training (ITT) programme, the TTA requires trainees to write a 'career entry profile', which highlights strengths and weaknesses and provides the basis for future professional development. NQTs are allocated mentors in their first teaching post, who help the NQT to develop their 'career entry profile' over the first year (Harrison, 2001) The professional development of Head teachers and prospective head teachers was recognised in the government's national launch of the NPQH (National Professional Qualification for Headship), which from 2004 all practicing heads are required to hold. (See leadership and CPD section earlier).

Changes to Teachers' Continuing Professional Development

In schools the traditional model of teacher development was to attend 'in-service training' courses (INSET), however, by the 1980s the emphasis was becoming increasingly focused on *'skills'*. Main (1985 p13) defined teacher development as 'the means by which a person cultivates those skills whose application will improve efficiency and effectiveness'. This represents the shift to *'increased effectiveness'* becoming the focus and desired outcome of teacher development, as an externally imposed government priority since the 1990s as part of the school improvement agenda. As Brown and Earley (1990) assert, in a frequently cited definition, 'professional development activities are engaged in by teachers to enhance their knowledge, skills and attitudes in order to educate children more *effectively'* (p5).

Earley's (1995) evaluation of CPD in schools, defined CPD as 'an on-going process building upon initial training and induction, including development and training opportunities and concluding with preparation for retirement'. Earley's evaluation makes reference to Madden & Mitchel's (1993) survey that identifies that the purpose of CPD is to fulfil three functions, namely: 1) to update & extend knowledge and skills on new developments and practice -to ensure continuing competence in the current job. 2) To train for new responsibilities and develop new competencies - for a changing role, e.g. promotion. 3) To develop personal and professional effectiveness - increasing competence in a wider context to maintain job satisfaction

Main's (1985) analysis identifies a problem with CPD; having stressed that teachers must first feel there is a need for the training, if doing so means admitting to a problem or inadequacy, teachers may be reluctant and the process may seem too threatening. However, in treating teachers as competent self-developers, there is another problem, identified by Bowles (1999) who argues that better teachers get better still, while the worst fail to improve at all. Arguably these problems were directly tackled when the government made CPD mandatory, as was the case with NOF ICT training for teachers.

Statuary ICT Competencies for Teachers (DfEE 4/98)

The most important legislation regarding 'ICT and teacher competence' came in April 1998, which specified that teachers must be able to use ICT for teaching. The DfEE stated in detail exactly what was expected in relation to ICT for both newly qualified teachers (NQTs) and for serving teachers.

The ICT set of standards for qualified teachers set out in the DfEE Circular 4/98 were statements about teachers' ICT capability presented in the form of a list of competencies, which applied to all newly qualified teachers from July 1999. The DfEE stated 'it is concerned with the ways in which ICT can be used effectively in teaching' (p17) and set out an Initial Teacher Training National Curriculum for the use of ICT in subject teaching, which would 'equip every newly qualified teacher with the knowledge, skills and understanding to make sound decisions about when, when not, and how to use ICT effectively (DfEE, 1998, Annex B, p17).

For heads of department (HOD) of curriculum subjects, ICT was also explicitly stated as a list of competencies by the DfEE, with particular reference to, first, the understanding of the current and potential use of ICT to aid effective teaching and learning of the subject, and second, the management of learning resources, including ICT. There was a specific requirement for HODs to understand how the use of ICT can enhance learning in their curriculum area. This raises the issue of the *role of middle managers* in effecting change with ICT, which is an area that has received little research attention.

Bowles (1999) argues that the DfEE set of standards has provided a clear structure regarding the use for ICT for teachers across their careers (from NQT to HOD), which is an improvement in a profession criticised for providing insufficient development guidelines and incentives. This highlights the role of CPD and the need for teachers to continue to learn throughout their careers. However, this does not address the pertinent issue of *how* serving teachers create new knowledge of ICT use for professional and pedagogical purposes.

Seeing the Value of ICT Change

The reluctance of some teachers to embrace ICT for classroom practice may be because the value of such change is not perceived by teachers in the same way as those requiring the change, namely policy makers. It is possible to contend that perhaps there will always be a *tension* between *external pressures for change*, e.g. from government and *teachers primarily 'conservative' practice.* The inherent 'conservatism' is often cited as a key characterisation of the profession and reason for stasis (Eckhardt 1995; Bowles 1999; Evans 2002; Sachs 2003). However, with respect to change Stenhouse (1985) argues 'as a starting point, teachers must want to change, rather than others wanting to change them': without the willingness of the teacher to participate in the process of restructuring their own knowledge, any legislation will be to varying degrees ineffective or limited' (Sternhouse cited in Eckhardt, 1995, p155).

Bowles (1999) argues that if an individual teacher is convinced that the effort involved in learning new (ICT) skills is not worth the perceived gain, or that the skills will only have a short shelf life, teachers are unlikely to make that effort. This argument is supported by Barnett's (1997) concept of *rationalisation*, on the part of the teacher who is over-burdened and must make informed decisions about what they can focus their time and energy on. Barnett argues that in an era of *'super-complexity'* it is not possible for teachers to do (or know) everything, therefore a rational decision needs to be made about *what can* and *cannot* be done.

Doyle and Ponder (1977) argue similarly when they state that the benefits of introducing something new (ICT) are counter-balanced by the additional effort required to organise it, which is conceptualised as the 'practicality ethic'. Tagg (1995) supports this argument by arguing that successful teachers, in particular, will be unwilling to drop approaches that work for the sake of something new unless teachers can see it can work too.

Having examined teachers' professional development in general terms, it is necessary to evaluate specific models of professional development for ICT.

Models of CPD for ICT

> Too often, efforts to help teachers learn about educational uses of ICT begin, and end, with short demonstration sessions where the 'expert' puts the hardware and software through its paces while novices watch. While such practice may help teachers become familiar with the mechanics of using ICT, it does little to help the teacher with the many professional issues that crop up when an innovation is introduced into a real classroom. (Willis, 1996, p7)

It was Russell's (1995) research that indicated that the preferred model of ICT INSET has consistently been that of 'cascade' and, it has been hugely *unsuccessful*. Typically, this model has three components. The first stage is often an externally delivered INSET session with a focus on the innovation itself rather than its classroom application. For example, in the early 1990s, the 1 to 2 day demonstration courses of CD-ROMs. Then, second the teacher is responsible for translating the course into the context of their school; however, because the INSET was not tailored to meet individual needs, it required interpretation. Then thirdly, dissemination, if any, consists of the teacher reporting back on the course, either informally (e.g. in the staffroom over coffee), or formally (e.g. a department meeting).

As Russell argues, the best method of ICT INSET has been for teachers to appreciate a curriculum application of the ICT before becoming familiar with it. Russell states that teachers are often expected to accept the use of ICT in the classroom as a good thing - as an act of faith- whereas their professional judgment is to look at the learning that will result.

> We derive little benefit by 'wowing' teachers with demonstrations of new computing technology if we fail to connect its use to the curriculum. Teachers may resist changing to a practice that someone *outside* the classroom decides is of importance for teachers to do *inside* the classroom. (Casey, 1996, p16)

In the 'Patterns of INSET Provision' (NCET Report 1995) there is an evaluation of the merits of *external* courses in ICT and *in-house* provision. Considerable reservations were expressed about 'the usefulness of set-piece courses as a route to expertise in ICT'. The ICT coordinator emerged as a key figure in many schools, providing both formal training and in-formal day-to-day support and troubleshooting, which is endorsed by other research (EDSI, 1997).

In 1995 the NCET report outlined concerns in relation to teacher development in ICT, which were identified as three major strands: first, making INSET more appropriate (to take account of the variation in confidence and skills of teachers). Second, the need for resources (including time, money, hardware, software) and third, pedagogical concerns.

Bowles argued in 1999, (p43) that

> It has taken 15 years for the educational establishment in the UK to acknowledge the extent of the changes being asked of teachers in relation to the use of ICT and - especially - the work that is necessary to bring those changes about. Even now, with clearly stated targets in relation to teachers and computers and new and costly structures taking shape (e.g. NGfL), little is being said or written about how to actually manage a change that has steadfastly refused to happen for many years.

Having warned of the need to change teachers' beliefs before they adopt new methods and the difficulties in effecting even slow changes in teachers' beliefs, Veen (1993a, 1993b) identified four consequences of this for ICT INSET programmes. First, an ICT INSET programme must fit with the existing beliefs of teachers. Second, a differentiated 'bottom-up' approach, appropriate to different subject areas, is needed. Third, change will be slow, it requires planning and managers must persist and fourth, it should be school based.

Rhodes (1989) identified two different approaches to ICT INSET for teachers based on contrasting theories of teachers as learners: the deficit and skills model. In courses based on the deficit model, the primary barrier to overcome was a teacher's *fear of the innovation*; the emphasis is on giving the *teacher confidence with the technology*, educational issues assume a secondary role. However, Rhodes (1989) argues that this model de-skills teachers, reducing them to novices and also makes the new techniques seem distinct from their normal work. Conversely, the skills model 'acknowledges teachers as experts...the barrier to innovation is seen as *psychological*...and the emphasis is on encouraging *teachers to use the technology in the classroom* and then return in order to discuss educational outcomes' (p5, emphasis added). However, both are 'deficit' in the sense that they regard teachers as being 'barriers' to be addressed rather than as experts willing to engage with new ideas.

CPD for ICT: stage-models and typologies

A number of more detailed and ICT specific models for teachers' continuing professional development have been put forward, which can be characterised as *stage models*. For example, Novello's (1989) five stage model, entitled SAPID (self-familiarisation, authoring, presentation, integration and design); Dwyer, Ringstaff and Sandholtz's (1991) five stage evolutionary model; Comber, Lawson and Hargreaves' (1998) 'familiarisation-adaptation' model and Hall's (1979) Concerns-Based Adoption Model. Also there has been the emergence of *typologies* that describe different types of ICT users, Dawes (2001) in the UK and Hadley and Sheingold (1993) in the USA.

Dwyer, Ringstaff and Sandholtz's (1991) major study into how technology-rich classrooms changed teachers' beliefs and practices over a period of several years concluded that the changes were significant, but only occurred after teachers had confronted deeply held beliefs about the nature of learning and the efficacy of their pedagogical activities. Though an American based study, the changes were theorised into a five stage evolutionary model, which teachers pass through in order to become fully competent users of technology in the classroom: Entry, adoption, adaptation, appropriation and invention.

1. Entry - teachers struggle to cope with technology
2. Adoption - successful use of technology at a basic level
3. Adaptation -discovery of potential in a variety of applications / can troubleshoot
4. Appropriation - mastery over the technology / use it to accomplish various classroom goals
5. Invention - active development of new learning techniques using the technology.

Dwyer *et al.*, (1991) observed that during the first phase of the project teachers demonstrated 'little penchant for significant change and, in fact, were using their technological resources to *replicate traditional learning activities*' (emphasis added). Consequently Dwyer *et al.*, (1991, p13) argue that teachers had little 'incentive or direction for making changes which might jeopardise...performance on existing criteria...They did not seek to create new approaches to instructional [pedagogical] excellence'.

However, by the fourth stage change did occur. This was evidenced by teachers' personal appropriation of the technology and was seen as particularly significant, since it enabled new pedagogical strategies. Teachers had gained a new perspective on how they could change classroom practice.

Dawes (2001) research lead to the development of a typology that described different types of ICT user, which her sample of teachers confirmed through member validation questionnaires. Dawes (2001) concludes that change occurs in individual and groups of teachers as they develop professional expertise and the motivation to evolve from being 'potential users' (through the stages of 'participant', 'involved', and 'adept') to 'integral users'. Hadley and Sheingold (1993) constructed a similar typology of teachers to Dawes (2001).

Comber, Lawson and Hargreaves (1998) used data from their work on the EDSI project (1995) to test a two-part model connecting teacher attitudes to ICT with actual use of ICT. Comber *et al.,* (1998) refined an earlier three-stage model (familiarisation - utilisation - adaptation) in light of the work done by Hord *et al.,* (1987) on a Concerns-Based Adoption Model. The new model identified six 'stages of concern' that represent changing attitudes towards the innovation, which move from concern about the immediate impact of ICT, through to those which relate to introducing ICT and concerns about its impact on working with other teachers. The affective and behavioural components of the model are closely connected, so each stage is associated with a level of use.

Comber *et al.,* (1998) suggest that a third dimension could be added to the model, which is building in appropriate intervention strategies that would enable teachers to move to a more sophisticated level of use. As Comber concludes, *further research is needed* to identify appropriate and effective intervention strategies. Arguably NOF was a national intervention strategy; however, both the TTA NOF Evaluation Report (1992) and Preston (2004) reveal that the success of such an intervention was dependent on a number of *other* crucial local factors, such as school leadership, which is a cultural and contextualising factor needing attention. This again highlights the complexity of change with ICT such that isolating one element, like CPD, is unlikely to guarantee effective implementation. Research to date has failed to adequately account for the multidimensionality of the change required.

This research is concerned with exploring teachers' experiences of implementing ICT and needs to examine the range and types of ICT training teachers have received and investigate the effectiveness of such professional development with respect to supporting the embedding of ICT into teachers' practice. This leads to the following research question: what ICT training is available to teachers and how effective is it for embedding ICT within the professional practice of teachers?

Summary: teachers' professional development with ICT

The research on models of teachers' professional development has failed to acknowledge the plurality of teachers' positionings, particularly how teachers come to navigate the tensions and pressures shaping teachers practice with respect to: curriculum and assessment, the implementation of ICT and teachers' existing preferred practice. The context in which teachers find themselves working is more fluid, complex and dynamic than currently conceptualized in the research. *How* teachers come to integrate ICT into professional practice requires further investigation.

The processes by which teachers develop new practices with ICT needs further explication, because, teacher development incorporates change that would generally be categorised as *learning,* however, insufficient attention has been given to the *social dimension* of learning and teachers' professional development, which necessitates an exploration of the cultural context in which teachers learn. Similarly, research has shown that organising external, cascade INSET models of CPD for ICT have been largely discredited (Hoffman, 1996; LeBlanc, 1996; Russell, 1995). Research concerning teachers' professional development with ICT demonstrates that there are a number of stages that teachers pass through on their way to becoming fully competent in the use of ICT (U.K: Comber, Lawson and Hargreaves, 1998; Dawes, 2001: USA: Dwyer, Ringstaff and Sandholtz, 1991; Hadley and Sheingold, 1993; Novello, 1989). However, again, these analyses do not explore the significance of the surrounding cultural influences that affect ICT implementation at the local level of the school. From NOF evaluations it is known that local factors affect take up.

3.3 CONTEXTUAL FACTORS EFFECTING TEACHERS' USES OF ICT

The following section is a review of research on factors affecting teachers' uses of ICT. This literature can be broken down into three areas: the first concerns research on factors that prevent teachers from using technology. The second on factors that encourage teachers to use technology, and third, the learning experiences of teachers in technology-rich and support-rich contexts. This review will evaluate the research in each of the areas identified above and specify where gaps exist in the research. The review will then specifically focus on the secondary school context and the impact of subject cultures on using ICT, which will be followed by a consideration of the importance of leadership for implementing ICT.

Factors Hindering Teachers' Uses of ICT

The aim of the review was to identify the factors known to inhibit teachers' use of ICT; these can be classified as either material or cultural, or a combination of both. Material factors refer to artefacts or equipment, like computers or finance. Cultural factors refer to the prevailing norms and values surrounding technology.

A number of authors (Cuban, 1988; Snoeyink and Ertmer, 2001) refer to two types of barrier; external, first-order barriers, such as lack of resources, lack of technical support, which can be classified as material barriers, and internal, second-order barriers, such as teachers' approaches, resistance to ICT, which can be classified as cultural barriers. It is important to consider the relationships between these factors and how *material* and *cultural interconnect*. Jones in his 2004 Becta review, although only identifying first and second order barriers, does argue it is the complex relationships between these factors that are in need of further research.

One cultural factor considered to hinder teachers' implementation of ICT was the *cultural connotations* surrounding technology. Somekh and Davies (1997) identified 'cultural alienation' as one of the main problems facing schools trying to promote the use of computers, because computing was seen as predominantly male and overly technical at that time. More recent forms of cultural alienation experienced by teachers pertains to pupils being perceived as digital natives, where pupils are seen to be more ICT savvy than teachers.

A number of earlier studies examined why teachers do not use ICT in their teaching and the following inhibitors were identified: (from Dupagne & Krendle, 1992; Hadley & Sheingold, 1990; Pelgrum, 2001; Rosen & Weil, 1995; Winnans & Brown, 1992):

- No prior computer experience

- Lack of computer availability
- Lack of teaching experience with ICT
- Lack of on-site support for teachers using ICT
- No ICT specialist teacher, to support pupils or staff
- Time investment required to successfully integrate ICT into the curriculum
- Lack of time to develop lessons that use ICT
- Lack of in-service training to develop teacher ICT skills and confidence
- Inadequate financial support

In contrast, Pelgrum (2001) conducted an *international* comparative survey of the obstacles to ICT integration. Pelgrum found that it was the *same factors* that *consistently* emerged across all the countries in the research (24 in total), namely the *lack of computers* and the *lack of ICT knowledge* among teachers. Interestingly, whilst Pelgrum's results were from a 'worldwide assessment', the UK was not a participating country. However, Opie & Fukuyo (2000) research in the UK did discover that inhibiting the use of ICT was also a lack of resources and training as Pelgrum had found.

Consequently, the research needs to investigate to what extent a lack of ICT resources affects teachers' use of ICT.

Relationships Between Barriers

The research on barriers to uptake of ICT by teachers was updated in 2004, with a Becta review by Jones. The findings support the above analysis and add further depth regarding the need to explore the relationships between the barriers. For example, the issue of *access* to resources was sub-divided in order to capture the complexity of this barrier. There are *different kinds* of access problems; from a *lack* of resources, to the *poor quality* of resources available, to noting that even where 'sufficient quantities of quality resources were available, teachers were still experiencing problems, as a result of the *organisation* of those resources' (p11). For example, if the majority of computers were housed in ICT suites that needed advanced timetable booking. Add to this *lack of technical support* and frequency of technical problems (due to poor quality hardware), then technical faults lead to lower levels of ICT use; reoccurring faults and the expectation of faults during lessons cause teachers to avoid using ICT (Jones, 2004, p16).

Similarly, the issue of *training* was complex with many factors inter-relating. Sub-barriers within training included, for example, the lack of *time* for training, which Snoeyink and Ertmer (2001) identified as a significant barrier; the lack of *pedagogical* training (Veen, 1993) and lack of *skills* training (Preston, Cox and Cox, 2000); these were also connected to the lack of *personal access* to ICT by teachers, which when overcome, was known to enhance teachers' confidence and competence (Cox, Preston and Cox, 1999). There is a great deal of literature evidence that states effective ICT training is crucial if teachers are to implement ICT (Kirkwood, Van Der Kyle, Parton and Grant, 2000), but this barrier is more complex than a singularly identified element.

Jones (2004) perceptively identified close relationships between many of the identified barriers to ICT use, leading to the recommendation for further research that investigates in more detail 'how they group together' (p4). Similarly, Jones (2004) suggests further research of the 'barriers to ICT use that are specific to secondary school teachers' and 'factors that enable the more widespread use of ICT' (p23), which provides post-hoc validation of the need for this research.

Teacher Resistance as a Barrier

Evans-Andris (1995) identified three styles of ICT use amongst teachers: avoidance, integration and technical specialisation. Her longitudinal research over an eight-year period found that the dominant style of ICT use among teachers was that of avoidance. Teachers typically distanced themselves from computers; whereas teachers engaged in 'integration' generally embraced computers and integrated the technology into their curriculum teaching. Teachers in this category were able to introduce a broad range of ICT applications and developed creative projects that integrated ICT. Teachers engaged in 'technical specialisation' embraced computers, as with the previous category, but viewed the technology as a challenge. However, whilst valuable, it should be noted that Evans-Andris' (1995) research focused only on elementary schools in one American city. This raises methodology issues of *transferability*, since the focus was only primary schools.

Given that 'avoidance' was the dominant style of ICT use among teachers in Evans-Andris' (1995) research, and was a trend identified in other research (Larner and Timberlake, 1995; Russell and Bradley, 1999) whereby teachers with little confidence avoided using computers, this again raises the issue of 'teacher resistance' (Jones, 2004). As discussed earlier, Dawes (1999) identifies the prevalence of the term 'teacher resistance' in the literature concerned with change and the implementation of ICT. Dawes (1999, 2001) argues that 'teacher resistance' is a convenient phrase that arises from a lack of understanding of the work that occurs in schools. In arguing for an alternative perspective, Dawes suggests that what happens during implementation of ICT, is that armed with their professional knowledge, teachers make informed and rational choices about the technology they are asked or required to use.

Dawes (1999, 2001) consequently argues that 'teacher resistance' is a stereotyping of the profession and not limited to academic literature, but also the media's portrayal of teachers and technology. In analysing adverts for computers, targeted at the education sector, Dawes identified unwarranted stereotypes of teachers with computers, with three common themes emerging: teachers as fearful, inept, and as less capable than pupils. Such cultural representations popularise the idea of teachers as technically inept, and keep 'alive and familiar' notions of a lack of ICT expertise in the teaching profession.

However, Robertson, Calder, Fung, Jones, O'Shea and Lambrechts (1996) argued in favour of the explanatory value of teacher resistance to ICT, and how this can be divided into several broad themes: resistance to organisational change; resistance to outside intervention; time management problems; lack of support from the administration; teachers' perceptions and psychological factors. Robertson *et al.*, (1996) investigated the ICT skills of teachers in a secondary school prior to the introduction to palmtop computers. Access to the palmtop increased the teachers' use of computers, particularly for administration. For example, class registers and recording pupils' assessment scores. However, a minority of teachers remained unconvinced about the potential of the computer and were dissatisfied with the quality of professional development in the use of the palmtop. Robertson *et al's.,* study (like others: Hoffman, 1996; LeBlanc, 1996) concluded that there is a *need for adequate and careful training so that teachers become knowledgeable of the range of uses* and benefits of ICT for professional practice.

In summary, from the research literature it would appear that the main barriers to using ICT are access to hardware, the suitability of software and the willingness (or resistance) of the teacher. However, Mumtaz (2000) rightly recognises how the research 'lends little insight into how identified barriers affect teachers in specific environments' (p49).

Factors Supporting Teachers' Use of ICT

Research that has examined the factors supporting teachers' uses of ICT has tended to be large scale, quantitative and American, with little qualitative research; of the latter which has been conducted, Veen's (1993) research was limited to only four teachers and Dawes (2001) and Loveless (2001) focus was on primary school teachers, whose working conditions are different to secondary schools.

Veen's (1993) case study examined the day-to-day practice of teachers from a Dutch secondary school who were implementing ICT in their classrooms. The sample consisted of four experienced teachers all of whom were novices with ICT. The teachers received in-service training to ensure computer competence. The teachers kept dairies of every computer-related activity, which were subsequently analysed. In addition to the diaries the teachers were interviewed at school every two to three weeks and their lessons were observed.

Veen's (1993a, 1993b) analysis revealed that *school factors* played an important role in how teachers made use of ICT, in particular the essential *technical support* offered (20 hours per week) and the *positive attitude of the head.* The most important finding from Veen's research was that if the software matched the teachers' pedagogy they used it. This is supported by the research findings of Agalianos *et al.,* 2001, who discovered that

Logo was 'more easily assimilated where it fitted with existing practice and caused no substantial changes in content or pedagogy' (p488).

The following large scale, quantitative studies all used survey data to identify the key factors that support teachers' adoption & integration of ICT: Becker, 1994; Hadley and Sheingold, 1993; Kerr, 1991; Sheingold and Hadley, 1990; all USA, and 'world wide' Pelgrum, 2001.

In America Sheingold and Hadley (1990) conducted a nationwide survey of teachers (from fourth to twelfth grade) and three key factors emerged where teachers were 'accomplished' in their use of ICT: first, teacher motivation and commitment to their own development as teachers and to their pupils' learning; second, the support teachers' experienced in their schools, and third, access to sufficient quantities of technology.

However, it should be noted that the teachers in Sheingold and Hadley's (1990) sample worked in schools where levels of ICT resources were twice the average; the teachers were comfortable with technology and used computers for many purposes. Teachers perceived that their classroom practices became more pupil centred with the integration of ICT in their curriculum. The researchers also identified that the source of the motivation for teachers to use ICT included gains in learning and using computers for their own professional development as teachers. Sheingold and Hadley (1990, p25) saw wider success among teachers if:

> ample technology, support, and time for teachers to learn the technology are provided, and if an academic and *cultural structure* exists to encourage teachers to take an experimental approach to their work. (Sheingold and Hadley,1990, p25) (Emphasis added).

Interestingly, these are all factors that generated barriers to integrating ICT, when there was a lack of technology, support and time, as identified in the previous section, which suggests validity across research studies.

Hadley and Sheingold's follow up research in 1993 identified five types of teachers in relation to ICT: 'enthusiastic beginners', 'supported integrated', 'high school naturals', 'unsupported achievers' and 'struggling aspirers'. What distinguished these teachers' from one another was: first, their experience and comfort with ICT; second, the age or grade level taught; third, the ICT applications used, and finally, the extent of support from colleagues and the school.

Importantly, this analysis indicated that all 'accomplished' technology-using teachers do not possess similar qualities, but rather a diverse and *complex combination of factors* have affected teachers' integration of ICT. This highlights the importance to attend to the multidimensionality of factors.

Hadley and Sheingold's (1993) work reinforces the complexity of factors involved in teachers' successful integration of ICT. Becker's (1994) work further reveals that other positive factors that encourage teachers to use ICT are: collegiality among teachers using computers in their school, resources for teachers' development, smaller class sizes and more formal ICT training.

However, these studies are American and quantitative. This is indicative of the majority of the research findings, which have tended to be large scale, survey based and American - leaving a gap with respect to qualitative UK research into teachers' integration of ICT: a point of omission that this research intends to redress.

A review of the research literature identifies a complex inter-play of factors that affect the integration of ICT, which suggests that a multi-site case study approach is required for this research, which is able to capture the range of complexity and differences between the factors identified in the literature; for example, schools with varying levels of technology and support, *in order to ascertain an understanding of the multidimensional relationships* between factors. It is important to adopt a *qualitative approach* that can *capture teachers' experiences of these factors as they negotiate ways of implementing ICT.*

Overview of Omissions in the Existing Research Literature

The studies examined present the *key factors* that encourage teachers to use ICT. From the research considered, it would appear that once these factors are in place, there are *stages* teachers go through in appropriating ICT, from little use to wider integration. However, the research findings do not provide an understanding of teachers' learning paths or professional strategies that teachers engage with to help them integrate ICT. In short, *how teachers' learn and create new knowledge about ICT for pedagogical purposes.*

An analysis of the factors that effect teachers' use of ICT do not, in and of themselves, reveal insight into teachers' professional development and learning processes for implementing ICT. This omission in the research is identified by Mumtaz (2000) and addressed by Dawes in her thesis (2001) and Loveless (2001). However, both theses focused on primary teachers and arguably the organisation of primary schools is different to secondary, such that the former are smaller and latter more fragmented. Given the importance of department collegiality and subject culture in secondary schools, it is necessary to conduct research into teachers' *professional development* and *learning processes* in the secondary school context.

Interestingly there was notably one UK study that addressed the secondary context, Underwood, Cavendish and Lawson (1996). However, this research urgently needs updating since it was the Labour government of the following year, 1997, that funded the National ICT Strategy, (NGFL and NOF), which provided the necessary infrastructure to develop ICT in schools. The government's ICT strategy aimed to supply schools with the key factors known to prevent ICT integration when absent, namely ICT resources in the form of computers and funding. This leads the research to explore how ICT resourcing has impacted on teachers' integrating ICT, and to ask what ICT resourcing is available to teachers and what configurations of equipment and access affect teachers' use of ICT? Followed by asking, in what ways and to what extent does the support of ICT technicians affect the integration of ICT into teachers' professional practice?

Teachers Learning To Use ICT In Technology-Rich Contexts

The following research focused on teachers learning to use ICT in technology-rich and support-rich contexts and analyses the importance of these factors, since when these factors are absent, there is significant hindrance in the integration of ICT. The analysis considers the most important research findings from Australia, America and the UK.

Stager (1995a; 1995b) conducted three types of 'support intervention' in a technology-rich Australian school district, which were: first, in-classroom assistance; second, a 3-day off-site programme; and third, a 2-day off-site problem solving sessions. 'Trainers' (who were classroom teachers that had successfully integrated technology) were deployed to work inside teachers' classrooms to observe, evaluate, model and answer questions about integrating the use of ICT. Off-site meetings, away from the school, offered time for peer collaboration, personal reflection and renewal of enthusiasm for learning about ICT and sharing of problems. Stager's analysis highlighted the importance of both on-site (use of familiar computers and software) and off-site (reduction of school pressures) professional development, adequate technical support and financial assistance for teachers purchasing a computer.

In the UK, Somekh's (1991) acclaimed PALM Project (Pupil Autonomy in Learning with Microcomputers) deployed an action research strategy for creating and sustaining teachers' development of computer skills. Teachers were asked to experiment with computer use in their classrooms, which proved to be very successful. At the start of the project the majority of teachers who worked with PALM had few computer skills and by the end the teachers considered themselves as confident. The theory of 'situated cognition' helps to explain teachers' learning in PALM since they acquired most of their computer skills in the classroom when working alongside the pupils. This research examined teachers learning to use ICT in technology-rich classrooms, clearly supplied by the PALM project. Hence, it must be noted that PALM provided a considerable amount of support for the teachers through three full time project officers, who provided participating teachers with both educational and technical assistance, as well as the financial resources for purchasing the technology-rich micro-computers for classroom use. Given the high level of resourcing involved, it clearly raises issues regarding the lack of transferability to all school settings.

Another widely acclaimed ICT research project was the 'Apple Classrooms of Tomorrow' (ACOT) as reported by Dwyer *et al.,* (1991) and Sandholtz *et al.,* (1997), which focused on technology-rich classrooms in America. In supplying the hardware, software and training, this programme of technology-rich intervention aimed to help teachers learn how to integrate ICT. This longitudinal research programme identified an *'instructional evolution'* through which teachers progressed. Teachers moved through the 'Entry phase', where teaching remained largely unchanged as teachers grappled with technical problems. In the 'Adoption phase' teachers began integrating ICT into their classroom practice and teachers' own personal attitudes changed, resulting in increased self-confidence with ICT. Finally, during the 'Invention phase', 'teachers experimented with new instructional patterns and ways of relating to students and to other teachers' (Sandholtz *et al.,* 1997, p44).

From this research, ACOT developed a new model of teacher development. This included week-long 'practicums' during the school year; four-week summer institutes; and support from project staff to visit departments during the year. This 'situated teacher development' programme enables teachers to observe ACOT classrooms, work in teams and plan technology-supported projects. The pre-requisites for teacher acceptance onto the programme included: possession of a classroom computer, two-teacher teams and support from the head teacher.

Clearly these research studies of technology-rich contexts have relied exclusively on special ICT *projects*, as a source of external funding for resources and support, which by their very nature of being one-off projects, are not nationally sustainable or transferable, as in the UK PALM project. Similarly, ACOT classrooms relied on Apple technological resources and ACOT support staff; the Australian case study relied on Stager's organisation and expertise for their project and the local school district's continued support and development of a technology rich context. Even though the research demonstrates the advantages of these intervention projects (teachers becoming motivated and integrating ICT), Mumtaz (2000) insightfully argues that there is a lack of research into the participants' technology use *after* such projects have ceased (e.g. months or years later). Each project's reliance upon external resources, coupled with their lack of research into participant teachers' technology use after leaving the project programme, fails to provide the evidence that these programmes will *sustain* technology use. Also the findings about in-service training are not generalisable to schools that do not have access to profuse technology, resources and technical support. In short, such research fails to explain the way ICT becomes embedded and institutionalised by teachers once initial projects have finished and initial funding and support have ceased.

However, such research does highlight the importance of teacher ownership of a computer (Stager 1995a, 1995b; Selinger 1996). This is also borne out by Becta's Multimedia Portables for Teachers Project in 1998. The research project sought to develop teacher competence and confidence in the use of ICT. Approximately 1150 teachers across 575 schools (primary and secondary) were provided with a multimedia portable computer together with Internet subscription and CD-ROM software. The research reported by Youngman and Harrison (1998) found that a very high proportion of teachers (98%) made effective use of their computer; a very high proportion made use of desktop publishing software, and 91% of teachers successfully used CD-ROM. The use of email (62%) and the Internet (76%) was high. The degree of computer literacy of many teachers increased to the extent that even relatively inexperienced teachers were quickly able to use their computer to evaluate software packages and select information to better suit their own curriculum purposes. Teachers' confidence and competence increased and teachers reported that their knowledge of ICT had grown 'substantially'.

Youngman and Harrison's (1998) analysis of the project showed that four conditions contributed to the success of the Multimedia Portables for Teachers:

1. Training: initial and immediate success with the technology through hands-on demonstration and the provision of user friendly hardware and software.
2. Ownership: personal ownership and exclusive use of a computer over an extended period.

3. Portability: the portability of the computer meant it could be moved between work areas and between home and school.
4. Technical support: a combination of formal and informal support - whereby the portability and ownership of the computer provided teachers with a greater variety of support from peers and other sources.

The findings of this national research were also largely supported by the evaluation of local portables for teachers scheme in East Sussex by Loveless and Williams (2000), Loveless and Stevens (2002). The research findings concluded that the Multimedia Portables for Teachers was very successful in leading to a significant enhancement of ICT skills for the great majority of teachers that participated. Similar findings regarding ownership and ICT participation were discovered by Selinger (1996) in a study of the effect of lending computers to 1000 trainee teachers (studying at a distance on a part time initial education course at the Open University) and DfES/Price Waterhouse Coopers (2001), which also highlighted the importance of teachers having personal access to ICT, increasing their confidence, competence and use.

Research literature omissions in technology-rich contexts

The above research has examined teachers' integration of ICT in technology-rich and support-rich contexts. Clearly what these studies do demonstrate is that is it a *combination* of factors that is critical to the integration of ICT, namely abundant *technology*, which provides *access* alongside *technical support*, with hands-on *training*. Also a key factor appears to be the role of 'situated cognition' in learning about ICT alongside *others*, with opportunities for discussion and reflection. This clearly has parallels with models of CPD that also accentuate the importance of 'situated learning' (Dawes, 2001) and 'communities of practice' (Loveless, 2001) that enables dialogue, analysis and evaluation of new skills and knowledge. However, whilst studies identify specific technological factors, pertaining to technical support, access and training, very little research analyses the *role of situated learning* and the *significance of belonging to a community of practice in relation to ICT:* in short, the *cultural dynamics* of change with ICT, particularly in the context of secondary schools.

Whilst technology-rich research projects are undoubtedly highly successful, as the findings demonstrate, the critical point remains that these projects for schools were externally funded one-offs. This raises issues of how the critical success factors emerging from the projects could ever be transferred to a national roll out.

Also, the level of sustainability once such ICT projects have ceased has not been researched. This leads to the important question: what needs to be in place once a project has finished in order to guarantee the embedding of the ICT, such that its use by teachers becomes habitual and institutionalised? Or - is a 'project' in this sense necessary - can integration be generated internally and/or from small beginnings? By exploring teachers' experiences of implementing ICT it maybe possible to identify what factors are necessary for the institutionalisation of ICT.

Summary of Factors Supporting and Hindering Teachers' Use of ICT

Research into teachers' use of ICT yielded interesting information about the barriers teachers face, the factors involved in supporting ICT use and the stages that teachers ascend when learning to use ICT for professional purposes. Some barriers included: lack of access to technology, lack of technical support and lack of appropriate ICT training. The quantitative survey research (Becker, 1994; Hadley *et al.*, 1990; Pelgrum, 2001; Sheingold *et al.*, 1993) that explored commonalties among 'accomplished' ICT-using teachers also identified significant factors such as: support and collegiality in schools; access to sufficient technology; commitment and resources for teachers' professional development and learning; provision for ICT training. However, these factors are not common among all 'accomplished' ICT-using teachers. This raises the question, which factors are the most important, or rather which combination, is needed to successfully integrate ICT into teachers' practice? What are we to understand about the relationships, if any, between the critical factors identified in previous research? And are any factors pre-requisite? And if there are relations between variables are these linear or non-linear?

As Mumtaz (2000) insightfully asks,

> Is it classroom management issues, inappropriate software, lack of awareness of what ICT resources are available, unfamiliarity with multimedia resources, or combinations of these factors that contribute to teachers' lack of appropriation and integration of ICT into their teaching? (Mumtaz, 2000, p62)

Mumtaz (2000) rightly argues that further research is needed to better understand the learning paths for teachers using ICT in context and to understand and act on the possible barriers they face. Mumtaz (2000) states that very few studies have addressed teachers' actual use in the classroom. Where studies have been of teachers' use they have focused much more on teachers' *personal* competence with ICT, rather than teachers' professional competence and pedagogical use, with the exception of Dawes (2001) and Loveless (2001), however, these two studies focused specifically on primary school teachers, as opposed to the secondary school context and how this shapes teachers' uses of ICT.

With respect to the secondary school context, one significant factor that has been under-researched until very recently is the role of leadership in relation to ICT. It is important to consider to what extent this factor supports or hinders teachers' integration of ICT.

School Leadership and ICT

Whilst the school improvement literature has recognised the importance of leadership, it is only recently that leadership has become recognised as a major factor regarding the implementation of ICT in schools (Lawson and Comber, 2004; Preston, 2004).

Lawson and Comber (1999, 2004) have made a strong case for recognising the relationship between integrating ICT and effective leadership. The role of leadership has been examined in two separate educational areas: the school effectiveness literature and ICT research; as Rudd (2002, p1) discovered 'reading across these two bodies of research literature one is left with the impression that these are two distinct, almost unrelated areas of educational research' (cited in Lawson and Comber, 2004, p146). Research into school leadership has 'neglected the role of ICT', and much of the research into ICT has 'underplayed the role of school leadership (ibid.). Consequently Lawson and Comber (2004) cite wide numbers of writers on leadership who have failed to refer to ICT (Dimmock and Walker 2002; Grace 2001; Morrison 2001; Neil *et al.*, 2001; Fidler 1997) and given that ICT represents a major challenge to schools, 'this omission is puzzling' (ibid.).

The Importance of Leadership in Implementing ICT into Schools

Schools that had effectively integrated ICT were identified as having a common feature, notably school leaders who had promoted and developed an ethos that embraced technological change. A whole-hearted support for ICT was found, which was signalled by leaders via school ICT policy, often:

> ...it was exemplified by a long-term view of investment in ICT in a climate of innovation and the recognition of the efforts of those involved in promoting good practice with ICT in the school, through rewards in terms of finance, status and power. (Lawson and Comber, 2004, p145)

NAACE (2001) argued that a supportive and forward-looking head was a critical component in the integration of ICT. Similarly, MacNeil and Delafield (1998) in the US identified the principal as essential to supporting ICT in their analysis of factors effecting computer use in schools. Yet Schiller (2000) found that the majority of school leaders are neither prepared for, nor recognise the significance of their role in the planning and management of ICT in schools (cited in Lawson and Comber, 2004).

Leadership and Continuing Professional Development

Earley, Evans, Collarbone, Gold and Halpin (2002, p64) pointedly observed, however, that the use of ICT by school leaders was 'currently under-developed in the majority of schools'. First, very little had been provided by way of professional development opportunities for headteachers with ICT, but, Lawson and Comber (2004) argue that this is not surprising, given the 'relative dearth of school leadership literature which considers ICT as an important school improvement issue' (p148). Yet, as Rudd (2002) argues, there is a clear link between ICT integration and the style of leadership associated with effective schooling, though this link has been largely ignored and is an omission cited by Rudd (2002) and Lawson and Comber (2004) alike.

The gap in CPD provision for headteachers was recognised in 2001 by the NCSL (National College for School Leadership), which set up a range of courses. The National

Professional Qualification for Headship (NPQH) for emergent school leaders, the Headteachers' Leadership and Management Programme (HEADLAMP) and the Leadership Programme for Serving Headteachers (LPSH). Most significantly was the launch of the Strategic Leadership in ICT (SLICT) programme in autumn 2001. The core objective was to encourage headteachers to examine the leadership implications of managing ICT in their own school. This involved developing a whole-school approach to ICT policy and developing a strategic approach ICT planning. An evaluation of the effectiveness of SLICT model of training, by Brundrett, Comber, Sommefeldt, McEune and Burton (2002), indicated that it has had a significant and positive effect.

Prior to SLICT, three different models of ICT training were identified in an analysis by Comber and Hingley (2004), who found varying historical approaches: an ICT skills approach, followed by the NOF training approach and then SLICT.

The first approach tended to focus on separate ICT skills and characterised most of the training received until the mid 1990s. Critically, Galton *et al.,* (1998) identified dissatisfaction and a lack of effectiveness with this approach, which led to training focusing more on relating ICT to classroom practice. The NOF programme was specifically developed to tackle the shift to teaching and learning, although there were some significant difficulties in implementation, as the earlier discussion raised (Preston *et al.,* 2004).

Comber and Hingley (2004) then identified a distinctive third approach that moves away from a 'traditional concentration on what *teachers* need to know to effectively integrate ICT' (p2) to how *school leaders* manage the implementation of ICT across the school. This clearly acknowledges the strategic importance of *leadership* as a shaping factor influencing the integration of ICT.

Strategic Leadership in ICT (SLICT)

The Strategic Leadership of ICT (SLICT) is the professional development programme for head teachers, jointly developed by Becta and NCSL, which focuses on developing effective strategic leadership skills for ICT integration across the school.

The outcomes of SLICT were an immediate impact on participant's *vision* for ICT and the development of school *policy* and *resources* for ICT, but 'much less subject to change were staff development' (Comber and Hingley, 2004, p1), although this aspect did not deter from the overall success of SLICT.

Leadership, ICT and School Culture

Becta/Pritchard (2005) identified that effective ICT practice in schools was occurring in pockets rather than as a 'distributed norm', that is, normal practice occurring in most schools and classes; a point supported by others who argue that ICT integration

> ...constitutes a considerable challenge for schools...If the integrative school is to become the norm rather than the exception, then an increasing number of school leaders will need to develop...a supportive leadership role... (Lawson and Comber, 2004, p145)

Further, Sherry and Gibson (2002) argue that innovative or integrative ICT practice will remain an isolated phenomenon, restricted to individual classrooms or departments, if the support of leaders is absent or withheld. Clearly leaders who support ICT engender a school ethos that facilitates the implementation of ICT. This highlights the importance of school culture, which was discussed earlier and found to be a significant factor that shaped the outcome of previous technological innovations.

Lawson and Comber (1999) identified *leadership* as a key factor in moving towards what they term the 'integrative' school: through 'the knowledgeable and enthusiastic involvement of the head teacher who is capable of promoting a *school ethos* that embraces technological change' (Comber and Hingley, 2004, p2). NAACE (2001) acknowledged a supportive head as critical to the integration of ICT. However, as Comber and Lawson (2003) and Earley *et al.,* (2002) perceptively highlight, such leaders had been in relatively short supply, certainly until the advent of SLICT, which was precisely what SLICT sought to address.

In addition to leadership, another factor that is important when considering the secondary school context in relation to ICT implementation is the dominance of subject cultures and departments in the organisation of secondary schools and how these shape teachers' uses of ICT.

The Secondary School Context: the impact of subject cultures on using ICT

A further criticism of research to date is that teacher development and use of ICT has been mainly conceptualised at the level of the individual teacher. There is nominal awareness in some research of the importance of *school culture* and the issue of *collegiality,* particularly at *departmental* level. This is specifically an issue for secondary schools with the existence of specialised curriculum subjects.

One important factor in how ICT is perceived and used by teachers is the 'community of practice' associated with their subject. The curriculum subject, within which Secondary school teachers' work, is a professional context within which teachers' practice occurs.

> Each subject community could be said to share a set of tools and resources; approaches to teaching and learning; curriculum practices; cultural values, expectations and aims. (Hennessy, Ruthven and Brindley, 2002, p3)

In the UK, the subject department acts as a basic social unit within secondary schools for the formal organisation of teaching and interaction between specialist teachers. In the UK, educational changes have led to departments playing a more active role in mediating between government policy (National Curriculum 1989) and classroom practice, on which the former impact (Acker, 1990; Hennessy, Ruthven and Brindley, 2002). This is achieved by departments developing detailed schemes of work and establishing departmental teaching polices. The indirect effect of these changes has been to increase *collegiality* within subject departments, thereby resulting in a sense of shared purpose in producing plans for delivering the curriculum, which identify appropriate resources (Cooper and McIntyre, 1996; Donnelly, 2000). This process will encompass the introduction and integration of ICT into subject teaching. In fact, research with Scottish teachers by Williams, Coles, Wilson, Richardson and Tuson (2000) discovered that the majority of teachers rely on their colleagues to keep them up to date with developments in teaching with ICT. Similarly, Rogers

(2002) in a large-scale study of science teachers, identified that one factor in the successful integration of ICT was *collegiality,* specifically learning from failures experienced by other teachers.

Hennessy, Ruthven and Brindley (2002) rightly identify that subject communities are inevitably subject to ongoing re-definition and adaptation. Like teacher positionings, subject communities are fluid and it is important to keep movements and frictions in play, since it is impossible to make static a situation that is inherently unstable due to shifting contexts and tensions. Subject communities are 'responsive to challenges and dilemmas encountered, to feedback received and to the reflection which participants within an established community of practice engage in' (Hennessy, Ruthven and Brindley, 2002, p3). As Lave and Wenger (1991, p82) argue 'conflict is experienced and worked out through a shared everyday practice in which differing viewpoints and common stakes are in interplay'. As Loveless and Ellis (2001) argue in relation to integrating ICT, the practice (that is, teachers' knowledge, understanding, skills, expectations, goals, beliefs and pedagogy) are developed over time, wherein the process entails developing ideas, experimenting, and critically reflecting on the process of developing new knowledge about how to use ICT for classroom practice.

Hennessy *et al.,* (2002) argue that little research has analysed how and why subject cultures differently affect teachers' use of ICT. The cited exceptions are Goodson and Mangan (1995) in Canada and Selwyn (1999a) in the UK. The former found that the main issue in implementing ICT into subject teaching could be described as one of 'congruence', that is, how closely the changes fit in with existing subject practices. Teachers were reluctant to adopt a technology that seemed incompatible with the norms of the antecedent subculture. Veen (1993a, 1993b) also found that if ICT fitted in with the teachers existing pedagogical practice, it was more likely to be adopted. Goodson and Mangan (1995) concluded that ICT is colonised differentially by subjects: ICT can colonise some curriculum areas, whereby the subject subculture co-opts and utilizes the computer, whereas for some subjects there maybe little colonisation.

This argument is followed by Selwyn (1999a), who asserts that traditionally computers were the domain of Maths, Science and Technology departments and this legacy may account for the ways in which different subject areas employ computers. Selwyn (1999a) also states that the computer is more congruent with some subject histories and more integrated into practice than others. To conclude, the research of Goodson and Mangan (1995) and Selwyn (1999a) argue that subject cultures are an important influence in explaining teachers' differential level of ICT implementation.

The very low use of ICT in subject teaching was exposed by Opie and Fukuyo's (2000) research. Their analysis concluded that the main hurdles to the use of ICT by subject areas have been lack of access to resources and lack of training (also noted by Hughes, 1997; Watson, 1997). This led Opie and Fukuyo (2000) to identify a major contradiction: the existence of legislation requiring trainee teachers to gain ICT experience in schools (DfEE 4/98) and yet the schools, pressurised by the demands of the national curriculum, were struggling to use ICT in the classroom.

In 2002, Hennessy, Ruthven and Brindley examined how secondary teachers of the core subjects of English, Mathematics and Science have begun to integrate ICT into mainstream classroom practice in UK schools. Drawing on an analysis of 18 focus group interviews in six schools they noted 'teachers' commitment to incorporating ICT was tempted by a cautious, critical approach to harnessing its potential' wherein only 'a gradual process of pedagogic evolution appeared to be taking place' (p1).

Teachers' positive approach to ICT for English subject teaching was found by Goodwyn, Adams and Clarke (1997), who discovered that the majority of English PGCE students and about half of serving English teachers welcomed the idea of ICT in English. The study involved tracking and interviewing a sample of student teachers and qualified English teachers. Goodwyn *et al's.,* (1997) analysis indicated that the teachers could be grouped into three distinct categories: the 'fearful', for whom ICT was a threat and seen as a cause of anxiety, which represented 16% of the teachers. The second category was the 'unresolved' who had strong mixed feelings and constituted 32% of the teachers. Finally the 'optimists' who were categorised as pro ICT and represented 50%

of the English teachers, who *believed* that ICT could significantly enhance English teaching. However, as a criticism, it should be noted that these research findings are based on *projections*, that is beliefs and hopes about what ICT can do for English teaching, as opposed to teachers' *actual usage of ICT* for English teaching.

This criticism is borne out by Hennessy *et al.*, (2002) whose empirical research on English teachers' use of ICT for subject delivery discovered that, in fact, ICT was not being used in the classroom. The researcher argues that Hennessy's findings substantiate the 'gap' between teachers' attitudes and beliefs, which may support ICT *in principle*, and the failure to actually deploy ICT *in practice*. Interestingly, Andrews (2000) accounts for why English as a subject may not have colonised ICT: 'the subversive, humanities-based, liberal and book-dominated culture of English... is undoubtedly a factor in the resistance of English teachers to new technologies' (p23, quoted in Hennessy *et al.*, 2002, p3). As Selwyn (1999a) argued: the computer is less congruent with some subject cultures and histories, and interestingly 'resistance' is again raised as an explanation, which refers to the culture of the subject and how this shapes teachers' practice.

Research therefore has to address what supports teachers integrating ICT into their subject teaching and is it possible to identify what enables the successful embedding of ICT in secondary school departments. Specifically, therefore the research will ask, what facilitates teachers' integration of ICT into their classroom practice and subject teaching? And what characterises the culture and dynamics of departments where ICT is embedded into subject teaching?

Consequently, to conclude from the research, the barriers to using ICT for *subject teaching* included a subject culture's resistance to ICT; teachers' lack of confidence, experience, motivation, time and training; lack of adequate access to technology and timetabled use of dedicated ICT suites; unreliability of equipment, and pressure to conform to curriculum and assessment demands. These contingencies provide an array of explanatory factors that account for differing levels of ICT implementation across secondary school subjects.

Also, there are *competing* internal and external cultural factors shaping teachers' practice: internal factors to the school and factors regarding the external subject community. The former may include school leadership and their creation of a supportive organisational culture that supports ICT (Williams *et al.*, 2000) and the external subject community, which may compromise ICT as a priority and consists of; subject inspectors; curriculum subject policy makers; national subject assessment strategies and a content-led statutory subject curriculum. Loveless *et al.*, (2001) argue that educators wishing to support the integration of ICT into subject teaching need to overcome the organisational and political obstacles arising.

Criticisms of the Subject Specific Analysis

The weakness of analysis at the level of curriculum subject departments, is that it fails to explain how it is that some subject departments have greatly integrated ICT in some schools and the very same subjects have not in other schools. For example, how it is that some science departments have fully embedded ICT and other science departments do not engage with ICT for subject teaching: it cannot be the subject alone that accounts for ICT use and pedagogic integration. However, hypothetically, analysis can be offered at the level of 'a community of shared practice', that is teacher habits and culture at department level, rather than the specific subject taught within those departments.

Pedagogy and ICT

An insightful and simultaneously damning analysis of ICT research by McCormick and Scrimshaw (2001) provides a clear rationale as to why further research must be conducted, since they observe a rather glaring omission:

> A variety of approaches have been used to analyse and support the integration of new technologies in schools, *but none of these pays sufficiently detailed attention to issues of pedagogy*. (McCormick and Scrimshaw, 2001, p38) (Emphasis added)

In support, Hennessy *et al.*, (2002) argue that increasing investment in technology infrastructures has not been matched by investment of time and resources to develop *pedagogy*: new ways of learning and teaching with ICT. The ImpacT2 interim report observed that 'relatively few teachers are integrating ICT into subject teaching in a way that...enriches learning or stimulates higher-level thinking and reasoning' (2001, p14). Of the few teachers that do achieve this, they tend to be those with an innovative pedagogic outlook. Rogers (2002) argues that limited resources were less of an obstacle to teachers using ICT in the classroom than teachers' reluctance to abandon their existing pedagogy (also found by Veen,1993a,1993b and Stronach *et al's.,* (2001) observation of teachers preferred 'ecologies of practice', as a factor that mitigated against change in teachers' practice). Similarly, Goodson and Mangan (1995) in Canada found very few examples of teachers endorsing the rhetoric about ICT revolutionising teaching or fundamentally reworking their lesson plans and pedagogy. Instead they found 'evidence of re-shuffling the pack of cards, but little evidence of anybody trying a new game' (p119).

Cuban's (2001) study of Californian schools with a long history of ICT confirms that even in technology-rich contexts such as Silicon Valley, use is not widespread. Moreover Cuban observed that teachers were simply using ICT to do what they have always done, although in fact they often claim to have changed their practice. This is supported by Deal's insightful observation that 'we have invested millions of dollars only to watch new skills disappear amidst old routines' (1990, p6). The persistent prevalence of 'old routines' or preferred practice appears to militate against change afforded by ICT.

Hennessy *et al.,* (2002) argue one possible reason why teachers' classroom practice has not changed significantly is that historically teachers have had little say in designing and implementing development plans for using ICT within their schools, nor for defining ICT's role within subject curricular. Moreover, this is especially true in the UK (and other countries) with a centralised curriculum. 'Imposed policy decisions often appear unresponsive to teachers' perspectives and their workplace constraints' (op.cit., p2). Again, this highlights the tension with changes that are externally imposed upon the profession, as opposed to coming from below, with a sense of ownership. Acker (1990, p267) observed that a lack of motivation comes when changes are superimposed rather than coming from teachers' own needs. Consequently research has revealed that changes in teachers' pedagogical thinking have been slow and measured (Hennessy *et al.*, 2002; Kerr 1991).

The research omission into how teachers create new ICT professional and pedagogic knowledge, was insightfully observed by McCormick and Scrimshaw (2001), who argued, as previously stated, that research into the use of computers in education has given *insufficient attention* to pedagogy and teacher knowledge.

McCormick and Scrimshaw (2001) identified three 'traditional' research approaches to ICT integration in schools, which all fail to address the issue of pedagogy and teacher knowledge. First, there are those ICT research approaches that have examined innovation models, where the use of ICT is characterised in stages: for example, 'entry, adoption and invention', Sandholtz *et al.,* (1997), or 'localised, coordinated, transformative, embedded and innovative' NCET (1996). Second, there are those ICT research approaches that have examined the complexity of the technologies themselves, and third, those that have focused on the computer-learner interface. Of these approaches, it is the latter focus on the computer-learner interactions that has represented the bulk of the research: as also observed by Mumtaz (2000). Importantly this approach has often assumed (wrongly) that the software and learner/pupils interactions are isolated from the *surrounding pedagogy* of the classroom.

> Research has shown that, even with highly 'self-contained' types of software such as Integrated Learning Systems, the success of the use of ICT is dependent upon the way in which the other elements of the classroom pedagogy relate to it. (McCormick and Scrimshaw, 2001, p38)

In 1997 Scrimshaw examined ICT in schools in terms of how knowledge, the learner, the relationships with other learners and the role of the teacher is viewed. In 2001 he offers a more sophisticated approach that extends the analysis to incorporate contemporary views of learning, knowledge and pedagogy. These views are referred to as social constructivist and situated perspectives, which emphasise the social aspects of learning, through ideas such as participation in communities (Lave and Wenger, 1991). Consequently teachers' are seen as creating identities by learning to participate in communities. Knowledge, as seen from this perspective, is not construed as an object acquired by individual learners (in the way cognitive constructivists would argue, but is a social process of knowledge construction. Meaning is created through participating in social activity' (McCormick and Scrimshaw, 2001, p39). The traditional approaches to ICT integration need to respond to these contemporary views of knowledge, and McCormick and Scrimshaw's (2001) analysis rightly identifies a gap in the research.

Yet there were attempts in the UK to relate pedagogy and the use of ICT in the work of Moseley, Higgins and Newton (1999) and Pachler (1999), but McCormick and Scrimshaw (2001) argue these do not explore pedagogy in terms of the latest theories of learning. Hence, research to date has failed to answer the key question: *how is it that teachers learn to integrate ICT into classroom practice and change pedagogy, through creating new knowledge of how to teach with ICT?* An understanding of teacher knowledge needs to acknowledge teachers' multiple identities as subject expert (subject knowledge), subject teacher (school knowledge) and teacher (pedagogical knowledge) (op.cit., p43). Consequently 'an exploration of teacher knowledge is necessary in order to indicate the way in which teachers need to change, which has implications for implementation strategies' (op.cit., p40).

With respect to integrating ICT, McCormick and Scrimshaw (2001) contend that ICT can affect practice on three levels, namely where existing practice is made more *efficient* or effective, where it is *extended* in some new way, and where it is *transformed.* In the UK the approach of government reveals a strong preference for the first level; an 'efficiency' level of ICT implementation.

Whilst McCormick and Scrimshaw's (2001) work is insightful conjecture rather than drawn from empirical teacher interviews, interestingly where there is research data of teachers' actual use of ICT, it too shows that teachers are using ICT only on the first and second level. For example, Hennessy *et al.,* (2002) found that on the whole ICT was enhancing practice, rather than transforming it. Interestingly, despite 'an almost unanimous expression of enthusiasm' with teachers for using ICT for subject teaching, Hennessy *et al.,* concluded that 'there is limited evidence for a fundamental impact on the nature and goals for subject practice' (p14). These findings are in line with the other literature reviewed, which indicated that teachers have tended to 'assimilate' use of ICT into *existing practices* rather than to 'accommodate' in terms of *changing their pedagogy* (Goodson and Mangan, 1995; Kerr, 1991; Watson, 1993). Consequently, teachers do seem to be using ICT largely to support and enhance existing classroom practice (Hennessy *et al.,* 2002; Noss and Pachler, 1999), rather than transforming pedagogic practice.

Summary of Pedagogy and ICT

A significant finding from the literature review is exposed by McCormick and Scrimshaw (2001, p41), who argue that the ICT research community have not kept up to date with learning perspectives that emphasise the *social dimension* of how teachers learn and professionally develop to create new ICT pedagogic knowledge. Although an exception, however, is Dawes (2001) and Loveless (2001), who examined teachers' situated learning in relation to ICT in primary schools, this does not account for ICT implementation in secondary schools. When it comes to teachers' knowledge, learning and professional development in secondary schools, it is evident that *subject identity and knowledge* are central. Therefore it is necessary to consider the way in which subject cultures affect pedagogy and ICT implementation.

Conclusions from Reviewing the Literature

In analysing the literature on teachers' use of ICT in secondary schools, a more complex picture has emerged than is implied by some of the prior research (Lagrange *et al.,* 2001). Hennessy, Ruthven and Brindley (2002) argue with respect to ICT that the gradual influences of its use on pedagogy are more complicated and significant than *simply the number of computers* installed by schools. In short, the quantitative measures of ICT in schools (with which statistical surveys are concerned) *over simplifies a complex picture* concerning teachers' evolving pedagogy with ICT. A meta-analysis of over 600 studies on ICT in education concluded that

> research struggles to tackle the complexity of the integration of the evolving technologies. (Lagrange *et al.,* 2001, p122)

One way of illuminating the complexities is to recognise that teachers' use of ICT is undoubtedly influenced by the working contexts of school/department and subject cultures in which teachers find themselves variously positioned, and that this area is seriously under researched. In particular what is omitted in the research is how teachers create new knowledge of how to implement ICT for professional practice.

One factor in this complexity is the considerable *variation* between individual *teachers, departments* and *schools* concerning different levels of ICT implementation (DfES, 2001; Ofsted, 2001). This highlights the need for further research into the *complexities of change*, in order to understand these variations concerning teachers' use of ICT for professional practice.

> Changes in the use of ICT require engagement with teachers concerning their views of knowledge (subject, school and pedagogic). Views of change that imagine that all that is necessary is to demonstrate that ICT is effective, and show teachers how to use it (the rational-empirical view of change) underestimate the amount of change in understanding and beliefs that teachers may have to undergo (requiring a normative-re-educative view of change). *It follows that there is a need for clearer thinking about the nature of change in relation to the use of ICT.* (McCormick and Scrimshaw, 2001, p54-5) (Emphasis added).

Educational change with ICT is understood to be dynamic and multi-dimensional and changes in teachers' thinking and practice are understood to be epistemological and behavioural. This research aims to create an understanding and 'clearer thinking' on the nature of change in relation to the use of ICT by teachers for professional practice.

3.4 SUMMARY

The following critical points were analysed from a review of the literature on ICT in education:

1. A majority of research on ICT comes from America and therefore reflects a distinctive American educational culture, as Hennessy *et al.*, 2002 note. This was also observed by the researcher, whose analysis of a special double issue of an academic journal dedicated to 'change and technology' found only two papers from the UK, and both of those focused on Higher Education, not schools (JITTE, 1996,

Vol 5 nos 1-2). So, in this example, 84% of the research was American, a trend largely replicated across the field.

2. The existing literature on ICT and education reveals a number of omissions, which this research attempts to address. Much of the research literature is based on quantitative surveys (Becker, 1994; Hadley and Sheingold, 1993; Kerr, 1991; Pelgrum, 2001; Sheingold and Hadley, 1990). Hennessy *et al.*, (2002) rightly argue that such quantitative studies represent the scale of computer use and the kinds of applications used, but *not* about the nature and appropriateness of that use; nor, the researcher would add, the *processes* by which teachers come to integrate ICT into their professional practices.

3. Similarly there are in-depth, qualitative research studies of technology-rich contexts (Stager 1995a, 1995b, in Australia; Somekh, 1991 in UK; Dwyer *et al.*, 1991 and Sandholtz *et al.*, 1997, in USA), but Hennessy *et al.*, (2002) accurately argue, in the UK there is 'little research concerning integration with established practice in mainstream schools' (p1).

4. McCormick and Scrimshaw (2001) argue that the bulk of research has been on the computer-learner interface; with a predominant focus on pupils' difficulties and learning with ICT, so that references to the 'teacher dimension' are sparse: also observed by Mumtaz (2000). There is a lack of research focusing on teachers' acquisition and development of new knowledge about ICT for professional practice and the *processes by which teachers come to implement ICT.*

5. Traditional research approaches to ICT have paid insufficient attention to pedagogy and *teacher knowledge*. By focusing on computer-learner interactions, the surrounding pedagogy has been ignored, as has *how* teachers come to create new knowledge regarding *ICT and subject teaching.*

6. Traditional approaches to ICT have failed to keep up to date with contemporary views of learning and knowledge acquisition; specifically the *social dimension* of

learning, the role of *situated learning* and *communities of practice* (critical points noted by Dawes, 2001; Loveless, 2001; McCormick and Scrimshaw, 2001).

In short, the research to date has seriously underestimated the complexity of change required in the knowledge base of teaching with respect to the integration of ICT for teachers' professional practice.

The next chapter outlines the methodology that informs this research, which attempts to address the omissions identified above.

CHAPTER 4
RESEARCH METHODOLOGY

4.0 INTRODUCTION

The purpose of the research is to explore teachers' experiences of implementing ICT as an example of a government policy initiative in education. The research methodology employed is shaped by the research paradigm that is used. This chapter examines the choice of methods made, which entails a description of the methods and why they were adopted. The framework for analysis is also considered, which involves a discussion of the processes of analysis as outlined by a grounded theory approach. The criterion used for selecting the sample of schools and teachers is discussed, alongside ethical considerations which needed addressing in the research.

4.1 RESEARCH PARADIGM

> A research paradigm is a network of coherent ideas about the nature of the world and the functions of researchers, which conditions the patterns of their thinking and underpins their research actions. (Bassey, 1995, p. 12)

Research in education has had strong links with the research traditions of the social sciences, (Bassey, 1995; Cohen and Manion, 1994; Hitchcock and Hughes, 1995; Marshall and Rossman, 1995), which have different paradigms and philosophical foundations that translate into different propositions about social reality.

Two major paradigms, that is, complete ways of thinking about educational research can be identified: the normative (positivist) paradigm and interpretive (anti-positivist) paradigm, which have differing accounts of reality. To the former, reality is external to the researcher and can be investigated by the methods of the natural sciences (quantitative). For interpretivists, reality is socially constructed and the researcher's central endeavour is to understand the subjective world of human experience. What is important is to discover the meanings and interpretation of events and actions, with the aim of retaining the integrity of the phenomena being investigated and to understand from within. The data collected by interpretive researchers are usually acquired through a qualitative methodology. Marshall and Rossman (1995, p. 39) state that:

> The most compelling argument is to stress the unique strengths of this paradigm for research that is exploratory or descriptive, that assumes the value of context and setting, and that searches for a deeper understanding of the participants' lived experiences of the phenomenon. (Marshall and Rossman, 1995, p. 39)

For interpretivist researchers the focus is attempting to understand participants interpretations of the world around them. Consequently 'theory is emergent and must arise from particular situations; it should be 'grounded' on data generated by the research act. From an interpretive perspective the hope of a universal theory gives way to multifaceted images of human behaviour as varied as the situations and contexts supporting them' (Cohen and Manion, 1994, p. 37).

The research has been conducted within an interpretative paradigm and utilised a qualitative methodology. A qualitative methodology is necessary because in this study it is contexts, processes and relationships that require examination. Therefore a qualitative approach offers 'sensitivity in picking up everyday facts about social structures and social systems' (Glaser and Strauss, 1967, p15).

Whilst working within an interpretative paradigm and adopting a qualitative methodology, the research was conducted according to the principles of grounded theory. The Strauss and Corbin (1998) definition of grounded theory is included here since this informed the research process with respect to the collection and analysis of data.

> A grounded theory is one that is inductively derived from the study of the phenomenon it represents. That is, it is discovered, developed, and provisionally verified through systematic data collection and analysis of data pertaining to that phenomenon. Therefore, data collection, analysis, and theory stand in reciprocal relationship with each other. One does not begin with theory, then prove it. Rather, one begins with an area of study and what is relevant to that area is allowed to emerge. (Strauss and Corbin, 1998, p23)

Research Strategy: the case study approach

The research strategy employed is that of a multi-site case study. The case study approach is the most effective research strategy to use when the aim is to understand in depth complex situations, or aspects of them and the interaction of people, events, structures and processes (Yin, 1994; Marshall and Rossman, 1995; Gomm, Hammersley and Foster, 2000; Denscombe 2003).

The purposes of the multi-site case study in this research are:

- analysis, explanation and the development of theoretical understanding of an issue (implementation) in one setting, i.e. the case (school)
- to use multiple case studies of similar contexts (schools) to develop theory across several cases, which is to engage in the 'constant comparative method' (Glaser and Strauss, 1967)
- to develop theory which may be generalisable (the use of multiple case studies may improve the generalisabilty of the theoretical explanations).

However the extent to which generalisabilty is a goal of the research is dependent upon the philosophical *paradigm* which frames the research. According to the grounded theory approach generalisabilty does not have to be the goal, rather qualitative researchers aim to produce what Geertz (1973) calls *thick description* - that is a rich and detailed account of a culture (in this case the professional culture of teachers interacting with ICT implementation). Guba and Lincoln (1985) argue that a thick description provides the basis for others to make judgments about the possible transferability of findings to other cases. The issue of generalisabilty is critically discussed latter in the chapter.

The decision to use the case study approach is a strategic decision and Denscombe (1998, p32) argues it 'does not dictate which methods must be used'. Indeed, the strength of this research strategy is the variety of methods that can be used. 'Any impression that case study research is a method for collecting data is wrong. Properly conceived, case study research is a matter of research strategy, not research methods' (ibid.).

It is necessary to state that for this research, 'case study' is conceived as a research *strategy* (Denscombe, 2003), which incorporates a qualitative approach to data collection with a range of methods namely, interviews and observations, alongside the use of documentary evidence and questionnaires, whereby the latter has a quantitative element.

Denscombe (2003) identifies three key reasons for the adoption of the case study approach. Firstly a case study can offer an *in-depth study*, secondly it enables *a focus on relationships and processes* and, it can provide *multiple sources* and *multiple methods.*

> What the survey approach cannot do, but case study can, is to study things in detail. The main benefit is to *deal with the subtleties and intricacies* of complex social situations. (Denscombe, 1998, p39)

The case study enables understanding of *relationships* and *social processes* that is denied to the survey approach. The real value of case study is that it offers the opportunity to explain *why.*

4.2 SELECTION OF CASES

The *research strategy* employed was that of a *multi-site case study* that utilized a *qualitative* methodology in order to capture the lived experiences of teachers as they negotiate the processes of ICT implementation in their professional practice in schools.

The seminal work of Yin (1994) on the case study approach informed the research strategy with respect to data collection. Yin (1994) identified three principles of data collection, which can help to establish construct validity and reliability of a case study: principle 1, use multiple sources of evidence; principle 2, create a case study database and principle 3, maintain a chain of evidence.

The use of multiple sources of evidence is the first of Yin's (1994) three principles of data collection, which can help to deal with the problem of establishing construct validity and reliability of a case study. This principle was adhered to in the following way: the research design built in *multi-site* case studies, which allowed for evidence from more than one case to be collected namely, multiple examples of cases (ICT implementations across schools), *and* also multiple sources of evidence collected *within* each case study; from teacher interviews, questionnaires, observations and school documents. This allowed for a level of triangulation necessary for establishing validity and reliability.

A case study database was established in order to adhere to Yin's (1994) second principle. The research was carefully recorded and data analysed, in the spirit of an audit trail, in order to maintain a chain of evidence; the third principle. The tables below provide an overview of the process.

Table 4.1 Methods for Data Collection

Sample for phase 1 and 2 combined	**Multi-Site Case Study: Methods for Data Collection**			
12 case study sites (11 schools, 1 After School Study Support Centre) 111 teachers and 2 ICT trainers (NGfL regional coordinator; ATP NOF trainer) **113 respondents**	**Interviews** unstructured and semi-structured	**Observations** structured	**Documents** case study school documents and visual images	**Questionnaires** Internet online version and paper version
	Research Journal to record field notes			

Table 4.2 Phase 1 Sample

School	**Type**	**Age Range**	**No. Teachers interviewed / observed**	**Total No. Interviews** (key informants interviewed more than once)
F	Secondary	11-18	7	10
A	Secondary	14-18	13	14
D	Secondary	11-16	16	24
B	Secondary	11-18	13	18
C	Secondary	11-18	11	11
E	Primary	4 - 11	3	4
Totals	**6 Schools**		**63 Teachers**	**81 Interviews**

Table 4.3 Phase 2 Sample

School	Type	Age Range	No. Teachers interviewed / observed	Total No. Interviews (key informants interviewed more than once)
F from phase 1	Secondary	11-18	24	39
A from phase 1	Secondary	14-18	7	12
D from phase 1	Secondary	11-16	9	10
G new to phase 2	Secondary	11-16	7	18
H new to phase 2	Secondary	11-16	4	7
I new to phase 2	Secondary	11-16	1	1
J new to phase 2	Primary	4 - 11	6	6
M new to phase 2	Secondary	11 - 18	1	1
L new to phase 2	After School Study Support Centre	5 - 16	1	2
NGfL regional co-ordinator	Higher Education	NA	1	1
NOF ATP provider	Higher Education	NA	1	1
Totals	**9 case study sites** (8 schools, 1 Study Support centre)		**62 Teachers**	**98 Interviews**

Table 4.4 Total Sample

Total Sample	No. of schools	No. of teachers	No. of interviews
Phase 1	6 schools	63 teachers	81 interviews
Phase 2	9 case study sites (8 schools and 1 study support centre)	62 teachers	98 interviews
Totals	12 case study sites (11 different schools)	**113 different teachers**	**179 interviews**
Explanation	3 schools from phase 1 were used again for phase 2 (there were 6 new case study sites added to phase 2)	12 teachers from phase 1 were in the phase 2 sample, and were interviewed in depth for phase 2	

Total number of respondents

Phase 1 had 63 respondents and phase 2 had 62, giving a total of 125, however, 12 teachers from phase 1 were also used in phase 2, therefore there were 113 respondents altogether. (See appendix G for the complete details of the sample used.)

Total number of case study sites

Teachers from across 12 case study sites were interviewed, of which 11 of these sites were visited by the researcher and used for the research.

Table 4.5 Sampling and Phases of the Research

Phase 1	Opening sampling	6 schools	63 teachers
Phase 2	Selective sampling	9 case study sites (8 schools and 1 study support centre)	62 teachers
Phase 3	Discriminate sampling	6 case study sites (5 schools and 1 study support centre)	35 teachers

For the purposes of this research the idea of theoretical sampling, which is a defining feature of grounded theory (Charmaz 2000), was adapted. In fact the *adaptation* is in keeping with Strauss and Corbin's conception of grounded theory, since the 'rigid adherence to any procedure can hinder the analytic process and stifle creativity' (Strauss and Corbin, 1998, p203).

The crucial characteristic of theoretical sampling is that 'rather than being predetermined before beginning the research (it) evolves during the process. It is based on concepts that emerged from analysis and that appear to have relevance to the evolving theory' (Strauss and Corbin, 1998, p202)

Sampling with respect to the research needed to occur on two levels with respect to (a) the choice of *schools*, and (b) the choice of *teachers* located within each school. Sampling also occurred in two phases; the first open and exploratory, the second selective and focused.

Phase 1: opening sampling

The aim of phase one was to sample a range of schools and teachers, to keep the selection process open to all possibilities. Sampling is open to those teachers and schools that will provide the greatest opportunity for discovery.

> At first, the investigator is open to all possibilities during interviews, during observations, when reading documents, and so on and will want to take full advantage of every opportunity that comes up, exploring each as much as is feasible. To ensure openness, it is advantageous not to structure data gathering too tightly... (Strauss and Corbin, 1998, p203)

Phase 2: selective sampling

'Sampling proceeds on the basis of theoretically relevant concepts (categories)' (Strauss and Corbin, 1998, p210) and the aim is to develop categories in terms of their properties and dimensions.

In data gathering the focus was on sampling schools that enabled the researcher to identify significant *variations*, which would allow for the development of categories in terms of their properties and dimensions. This is the constant comparative method (Glaser and Strauss, 1967).

Strauss and Corbin (1998) argue that the act of purposively choosing sites based on maximising differences among emerging concepts is deductive and presumptive, since one can only presume that they will find the dimensional variation required. 'In reality, the analyst's hunch that a place will provide that added dimensional variation might not be borne out' (Strauss and Corbin, 1998, p210).

However, the advantage of this research was that the first phase of open sampling had identified a number of schools that offered variational differences. Hence, first, the sample needed to be enriched, if the categories were to be fully developed, and so a number of additional schools were added to the sample in phase two. Then, second, it was necessary to interview an ICT expert who had knowledge of the schools in the sample area with respect to the different levels of ICT integration in the schools, in order to enrich the sample.

The person who had this 'insider knowledge', since it is actually hard to ascertain this kind of knowledge from the outside, was the coordinator of the NGfL programme for the region. An interview with the NGfL coordinator was secured and enabled a large range of schools to be considered that varied in their ICT development. At this stage the sample needed to be large, because, for each letter written requesting access, inevitably there would be those that would decline access.

Table 4.6 Theoretical Sampling Adapted for Phase 2

1	Identifying new sites (schools) = via an interview with the regional NGfL coordinator interviewed
2	Identify large sample of schools with differing levels of ICT integration
3	Letters to Headteachers of each school
4	Acceptance from Headteacher to participate in the research and access negotiated
5	Phase 2 sample confirmed and additional new schools identified

Phase 3: discriminate sampling

Discriminate sampling is highly selective; choosing schools purposively to examine differences. Sampling becomes very deliberate with the aim to integrate the categories along the dimensional level to form a theory.

In discriminate sampling the researcher chose schools that would maximise opportunities for comparative analysis. The purpose was to saturate categories and this involved returning to previous schools, teachers and documents as well as visiting new schools to gather data necessary to saturate categories. 'Only the categories that stand up to this rigorous constant comparison process become part of the theory' (Strauss and Corbin 1998 p212).

When building theory it is necessary to gather data until each category becomes saturated (Glaser and Strauss, 1967, pp 61-2, 111-112). Hence sampling continued until theoretical saturation, that is until no new relevant data emerge regarding a category; the category is well developed in terms of its properties and dimensions, and the relationships among categories are well established and validated. Validation of analysis is a crucial part of theory building and in phase three, entailed respondent validation.

Selection of cases for study

The rationale for selecting schools for phase 2 was to provide a sample of schools that were varied in their level of ICT development, so it would be possible to compare schools that had recently started to develop ICT, alongside other schools that were much more developed. This would provide a cross-section of schools in the sample that reflected different stages of ICT development and would enable the categories that emerged in phase 1 to be investigated in more depth with a wider sample of schools.

Criterion for school selection

The criterion for selecting schools was taken from the National Council for Educational Technology (1996) 5 point scale of school ICT development. NCET conducted research to identify the range of ICT uses being made by schools and a matrix was developed to 'help schools identify their current stage of ICT development' (1996, p24). The 5 stages ranged from early ICT development to mid, late and advanced development, with each stage having a descriptor and a set of characteristics outlining ICT use. This provided a set of criteria from for identifying ICT development in schools (see table 4.7 below), which then enabled an appropriate selection of schools that covered the 5 stages across the matrix (NCET, 1996, p.23-24). Becta, which replaced NCET, continued to develop the matrix, though this has since been superseded by the SRF (Self Review Framework), which enables schools to identify their level of ICT maturity from 2006.

Table 4.7 Criterion for school selection

	1	2	3	4	5
Stage of ICT Development	**EARLY**	**EARLY – MID**	**MID- LATE**	**LATE**	**ADVANCED**
Descriptor	Localised	Co-ordinated	Trans-formative	Embedded	Innovative
Characteristics of ICT use	Experimenting with ICT use, but practice is not yet co-ordinated	Use co-ordinated, but not all teachers equally convinced about ICT	Agreed ethos and commitment made to ICT	Experiences are shared and teachers aware of different types of use	Schools functioning has been significantly altered
Phase 1	School C	-	School D	School B, E	School A, F
Phase 2	School M	School H	School D	School G	School A, F, J

Strategies for identifying suitable schools (using the NCET criteria)

This section describes the process by which schools were selected to participate in the research according to the criteria above. First, this necessitated gathering data about schools regarding their use of ICT. This was achieved via six strategies, which were employed to identify suitable schools that would cover the range of stages of ICT development from 1 to 5. Primarily, it was necessary to interview ICT experts who could recommend schools across the range and this was achieved by:

1) Interviewing the NGfL Regional Coordinator, whose working knowledge enabled him to identify the level ICT use within a range of schools in the geographical area in which the research was to be conducted.
2) Additionally, two regional NOF ATPs (Approved Training Providers) were asked to recommend schools that reflected the range of ICT integration from early to advanced on the criteria specified above.
3) For identifying advanced ICT using schools, schools listed on the European Network of Innovative Schools (ENIS) were selected and asked if they were willing to participate in the research. This led to the selection of school A in phase 1, which as a successful example, was also used in phase 2.

4) Similarly, to increase the number of advanced ICT schools, schools involved in the Microsoft 'Anytime Anywhere Learning' Project were identified, which led to school F being selected (for phase 1 and 2) and school J as a further example of an advanced school being selected for phase 2. This would maximise opportunities to densify categories, by examining similarities and differences (i.e relational and variational sampling).

5) For additional schools, the British Educational Communications and Technology Agency (Becta) was asked to recommend some primary and secondary schools, which their records showed as having different levels of ICT practice according to the criteria.

6) Further schools were known to the researcher through prior research projects, for example the EUN project (European Schoolnet Multimedia MMII) and these were considered in relation to those already identified above.

By combining all the above strategies, a range of schools could then be considered and the most appropriate selected in order to cover the different levels of ICT use from early to advanced stages of development.

School Sample: identifying stages of ICT development from 'early to advanced'

NCET (1995, 1996) identified approaches to ICT use for each stage of development. Schools at an early stage of development tended to focus on the use of ICT for specific tasks, which NCET identified as 'planned use' (1996, p17). 'Teachers plan particular activities at particular times, and rarely use ICT in other ways' (ibid.) ICT is used to undertake specific tasks and this type of approach was commonly found in schools at Stage 1. At a later stage of development, ICT is regarded more as a resource, 'to be used when the occasion demands' (op.cit., p18) and is common at Stage 2. At a later stage still, ICT becomes 'an integral part of the teaching and learning environment' (ibid.) and by this stage, teachers are comfortable with ICT, 'they know how ICT can be used, and can introduce it as and when the need arises' (ibid). This approach is commonly found in schools at Stages 3, 4 and 5. The selection of schools that cover the range of stages are outlined below.

Table 4.8 Phase 1 school sample: stage of ICT development

School	Type	Age Range	Stage of ICT development	Level	Descriptor
A	Secondary	14-18	Advanced	5	Innovative
B	Secondary	11-18	Late	4	Embedded
C	Secondary	11-18	Early	1	Localised
D	Secondary	11-16	Mid-Late	3	Transformative
E	Primary	4-11	Late	4	Embedded
F	Secondary	11-18	Advanced	5	Innovative

Table 4.9 Phase 2 school sample: stage of ICT development

School	Type	Age Range	Stage of ICT development	Level	Descriptor
A (P1)	Secondary	14-18	Advanced	5	Innovative
D (P1)	Secondary	11-16	Mid-Late	3	Transformative
F (P1)	Secondary	11-18	Advanced	5	Innovative
G new	Secondary	11-16	Late	4	Embedded
H new	Secondary	11-16	Early - mid	2	Co-ordinated
I new	Secondary	11-16	Late	4	Embedded
J new	Primary	4 - 11	Advanced	5	Innovative
L new	After school study support	5-16	Late	4	Embedded
M new	Secondary	11-18	Early	1	Localised

Selection of schools for phase 2 using categories found in phase 1

The sample of schools for phase 2 needed to be selected in order to probe in more depth the categories/sub-categories found in phase 1. This relates to 'relational and variational sampling' techniques from grounded theory that demand further samples are selected to investigate the categories to maximise similarities and differences: to purposefully choose sites for 'dimensional variation', 'based on the potential of maximising differences among emerging concepts' (Strauss and Corbin, 1998, p.210). This meant selecting a range of schools and teachers that could be examined regarding 'similarities and differences' for technology, teachers' continuing professional development and training for ICT, ICT pedagogy and school management.

Crucially then, the sample of schools for phase 2 was *widened*, to provide *more examples* of schools (across the range of ICT development) in order to provide *opportunities to examine* the *categories in more depth.* Three schools from phase 1 were carried forward into phase 2 as these schools had demonstrated some evidence of the categories (technological infrastructure initiatives, ICT training programmes for CPD, leadership issues), which could be further interrogated for their differences and similarities (between these categories) hence providing the opportunity for *densifying the categories*. The teachers were selected from within and across the schools in accordance with this rationale. For example, a range of teachers that were participating in the different CPD ICT training models were selected to investigate which model was most effective for teachers for facilitating the integration of ICT into professional practice.

The specific rationale for the choice of each school for phase 2, which considers the level of ICT development and how each school relates to widening the sample in relation to phase 1 is now considered below.

For phase 2, an additional 'advanced/stage 5' school (J) was selected (whilst keeping schools A and F from phase 1, because these were worthy of further investigation regarding the categories); an additional 'late/stage 4' school (G) was selected, as this had a purposefully built new block with 'state of the art' technology incorporated into every classroom. An additional case study site at this level was an 'After School Study Support Centre', which utilised ICT for homework support as part of the government's initiative from the DfES that targeted students who were borderline achievers. An 'early to mid/ stage 2' school (H) was selected as phase 1 did not cover this level and an additional 'early/stage 1' school (M) was selected for phase 2. This represented a greater sample that would enable the researcher to probe the categories and sub-categories from phase 1 in more depth; specifically in order to flesh out the 'properties and dimensions', 'similarities and differences' in the categories.

Table 4.10 Research Design

Phase 1	**Sample**	**Open sampling** (schools and teachers) in accordance with grounded theory (Glaser and Strauss 1967)
Oct 1999 to April 2001	**Interviews** **Documents** **Questionnaire**	**Unstructured Interviews**
	Analysis	**Open coding** as defined by Strauss & Corbin (1998). Yields concepts, which are grouped together and turned into categories.
Phase 2	**Sample**	**Relational & Variational Sampling** (schools and teachers)
May 2001 to May 2003	**Interviews** **Observations** **Documents**	**Semi- Structured Interviews** (referred to as focused interviews by Yin 1994)
	Analysis	In accordance with **Axial Coding** as defined by Strauss & Corbin (1998): connections / relationships between categories.
Phase 3	**Sample**	**Discriminate Sampling**
May 2003	**Interviews** **Questionnaire** **Documents**	**Semi - Structured Interviews for Respondent Validation** and theory/framework testing
	Analysis	in accordance with **Selective Coding** as defined by Strauss & Corbin (1998): core categories and substantive theory / frameworks developed.

Access and Ethics

A crucial consideration was that participation in the research should not involve any additional work for teachers, other than an interview for 30 minutes and an observation, if mutually agreeable. Under the new performance management criteria for teachers, observation has to be conducted and it was made clear to teachers that they could draw on their work with the researcher to support their professional development observation (and if applicable, threshold applications). The research observations would permit the teachers an opportunity to reflect on their practice in a supportive and non-judgmental way. The researcher explained that the teachers were not required to prepare any additional work; rather the researcher would like to collect data on what constitutes teachers' daily practices and processes. The researcher was particularly sensitive to the demands on teachers' time and the heavy workload already encompassed. When negotiating access, the researcher did not want the research to be perceived as anything onerous, which may have prevented access.

> The method employed should not be too demanding on the teachers' time. (Hopkins, 1993, p116)

An important point about access is that it has to be *constantly re-negotiated.* It is not a singular event; rather, it is a *continual* process. Once initial access has been granted and the first school visit conducted, the need to *revisit* throughout the course of the research (over a number of years) requires careful negotiation each time *re-entry* into the field is required. Consequently, it is exceedingly important to write *formal thank you letters* to the teachers, as a matter of courtesy and, to establish and maintain access.

Ethical Considerations: gaining the consent of all participants

Before collecting data, it was essential to establish an ethical code that would guide the conduct of the research. In order to create a 'Form of Consent' for the participants, the researcher consulted the following professional bodies for guidance on ethical matters: British Education Research Association (BERA) *Ethical Guidelines* (1992 and 2004), British Psychological Society (BPS) *Ethical Principles and Guidelines* (1996) and Hopkins (1993, p221-223) for conducting research with teachers.

Consequently the following points, which were strictly adhered to by the researcher, were covered verbally and in written format (see appendix B: 'Ethics: Informed Consent').

- An outline of the research aims and objectives
- An outline of the data collection methods; data to be collected by interview, questionnaire, documentary form and observation
- Anonymity assured for all participants, thereby securing the privacy of those taking part, which will be respected at all times
- All data collected will be completely confidential and will not be published in any way that will allow identification of individuals

- Access to raw data will be restricted to the researcher and the assistant transcriber
- The research data will be collected and stored in accordance with the principles of the Data Protection Act (1998)

The following ethical procedures were systematically replicated with each participant.

Table 4.11 Ethical Procedures

1. Researcher created an ethical consent form and produced multiple copies (appendix B).
2. Signed written consent was procured from all participating teachers - teachers signed 2 copies of the ethical consent form: one to be kept by the researcher, the other by the teacher. The form contained contact information of the researcher and her supervisor, should the teachers want to follow anything up at any point.
3. Researcher was to keep all ethical consent forms signed by participating teachers for duration of the research.
4. Verbal permission and consent gained from teachers to tape recording of interviews.
5. Verbal consent secured from teachers to take field notes during the interviews.
6. Verbal consent acquired from teachers to conduct classroom observations and record observation findings.
7. Permission from head for whole school observations and the use of a camera for photographing areas of interest. It was specified that the photos would focus on the situating of computers across the school and their use by teachers and pupils in those settings.

The research was conducted in accordance with the Data Protection Act (1998) with respect to following data protection. Since the data are anonymised and cannot be traced to any particular individual, the legislation does not apply. However, as Denscombe argues (2003, p142), even when formally exempted for the provisions of the Act, it is good practice to adhere to data protection principles. Consequently the researcher ensured that the data was: kept secure, anonymised and to be kept no longer than necessary.

Data Collection

Audit trail

This involved providing an audit trail to represent each stage of the research.

Table 4.12 Data Collection Methods and Analysis

Method of Data **Collection**	Method For **Recording** Data	Method Of Data **Retrieval**	**Analysing** Data
Interviews 1. Teachers 2. ICT co-ordinators 3. Headteachers; senior leaders 4. ICT Technicians 5. ICT Network Managers 6. Learning Support Assistants (LSAs) 7. New Opportunities Fund (NOF) ICT Approved Training Providers (ATPs) 8. National Grid for Learning (NGfL) Regional Coordinator and Trainer	Tape recorder + Fieldnotes	Tape transcriptions Analytical memos	Database teacher interviews Coding data + defining categories
Observations - **Classrooms** - **Whole school environment** - **School meetings** (e.g. teachers ICT development meetings) - **NOF ICT Training** sessions - **School ICT events** (e.g. Video Conferencing and Lap Tops for Pupils scheme, presentation to parents. School Open Day on Wireless Technology, for visiting teachers to school F.)	Observation sheets Camera Fieldnotes	Analytical memos Photos	Coding data + defining categories

The recording of data was completed in a systematic manner in order to facilitate analysis. With respect to ethical considerations regarding the impact of the researcher's presence, it was necessary that the recording of observations, interactions and interviews did 'not excessively intrude in the ongoing flow of daily events' (Marshall and Rossman, 1995, p109). This pertains to issues of non-intrusiveness, which need to be preserved in order to capture the 'naturalness' of the setting.

Plans to use *recording devices* demonstrate that the researcher has employed data recording strategies that fit the setting and the participants' sensitivities, and most importantly that these are only used with the participant's *consent.* This was systematically sought with each participant signing the informed consent form prior to partaking in the research.

The researcher used a *tape recorder* for interviews, *camera* for capturing visual images (photos), *observation record sheets* for whole school and classroom settings, *research journals* for field notes and analytical memos. The practice of labelling audio tapes, carrying extra batteries and negotiating *a quiet place* for conducting interviews, note taking and generating analytical memos in each case study site, facilitated the recording and organising of data.

Following Marshall and Rossman's guidance (1995, p110), the process of making field notes from observations and interviews were recorded in hard-backed notebooks (research journals) that could be 'held in the lap or used on the run', and in total, 11 notebooks size A5 were used. Following each interview, the recorded field notes were immediately revisited for fleshing out the details of the answers and recording early reflections, i.e. analytical memos. The latter consisted of selecting conceptually interesting issues, an awareness of emerging patterns and an increased sensitising to potential categories for analysis. The process of preserving the data and meanings on tape and the combined preliminary analysis with the analytic memos greatly increased the efficiency of data analysis.

This was supplemented with a system for *retrieval* of data for analysis, which was invaluable for identifying patterns, defining categories and planning further data collection. In short, as the research progressed, 'this was coded and reflexively refined into analytic frames. This method involves constant reflection through the observation and interview data that emerges to identify key analytical themes grounded in the data' (Watson, Blakeley & Abbot, 1998, p17).

Analysis of Data

> Data analysis is the process of bringing order, structure, and meaning to the mass of collected data. It does not proceed in a linear fashion; it is not neat. Qualitative data analysis is a search for general statements about relationships among categories of data; it builds grounded theory. (Marshall and Rossman, 1995, p111)

The process of data collection and analysis in this research was informed by the procedures of grounded theory. Grounded theory has been defined as - ' theory that was derived from data, systematically gathered and analysed through the research process. In this method, data collection, analysis and eventual theory stand in close relationship to one another' (Strauss and Corbin, 1998, p12).

There are two central features of grounded theory, firstly it is concerned with the development of theory out of data and secondly that data collection and analysis occur in tandem, which is an interactive or recursive process.

Bryman (2001) succinctly distinguished between *tools* and *outcomes* of grounded theory, which is a pragmatic distinction aiding the use of grounded theory for this research. The tools of grounded theory used were: *theoretical sampling; coding* (a key process, which entails reviewing data and giving labels to component parts); *theoretical saturation* (where data is collected until the point at which nothing new emerges) and, *constant comparison.* The outcomes of grounded theory, that is, the *products* of different phases of grounded theory were: *initial codes* (labels given to discrete phenomenon); *categories* (more crucial codes were grouped to form a category; categories are a higher level of abstraction); *concepts* (attributes or aspects of a category); *theory* ('a set of well-developed categories...that are systematically related through statements of relationship to form a theoretical framework that explains some relevant social phenomenon' (Strauss and Corbin, 1998, p22).

> In qualitative studies, data collection and analysis go hand in hand to promote the emergence of substantive theory grounded in empirical data. (Marshall and Rossman, 1995, p112)

4.3 DATA COLLECTION AND ANALYSIS

Interviews

A research interview has been defined as 'a two person conversation initiated by the interviewer for the specific purpose of obtaining research relevant information' (Cannell and Khan, 1968 in Cohen and Manion, 1994, p271). Moser and Kalton (1971, p271) describe the interview as 'a conversation between interviewer and respondent with the purpose of eliciting certain information from the respondent'. However this reference to a conversation oversimplifies the interview process, since 'interviews involve a set of assumptions and understandings about the situation which are not normally associated with a casual conversation', which concern the right to pose questions and understand that what has been said is 'on record' (Denscombe, 1998, p109).

Hopkins (1993) argues interviews are very productive sources of information, with the advantage of producing specific *in-depth information*. In qualitative research the aim is to try to understand how respondents think and feel about the issue with which the researcher is concerned. Interviews produce data based on the *respondents' priorities* and give them the opportunity to expand their ideas, explain their views and identify what *they* regard as important. The justification for interviews is the value of contact with key players in the field who can provide valuable *insights* (Denscombe, 2003).

As a method of data collection, interviews have the advantage of *flexibility* such that adjustments can be made to the lines of enquiry during the interview. Another advantage is that interviews permit the researcher to 'follow up ideas, probe responses and investigate motives and feelings, which the questionnaire can never do' (Bell, 1993, p91). Similarly the interview allows a reconstruction of events to unfold, for example how the teachers came to understand the value and use of ICT for professional practice through a series of events. This reconstruction of events is something that cannot be accomplished through observation alone (Bryman 2001, p329).

Importantly, another key advantage of interviews is that they allow the generation of data that then can be combined with data from other methods (observations, questionnaires and documents) in order to *corroborate* facts, allowing *triangulation* (Yin, 1994; Denscombe, 2003).

Bryman (2001) argues whilst there is a proliferation of terms referring to the different *types* of interview, although there are two main types in qualitative research, the unstructured and semi-structured interview. Grebenik and Moser (1962 p16 in Bell 1993, p92) argue that the different types of interview can all be arranged somewhere on the *'continuum of formality'*, with unstructured as the least formal.

In phase one of the research, preliminary interviews were at the 'completely unstructured' end of the continuum of formality. This approach was essential in order to ensure a wide ranging approach to potential information – to be open to any insight the respondent might offer. The second phase used semi-structured interviews, which had more structuring in the form of an interview guide. In these interviews, the experience from phase one was used to inform the structure and provide a clearer focus for questioning. Hitchcock and Hughes (1995) argue the semi-structured interview is 'most favoured by educational researchers since it allows depth to be achieved by providing opportunities on the part of the interviewer to probe and expand the respondent's responses' (p157). In comparison the rigidly structured interview is unlikely to reveal the complex and emergent factors that constitute the social world of schools. (See appendix C regarding the deployment of semi-structured interviews for the research.)

The interviews were recorded on audiotape in order to ensure *accuracy*. The interviews were transcribed and entered into the research database. However, the researcher was aware that tape recording can be disconcerting and that necessitated proceeding with caution when raising the issue of its use in the interview. The researcher made an assessment of its feasibility before embarking on its use and permission was always sought beforehand. To help manage respondent's wariness the recorder was located in as unobtrusive way as possible. Some teachers expressed initial hesitancy towards the tape recorder, which waned once the confidentially clause was reiterated. Only one teacher asked not to be recorded. Bryman (2001) asserts that it is not uncommon for a small number to decline being recorded.

Although audio tape recording offers a permanent record, Denscombe (2003) argues it captures *only speech* and consequently misses non-verbal and contextual factors. To record such factors, it is essential to also take field notes during an interview. A crucial advantage of field notes is that it allows the researcher to fill in relevant information regarding the context of the location, the climate and atmosphere under which the interview was conducted, body language and any other visual clues deemed to be important.

Analysis of Interview Data: coding interview data and constructing categories

The analysis of the data was conducted in accordance with the principles of grounded theory. Open questions in both the interviews and questionnaires provided data for qualitative analysis. The analysis, as suggested by Bryman and Burgess (1994), was a continuous process and not a distinct phase. The analysis of all the data, including the field notes, documents and observation recordings, required *coding*. This involved breaking down the data into smaller parts, or *units* (Denscombe, 2003) for analysis.

> Coding (or indexing) is seen as a key process since it serves to organise the copious notes, transcripts or documents that have been collected and it also represents the first step in the conceptualisation of the data. (Bryman and Burgess 1994, p219)

Coding as an ongoing process involved looking for occurrences of particular ideas or events, and scrutinising the data for similarities, differences, links or contradictions: 'coding is analysis' (Miles and Huberman, 1994, p56). Coding is analytical in that it involves *categorising* the units. The categories are subject to a continual process of refinement during the research, so if initial categories are 'incorrect', later versions will be refined and improved. The initial stage of coding has been termed 'open coding'. 'The aim of open coding is to discover, name, and categorise phenomena; also to develop categories in terms of their properties and dimensions' (Strauss and Corbin, 1990, p181).

The researcher then engages in reflecting on the early coding and categories, which involves going through the data and adding comments and *analytical memos*. As the analysis progresses, new interpretations may be given to the same extract of data. The next phase in the analysis is the identification of *themes* and *relationships*. A vital part of the researcher's reflections is the attempt to identify 'patterns and processes, commonalties and differences' (Miles and Huberman, 1994, p9). The researcher is looking for themes or *interconnections* that recur between the categories that are emerging. The analysis of qualitative data is repeated time and again in order to refine the explanation.

As the various explanations and themes emerge it is essential that the researcher should return to the field with these explanations and themes to check their validity against 'reality' (Denscombe, 2003). This is why respondent validation is such a crucial part of the research process. It is through the analytical process of reflection the researcher comes to develop *theory* or frameworks to explain the themes and relationships identified in the data. The researcher should compare the developing theory with existing theories or explanations and develop this in line with the findings from the fieldwork.

> The goals of producing theory from data, rather than merely testing prior theory, require that the researchers remain open to ideas, patterns, new categories or concepts that may emerge during the process of making data. Hence methods of handling qualitative data must contain ways of catching and developing ideas, exploring fleeting hints, and drawing connections between them and the data from which they derive. (Richards and Richards, 1994, p149)

Problems Associated with Interviews as a Research Method

The main sources of bias are the personal characteristics of the interviewer (Cohen and Manion, 1994; Hitchcock and Hughes, 1995; Denscombe, 2003). The key variables of age, gender, ethnicity will all play a crucial role. Since 'research on interviewing has demonstrated fairly conclusively that people respond differently depending on how they perceive the person asking the questions' (Denscombe, 1998, p116).

The personal attributes of the researcher will have a bearing on the amount of information that respondents are willing to divulge. Hence, the social status, educational qualifications and professional expertise of the researcher may affect the relationship with the respondent. To encourage the engendering of rapport and trust in the interview relationship, the researcher explained her background as a classroom teacher. To minimize the impact of the researcher on the interview process, she ensured that self-presentation was conventional and courteous and that she remained neutral and non-committal on statements made during the interview. As Denscombe (1998, p117) argues 'the researcher's 'self', is kept firmly hidden under a clock of cordiality and receptiveness to the words of the respondent'.

With respect to bias, Bell (1993) argues it is 'easier to acknowledge the fact that bias can creep in than to eliminate it altogether' (p95). As Gavron argues ' it is difficult to see how bias can be avoided completely, but awareness of the problem plus constant self-control can help' (1966, p159).

The interviews were scheduled from 30 minutes to an hour, with most lasting an hour. Dawes (2001) argues it is hard to understand why teachers would spend an hour talking unless the discussion had some purpose for the teachers themselves as well as the interviewer. Denscombe (2003) argues that interviews can be *therapeutic* for the interviewee; a rewarding experience that people tend to enjoy given the rare chance to talk about their ideas at length to someone whose purpose is to listen and not be critical. In the case where the two teachers were interviewed together, one commented at the end of the interview that 'she felt much better for talking', she commented that it was as though she had seen a counsellor, which attests to Denscombe's notion of the interview as therapeutic.

Similarly the researcher found busy headteachers were willing to be interviewed, which could be explained by the fact that without an in-school peer group, headteachers are quite isolated and welcome the opportunity to discuss their work as it provides a chance to describe and reflect on their practice. This phenomenon has been recognised through the establishment of the National College for School Leadership (NCSL), which is attempting to network heads (online) and end the era of 'splendid isolation'. Some teachers were interviewed more than once over an extended period. After the first round of interviews in phase two, some teachers changed jobs and moved to other schools. Where this happened, a suitable replacement was sought.

Observations

In contrast to interviews, which provided data based on what the teachers *told* the researcher and documents, which provided information, though a step *removed* from actual events, the use of observations allowed direct witnessing of teachers' professional practice with ICT in the classroom. As Bell (1993) argues, observation can reveal information, which would have been 'impossible to discover by other means' (1993, p109). What respondents *say* reflects the way they wish to present themselves and events. Observation allows an opportunity to witness interaction between teacher and contexts.

In phase one of the research, the researcher engaged in *unstructured observations*. When visiting schools in the open sampling phase, the aim was to *discover* issues; for these to *emerge*. For this to occur, it was essential that the researcher adopted an unstructured approach, which kept the researcher *open* to all things.

In phase two the researcher used systematic *structured observations* where data were recorded on observation record sheets, from lesson observations. This in-depth phase of research also necessitated *less structured* observations, but *not fully* participant observations. These were in the form of observations of the whole school environment and culture. For example, observing the location and use of computers in social places; staff rooms during breaks; school cyber café; staff department offices; professional development sessions, ICT training for teachers, formal NOF training and informal, in-house training; school ICT meetings; school 'wireless' open days; ICT parents' evening launching the laptop for pupils scheme. Hence the researcher *participated* in the normal routines of the school day (lessons, breaks, meetings) and observed these, but the research was not ethnographic or fully participant.

Phase 1	Unstructured observations during open sampling
Phase 2	Structured observations AND less structured observations, but NOT fully participant observations.

Empirical Fieldwork: conducting observations

In the first phase of the research during the theoretical sampling period (Strauss and Corbin 1998) observations were conducted in an *unstructured* manner, in accordance with grounded theory techniques of open sampling. Once access was negotiated, lessons were observed with a view to *allowing the focus to emerge*. Observations were recorded in the research journal and then analysed to identify the emergent themes and foci, which formed the basis for the second phase of research. In phase 2 observations were conducted with *a focus* that had emerged from phase 1, and were formalised into an observation record sheet for *structured* observations. The schedules were used for systematically recording observations of lessons and the whole school environment (see appendix D).

The aim of the observation schedule is to provide a framework, which will attend to the researcher minimising the problems of selective perception and recall, and enable the researcher to be alert to the same activities across settings and to record the data systematically and thoroughly. The coded observation sheet allowed the researcher to prioritise those aspects of the situation to be observed. Hence the items for inclusion were selected as the *most* significant and the *most* relevant, which had been identified from phase 1 and, because it is simply not feasible to include everything (Bell, 1993).

Denscombe (2003) argues that when selecting the items for inclusion in the observation schedule there are a number of conditions that need to be met regarding the items suitability. What is to be observed must be *overt:* behaviour which is observable (teachers using ICT). *Obvious*: clear and apparent, little need to decipher the action. *Relevant*: the most relevant indicators (ICT resources and their use). *Complete*: care is taken to ensure that the categories on the observation schedule cover the full range of possibilities (pilot the observation record sheet and review). *Precise*: no ambiguity about the categories (usefulness of categories reviewed after pilot). *Easy to record*: able to write the occurrences adroitly (ease of coding under the categories reviewed after pilot).

Bell (1993) argues when devising an observation record sheet it is essential to consult published examples (see examples in Bell, 1993; Hopkins, 1993; Denscombe, 2003) and adapt where necessary. Given the OECD (2001) research into ICT implementations in schools, it became apparent that this could be usefully adapted to fit the themes that had emerged from the phase 1 observations and thereby provide a clear structure for systematic observations in phase 2.

What and when to observe entailed strategic decisions concerning sampling. In the phase 2 structured observations, the observations occurred *across:* the school year; the school week; the school day; the case study schools; the teachers within the schools; the curriculum subjects and pupil year groups.

It was important for the researcher to consider how to counter the *decontextualisation* of the observation schedules, which is an important criticism concerning structured observations (Galton *et al.*, 1980).

> Precisely because the use of an observation schedule has the tendency to decontextualise the things it records, more advanced practice in this area has made a point of insisting that researchers collect information about relevant background matters whenever they use a schedule. (Denscombe 1998, p144)

For this very reason, the *whole school observation sheet* was devised - to combat decontextualisation. The whole school observation sheet was an invaluable tool for recording *contextual factors* pertinent to each case study school. It was this background information that was illuminating to the individual classroom observation sessions since this allowed the events to be placed in their organisational contexts.

With systematic observation it is important to retain the naturalness of the setting and be as unobtrusive as possible (Bell, 1993; Denscombe, 2003). This necessitated 'fading into the background' and to minimize the likelihood of disruption, the researcher followed Denscombe's (2003) three guidelines: *Positioning*: unobtrusive positioning is vital and this was achieved by sitting quietly at the back of the classroom, which still enabled a complete view of the class. *Avoiding interaction:* not engaging with the participants in the setting meant becoming 'socially invisible', which was possible by not interacting with the teacher or pupils during the lesson. *Time on site*: the longer one is on site, the more one's presence becomes unnoticed and has less effect on proceedings. Attention to the latter two points by the researcher also reduced the impact of the observer effect.

Table 4.13 Types of Observation

Location	Focus
Classroom settings	Lessons – teachers' use of ICT
Whole school environment / culture	ICT facilities and locations
School ICT meetings	senior staff meetings, cross-school ICT team meetings
School based ICT training sessions	formal NOF ICT training for teachers; informal in-house ICT training sessions
School ICT open days / open evenings	Wireless Open day for teachers; Laptops for Pupils and Video Conferencing launch to parents and local community

Documents

Documentary analysis of educational records 'can prove to be an extremely valuable source of data' (Bell 1993, p67). Hopkins (1993) argues that the main use of documents in educational research is to provide a *context for understanding* a particular issue. For example, documents surrounding a curriculum concern, in this case the implementation of ICT into classroom practice, documents can 'illuminate rationale and purpose in interesting ways' (Hopkins, 1993, p141). The use of such material can 'provide context, background information and understanding of issues that would not otherwise be available' (ibid.).

As well as providing value in their own right, the rationale for using documents is furthered by Yin's (1994) argument that documents allow the *corroboration* of evidence from other sources. Since the case study research strategy necessitates 'multiple sources of evidence' as a methodological strength, ' the most important use of documents is to augment evidence' from elsewhere (Yin, 1994, p81).

Classification of Documentary Sources

Given the wide range of documents collected during the research, it was essential to attend to classifying the different sources of documentary evidence. The following classifications were used: official documents produced by the state and official bodies;

school documents; mass media outputs (newspaper articles); electronic sources (the Internet and email), and documents produced by the researcher.

Official Documents

Hitchcock and Hughes (1995) have identified a useful distinction between internal and external documents in educational research: namely documents created inside or outside school. External documents include Acts of Parliament, Select Committee minutes, Government Green and White papers, Department of Education policy documents. Also documents from official bodies such as Teachers' Unions, the General Teaching Council, other professional/subject association statements as well as local education authority policy statements and guidelines. These constitute documents deriving from the state and official bodies that are accessible in the public domain. Specific to this research was also a OECD (2001) report on ICT in schools, which is an external document, alongside government ICT reports, for example, Becta ICT research documents. (See appendix A for list of government reports used).

School Documents

Internal documents include those produced by the schools: staff meetings and minutes, policy statements produced by the school, brochures, newsletters and photographs. These are official documents that in the interests of accountability can be scrutinised by others. Bryman (2001) classifies these as official documents deriving from organisations. There are however other types of school document which are not open to public scrutiny, rather they are private and pertain to the inner workings of the school, such as school memos, curriculum planning documents and minutes of meetings.

In addition to school wide documents, some teachers also granted the researcher privileged access to professional documents pertaining specifically to those individual teachers. For example, copies of lesson plans, curriculum resources, worksheets, display materials and electronic reports. One teacher even provided a portfolio of documents for the researcher to analyse. The documents were treated in accordance with the ethical guidelines, which guaranteed confidentiality and anonymity.

Mass Media Output

Documents from the mass media have also been collected, namely from newspapers and educational magazines; again these constitute publicly accessible records. In the case of newspapers, articles pertaining to the *general* issue of ICT in schools were collected from the quality press. Also articles that referred *specifically* to the *case study schools'* use of ICT were systematically gathered. As two of the case studies were leading edge schools with ICT, a number of press statements and photographs were released to the national and local media during the research period.

Electronic Sources: internet and email

The Internet also provided a source of documents pertaining to the case study schools as each school has an *Internet home page*. The school Internet documents then became a focus for research on how the schools were utilising the Internet for communication. The scope and extent of development pertaining to each home page was evaluated and analysed, alongside a consideration of each school's *intranet.* The intranet is a closed part of the school's home page that is password protected and is only accessible to school members, namely teachers and pupils. Intranets house school documents that can be accessed remotely allowing teachers and pupils to work from home. For example, curriculum materials are available, information on school policies, events and email exchange facilities.

The researcher also found emails and list serves an important source of information, as she was active in online research discussions about the use of ICT in schools. These list serves were run by *government bodies*, such as the Becta 'ICT Research Network Online'. Also *national committees*, such as the Information Technology in Teacher Education 'ITTE list serve' and *professional associations* such as Mirandanet, which is an academic online community. A print out of the discussion threads provided a valuable documentary source of up to date information on issues pertaining to ICT in education. As Bryman (2001) and Denscombe (2003) argue there is a growing interest in emails in their own right amongst researchers and electronic communication has considerable potential for research.

Websites were also investigated for relevant documents on ICT use in schools, the following government websites were useful: DfES, TTA, Becta, NGfL, VTC, QCA and independent sites ITTE, Mirandanet, NAACE. Information from online conferences and journals was also used.

Documents Produced by the Researcher

Researchers themselves can also be *producers of documentary data* in the form of *photographs, field notes, interview transcripts* and *observation record sheets* as argued by Hitchcock and Hughes (1995 p212). The researcher conducting the multi-site case study produced all of the above documents. The use of a research journal for recording field notes enabled the researcher to note *diagrammatically* issues pertaining to ICT, namely where computers were located across the school; staffing structures; professional development routes, etc. The diagrams became important visual devices that clarified the data gathered on the case study schools. This was in addition to recording factual and reflective points in the journal during school visits. The photographing of schools was used to aid description of each school and provide visual data for analysis (see latter section on using visual images).

Access to the following types of documents was secured and this enabled the compilation of a comprehensive overview of the key issues pertaining to ICT use by teachers in schools. See list below for documents used.

Official Documents
Ofsted reports - copy of each case study school's previous OFSTED reports
Ofsted NOF ICT Reports
TTA NOF ICT Reports
Local Education Authority guidelines
OECD (2001)
DfES/Betca ICT Research Reports (see appendix A)
School Documents – external (publicly available)
School policy documents
School brochures and prospectus
School newsletters
Book (The local history of one school)
School Documents – internal (restricted access)
Whole school Development Plans
ICT Development Plans
Minutes of meetings
Information produced by Training Providers
Maps and official plans of school buildings - future build, location of computers across school
Diagrams - of curriculum developments, staffing structures, procedures for professional

development
Teachers' Documents
Printed copies of electronic reports
Lesson plans
Worksheets
Curriculum resources
Display materials
Mass Media
Newspaper articles - national press (Times Educational Supplement, Guardian)
Newspaper articles - local press (features on case study schools)
Magazines (e.g. 'The Teacher' published by the National Union of Teachers (NUT))
Electronic Sources
Internet home pages for each case study school
Intranet pages for each case study school
Emails
List serves discussion forums - Becta 'Teachers Online' discussion forum and electronic newsletters
Websites - DfES, TTA, Becta, NGfL, VTC, TeacherNet UK
Documents Produced by the Researcher
Photographs
Field notebooks x 11
Interview transcripts
Observation record sheets

Evaluating Documents

In reviewing documents Yin (1994) argues it is important to understand that documents were produced for a specific purpose and a specific audience (other than that of the case study investigation) and, that 'these conditions must be fully appreciated in order to interpret the usefulness of any document' (Yin 1994, p84).

Similarly whilst documents and records may purport to depict events in an accurate and complete manner, Denscombe (1998) argues they tend to be partial. Documents 'will tend to be selective in terms of what they report, emphasising some things and ignoring others, and thus recording only part of the overall event' (op. cit., p162). Consequently the researcher must be cautious and not accept records at face value.

Scott (1990) provides an authoritative framework with four clear criteria for evaluating documents, which is often quoted by theorists writing on methodology (Bryman, 2001; Hitchcock and Hughes, 1995). Scott (1990) identifies *authenticity* (documents are shown to be genuine, not fake or forgeries); *credibility* (documents are accurate, free from bias and errors); *representativeness* (the document is typical of its type); *meaning* (documents are clear and comprehensible, the meaning of the words is unambiguous).

Analysing Documents

> Documents are produced in context - for some purpose. Their interpretation is not self-evident. (Hitchcock and Hughes, 1995, p215)

Theorists have identified three approaches to interpreting documents: content analysis, semiotics, hermeneutics (Bryman, 2001; Hitchcock and Hughes, 1995). Bryman (2001) argues the most prevalent approach to analysing documents is qualitative content analysis, which seeks to identify underlying themes. The extracted themes are illustrated through quotations from the documents. Altheide (1996) has developed an approach called *ethnographic content analysis*, which is different to traditional quantitative content analysis, in that the researcher is constantly revising the themes or categories that have been identified in the interrogation of the documents. The qualitative content analysis strategy of searching for themes in the data is congruent with the coding approach of grounded theory and is therefore particularly suitable for analysing the documents in this qualitative research.

However, this approach has been supplemented with an acute awareness of the social and historical context within which the documents were written (schools). Sensitivity to the context of document production is part of the hermeneutic tradition of analysis. Bryman (2001) argues that qualitative content analysis can be hermeneutic when it is allows an understanding of *context* to be realised. Hence the researcher's interrogation of the documents and the extraction of themes from them were in *reference* to the researcher's knowledge of the *organisational context* within which the documents and the people and the events within them were located.

For example, those school development plans (documents) that had a strong ICT emphasis could be analysed in light of the cultural and political *context* of that school, namely designation as a Technology College. Similarly, Government documents about the National Grid for Learning (NGfL) can be analysed as part of a broader economic policy of post –Fordism, which subsumes educational policy to the needs of advanced capitalism, which can only be understood as part of the social and historical context of the UK.

Image Based Research: the use of photography

The documents considered so far have been text-based documents. However, there are alternative kinds of documentary evidence available to researchers, namely *visual* images. 'Visual images can be used as data in their own right' (Denscombe, 2003, p222).

The visual image is taken to be of significant value as a display of *culture*. For example, a photograph of a 1930's British infants school that depicts separate entrances for girls and boys illuminates the gendered organisation of education at that time. Photographs are seen as important adjuncts to understanding culture, although the photos in their early uses were assumed to be self-evidentiary, as unproblematic representations of reality. If it is possible to capture aspects of culture in a still photograph, this nonetheless leaves researchers with considerable methodological and theoretical problems. Prosser's (1992) use of photography in an educational ethnography of a newly formed comprehensive, attempts to clarify the use of photos, but argues for the need for theoretical and practical guidelines. Prosser (1992) believes the use of cameras to record aspects of school life is an exciting undertaking, but that it requires care. Most importantly Prosser (1992) suggests that photographs maybe used to explore what he describes as the 'taken-for-grantedness' of school settings. Photographs taken by the researcher can be analysed to see what they reveal about the generic culture of each case study school.

In keeping with the case study research strategy of using multiple sources of data, the use of still photography was employed to provide an additional data source, which is important for triangulation purposes, and is supported by Bryman (2001), Denscombe (2003), Hitchcocck and Hughes (1995), Hopkins (1993) and Prosser (1992).

As visual records, photos help the researcher to develop a closer feel and appreciation of the setting', photographs can 'add depth and richness and are useful as descriptive resources' which the researcher can analyse as an additional source of evidence (Hitchcock and Hughes, 1995, p278). However, as Hitchcock and Hughes (1995) argue, photographs 'can never hope to capture the dynamic ebb and flow' of school life (ibid.).

The researcher generated images specifically for the purposes of the investigation, which is the use of 'created' images (Denscombe, 2003). Hence the visual images provide primary source data. Importantly visual records provide an alternative to tape recordings, that is the *sound* (of the teachers voices in the interviews); and an alternative to the use of written documents, that is *text* in the form of field notes, interview transcripts, school documents and observation records.

However, the key issue concerning the collection of 'created' images is reflexivity (Denscombe, 2003); what Prosser (1998, pp104-5) refers to as 'procedural reactivity' and 'personal reactivity'. The former concerns the way in which the researcher becomes more obviously visible when taking photographs, and the latter is how the researcher can have an effect on the situation. This (procedural reactivity) is similar to the observer effect and was avoided in this research as the photographs were of the school environment (*spaces)*, places housing computers, not the participating teachers in lessons. However, the researcher was actively constructing the visual images (choosing, selecting what to photograph) and to this extent 'personal reactivity' is an unavoidable consequence of taking photos.

Visual Analysis

The researcher regarded visual material and in particular photographs as documentary sources, which were to be subject to the same analytical questions regarding the 'whom', 'when', 'where' and 'what'. Ball and Smith (1992) have identified five major frameworks for the analysis of visual data: content analysis, symbolism, structuralism, cognitive anthropology and ethnomethodology, though Hitchcock and Hughes (1995) argue that the analysis of visual data is 'still largely being worked out by researchers' (p301). However, Hitchcock and Hughes (1995) argue that visual documents maybe regarded in the same way as written texts with respect to their interpretation and Scott's (1990, pp188-91) criteria of authenticity and credibility can be employed with respect to the analysis of images. Certainly a researcher who uses visual images will want to interrogate the *authenticity* of the image and must consider whether the image is genuine and original, or altered, or edited (Denscombe, 2003).

For this research, the analysis of visual data concerned primarily the *content* of the images for both 'found' and 'created' images. In accordance with Denscombe (2003), images were used for two reasons; one, for *factual information* (to identify where computers were placed in and around the school, e.g. in open spaces, cybercafe, library, IT suites), and the second reason; for the *cultural significance and symbolic meaning* inherent in the content of the images (the cultural meaning of situating computers in open spaces is about providing access to ICT for pupils in social areas). See appendix I and J, which uses photos to visually illustrate the use of ICT in school F. The researcher worked in collaboration with the teachers, whereby the photos taken for the research were made available to the teachers for their use afterwards, for example, the document in appendix I. Again ethical guidelines were strictly adhered to in order to ensure the anonymity of the pupils in the photos.

Research Journal: recording field notes

> The advantage of a journal for recording field notes is that it is simple, ongoing and acts as an aide memoir. (Hopkins, 1993, p145)

Field notes are detailed recordings of interviews, observations and impressions that occurred during visits to the case study schools. Recordings of information about the schools, teachers, events, behaviours and conversations, occurred alongside noting the researcher's initial reflections, which became the first step in interpretation and analysis. The field notes therefore contained analytical memos.

This strategy was developed at the leading case study school, since the researcher was assigned a quiet room to work in for the duration of site visits. When visiting teachers in their classrooms for observations, after the event there was a quiet room that could be utilized for making detailed field notes. This space also afforded discretion with respect to *recording mental notes* made during *other observations* that were not suitable for covert writing, namely during coffee breaks, lunches, bus duty, school events, etc. Also whilst field notes were made during the interviews, this strategy permitted an *amplification* of the records either immediately afterwards or at the end of the day. Importantly, field notes of the interviews enabled a recording of the *context* of the location and early *analytic memos.* - which are written records of analysis (Strauss and Corbin, 1998). Analytic memos are early reflections and analysis of field note data.

The research journal, in addition to recording factual and reflective issues, enabled notes to be made on *language use* or *argot*, and for the researcher to *construct maps, plans* and *diagrams*. This data gathering offered a visual representation of the issues and themes the researcher was exploring. For example, staffing structures, the location of computers across the school, routes for professional development, etc. Hence the use of a research journal for recording field notes enabled the researcher to note *diagrammatically* issues pertaining to teacher's professional practice and development.

The use of the research journal to record analytical memos aided the generation of concepts and categories in the spirit of grounded theory. Strauss and Corbin (1998) argue memos are specialized types of written records, namely products of analysis that are meant to be analytical and conceptual rather than descriptive (p217). The researcher's memos enabled the recording of initial interpretations and reflections, which helped to crystallise ideas and facilitate the emergence of categories. Memos also explained terms being used and allowed the researcher to not lose track of thinking.

Questionnaires

The open sampling of phase 1 was completed with a questionnaire that enabled the researcher to collect a mix of qualitative and quantitative data, which provided base line information about teachers' use of ICT in schools in July 2000.

Questionnaires are instruments that allow the recording of factual information *and* teachers' ideas in a format amenable to analysis (Cohen and Manion, 1994; Hammersley, 1986). Two questionnaires were conducted for the research. The first was in phase one, in order to provide base line information about teachers' use of ICT in schools in July 2000. The data that emerged then formed the focus of the next phase of research, which explored the issues in-depth using semi-structured interviews and observations. The second questionnaire was conducted in the final phase of the research and was administered for the purposes of respondent validation. (See appendix E1 for the online questionnaire and appendix E2 for the respondent validation questionnaire).

Administering the Questionnaire

The *analysis* of the *unstructured interviews* and *observations* from phase one allowed *issues* to emerge, which became the focus of the first *questionnaire*. The questionnaire was developed for use online, for those schools and teachers that had Internet access, and also a paper version was developed, where online access was problematic. The electronic questionnaire was Internet based with a specific url (universal resource locator), that is website address, which was hosted on the university server from April to July 2000. A database was developed that invisibly 'sat behind' the online questionnaire and allowed the automatic uploading of the data from the questionnaire into the database. The data from the paper-based questionnaire was manually loaded into the database.

The use of the electronic online questionnaire and database necessitated exceedingly careful planning and development. This was because the codes for each question, and the fields for the database that related directly to each question, had to be developed prior to administering the questionnaire. In total seven drafts were drawn up and each piloted to check online functionality. The piloting process was conducted with university colleagues and trainee teachers (PGCE students) not involved in the research. This was in order to check that, a) the questions made sense, b) provided data of the type and nature required by the research, c) the online questionnaire and database functionality was fully operational and d) the online questionnaire was easily navigable by the respondents.

Each draft of the questionnaire was amended after trialling, which was a process that continued until a final draft was achieved. Only the final version was used with classroom teachers, as the researcher did not want to 'waste' some teachers' responses on a pilot, which would have prevented those teachers from completing the final questionnaire. As teachers' time is precious (Hopkins, 1993), all those willing to complete the questionnaire were needed as respondents for the final sample for the questionnaire. The questionnaire was completed by 55 teachers and took approximately 15 minutes for each teacher to answer.

Asking Questions in a Questionnaire

The questionnaire used unambiguous language and had clear instructions. The questionnaire was clearly marked confidential and was treated as such, ensuring that ethical procedures were strictly observed.

The phase 1 questionnaire collected a mix of qualitative and quantitative data, which provided base line information about teachers' use of ICT in schools in July 2000 (the end of the academic year 1999 - 2000). The questions were presented as a mixture of *open* and *closed questions* (Foddy, 1993). Closed questions were used to collect quantifiable information on teachers' uses of ICT and these questions had tick box responses. The open questions allowed the teachers to respond in more depth and in their *own language* (argot), because the answers were recorded in an open box, which enabled teachers to type their personal responses online, in these 'open text boxes'. Consequently the responses produced statements from the teachers, which could be used as quotes that were ethically anonymised. The questionnaire took on average 15 to 20 minutes to complete.

The questionnaire collected background information on the teachers and then focused on the use of ICT for professional practice. Questions about similar issues were grouped together to make the data collection more coherent for the teachers. The identification of a discrete focus for each section of the questionnaire was evidenced in the *headings* used, which aimed to discover the following:

A) **Background Information:** to identify the age, gender, number of years teaching experience, type of school, number of pupils on roll, LEA, teaching responsibilities and, access to a computer linked to the Internet, across the sample of teachers.

B) Use of Electronic Networks: to identify teachers' use of the Internet for professional use and with pupils; the use and value of government education websites, for example, Teacher Training Agency (TTA), Virtual Teachers' Centre (VTC), National Grid for Learning (NGfL), Qualifications and Curriculum Agency (QCA), Department for Education and Employment (DfEE), and Office for Standards in Education (OFSTED); and, non-government education websites that were valued by teachers for professional use.

C) Factors Supporting and Hindering Teachers' Learning about New Practice with ICT: to identify if teachers knew how to use ICT in their teaching; how teachers have gained their current knowledge about ICT: and, which factors supported and hindered their use of ICT for professional practice.

D) Pedagogy: How ICT is Used to Support the Curriculum: to identify how ICT is being used by teachers in their teaching.

E) Management strategies: helping or hindering teacher and pupil use of ICT: to identify which strategies senior managers are employing in order to integrate ICT into the school; discover sources of funding; and, which factors support and hinder change with ICT in the school.

Recording Responses

In the early drafts and piloting of the questionnaire teachers were asked to rank some of their answers in order of importance. For example, with respect to 'factors supporting the use of ICT in teaching', teachers were provided with a list that they were asked to rank in the order of the helpfulness of each factor. This style of question was repeated for 'the factors hindering the use of ICT in teaching'. However, because the list contained 8 factors, when the researcher trialled this, it was found to take too much time and be too complicated. Instead the decision was taken to produce a Likert Scale of responses, which enabled teachers to identify each factor on a scale of 1 to 5, with 5 being strongly agree, to 1 strongly disagree. This proved to be easier operationally for the teachers and produced quantifiable responses (see appendix E).

4.4 DATA EVALUATION

Generalisability

The key debate here is the question of whether case study research can or should lead to generalisations. Generalisations are taken to be the discovery of findings that apply *beyond* the boundaries of the case study and as such, their generation is part of operating within the positivist paradigm. In science this leads to the discovery of universal laws and in social science, surveys that lead to statistical generalisations. Aristotle identifies these respective deterministic and probabilistic laws as knowledge that is 'that which always is' and 'that which is for the most part'.

Stake (1995) argues that case study research does not provide the kind of foundations necessary for conventional generalisations that are part of the scientific endeavour regarding the discovery of laws. Rather, he argues, the strength of case studies is that they are able to form a 'full and thorough knowledge of the particular'. What is required is not that case studies provide generalisations, but rather they describe the case in depth in order to capture the uniqueness and in doing so create 'naturalistic generalisations'. 'The case study attends to the idiosyncratic more than to the pervasive' (Stake, 1995, p7).

In the seminal text, entitled *'The only generalisation is: there is no generalisation'*, Lincoln and Guba (1985) also criticise the idea that researchers should aim for scientific generalisations as an outcome of case studies. However, they also criticise the alternative advocated by Stake of 'naturalistic generalisations'. Lincoln and Guba argue against the reductionist dichotomy of either searching for general laws or studying the unique. Instead they argue that it is possible to draw conclusions from studying one case which may hold in another similar case or cases. This according to Lincoln and Guba is the *transferability* of conclusions, but in order to be able to provide this, case studies must offer 'thick descriptions' (Geertz, 1973).

Donmoyer (1989), who builds on the work of Stake (1995) and Lincoln and Guba (1985), provides a more adequate account of the concept of naturalistic generalisation. Importantly, Donmoyer (1989) argues that the pursuit of generalisation as advocated by the positivist paradigm and attained via quantitative methodology is not appropriate in applied areas like education. Also significant, Donmoyer (1989) criticises Lincoln and Guba (1985) for assuming that the knowledge gained from one case can only be applied to understanding another case when the cases are *similar*. Rather, Donmoyer (1989) argues, there is also much to be gained from *differences*, which can be illuminating. Schofield (1980) who also rejects the idea of generalising from case studies argues that this position should not to be conflated with the notion that case study researchers can put forward general conclusions. It is the universalising which is to be adhered against.

Gomm, Hammersley and Foster (2000) in their seminal text that assesses the key debates of case study research, begin by questioning whether naturalistic generalisations or transferability, as proposed by Stake (1995), Lincoln and Guba (1985), and Donmoyer (1989), offer alternatives to the drawing of general conclusions. Gomm *et al.*, argue they do not. Rather, Gomm *et al.* (2000), believe it is possible to produce general conclusions of the kind that survey researchers aim for.

Interestingly, Bassey (1995) has changed his mind regarding this issue, shifting position from against the possibility of generalising from case studies to now advocating exactly this. Previously Bassey (1995) argued for the 'study of singularities', which incorporated all empirical work that was *not* 'carefully selected as a representative sample', since only the latter could ever lead to generalisations. 'A study of a singularity is research into particular events whose findings may be related to other situations, but should not be generalised' (Bassey, 1995, p117). Where data collection has not been subjected to rigorous representative sampling, which is the only kind of research that can lead to legitimate generalisations, Bassey categorised the research as the 'study of singularities'.

However, now Bassey (1999) argues case studies can produce generalisations, but they are of a different kind to 'scientific generalisations' in scientific research and 'statistical generalisations' in social science research. Rather the generalisations produced by case study research in education are 'fuzzy generalisations', like fuzzy logic. Such generalisations tell us 'that something *may* happen, but without any measure of it's probability. They are 'qualified generalisations', carrying the idea of possibility but no certainty' (Bassey, 1999, p46). Hence, Bassey argues, by formulating fuzzy generalisations educational researchers can make important contributions.

In case study research each case is one of a type. Although each case is in some respects unique, it is also an example of a broader case of things. 'The extent to which findings from case studies can be generalised to other examples in the class depends on how far the case study example is similar to others of it type' (Denscombe, 1998, p36). To enable this Denscombe argues it is necessary to a) identify significant features on which comparison with others in the class can be made, and b) to show how the case study compares with others in the class in terms of these significant features. For example, with schools it is necessary to show the significant features of schools in general and then demonstrate where the case study fits in relation to these.

Importantly Denscombe (2003) rightly acknowledges the role and responsibility of the reader when it comes to making judgments about generalisability, a point ignored by Bassey (1995). Hence, when reporting the case study findings, it is necessary to include 'sufficient detail about how the case compares with others in the class for the reader to make an informed judgment about how far the findings have relevance to other instances' (Denscombe, 1998, p36).

With respect to making generalisations on the basis of the case study, part of the responsibility then falls to the reader. It is the reader who will assess how far the findings have implications beyond the confines of the case study. However, for the reader to make an informed judgment on this matter, the reader must be provided with the necessary information, hence the need for 'thick description' (Geertz, 1973).

To summarise, the pursuit of generalisations from case studies is perceived as unnecessary or impossible by Stake (1995), Lincoln and Guba (1985) and Donmoyer (1989), who argue in favour of thick description, naturalistic generalisations and/or transferability. However, Schofeild (1980) and Gomm *et al.,* (2000) argue that case study research can provide empirical generalisations of the kind that survey researchers pursue. Bassey (1995) argues for fuzzy generalisations as the distinctive product of case study research in education, which are different from scientific generalisations in scientific research and statistical generalisations in social science research.

Criteria for Evaluating the Research

There are essentially four criteria against which research design will be judged. The following section will address these important methodological considerations.

Internal validity: are the research findings true for the particular context and subjects with which the inquiry was conducted?
External validity or generalisability - applicability: are the findings applicable in other contexts and with other subjects?
Reliability - consistency: would the findings be repeated if the inquiry were replicated with the same subjects in the same context?
Objectivity - neutrality: how far are the findings determined by the biases, interests and perspectives of the researcher?

Reliability

Reliability is concerned with the question of whether the results of the study are repeatable. The term *external reliability* refers to the degree to which a study can be replicated, which is a difficult criterion to meet in qualitative research. LeCompte and Goetz (1982) argue it is impossible to 'freeze' a social setting. Indeed the hallmarks of qualitative research are the understandings achieved regarding the participants' experiences, and the suggestion that this kind of research is easily replicable is problematic. As Hitchcock and Hughes (1995, p108) argue 'the assumption here is that the same situation ought to be able to be researched in the same way, producing roughly the same sort of findings from different researchers. The fundamental misunderstanding here is that the situation will be the same. Situations never remain the same, they change.' The assumption underlying qualitative research is that reality is 'holistic, multi-dimensional and ever-changing; it is not a single, fixed, objective phenomenon waiting to be discovered, observed and measured' (op. cit., p334).

However, LeCompte and Goetz (1982) do argue that despite the impossibility of 'freezing' a social situation there are strategies that can be introduced in order to approach the requirements of external reliability. That is, by explicitly outlining the research methods used it would be possible in principle to replicate the research. Denscombe (1998, p213) argues that the issue of reliability is then transformed into the question: if someone else did the research would they have got the same results? Whilst there is no way of knowing this for certain, *if* there is an explicit account of the *aims* of the research and *how* it was undertaken, this would provide a way of dealing with the issue of reliability in qualitative research.

McCormick and James (1983, p187) identify two other types of reliability, which can be considered in relation to the research undertaken:

1. *Inter-judge reliability*, which refers to the degree of agreement between two researchers observing the same or similar phenomena.
2. *Intra-judge reliability*, which refers to the consistency of a researcher's observations on different occasions.

For inter-judge reliability the research literature was able to provide checks. Studies of teachers using ICT (Brosnan, 1997; Dawes, 2001; Leask and Pachler, 1999; Scrimshaw, 1993; Sellinger, 1999; Somekh and Davies, 1997; Watson, 1993) provided indication that the teachers in the case study sample were reporting similar experiences with ICT. Also, academic papers written during the research period were submitted to international conferences and to journals for publication, a process that subjected the research to peer review. Successful acceptance was taken as partial evidence of inter-judge reliability (see appendix F 'Inter-Judge Reliability: academic peer review'.)

Intra-judge reliability necessitates consistency of a researcher's observations on different occasions. The research design minimised researcher fluctuations in recorded observations by using a large number of participants, over a long period of time. Also audio recording the interviews enabled the data to be reviewed on numerous occasions to minimise errors arising from early judgments; maximising consistency.

Validity: construct, internal, external

Reliability and validity are important criteria in establishing and assessing the quality of research. However, since these criteria are mainly relevant to quantitative research, there are two different positions taken by writers with respect to applying these criteria to qualitative research. Firstly, there are those whose stance is to assimilate reliability and validity into qualitative research with little change of meaning and secondly, there are those who argue that the meanings of the terms need to be altered. Lincoln and Guba (1985) argue that qualitative research should be evaluated according to different criteria. Both stances shall be examined in relation to this research.

Interestingly, Hammersley (1992) lies midway between the two positions. He proposes that validity is an important criterion but he reformulates it. For Hammersley (1992) the plausibility and credibility of a researcher's 'truth claims' are the main considerations in evaluating qualitative research. Hammersley (1992) also suggests that *relevance* is an important criterion of qualitative research. Relevance refers to the importance of the topic within its field or the contribution it makes to the literature in the field.

Validity is concerned with the integrity of the conclusions that are generated from the research (Bryman 2001). McCormick and James (1983, pp187-188) identify different types of validity, which are considered with respect to the research methods selected.

1. **Face validity**: *a measure looks as if it measures what it purports to measure.* A proposition has face validity when it seems reasonable, rational and appropriate for what it is. As Hitchcock and Hughes (1995, p106) state, do the descriptions ring true? Do they feel right? Some of the documentary evidence referred to appeared to have face validity (for example, government reports, school policy documents), however, other documents (such as newspaper reports) may not, because of their editorial stance.

2. **Content validity:** *the data covers all relevant subject matter.* The research focus is the interaction of teachers with ICT; that is teachers' professional interaction with the processes of ICT implementation. The research design ensured a variety of methods were used to collect data (namely multi-site case study that utilized

interviews, observations, documents and questionnaires). This choice of methods helped to ensure content validity.

3. **Internal validity:** *soundness of explanation: whether what is interpreted as 'cause' produces the 'effect'.* Some effects may be attributed wrongly to perceived causes. The following example from Dawes (2001) neatly illustrates this. One school in her study had impressive displays of ICT on the notice boards. Dawes argues that the initial cause seemed to be a strongly orientated ICT staff, but the real causes of this effect (revealed in interviews) was a new and charismatic ICT coordinator and a focus on ICT for the school's Ofsted inspection. This clearly highlights the need to triangulate data obtained from observations (of the school environment, e.g. the notice boards) with additional data gathered by other methods (interviews), in order to rigorously check and ensure internal validity.

LeCompte and Goetz (1982) argue that internal validity tends to be a strength of qualitative research, because participation in the social setting (in schools with teachers) over a period of time allows the researcher to ensure a high level of congruence between concepts and observations and interview findings.

4. **External validity:** *generalisation from one set of conditions to another;* whether the results of a study can be generalised beyond the scope of the specific research context. Exponents of case study research counter the critique of restricted external validity by arguing that it is not the purpose of this research design to generalise to other cases. Rather, the aim is to generate an intensive examination of 'the case' in order to then engage in a theoretical analysis. The central issue is the *quality* of the theoretical reasoning: how well does the data support the theoretical arguments that are generated? The issue is *not* whether the findings can be generalised to a wider universe, but how well the researcher generates theory out of the findings (Bryman, 2001; Yin, 1994).

The notion of *validity checks* suggests that there are things that a researcher can do to increase validity. Hitchcock and Hughes (1995) argue that the most common way in which validity can be strengthened is through *triangulation* and *respondent validation.*

Triangulation

The researcher adopted the strategy of triangulation in order to increase the internal validity, which is considered vital by writers on case study methodology (Yin, 1994). With respect to triangulation Denzin (1970) identified four types, which guided the researcher:

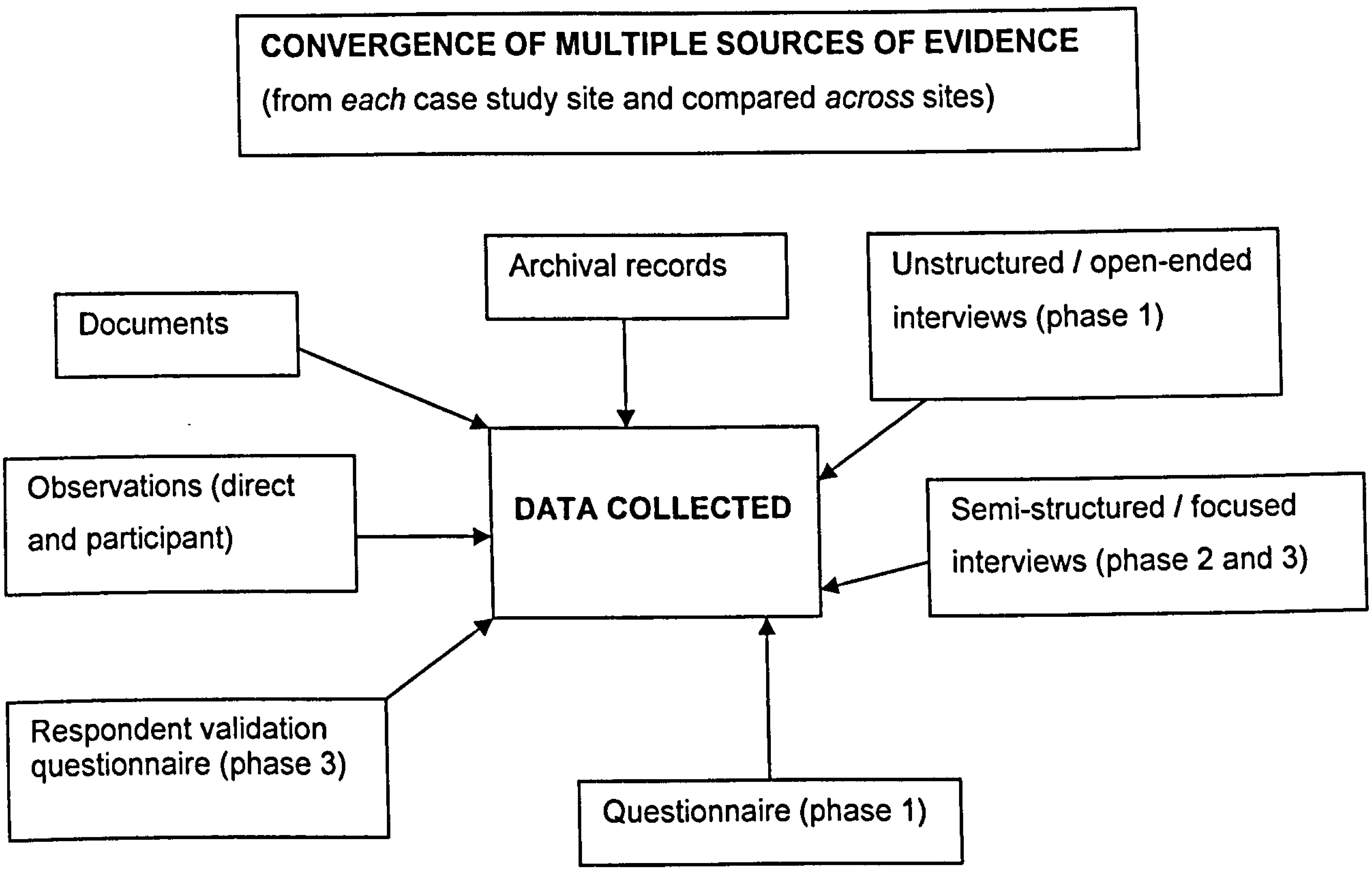
- *Data triangulation;* involves data collected over a period of time, from more than one location and from more than one person. The longitudinal nature of the research combined with the variety of schools and numbers of teachers permitted the researcher to engage in data triangulation.

- *Investigator triangulation;* involves the use of more than one observer for the same object and can involve respondent checks. The use of respondent validation was integral to ensuring investigator triangulation.

- *Theory triangulation;* involves the use of more than one kind of approach to generate categories of analysis. Hitchcock and Hughes (1995) argue that Denzin (1970) can only give theoretical examples here, which implies that this is difficult to achieve.

- *Methodological triangulation;* involves the use of more than one method of obtaining information. The researcher's use of interviews, observations, documents and questionnaires ensured methodological triangulation. Hence the findings from one source were triangulated with alternative sources as a way of bolstering confidence in their validity. See diagram below.

Figure 4.1 Triangulation



Respondent Validation

Respondent validation required taking the data and interpretations back to the participants in order to ask if the results are plausible (Guba and Lincoln, 1981). By feeding back findings to the participants to get their opinions on the explanation proposed, and to check that the research account accords with their experiences, the researcher enabled the participants to validate the findings.

Opportunities and Markers for Validation in the Research

These markers were:

1. Phase one: questionnaire information and early interview information could be compared with one another.
2. Phase two: interview, observation information and documentary evidence (e.g. school development plans and ICT policy) from the leading case study school could be compared (intra case study site).

3. Phase two: information collected (by interviews, observations and documents) from each school could be compared with one another (inter case study sites). This enabled the interrogation of data *across* the multi-site case study and allowed triangulation by comparison of the data from each of the schools.
4. The breadth of the study was widened in phase two by the addition of more schools.
5. Phase three: respondent validation was conducted.
6. Academic peer review: discussion of the data analysis and emerging framework with academic colleagues, via conference papers and publications.
7. Comparing questionnaire 1 and questionnaire 2 responses. The comparison of data from phase one with that obtained in phase three provided an indication of change over time.
8. The comparison of earlier and later interviews with the same teacher allowed developments and changes to be identified.

Drawing and Verifying Conclusions

The conclusions drawn from the data were verified in accordance with the guidelines (tactics) provided by Miles and Huberman (1994, p28).

A) Tactics to ensure the basic quality of the data:

a) check for representativeness
b) check for research effects
c) triangulating
d) weighing the evidence

B) Tactics using the data within the data set:

e) making contrasts and comparisons
f) replication of findings
g) checking for rival explanations
h) looking for negative evidence
i) obtaining feedback from informants

The following section demonstrates how the tactics were employed.

Check for representativeness: When a category or theme had been identified, checks for representativeness were conducted by looking for evidence of the category across more than one data source.

Check for research effects: in order to minimise the effects of the researcher, a variety of data collection methods were established.

Triangulation of data: the study's internal validity was bolstered by the cross-checking of data from interviews, observations, documents and questionnaires.

Weighing the evidence: Analysis of the data proceeded by simultaneously examining different forms of data, and identifying the relationships between them. Hence, evidence was 'weighed up' in the light of data from other sources. The integration of data was achieved by the following strategies proposed by Bryman and Burgess (1994, p105):

- following up similar themes in different data sets
- generating propositions that can be checked against the data, which enables exploration of the data from different angels
- using the data sets to examine a particular issue from a variety of viewpoints

Contrasts and comparisons: between the data were used to establish an overall picture of teachers interacting with ICT and implementation processes.

Replication of findings: this became possible as the data collection proceeded and teachers' interview responses were shown to replicate the same issues. An accumulation of the data led to saturation of the categories and themes.

Rival explanations for findings: this entailed the researcher critically considering different explanations for the findings.

Looking for negative evidence: trying to locate the deviant response or negative examples was an important part of the analysis. Consideration also had to be given to 'absences', for example what teachers *didn't say* - the gaps and silences.

Feedback from informants: this was obtained by providing the teachers and other participants with a summary of the findings, which were offered, for confirmation. This is the process of respondent validation.

4.5 SUMMARY

The aim of this chapter was to carefully describe the methods selected for the research and to:

- Provide a rationale for the methods chosen: a multi-site case study approach that utilized interviews, observations, documentary sources and questionnaires, in order to conduct qualitative research aimed at understanding the lived experiences of teachers interacting with ICT.
- Outline which methods drew on the work of earlier research workers: namely the foci of the interviews and observations drew on the OECD (2001) research on ICT in schools.
- A detailed description of the methods used; in order to provide an audit trail.
- A critique of the methods used and an understanding of validity and reliability as applied to the evaluation and assessment of all research.

The following three chapters will present the evidence and analysis arising from the data collected in this enquiry. The findings are outlined in depth in the next chapter and pertain to the categories that arose following a grounded theory approach.

CHAPTER 5

FINDINGS: PHASE 1, 2 AND 3

5.0 INTRODUCTION

The theoretical framework that allowed for the identification of themes emerging from phase 1 of the research was grounded theory. Following the exploratory approach of phase 1 a number of themes concerning teachers became apparent. These were probed more systematically in phase 2 and the findings from this in-depth phase were presented back to a sample of the teachers for respondent validation. This chapter discusses the findings from each phase of the research.

In staying faithful to the premises of grounded theory, the structure of this chapter reflects and presents the categories and coding that emerged from the data. Consequently, whilst the findings chapter focuses on the *categories* as they emerged from a grounded theory approach, only selective extracts can be used to illustrate these, which inevitably fails to do justice to the volume and richness of the data collected. However, given the constraints of space it was essential to prioritise the data that best illustrates each category. The following chapter discusses the analytical themes that were developed from the findings. The analysis and linking of the categories together in a more sophisticated understanding of the data is therefore presented in the next chapter.

5.1 FINDINGS FROM PHASE 1: EXPLORATORY

In phase 1, sampling was open to those teachers and schools that would provide the greatest opportunity for discovery, hence the term 'open sampling'. The analysis of the unstructured interviews and observations from phase 1 allowed issues to *emerge*. These initial issues were coded into *categories*, which became the focus of the questionnaire conducted at the end of the first phase of research. The aim of the questionnaire was to explore the categories that had emerged and provide baseline data on teachers' patterns of ICT use.

The questionnaire was administered in electronic and paper versions. However, a cautionary reflection suggests that the schools that responded to the questionnaire online were more advanced in their use of ICT than the majority of schools at the time in 2000.

As these schools were already involved in ICT innovations and international projects, the sample is *not indicative of the national context*. For example, school A was selected at national level to join the European Network of Innovative Schools (ENIS) (http://www.en.eun.org/enis/set-enis.html), so consequently the results must be considered as reflecting the more advanced ICT using schools.

The response rate to the questionnaire was 87%; that is 55 teachers out of the initial sample of 63 teachers completed the questionnaire. The majority of questionnaire respondents were classroom teachers 75%; the other 25% were senior leaders (Heads and deputies). The total sample therefore can be said to represent the interests of school leaders and classroom teachers.

The age range of pupils taught by the teachers in the total sample was age 5 – 18 years. The teaching experience of the total sample was very experienced, with 70% teaching more than 10 years, the remaining 13% of teachers in the sample have taught for 3-5 years and 12% are in the first two years of teaching. The age range of the sample of teachers (age 20-60 years) was evenly spread, with 20% age 20-29 years, 26% age 30-39, 30% age 40-49 and 16% aged over 60 years old. In the sample more than 50% of the teachers were from large schools with over 800 pupils.

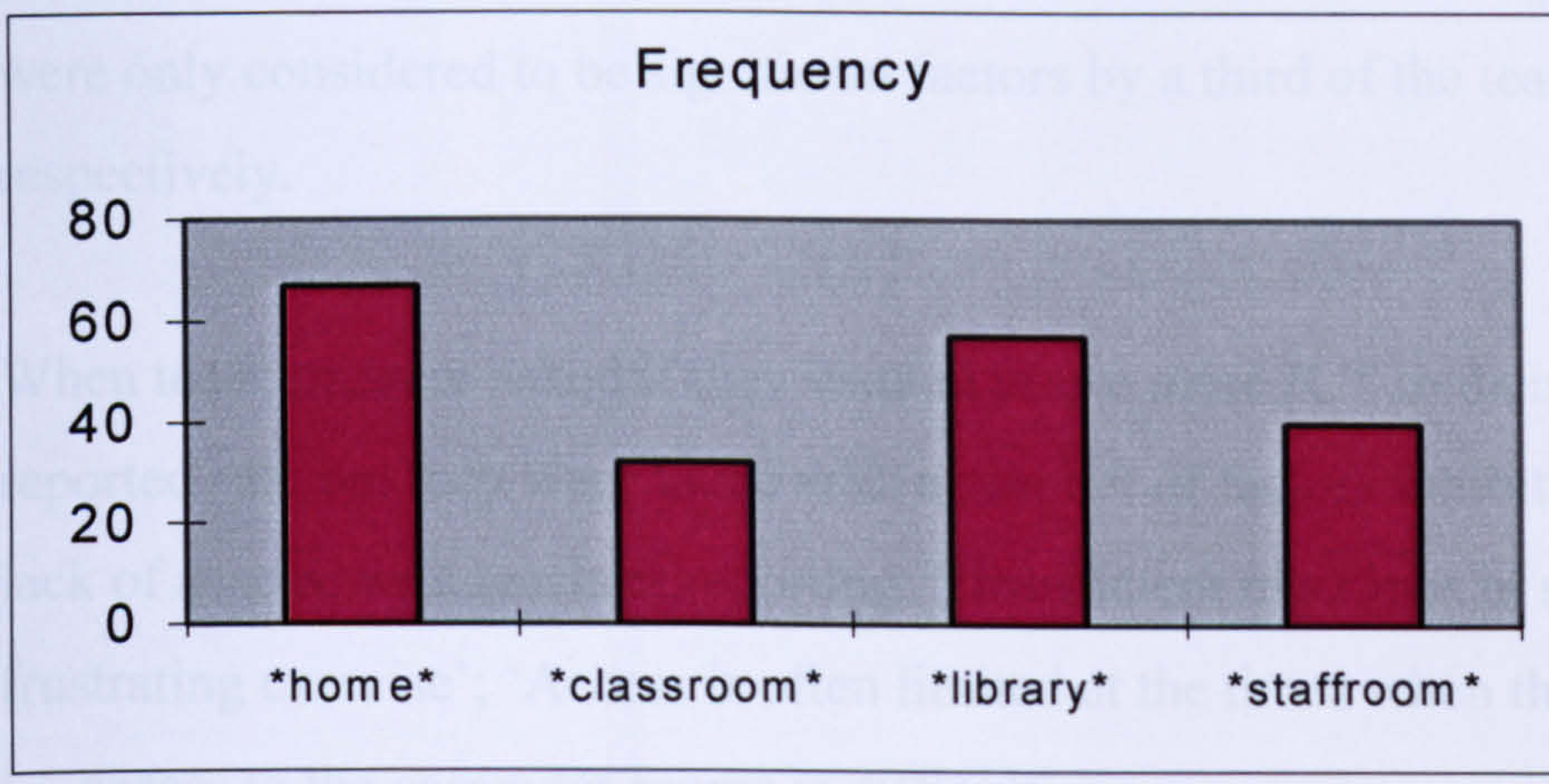
The teachers responding came from all subject areas. The sample of teachers taught the following subjects; 15% IT, 11% Science, 11% Modern Languages, 10% Maths and the remainder of the sample were spread across the other subjects though in smaller percentages.

Results of the Questionnaire

A database was created for recording the questionnaire responses, however, whilst this was largely successful, it was not fool proof and there were a minor number of nil returns: 5 questions failed to record data. This was despite repeated pilot runs with the electronic version, which only emphasises the fact that technology is not always reliable. Given that this occurred with such a small number of questions, it did not affect the overall questionnaire data collection.

The findings are summarised below in order to illustrate data that emerged as important. Detailed, quantitative findings for each question are contained in appendix H. The findings concerning teachers' access to computers revealed that most had access via home 80%, which was closely followed by the school computer room school 79%, the school library 68%, the staff room 48% and lastly, classroom 38%.

Figure 5.1 Frequency of Use of Computers



Regarding the use of national electronic networks, of those who found government education websites helpful, 74% reported they found the access to information useful for general information, 61% for information about examination syllabi, 58% for inspection information, 42% for teaching resources and 37% for school performance tables.

The questionnaire elicited a consideration of which factors supported and hindered teachers' learning about new practice with ICT. With respect to how teachers gained their current knowledge of the use of ICT, most reported through *training courses* and *networks of family, friends and colleagues*. This latter way of gaining ICT knowledge is referred to as *'networked relations'*, and was reported in Leask and Younie (2001). Most significantly, teachers in this sample have gained most of their current knowledge about how to use ICT through networks of family, friends and colleagues.

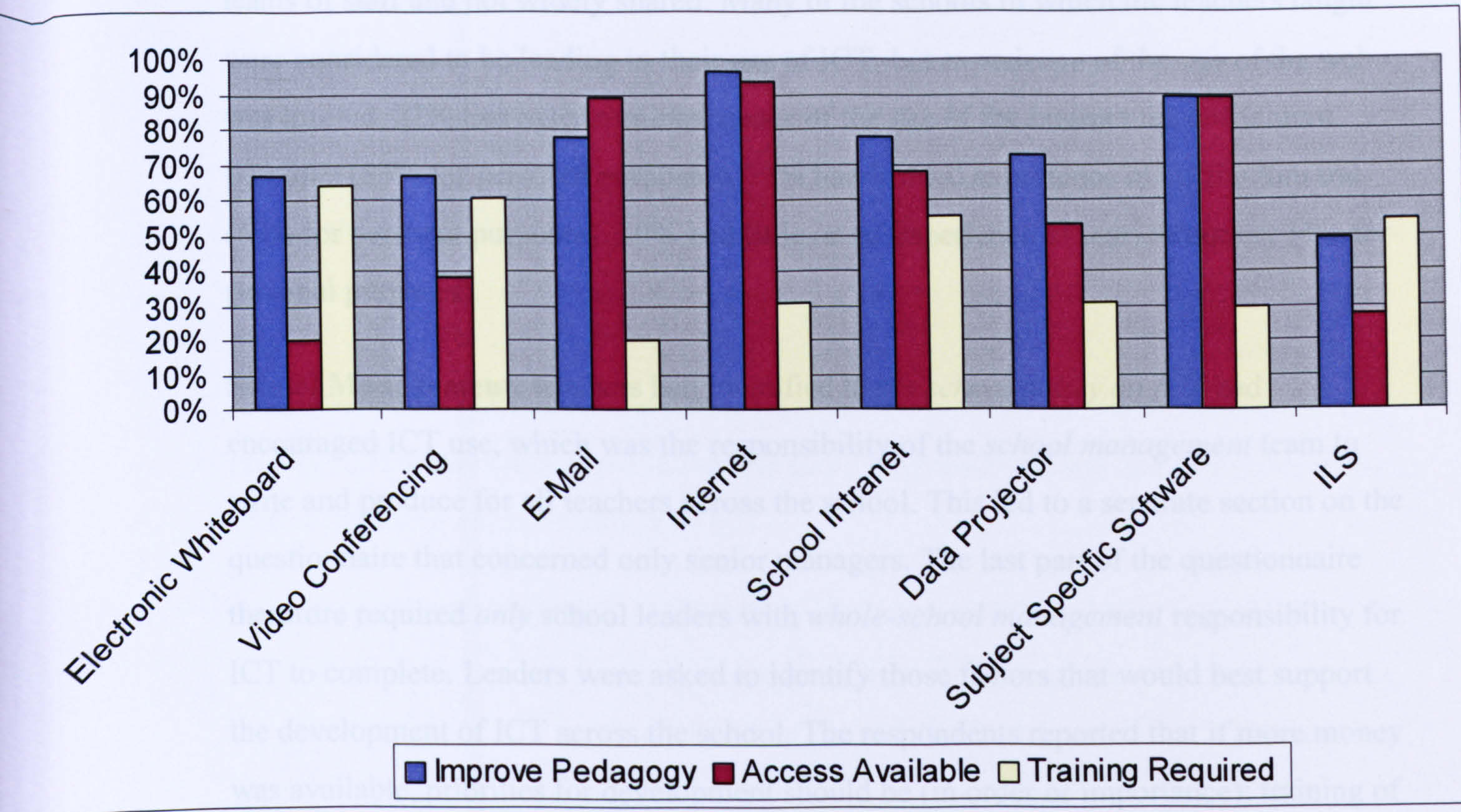
Factors identified by teachers as most supportive to using ICT in teaching: the teachers identified a *supportive network in their school* as a major factor helping their use of ICT- half of the entire sample 50%. This was closely followed by a *school policy that encourages ICT use,* which was identified by 43% teachers as helpful to them using ICT in their teaching, which relates to *school management,* since it is their responsibility to produce a school ICT policy. *Access to computers* and equipment was identified by 63% of teachers as supportive; whereas *technical support* and *training* were only considered to be significant factors by a third of the teachers, 32% and 31% respectively.

When teachers were asked if they wanted to use more ICT in their teaching, teachers reported yes, but they were faced with a number of factors inhibiting ICT use, mostly a lack of access, with teachers reporting: 'Insufficient machines in school makes it a frustrating exercise'; 'Access is often limited at the times when the lesson is required'; '...access to the computer rooms is difficult'.

The use of technology in teaching: Teachers were asked their views on interactive whiteboards, video conferencing, email, internet, school intranet, data projectors, software, integrated learning systems (ILS). The data represented in the graph below illustrates teachers' desire to have the technology and the numbers responding that had actual access at the time of the questionnaire in 2000. In each case *the desire to know more about the technology outweighed the teachers' ability to access the technology.* The issue of access was being addressed at a national level (with key initiatives: NGfL and 'Computers for Teachers Scheme'), however, the local roll out was slow to take effect, although it was *starting* in the schools in the sample at the end of phase 1.

Below then the graph illustrates the findings pertaining to teachers' views on different types of technology and the extent to which teachers consider that technology as supporting and improving pedagogy. The graph also incorporates the extent of access available for each type of technology and whether the teachers wish to have training in that technology.

Figure 5.2 Teachers' Views on ICT



Teachers' views about: whether various forms of technology support teaching and learning; whether teachers have access to this technology and whether they wish to have training in the technology.

The questionnaire explored factors that emerged as supporting and hindering teachers' use of ICT for professional practice.

Access to computers was identified by teachers as a key factor, which if limited, hindered or prevented ICT use for professional practice. Overall, the data illustrates that even with specialist equipment in computer suites and teachers' rooms; *access is limited*, because of the numbers wishing to use the facility. The best scenario teachers suggest is that computer access and internet connectivity is available in all areas: namely *classroom, the school library, specialist computer rooms, the staff room, computers on wheels (mobile trolleys) and open areas of networked computers* shared by 3-4 clusters of classrooms. However, teachers did report that the most cost effective and flexible model of organising computer access for pupils was laptops on a trolley.

Regarding teacher knowledge and ICT pedagogy, even within innovative schools, experience and understanding about the use of ICT in education was held within small teams of staff and not widely shared. Many of the schools in which the teachers taught were considered to be leading in their use of ICT, but experience of the use of the web was limited. 27% had extensive experience of the use of the internet for curriculum purposes (53% for personal purposes), 73% had limited experience of curriculum use (43% for personal purposes). 19% had little or no experience of curriculum use (4% for personal purposes).

School Management: teachers had identified that a *school policy on ICT* had encouraged ICT use, which was the responsibility of the *school management* team to write and produce for all teachers across the school. This led to a separate section on the questionnaire that concerned only senior managers. The last part of the questionnaire therefore required *only* school leaders with *whole-school management* responsibility for ICT to complete. Leaders were asked to identify those factors that would best support the development of ICT across the school. The respondents reported that if more money was available, priorities for development should be (in order of importance): training of teachers in ICT skills (90%), with the provision of hardware (including peripherals such as whiteboards, videoconferencing, LCD projectors) and technical support both being strongly favoured (85% each). Software and development of the school network came next (70%), followed by the school intranet and developing networking in the community, then training in pedagogy, (55%). The lowest priority was given to putting money into the local and regional intranets and government sites (45%).

When asked what factors hinder or prevent change with ICT schools, the most significant factors reported on by leaders were lack of funding for hardware 90%; lack of qualified staff 80%; lack of innovative teachers 75%. Lack of resources for training was considered an issue by 55% of the respondents. The lack of evidence or conviction about learning gains for pupils through ICT was cited by 50% and was placed as least important a factor hindering change.

Regarding finance for ICT, only 10% of schools had funded their ICT provision just from the school budget. Other sources included: support from regional and national funding authorities (50%) and recycled computers (20%). 90% of the schools reported using supermarket voucher schemes to obtain hardware.

The findings from phase 1 led to the identification of curriculum advantages of ICT for teaching; for subject specific affordances with ICT, and the advantages of ICT applications for pedagogy, administrative purposes, pupil activities and the impact of ICT on the classroom, however, given the constraints of space there is not the opportunity to warrant detailed consideration of these here. Similarly, teachers' views on the organisation of computers within the school and the different ways access to computers can be organised in a school, alongside the advantages and disadvantages of each type of organisation were found, but more important was the identification of key factors affecting implementation of ICT.

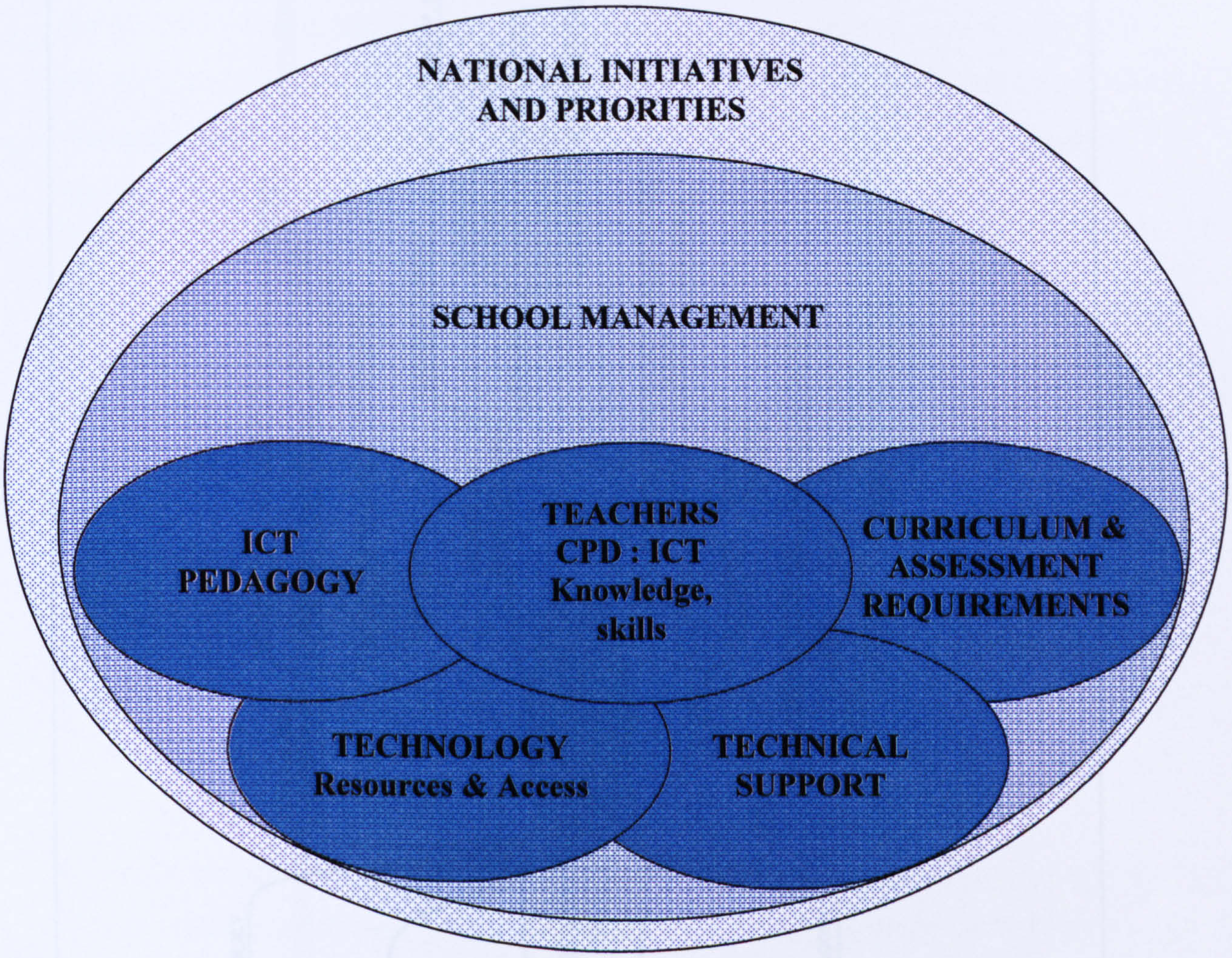
Summary Phase 1 Findings

The aim of phase one was to sample a range of schools and teachers that would provide the greatest opportunity for discovery. The phase 1 findings from the questionnaire, interviews and observations led to a detailed list of factors that could be identified as supporting and hindering teachers' use of ICT for professional practice. Specifically the findings indicated six factors that affect the integration of ICT into teachers' professional practice. These were:

- Curriculum and Assessment
- Technology: resources and access; technical support
- Teachers' CPD: ICT training
- ICT Pedagogy: teacher knowledge and skills of ICT applications in the classroom
- School Policy on ICT: school management
- National initiatives and priorities for ICT

These factors are represented in the diagram below.

Figure 5.3: Factors that Effect Integration of ICT into Teachers' Professional Practice

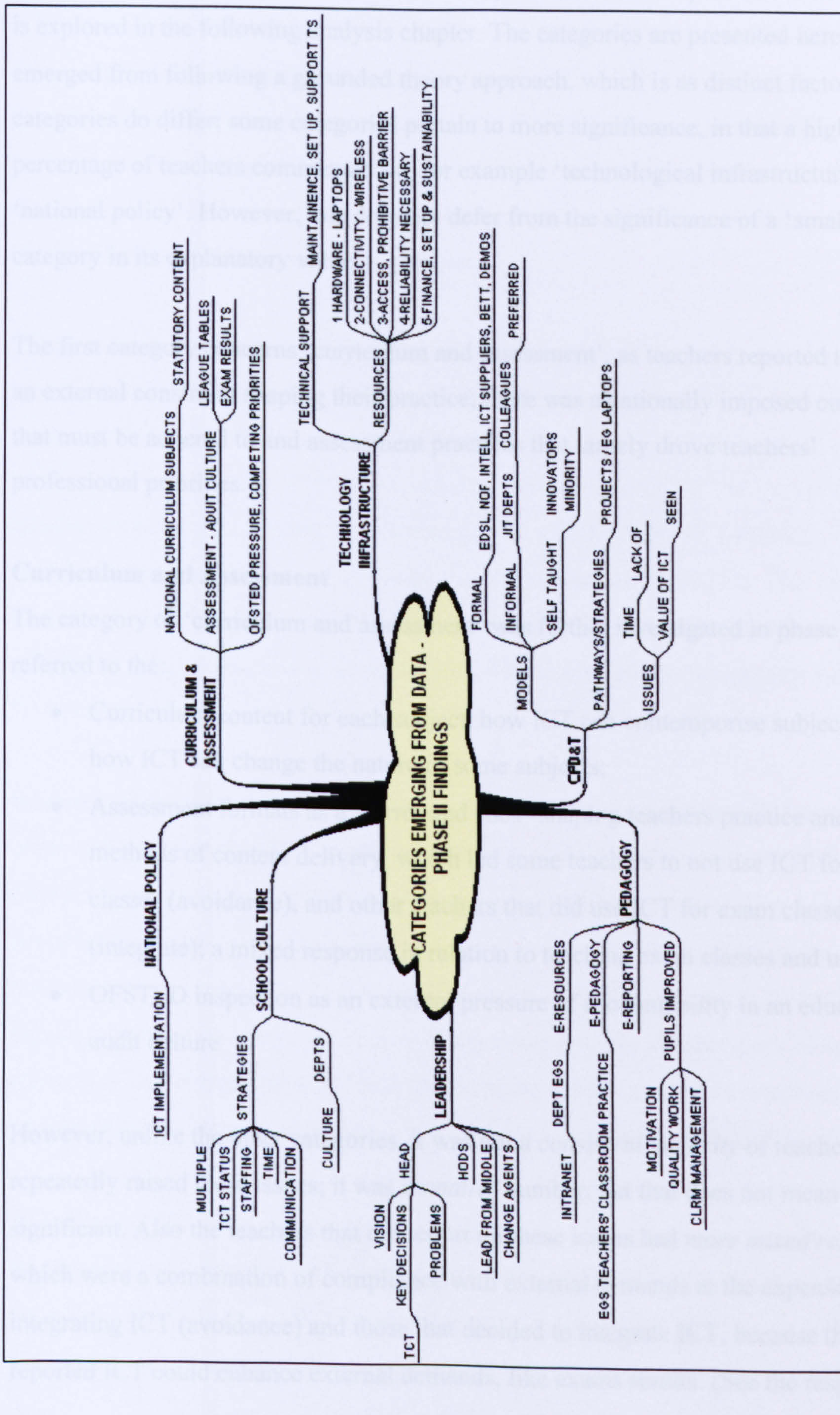


The second phase of the research enabled these categories to be investigated in greater depth and is discussed in the next section.

5.2 FINDINGS FROM PHASE 2: REFINING RESEARCH CATEGORIES

In phase 2, the categories from phase 1 were explored in significantly more detail, across a wider number of teachers and schools. Also, importantly in phase 2 a new category emerged: school culture. The categories are illustrated in a mind map below.

Figure 5.4: Mind map of findings



The categories represent discrete themes, and although each constitutes a separate category, they are *interrelated* and exist in a dynamic relationship to each other, which is explored in the following analysis chapter. The categories are presented here as they emerged from following a grounded theory approach, which is as distinct factors. The categories do differ; some categories pertain to more significance, in that a higher percentage of teachers commented on, for example 'technological infrastructure' than 'national policy'. However, this does not defer from the significance of a 'smaller' category in its explanatory value.

The first category concerns 'curriculum and assessment', as teachers reported this was an external constraint shaping their practice; there was a nationally imposed curriculum that must be adhered to and assessment practices that largely drove teachers' professional priorities.

Curriculum and Assessment

The category of 'curriculum and assessment' was further investigated in phase 2 and referred to the:

- Curriculum content for each subject, how ICT can contemporise subjects, and how ICT can change the nature of some subjects;
- Assessment formats as a 'carrot and stick' shaping teachers practice and methods of content delivery, which led some teachers to not use ICT for exam classes (avoidance), and other teachers that did use ICT for exam classes (integrate); a mixed response in relation to teaching exam classes and using ICT;
- OFSTED inspection as an external pressure of accountability in an educational audit culture

However, unlike the other categories, it was not a *consistent majority* of teachers that repeatedly raised these issues; it was a *smaller* number, but that does not mean less significant. Also the teachers that did report on these issues had *more mixed responses*, which were a combination of compliance with external demands at the expense of not integrating ICT (avoidance) and those that decided to integrate ICT, because they reported ICT could enhance external demands, like exams results. (See the respondent validation graph, which reflects this split in teachers' responses at the end of this chapter on page 236.)

Curriculum Subjects and ICT Integration

Firstly, teachers reported that they learnt about *ICT developments pertaining to their curriculum area* through subject associations, for example, through advisory newsletters that review ICT packages. (Other ways of learning about ICT for subject use are discussed in the CPD section of this chapter.)

Teachers reported that the use of ICT was significant in giving their curriculum subject an '*up to date'* feel (CC, school H, Maths, 28/05/02) and teachers welcomed the contemporaneous credibility that ICT afforded their subject. MFL teachers in particular commented on the value of ICT for '*authentic learning*; using the internet for French hotel room prices and writing for a brochure' (TI, HOD, school D, 24/05/02), because 'computers give access to *real language use'* (IT, school D, 26/06/02). This teacher strenuously asserted the need to 'be ruthless about ICT, for meaningful ICT activities and not be trapped into low level use' (ibid), which attests to pedagogically meaningful ICT implementation.

Interestingly in phase 2, two curriculum areas stood out as integrating ICT *more* than other subjects, notably MFL, as above, and science. MFL and science certainly utilised *interactive testing* the most. The debate concerning why some subjects lend themselves better to ICT was explored by some teachers. One argued that 'art teachers are resistance to computers; they enjoy paint, the tactile bit' (QS, school F, 20/11/01), but argued however that 'now the vision is to *use computers for artistic work'* (ibid). Some teachers acknowledged how ICT may be changing the nature of the subject and this transformational element is explored in McCormick and Scrimshaw (2001).

Assessment: the 'carrot and stick'

Assessment strategies and pressure on attainment resulted in teachers at Key Stage 4 choosing either, not to use ICT for exam preparation (avoidance) or, to use ICT as an aid to support attainment (integrate).

This split in responses reflects different strategies teachers took in relation to ICT and teaching exam classes, in particular, preparation for the exams taken at the end of Key Stage 4 (KS4), which represent the external demands of curriculum and assessment, in which the results (attainment) form the basis of public school league tables. The findings illustrate that teachers tended to either 'avoid' using ICT with KS4 classes, as a deliberate decision to focus more on didactic teaching of subject content, or to 'integrate' ICT into the revision process and see ICT as an aid to support exam preparation and attainment.

Whilst the above refers to teachers' decisions to either use, or not use, ICT for Key Stage 4 exam classes, there were teachers who argued that ICT affords new skills that are not tested or examined under the current assessment system and should be. These teachers reported that the traditional assessment format presented a problem for them utilising ICT, since the *exams did not account for new skills ICT afforded.*

Assessment, predominantly exams and coursework, has been in paper format. This was a problem for the teacher above who had revolutionised art lessons through digital video and cameras, transforming pupils' work from paper form to digital, which consequently presented a problem regarding *assessment*. The teacher put all pupils' work onto CDs, which constituted the inaugural submission of digitalised art: 'this was the very *first time* any one had ever sent CDs' and he was unsure that 'the exam board would accept this, but they did and this has now been established' (QS, school F, 20/11/01). This illustrates the need to re-examine the nature of the curriculum and assessment in light of changes that ICT brings.

In addition, traditional exam formats and success in them, was the reason why other teachers *justified not using ICT*, since their good results were achieved without ICT at Key Stage 4 (Geography, school A; History, school D). These departments were achieving good performance positions in the league table *without using ICT.* Hence, some teachers reported that non-ICT use was excusable: success in assessment became the justification for *not* needing to use ICT - what is the motivation to use ICT, when 'ICT is still an effort for some and you can *still get results without it*,' which won't change 'until teachers can see that ICT makes their lives *easier'* (HL, Deputy Head, school A, 29/01/02).

Some teachers aptly identified, what and how teachers teach won't change 'until we alter the exam system' (DI, school F, 4/7/03). The assessment format of exams dictates teachers' practice:

> ...for key stage 4, there's so much [curriculum content] to get through, not have time to do ICT ...time is so limited in a packed curriculum. (NS, school G, 28/06/02)

Another shamefully admitted 'we're a Technology College, but don't use much ICT with Year 11, because of focusing on *exams'* (WW, Deputy Head, school X, discussion, wireless open day, at school F, 30/05/02).

The findings indicated that current assessment practices appeared to constrain ICT integration. Teachers reported that the use of ICT developed skills not measured by traditional assessment: '*problem solving, information finding, independent learning, do not show on league tables these skills'* (QI, school F, 27/05/02). However, such skills are not directly examined under the current system. One Head argued how assessment failed to take into account new learning affordances with ICT.

> ...the strategy of assessment needs to change, to 'just-in-time' assessment... today's government obsession with measurement...restrictions from curriculum...testing a narrow range of skills ...[we] can't change the way pupils learn with our current content curriculum and assessment. (LX, Head teacher, school F, 11/07/02)

This Head teacher pointed to the *contradiction* from government who have heavily invested in ICT, yet failed to change the one aspect (assessment) that drives teachers' practice: 'the government spend money on technology, but is not responsive to adventurous risk taking' (ibid.). Risk taking (a characteristic of this Head by self admission), paid off for his art teacher who effectively changed assessment formats by submitting digitalised art.

However, this one example does not detract from the inherent contradiction that 'there is a *tension* between ICT innovating and developing *new models* and curriculum and assessment, *old models*' (LX, Head teacher, school F, 11/07/02). As one teacher commented,

> ...changing teachers' practices with ICT is complex. It's not like the national curriculum, where you just have new content and have to teach it, because the assessment is based on the new content. *With ICT there's no carrot; no need to incorporate it, because you're not assessed on ICT in cross-curricular subjects.* (NM, ICT co-ordinator, school M, 12/11/01)

Teachers reported that there was no *incentive* (in the form of *assessment strategies*) to encourage changing practice to incorporate ICT.

Ofsted Inspection: professional accountability and pressure

When teachers referred to Ofsted, *all* commented that a visit exerted pressure that prioritised the inspection above integrating ICT, and everything else: 'Ofsted inspection impinged on teachers' time and sense of priorities, so ICT training took a back seat' (TQ, school F, 22/06/01).

School H was placed in special measures 'and the pressures of this Ofsted position on staff are enormous' (WQ, school H, 2/7/02), such that ICT was not effectively engaged with by teachers.

> ...watched by Ofsted, puts a pressure on the staff; staff overload of priorities; staff leave/unstable staff, supply teachers used. HODs are under pressure from all directions, e.g. managing supply; ICT is just another pressure. There's overload, because we're in serious weaknesses. (WQ, school H, 23/05/02)

However, some teachers reported that Ofsted is also the 'stick' that makes some use ICT, rather than valuing ICT from their own volition for their teaching:

> I use data loggers when I have to do it, e.g. Ofsted, if you're having an inspection, and you need to use ICT, you do, rather than because it enhances what you're doing. (XX, school D, 26/06/02)

This teacher admits, 'there would be pressure (to use ICT) if another inspection happened' (ibid.). In a department with little ICT integration, Ofsted was the only reason proffered for ICT's use by teachers.

The category of curriculum and assessment was further investigated in phase 2 and the following was found:

ICT and the Curriculum: teachers were grateful where ICT contemporised their subject. Teachers used ICT to enhance authentic learning, particularly in MFL.
One art teacher recognised that ICT changed the nature of his subject (ICT afforded a transformation of pedagogy).

Assessment: traditional formats engendered conservativism in teachers' practice as good results were attained without ICT. However, ICT also afforded skills that were not assessed, but that enhanced subject teaching; 'information finding, independent learning, organisational skills, etc', which identified a 'tension' in the system, between 'old models' of assessment and 'new models' of learning with ICT.

Ofsted Inspection: in the school that was placed in 'special measures' by Ofsted this exerted a pressure on teachers that distracted attention away from ICT and hindered integration. However, at a Technology College (TCT), teachers reticent to use ICT (at school D) identified Ofsted as a mechanism that *ensured* ICT use, at least for the *duration* of the inspection.

Another category that was significantly commented on by all teachers interviewed in phase 2 was ICT resourcing.

Technological Infrastructure

The category most consistently commented on by teachers was 'technological infrastructure', which comprised of two sub-categories:

- **Technical support (ICT personnel):** qualified technicians, to *maintain ICT equipment* and availability to *support teachers'* use of ICT
- **Technology resources (ICT equipment)**: hardware, software and network connectivity; teachers wanted guaranteed *access* and *reliability*

Technical support: repeatedly requested was the need for ***qualified technicians***, who teachers wanted available to help do 3 things:

1) ***maintain*** ICT equipment, *before and after lesson use,* to keep ICT in working, in order to provide ICT *reliability*
2) ***set up*** ICT equipment *before lessons*, to ease teacher workload, in order to provide *access* to ICT
3) to be *available* to provide ***technical support during lessons***, when teachers experienced technical failure: to maintain ICT *reliability*

When technicians were available, teachers' *confidence* to use ICT was *enhanced.*

In addition to the above, the *problem* of the *recruitment and retention of qualified technicians* was paramount, since all school leaders, from every case study school, repeatedly stated there was the 'need for well qualified technical support' (NW, Deputy Head, school A, 05/10/2001). However, because *trained ICT personnel* often moved on to better paid ICT jobs outside of schools, this created a problem regarding a high turn over of technical staff and consequential lack of continuity: 'it's a problem, train staff up and then loose them... network managers, we've had 3 in the last 3 years' (NI, SMT, school D, 10/01/02). Even schools that had 'a large technical team', which is 'vitally important', claimed its 'difficult *keeping* technical staff and, difficult *getting* them' (QI, ICT co-ordinator, school F, 30/04/02). *All* the schools stated: 'technical support is not adequate; weakness here and this is expensive' (DL, AST, school F, 20/06/02).

The *solution* for 3 schools (A, F, G) was to employ IT undergraduate students, which were cheaper to employ than qualified IT technicians, however, whilst more *affordable* for schools, the disadvantage was 'they come for a year, but then *leave*' (DL, AST, school F, 20/06/02), so continuity remained a problem.

School (F) developed two further solutions: 1) they used Post 16 students 'as part of their community service in their free lessons' (QS, school F, 20/11/01). 2) for *retaining* technical staff, the school offered accreditation in CISCO networking (TQ, school F, 30/04/02). A solution celebrated by the ICT co-ordinator; this 'means technical staff *stay* for two years to complete it; get staff stability. This is a valuable qualification; means you don't have to advertise for technicians every six months' (QI, school F, 30/05/02).

The consequence of not having qualified technicians was that ICT competent teachers were called on to *act as technicians:*

> Every lesson I'm sorting out problems, technical hitches, rather than teaching. We need a technician to run around and do the technical fixing. (QS, school F, 20/11/2001)
>
> ... (you) need to have a strong technical team, not teachers leaving classes to do it. Get the *burden away from the teacher.* (LM, Deputy Head, school F, 14/06/02)

Teachers across all the schools reported the need for more ICT technicians, because weak retention meant teachers were having to act as technicians in the absence of sufficient numbers of technicians. What teachers wanted were technicians to maintain and set up ICT equipment, and respond immediately to technical failure when teaching.

Technicians: for ICT maintenance

First, you must have 'a number of committed ICT technicians for daily maintenance' (KQ, school A, 11/06/02), because 'hardware is no good if it doesn't work; spend all that money on equipment and not got technical support to maintain it' (DL, AST, school F, 20/06/02). Teachers reported the regular maintenance of hardware by technicians was essential and as more schools move towards laptops this increases the need: 'laptops require more technical support than desk tops, a lot more; more damage done to laptops, need more maintenance... and must be fixed really quickly, otherwise staff lose confidence' (QI, school F, 18/06/02).

Second, technicians played a vital role in 'policing' ICT areas, for example, hubs of computers shared between clusters of classrooms: 'the maths hub was unstaffed and was trashed by pupils; this is prevented with a technician' (UU, HOD School A, 26/04/02).

Third, teachers were more willing to use ICT when *technicians were available*: 'teachers will take full class of pupils in ICT suite if they can have ICT technical support when in there' (WQ, ICT co-ordinator, school H, 2/07/02). Teachers also wanted technicians to support setting up ICT: 'the hardest thing, why I don't use ICT, is getting it out and setting it up' (GN, school F, 22/06/01). The findings indicated that the presence of technicians greatly facilitated ICT use by teachers, as it helped to manage the practicalities of setting up the equipment for lessons and providing confidence that technicians were available to troubleshoot during lessons.

The reason technicians were cited so *often* as necessary, was to solve *reliability* issues during lessons, because: 'ICT has a risk factor – could go wrong' (XX, school D, 26/06/02). When teachers experienced technical failure they reported stress and frustration:

> ...book ICT suite, but then mouse balls gone, printers not work, becomes stressful then. You ask, why did I bother? The lesson's not been productive, you feel frustrated. (NS, school G, 28/06/02)
>
> I was put off using ICT, because of a lack of technical support in the ICT suite. I took disgruntled pupils and would have a bad lesson. (IS, school L, 2/07/02)

When ICT fails, 'teachers are *frustrated*' (DE, school F, 27/05/02), hence technicians are essential for ICT maintenance and to buffer teachers from technical problems: in particular teachers reported the need for ICT technicians for managing a) pupil vandalism of ICT; when ICT is not robust enough, b) Technical failure; when ICT is not reliable enough, and c) reducing teachers' time taken for setting up ICT. For example, delivering a class set of laptops to a lesson, then collecting and recharging them (School A and F).

Summary: the sub-category of technical support emerged in relation to the broader, overarching category of technology infrastructure. As part of this sub-category, teachers wanted qualified technicians to: first, *maintain ICT equipment;* ensuring ICT functionality and reliability; second, *support teachers;* when technicians were available, teachers' *willingness* and confidence to use ICT was enhanced, because of the security afforded by technicians on hand to solve technical difficulties. Conversely, the barriers teachers identified were, frustration at the *lack* of technical support for a) ICT maintenance (*reliability*), b) to set up ICT before lessons, so teacher time was not impinged upon for securing *access*, and c) technicians to be available during lessons to trouble shoot technical problems. For senior school leaders with whole school responsibility for ICT, they *all* reported concerns about weak *retention* of qualified ICT technicians.

In addition to wanting more technical support, teachers reported wanting more ICT resources.

Technology resources: the category of technology resources consisted of five related concepts and issues:

1. **Hardware:** i) a lack of hardware, ii) teachers preferred hardware was laptops, which afforded flexibility of use due to portability
2. **Connectivity**: wireless access to the school's network was favoured
3. **Access**: a lack of access to ICT was cited as a major barrier by teachers
4. **Reliability**: insufficient reliability was a major barrier identified by teachers
5. **Finance**: schools gaining TCT status had significantly increased funding for ICT

ICT Resources: hardware

The research indicated that a major factor hindering teachers was the *lack of hardware*. Teachers must have the ICT tools, as insightfully observed by an ICT co-ordinator, who sharply criticised the computer voucher scheme:

> ... 'computers for teachers' is like 'scalpels for surgeons' - they're the best tool, not a kitchen knife; you don't ask patients to go to Tescos and buy 'scalpels for surgeons'. Laptops make a difference to teachers. Surgeons don't pay for their own masks and scalpels. (QI, ICT co-ordinator, school F, 20/11/01)

The most requested type of technology by teachers was laptops and interactive whiteboards (IWBs). In particular, teachers reported how vital laptops were: 'they are the way forward, because they are portable' (ibid.). Teachers claimed that laptops afforded *portability & accessibility*: 'laptops with wireless base unit become a mobile office; use for *all* professional practice; teaching documents, email, internet. Before you would have to move from your desk to a networked computer, now you can work from *one machine'* (QE, school F, 22/06/01). The versatility and flexibility afforded by laptops have led to changing working practices for teachers:

> ...having a laptop *transformed* my work. Now I do everything on the laptop. I can't live without it now - amazing e.g. Scheme of Work, before it was written by hand, now I just update and tweak on the computer. (EX, HOD school F, 22/06/01)

Laptops enabled greater coherence of the disparate jobs teachers have to juggle; for example, in school F teachers used laptops for the creation and storage of *e-resources*; the generation of an *e-portfolio* for professional development; writing *e-reports* on pupil progress, facilitated by an *e-markbook;* these are further outlined in the pedagogy section. School leaders saw laptops as the 'secret' key to ICT integration: 'lent out the laptop, for the teacher to practice, that's the *secret* to it all, *getting the laptops to staff*' (QE, school F, 22/06/01).

Laptops for teachers were an example of a successful strategy that aided ICT implementation. How this strategy was implemented in school F provides a pathway that other schools could use.

A Whole School Laptop Strategy: providing pathways

Given the benefits of laptops, School F's specific 'laptop strategy' was to 1) provide the hardware to all staff and 2) to change teachers' professional practices to incorporate ICT.

> ...for the laptop initiative we attached criteria that were measurable: 1) staff had to attend an ICT development meeting each term; 2) undergo ICT training sessions; attend in-house training, as this was pre-NOF; 3) develop online resources for the intranet for their department; 4) cascade the ICT training to other staff at department meetings; [i.e.] go to a computer room, show what they had learnt, show the resources they had made. (QI, ICT co-ordinator, school F, 20/11/01)

In school F, providing all teachers with laptops, combined with introducing online registers, significantly *shifted the baseline* of teachers' ICT use. Also, teachers *had* to use the laptops for recording pupil grades in a school-wide database, which was linked to an electronic reporting system. By making laptops an integral part of the schools daily practices, school F had the most embedded use of ICT of all the schools researched, that is from 12 schools across 5 different LEAs.

ICT Resources: providing connectivity

In addition to providing every teacher with a laptop, school F invested in wireless connectivity. As a very large school, with 2000 pupils on a split site, the benefits of wireless connection clearly outweighed the cost and disruption of hardwiring the school. The ICT expertise that afforded this crucial whole-school development was attained by the ICT co-ordinator 'reading magazines, belonging to the TCT *network* and attending conferences' (QI, school F, 20/11/01). This allowed the school to become early adopters of wireless ICT and enabled the school to become a pathfinder for others.

However, there was a cost to pay for early innovation, because they adopted so *early*, in 2001, they now need to *upgrade* their system. Whereas schools that *waited*, can now get the most *recent* technology, which should not incur the cost of upgrading for sometime, unlike school F that needs to upgrade now. School B experienced a similar problem regarding expenditure and early innovation. School B installed fibre-optic wiring at a cost of £60,000, in 1998/99, believing this to be the future, which was then rendered redundant with the advent of wireless connectivity (TT, Head teacher, school B, 09/10/99). This illustrates how vitally important it is for schools to have access to expert ICT advice and have collaborative dialogue with expertise distributed beyond the school. The research indicated a strong need for schools to develop networked knowledge about ICT development.

ICT Resources: increasing access to ICT

A lack of ICT access was a major issue, reported consistently by *all* teachers: insufficient access prohibited use and was a significant barrier. Where access was created, teachers reported this was the most important factor facilitating ICT use.

Teachers reported a lack of access rather rendered redundant the ICT training received: 'staff are trained in ICT, then not use it in class, because the equipment's not there' (ST, Deputy Head, school G, 13/07/01); this was the first most fundamental barrier teachers cited.

Second, teachers reported that booking out equipment prohibited use: 'it's a *massive barrier* if you have to book out equipment, its one more step to take for each lesson – there has to be easy access' (ST, Deputy Head, school G, 09/11/01); 'I need to book the equipment, this adds another layer of difficulty: easy access is very important' (DD, History, school F, 22/06/01). One solution to booking out the computer suites, in school H, only exacerbated the problem:

> ...for access to the computer lab, there's a booking system, which was on paper. However, staff came to blows, nearly *fighting* outside the computer lab; staff *tippexed out names* already booked in. (WQ, ICT co-ordinator, school H, 26/09/01)

The ICT co-ordinator was incredulous that staff actually resorted to tippex, to eliminate rival teachers from access; such was the fierce competition for access.

When teachers had to change existing timetable arrangements, to move to another classroom to gain access, this also prohibited use: 'I wasn't *timetabled in a room with an IWB* this year, so I've not used it this year... [This] shows it doesn't matter how much training you have, but rather its access to the kit' (NF, school F, 14/06/02). Similarly, 'moving computers from room to room, *is not trivial*' (UU, school A, 26/04/02) and 'it's no good if you have to move PCs in and out of the classroom' (XX, school D, 26/06/02).

The logistics of having to move computers was clearly a barrier to use:

> ...it's a balance between how much the ICT will benefit the lesson, versus the hassle of getting it in the first place, if you have to collect it, book it, etc... (SC, school F, 19/06/02)

However, conversely when ICT was readily available at the time of teachers' need and preferably in their usual teaching room, ICT was appropriately embedded into the pedagogy. When teachers had 'seamless access', 'this motivates me to use ICT in the classroom, because it's part of the classroom, part of the fixtures and fittings, and easy to use. Everything is here, you never have to book it out - ICT becomes a hassle then' (MI, school G, 27/11/01).

The findings indicated that teachers' use was governed by *architecture and timetabling.* Teachers required *ease* of access, (anytime, anywhere in the school) and, *multiple access within departments* (teams of teachers having simultaneous access within the same department), which enabled teachers to 1) innovate and 2) to do so *quickly.* Once the 'practicality of access' was addressed, then teachers communally developed ICT within their departments. For example, in school G:

> Teachers have got access to ICT in every lesson, in every classroom in the language block, and the language teachers innovate quickly, because they have access, its regular, *there all the time* - and the *whole department builds up momentum and culture.* This is *important* and compares to the rest of the school. In languages all classrooms have got data projectors, laptops, internet [whereas] other departments by contrast have only 1 data projector, so teachers don't build up skills, so the data projector remains in the cupboard. Departments do not move forward... (ST, Deputy Head, school G, 09/11/01)

Ease of *accessibility*, across a *team* of teachers, enabled a *culture* of use to build. Creating access to *enough* ICT was a necessary condition to teachers integrating ICT into classroom practice: 'languages department, 10 data projectors, on Friday *all* in use, *all* day. Humanities department, 1 data projector - free all day' (ibid). Teachers reported a bottom line regarding ICT: 'I used it, because it was *there* and I knew it *worked'* (XX, school D, 26/06/02): when *access* and *reliability* are guaranteed, teachers used ICT.

Increasing Access: a whole school strategy

The 'pathfinder' solution to creating *flexible access* to ICT in school F was to situate computers in different locales; this had entailed a 4 stage development programme:

1. starting with ***ICT suites***, which are now used only for teaching discrete ICT courses, then
2. moving to department's having their own ***ICT hubs*** (cluster of computers in department areas),

3. then department's having their own ***class sets of laptops*** (sets of 10-15 secured on a laptop trolley, which could be wheeled into classrooms)
4. then move to ***wireless networking*** across the split site campus

Most importantly, according to school leaders devising the strategy, was to push responsibilities *to departments* to manage ICT. Flexibility of access was also generated by situating ICT in open spaces: in social areas across the school. The solution to access through class sets of laptops was a pathway deployed by both school F and A. Departments had a 'lap safe' that housed 10 laptops on a trolley, which was a movable cabinet for storing laptops, alarmed and plugged into a power supply to charge between lessons.

> ...staff wanted flexibility and access. For example: in a 1 hour lesson, you may want to use ICT for 20 minutes, so you don't want to book the computer suite for a whole lesson, *also* there's the issue of getting into the suite in the first place. (QI, ICT co-ordinator, school F, 30/05/02)

Teachers wanted access to ICT in order to provide variation in lessons, that is; to use ICT activities amongst other learning activities. However, when teachers booked ICT suites, they felt constrained to use ICT for the whole lesson, which was not necessarily the most appropriate use of time. When ICT is seamless (access is readily available in the classroom at any time) teachers had pedagogical choice; as opposed to the architecture of the room (ICT suites) dictating the pedagogy. As another teacher from another school commented:

> [the problem] was you had to book the computer room, then do the whole lesson with an ICT focus. (EB, science NQT, school A, 12/06/02)

This supports Loveless, DeVoogd and Bohlin's (2001) research who argue that 'the *context* in which the teaching takes place clearly influences the purpose, pattern and pace of activities. Teaching a whole class in a computer suite, demands a different set of skills from using a single machine or set of portables...the sheer physicality of the equipment, effect the movement and level of interaction in the room and need careful consideration' (p71). This illustrates that there is a relationship between technology and pedagogy and that patterns of access affect actual teaching practice.

With respect to managing technology resources and access, a summary of the specific whole school strategies developed by school F to increase their technology infrastructure is recorded below.

Strategies for increasing ICT access: school F pathways

Hardware: funding directed to

1. Increase the *size of the network*
2. *Wireless* networking of the laptops, for access to the intranet and internet
3. *Class sets of laptops* for pupil use; laptop trolleys
4. All teachers given own their *own laptops*, alongside 'laptops for pupils' scheme.

Software: the use of which was built into the schools daily practices, thereby embedding use through

1. online registration **(e-registering)**
2. online database for recording/monitoring pupil progress **(e-attainment)**
3. online reports **(e-reporting)**
4. intranet: online resources for each department/subject area **(e-pedagogy)**
5. pupil online referrals; incident of pupil misconduct, reported via wireless laptops **(e-pupil referrals)**; action taken recorded on school-wide database, which
6. enabled staff to identify and monitor patterns of behaviour **(e-monitoring)**

ICT Resourcing: ensuring reliability

The lack of reliability was clearly evident from the need for more ICT technicians. Commonly reported problems were network connectivity failing and laptops lacking reliability. Most importantly, the *consequences* of technical failure, resulted in teachers not wanting to use the ICT again; 'when it goes wrong, this is what prevents teachers from using ICT' (XX, school D, 26/06/02); 'encounter problems, this is exhausting for teachers; if it's a problem, you'll not do it again' (ibid.).

> ...biggest pitfall for developing ICT is technical problems, this stifles innovative work...Teachers must have ICT that operates and systems that sustains ICT to be operable and reliable; *great stumbling block - technical problems and lack of resources.* (SI, school A, 3/07/02)

The *pragmatics of implementation* was an important source of concern for teachers since unreliable ICT, combined with a lack of access, made ICT integration too hard; these were clear barriers that hindered teachers' use of ICT.

ICT Resourcing: securing financial investment

All schools reported wanting more *hardware*, both ICT rich and poor. Teachers claimed that ICT 'exposure and conversion' generated the demand for more resources. Teachers reported there is something unique about ICT, in that even limited access breeds increased demand: there is 'never sufficient resources, no matter how many you have, as soon as you get, for example, a data projector, IWB, *you want more* of them' (SI, school A, 1/03/02).

Interestingly, *both* leading ICT schools and schools in difficult circumstances reported needing *more* computers. For one ICT poor school, Ofsted reported half the national average computer ratio and the Deputy Head commented that despite NGfL money, the school *still* does not have enough computers (NI, school H, 7/11/01). However, even in resource rich schools, teachers commented more ICT was needed (school A and F).

Specific factors that supported the purchasing of ICT were 3 fold: first, gaining *TCT status,* which significantly increased funding. Second, involvement in *external ICT projects* with financial benefits, for example: 'we got free software licensing for Microsoft products worth £35,000. As the school has not had to pay that money out, we used that money to 'buy out' teachers time, so gave teachers 2 free lessons to develop online resources' (QI, ICT co-ordinator, school F, 20/11/01). Third, the adoption of a *staffing strategy* that involved employing NQTs to keep staffing costs down and then divert the money saved into ICT. (Schools A and F utilised all three of the above strategies and school B and G, the first two.)

Regarding finance and gaining TCT status, it was noteworthy that the most ICT developed schools were *all Technology Colleges.* This is a significant finding, because specialist status gave enhanced funding specifically to technology, which enabled a level of resourcing that non-TCT schools could not match. For example, in school G their ear-marked funding enabled

> Seven key developments: 1) new building, ICT networked block; 2) data projector in each classroom; 3) IWBs in every classroom; 4) video conferencing; 5) computer suit, just for languages to use; 6) laptops for all

> languages staff; 7) flexible classrooms, with partitions... (ST, Deputy Head, school G, 13/07/01)

Clearly gaining TCT status was *crucial* and provided funding that *afforded* development *paths* that generated ICT integration. For example, school F's ICT budget was *10 times* greater than school H's (£200,000, compared to £20,000), which is a significant difference, particularly given the fact that the schools are of nearly comparable size. This finding concurs with the national ICT evaluation reports that found significant disparities of funding between schools (DfES, 2001, 2002; Ofsted, 2001).

In this research even ICT rich schools, however, reported that *ICT sustainability* remained a financial problem. Even in Technology Colleges well funded position, there was still the thorny issue of paying for *maintenance* and *upgrades*, irrespective of purchasing additional new kit.

> ...£200,000 in the 1st phase of TCT funding; mostly spent on equipment, hardware, but *no* network, *no* software. No budget to replace computers. *Sustainability - huge issue.* NGfL money this year went on *replacing* computers, rather than *increasing* number of computers. (NL, SMT, school D, 10/01/02)

With respect to finance, there were clearly *disparities of funding* between schools. Additionally, the research found that even in well-resourced schools, there was still the expensive issue of sustainability of existing resources. Overall, teachers reported overwhelmingly for more technical support and ICT resourcing, in order to increase *access* and *reliability*. This was followed by teachers asking for ICT training, which is discussed in the next section.

Teachers' Continuing Professional Development with ICT

All the teacher interviews were permeated by the issue of ICT training, which emerged as an important category in the research. The key concepts within this category pertained to different *models of ICT training* (formal, informal, self-taught) and *issues* that emerged were to do with teachers' *time* and the perceived *value* of ICT. Also, a link emerged between the categories of ICT training *and* technology resources, whereby the first stimulated demand for the second.

> ...*training* of staff *first*, most important job, absolutely crucial. The *key* is *intensive training* and then have *access to the ICT*. Not take long then before teachers can't manage without ICT... The ICT innovation process can be 'quick', if training and access are provided. (ST, Deputy Head, school G, 28/06/02)

All the different ICT training courses that teachers had partaken in were listed and categorised in order to provide clarity in an area where there was great diversity of experience and are outlined below.

Formal ICT training: the following courses were all *accredited* by *external agencies,* which were *delivered* both *internally* at school and *externally* at outside venues. Formal short ICT courses that teachers had participated in were:

- ECDL (European Computer Driving Licence; pre-NOF)
- NOF (New Opportunities Fund; roll out from 1999)
- INTELL (Post-NOF)
- ICT Suppliers - delivered internally and externally (e.g. Promethean IWB training)
- BETT (British Educational Technology Trade show) – demonstrations of ICT delivered externally during the exhibition at Olympia.

Informal ICT training: teachers' examples of informal training were delivered either internally at school (predominantly in departments, from other teachers), or outside school in the home environment from friends and family. Both types could be categorised as just-in-time (JIT) training; as and when the need occurred the training was sought by teachers from more knowledgeable others.

- JIT in-school: colleagues sought just-in-time ICT training, usually in the same department
- JIT from wider network of contacts (or 'networked relations', outlined in Leask and Younie, 2001)

Self taught: a small number of teachers were self taught and could be identified as ICT innovators or early adopters (Rogers, 1983), who were keen and motivated to learn about ICT from reading ICT manuals, technical trade magazines and internet sources.

Formal ICT training courses

Teachers' experiences of the different models of ICT training form an important part of the research as it is necessary to identify which, if any, effected change in teachers' practice.

Overall, NOF ICT training did not come out favourably with the teachers: 100% of those that spoke about their NOF experience did so disparagingly. Commonly, the lack of satisfaction was for two reasons: 1) the training did not meet teachers' individuated requirements; 'NOF mis-targetted teachers' needs' (KX, school F, 17/06/02), and 2) training time was after school and the use of 'twilight was resented by staff' (IS, school L, 2/07/02).

Teachers also cited further specific reasons why NOF was not successful: first, the lack of *subject* application: 'our NOF provider – trying to cover it *all*, across *all subjects*, for *all teachers*...not subject based' (TI, school A, 3/07/02); second, the training pedagogy: the delivery mode was *undifferentiated;* third, training clashed with teachers' *competing priorities*; particularly in school H, which had been placed in 'special measures' by Ofsted:

> NOF training was not effective; an *abysmal pass rate*. Heavy staff turn over meant completion was poor, which is one factor, and a second factor was, the Ofsted action plan is their *priority*, not ICT training. (WQ, ICT co-ordinator, school H, 2/07/02)

The reasons for NOF's lack of success in the research sample are strikingly similar to those found in the national evaluation of NOF conducted by Preston (2004).

Teachers did identify *cascading ICT training in and between schools* as a route to collegially building professional knowledge. Teachers reported developing ICT expertise internally in their schools, through all the routes identified above, and then also sharing their knowledge externally with other schools. This was particularly the case with the Technology Colleges (F and G), which consequently 'raises our status as ICT experts...[we] can now deliver bespoke training to other schools, who now ring up and ask' (ST, Deputy Head, school G, 13/11/01).

Significantly, the research found a link between *training* and *access* to ICT. Teachers did specify how important it was to *use* ICT *after* training. Access was essential in order to embed newly learnt ICT applications: '...great to do the training, but you have to *use it*, otherwise it's no good: after the training you forget how to use it' (QE, GTP trainee teacher, school F, 22/06/01). The pertinent issue of access was referred to by all teachers as raised in the 'technology infrastructure' section.

Informal ICT Training: networks of knowledge

Teachers often spoke of informal ICT training as *particularly beneficial,* which was based on exploiting networks of colleagues known to have ICT capability. The *key characteristics* of informal ICT training were:

- *just in time* learning – sought when required; 'on demand' ICT training
- *bespoke training* - to meet individualised needs; personalised learning for teachers
- *model of training*– delivery face-to-face: either 1-on-1, small groups or department based

As teachers reported,

> Training that worked was 1-to-1, *tailored to my needs*, where I could ask questions for myself when they came up... [the] knowledge gained was extremely useful. (IS, school L, 2/07/02)

Teachers asserted how important the *'on demand' ICT training* was in meeting individualised needs. School F, for example, ran 'drop-in' ICT sessions for teachers, and departments could also request subject specific training on demand:

> ...for example, we ran an art workshop on how to use Adobe Photoshop, digital cameras, etc. Department on demand training, i.e. subject specific ICT training is available. (TQ, ICT Training Centre Manager, school F, 22/06/01)

'Just-in-time' learning was a crucial aspect of training that came through the interviews: 'you move to *when you need to know*, needs to be informal, ask when you're ready and need it' (UU, school A, 12/06/02). Consequently, *'just-in-time' from other staff is key*; for example, the most recent software on mind mapping was done within the department' (EB, school A, 12/06/02).

Teachers also commented favourably on 'just-in-time' training delivered within departments and its *bespoke* nature. Importantly this ICT training was often delivered by Heads of Departments (HOD), who were critical in driving ICT for their teams (see the Leadership section on the role of middle managers as ICT change agents). As HODs identified, '*you need different courses for different people at different levels...* by sharing skills amongst ourselves in the department' (EX, HOD, school F, 19/06/02). As another HOD perceptively recognised: '...training is about *teacher confidence*' (LN, HOD, school G, 24/06/03) and also HODs 'leading by example': both proved to be successful and influential in getting teachers to use ICT.

In departments effectively implementing ICT the following training strategies were deployed by HODs:

- *Modelling use*; HODs leading by example and regularly using ICT for classroom practice
- *Sharing ICT practices,* between teachers in the department, through 1) department meetings, as a standing item on the agenda and 2) more informally, talking in between meetings, at break times, lunch and after school in the shared office: a *discursive dynamic* between colleagues was observed.
- Sharing ICT resources, through a variety of *dissemination mechanisms* (so teachers could comment on, use, adapt and develop the resources) through 1) the department's intranet area and 2) distributing hard copies via the department's notice board, pigeon holes and desks.

As the HODs identified,

> The first key issue was to build up staff confidence with ICT by *modelling*, I used the ICT and led by example, and sharing good practice. The first time... teachers were worried. Then, teachers *see* the benefit of using ICT. (LN, HOD, school G, 24/06/03)

Once teachers were confident with ICT, through the HOD providing a pathway (i.e. the ICT skills and resources), the very same teachers could then cascade this to colleagues.

> ...these teachers *now* have no fears. They can offer 1-to-1 training for *other staff* and extend ICT training out of the department into other departments in the school (ibid.).

Importantly HODs instigated a collaborative culture for ICT, where teachers could comfortably seek ICT training and mutually support one another's ICT development: 'we're always helping each other... we share it, and teach others what we've learnt' (MI, NQT, school G, 1/07/02).

The pattern for informal ICT training within departments was observed across schools A,B, F and G, illustrating a 'collaborative learning culture': 'as a team we train each other, very *informal*, staff can ask other ICT competent teachers in the science department...' (BB, HOD, school F, 18/06/02).

JIT: wider 'networked relations' and ICT change agents

When teachers sought just-in-time ICT training, the first port of call was their department and immediate colleagues, beyond that, teachers went to a) the ICT co-ordinator, b) the ICT leaders (change agents) in their school (if this was not the ICT co-ordinator) and, c) family and friends with ICT expertise.

Teachers reported *asking* key ICT 'leaders' in their school for help to meet their individualised needs for ICT training. In addition, the ICT leaders were also very *proactive* in engendering change through offering 1-to-1, just-in-time training, which teachers claimed to be a highly effective and successful strategy. One AST in ICT was repeatedly referred to as 'Mr ICT evangelist... [who] now does drop in sessions, after school' (SI, school A, 1/03/02). Further,

> ...he has always been *available*, to approach and ask about ICT. (EB, school A, 12/06/02)

In school F, the ICT co-ordinator was seen as '...inspirational – [the way he] takes ICT out to other teachers' (DD, school F, 20/06/02). Identified as a change agent by other teachers, the ICT co-ordinator had a clear *vision* about how to engender change in teachers, by

> ...identifying key people in departments using ICT; encourage and foster these, they act as disciples and apostles, spreading the message. ...other teachers see and become interested. I call it the '*pressing your face against the window*' INSET, then they *want to find out* about it, then they *ask me*, but the interest has come from them. (QI, ICT co-ordinator, school F, 27/05/02)

For effective ICT training it is essential to '*spark* them *first*, *then train* them, to breed confidence, its not necessarily formal training that's needed' (ibid.). Informal just-in-time training was particularly valuable for teachers, who utilised 'networks' of ICT competence, it was not the *source* of the knowledge that was important, but rather the fact that teachers could *learn* from knowledgeable others; in essence it could be anyone 'who passes the skills on, doesn't matter, anyone who does this is OK, e.g. teachers, classroom assistants, pupils...' (ST, Deputy Head, school G, 13/07/01).

Location of the Training

The location of the training was identified as significant. Previously, Stager (1995a; 1995b) highlighted the importance of both on-site training (the use of familiar computers and software) and off-site (reduction of school pressures). This research supports these findings: for example with school F's 'laptop initiative'. First, teachers were given a personal laptop, of which the ownership and portability were analysed to be the most significant element of the materiality of the scheme (material culture). Second, training was given by the school's lead learners (change agents) in a local hotel, sheltered from school disruptions. Upon their return to school, the teachers participating in the laptop initiative were required to share their newly acquired knowledge with their department thereby relocating training to on-site. This strategy also celebrated using teachers as a preferred source of knowledge, a factor found to be highly significant in the management of change (Fullan, 1985, 1991; Becker, 1994).

Strategies: whole school initiatives for ICT CPD

The research identified three strategies across the schools, which were: one, *ICT Projects*: schools became actively involved in external ICT projects. This strategy was pursued by 4 schools as part of an active policy of global ICT networking, initiated by the Headteachers (A,B,F and J); Second, *laptop initiative*: teachers received their own laptop; Third, *timetabling*: creating protected time for ICT development. A fourth strategy that was unique to school F was an on site *'ICT Training Centre'* for teachers' professional development.

With respect to ICT Projects, these afforded teachers ICT knowledge and skill exchange, collaborative, pedagogic ICT implementation and international networking. Projects provided a rich context for teachers' professional development with ICT, which was pivotal for some teachers: 'the Targeon project was key for me...crucial to my ICT development and skills' (BB, HOD, school F, 18/06/02).

Examples of international ICT projects in schools

- School F multiple projects: Targeon Project, with 3 European schools; AAL (Anytime, Anywhere Learning) Microsoft Project - only 1 of 6 secondary schools in UK.
- School J: AAL Microsoft Project - only 1 of 2 primary schools in UK to be involved.
- School A: designated ENIS status, part of the European Network of Innovative Schools.

A second whole school strategy for developing ICT skills was the 'laptop for teachers' initiative'. In school F and J, their laptop initiative was aligned to the Microsoft AAL Project, which gave free laptops to participating schools; supplying hardware, software licensing and training to teachers, which teachers reported was 'motivating and very precious' (TP, Maths, school F, 22/06/01).

The particular strategy for allocating laptops in school F was to allocate one to each department, so every curriculum subject was linked in. Teachers had to 'deliver content for the intranet' (TP, school F, 22/06/01). This strategy *deliberately* required teachers to make visible their learning; to produce *outcomes.* The strategy was that 'as more teachers get laptops, so more people develop the intranet...lots of keen people, you have a culture...' (ibid.).

The laptop initiative provided a pathway for ICT integration, by equipping teachers with the hardware and training that engendered a collaborative, learning culture towards ICT. This was crucially the key to ICT integration, a *culture* of ICT support, training and sharing practice.

> The laptop initiative started with 10% staff coverage in 1997, and had 100% by 2001. The first year [the initiative] *made noises, had an effect*, other teachers saw how laptops were used. In the second year, it generated *its own demand...* (QI, ICT co-ordinator, school F, 30/05/02)

The laptop strategy, was aligned to the Head's belief that 'teachers *have to have access to high quality training*' (LX, Headteacher, school F, 11/07/02). This was provided by creating a specialist ICT Training Centre (prior to NOF), which was a visionary and inspired commitment by the Head, and an addition to the Microsoft training teachers were cascading.

Innovation: an ICT Training Centre based in school for CPD

The ICT training strategy in school F was '*tutor led* approach to training - so *bespoke* training; [since] models of training do not work where schools didn't have tutors meeting individual teacher needs' (LX, Head teacher, school F, 11/07/02). Importantly this vision was shared by the deputy, as he asserts, 'a strategic plan of training is needed; identify on *all levels* the training needed for staff development' (LM, Deputy Head, school F, 14/06/02). Consequently, the ICT Training Centre catered to teachers' specific ICT training needs, whether it was an accredited course, or on-demand, just-in-tine training: '...lunchtime drop-ins, *sensitive to need,* teachers less confident came to these' (TQ, ICT Training Centre Manager, school F, 30/04/02).

The *differentiated* approach to training was the key to enabling nearly 200 teachers to receive *appropriate ICT training,* to meet their needs. The school leadership's decision to develop an ICT Training centre was an inspired strategic commitment to ICT.

What the ICT training centre provided was the need for:

Differentiated ICT training, from basic to advanced *accredited* courses, via

- NOF: with a choice of 2 different ATPs (Approved Training Providers) national TCT or local HEI programme
- ECDL: pre-NOF
- INTELL: post-NOF training provision

In addition, the ICT training centre also supplied:

- 'One offs'- ad hoc training
- Refresher courses for teachers (e.g. intermediate excel courses for pupil data)
- On demand training (e.g. for teachers and departments on IWBs)
- 'Drop in' sessions offering flexibility

Crucially the Training Centre could 'meet training needs of staff in a variety of different ways' (TQ, ICT Training Centre Manager, school F, 30/04/02).

The necessities of providing bespoke training were also met through *uniquely organised events*. For example, the deputy arranged an 'ICT and MFL Training Day', which utilised local expert knowledge both internal and external to the school, leading to networks of situated and distributed ICT expertise. Significantly, in school F, identifying teachers training needs was formalised into the whole-school development programme.

Regarding *teachers' CPD concerns* with ICT from across all the schools, two concepts that repeatedly emerged were one, the *time* required to learn ICT skills, in addition to other competing priorities, and two, the *value* of ICT: teachers either, did see the value, following a critical episode that there after convinced them, or, teachers were not convinced of the value of ICT and/or lacked confidence, which training had not rectified for them.

CPD Summary

Where teachers had initially lacked confidence with ICT, they were supported by having their training needs addressed. This was achieved through a number of *models* of training that were developed by schools, with a *differentiated* approach winning out, whereby teachers were offered a variety of ICT training routes to meet individualised needs. Significantly, teachers reported that the most effective ICT training was *just-in-*

time, delivered by *colleagues* (usually other teachers in their department, or the ICT co-ordinator). The impact of effective training was consequently illustrated in teachers' pedagogical applications of ICT. These were observed in lessons and reported on by teachers in interviews and are outlined in the next section.

Pedagogy and Subject Teaching with ICT

The following five concepts, with definitions, emerged from the data, which enabled the category of pedagogy to be developed in more depth: all concern teachers' use of ICT to organise their professional working practices – inside and outside the classroom.

- **e-resources**: teachers' use of ICT to *develop* resources and, in some schools upload to the intranet for online access
- **e-pedagogy**: how teachers have *integrated* ICT into the learning experiences in their classrooms for subject teaching
- **e-portfolio:** how teachers record examples of best practice for professional development purposes
- **e-reporting**: teachers' use of ICT to *manage* pupil assessment, recording and reporting. This includes the development of an **e-markbook**
- **e-impact**: teachers claimed the *outcomes* of ICT use in the classroom *improved* a) pupil motivation; b) quality of pupil work and c) classroom management.

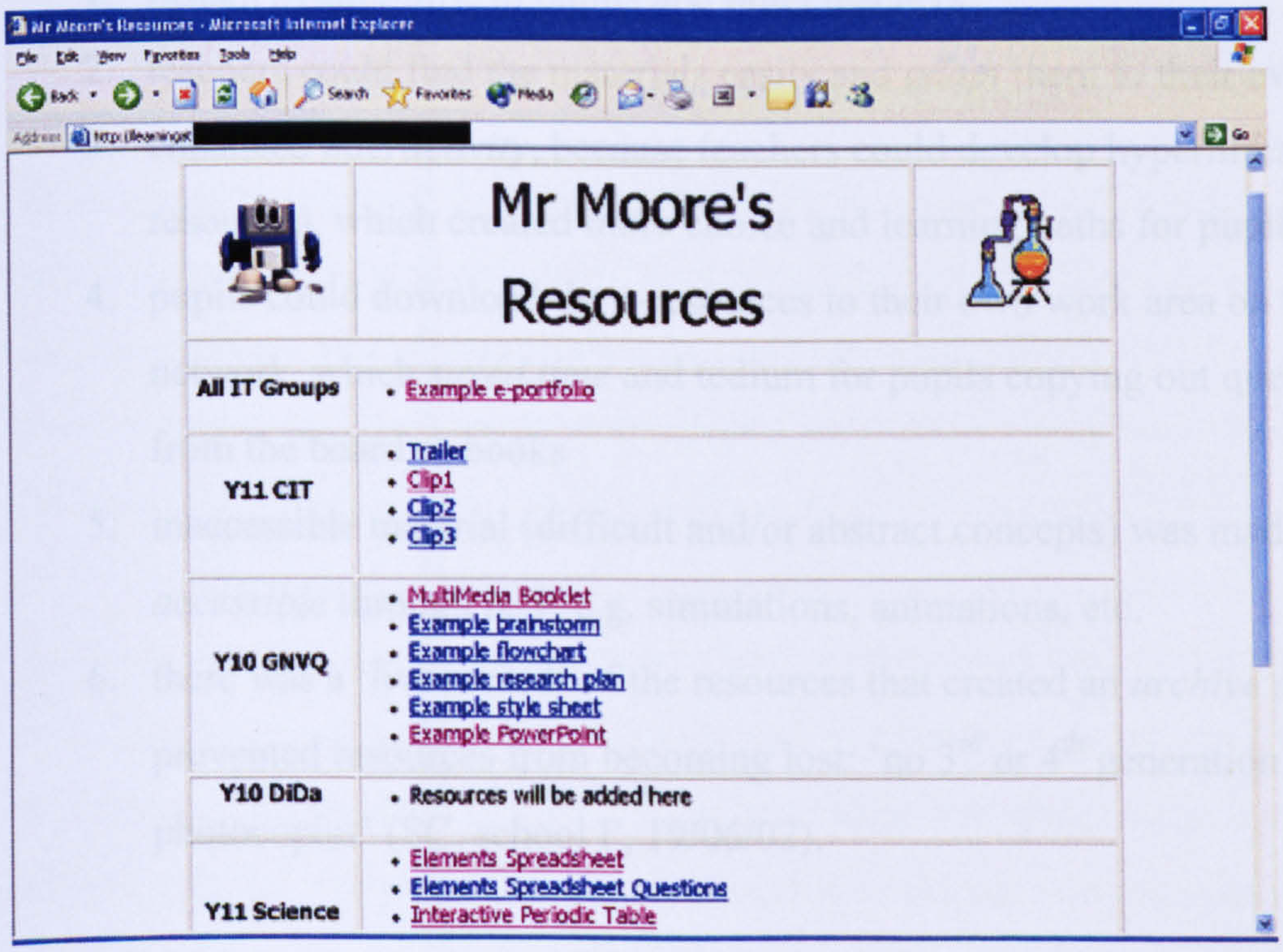
The research findings outline the ways in which teachers have developed each of the above, by identifying the steps that teachers have taken, in order to identify the *pathways* involved, such that it is possible for others to deploy if required. Teachers identified the *advantages* and recognised the *outcomes* for pupils that these ICT developments afforded. Given the constraints of space, only a summary is provided, however, the detailed steps involved in each of the above can be found in Younie (2005a), Younie and Moore (2005).

The concept 'e-resources' refers to classroom teaching resources transformed into an electronic format. The concept of e-resources also refers to 2 *related concepts* that emerged when teachers discussed why they used ICT to prepare teaching materials: first, ICT improved the ***quality of presentation*** of teaching resources, claimed by 95%

of teachers, and second, the importance of a school's ***intranet*** for e-resource storage and retrieval, which teachers claimed facilitated online accessibility for other teachers and pupils. As teachers commonly reported, 'resources are the most important thing, [without ICT] we would lose our online resources; it would be a *disaster* to not have these now' (UU, HOD, school A, 12/06/02).

In 3 schools, e- resources were stored on the intranet, in one place, accessible online, with teachers reporting that 'the network has been a huge innovation' (KQ, school A, 11/06/02). Some teachers created a *portal* of all their teaching materials, to facilitate pupil learning and enable collegiate, departmental resource development. Figure 5.5 below shows the front page of one teacher's portal on the school's intranet (TM, school F, 22/10/04).

Figure 5.5 Example of e-resource area on School Intranet



When more than one teacher from the same subject area created resources on a topic, then it became possible to build up a range of resource:

> ...the staff shared area on the network; gave a chance for resources to evolve then; saves teachers time, to use as it is, or adapt. (SC, school F, 19/06/02).

The development of e-resources amongst teachers created a *culture of sharing* and support, as it modelled best practice with ICT, in a climate of mutual exchange and adaptability. Teachers cited this strategy as the main ICT innovation in three schools: A,F and G.

> ...a shared area; any resources developed are stored there for science staff, to see, take, develop. Saves time, can modify, save doing from scratch. The NGfL; 1) took along time to find, 2) when you found it; not suit our needs and needed *a lot* of adapting. Our science shared area on network, with our resources, these are more tailored to our needs. If these ideas were stored on a disc, it would've been lost. The knowledge is on the server/network, as a live record. (SC, school F, 30/05/02)

Teachers commonly reported that the advantages of developing e-resources included:

1. instant *availability*, to pupils and other teachers
2. teachers could find the materials easily and *adapt* them to their own needs
3. enhanced *interactivity*, because teachers could develop hyperlinks in the resources, which created more choice and learning paths for pupils
4. pupils could download the e-resources to their own work area on the school network, which *saved time* and tedium for pupils copying out questions or work from the board or books
5. inaccessible material (difficult and/or abstract concepts) was made more *accessible* through ICT, e.g. simulations, animations, etc.
6. there was a 'live record' of the resources that created an *archive* and prevented resources from becoming lost: 'no 3rd or 4th generation photocopies' (SC, school F, 19/06/02).

School F had a specific *strategy* for *developing e-resources* on the intranet, namely specialised staff to do the tasks: 'Learning Resource Assistants' (LRAs). This proved to be of major importance, because school F had significantly *more* online resources than any other school and, had learning resources with greater *interactivity*. LRAs had an *active role* in re-designing and enhancing teachers' resources for e-learning.

Teachers reported that ICT enhanced resources illuminate inaccessible material: 'it's difficult to visualise molecules, but can show these, stop, and annotate' (BB, school F, 18/06/02); 'using ICT to improve understanding of the most abstract concepts; the visual display of exothermic equations' (SC, school F, 19/06/02). Teachers' comments highlight the pedagogical advantages of e-resources:

> In Design, it's difficult to teach on the board 'injection moulding'; the CD ROM has an animation of this and there's a website about cogs – it's quicker to teach when you have these resources, rather than draw on the board; more accessible, pupils can see these difficult design processes; it's easier to get the information across. (EX, HOD, school F, 19/06/02)

e-pedagogy

E-pedagogy is the term used to describe the ways in which teachers have integrated ICT into their classroom practice. The research identified the processes by which teachers developed ICT in increasingly sophisticated ways for pedagogical purposes.

> The killer reason for 'why use ICT?' is, because it's easier to use than *not* to, for example, data logging. (UU, HOD, school A, 26/04/02)

First, teachers upgraded their written materials into an *electronic format* (developed e-resources) and uploaded onto the *school network* (intranet). Second, teachers provided *online templates* and *writing frames* for pupils to work on (to edit, add answers to, or solve a problem). Three, teachers developed pupil *interactivity* with the online resources by inserting *hyperlinks*. Fourth, teachers *enhanced* interactivity through the deployment of *free software* from the Internet. For example, in school F, teacher KX used free software to create a shell for interactive testing so teachers could insert their own curriculum content. Other teachers generated word searches, crossword puzzles, interactive quizzes, mix and match exercises, using freeware such as 'hot potatoes' (http://web.uvic.ca/hrd/halfbaked/). Figure 5.6 below provides an example of an online template for pupils to complete, figure 5.7 an online worksheet with an interactive link and figure 5.8 illustrates the hyperlink incorporated into the worksheet.

Figure 5.6 Example of an Online Template

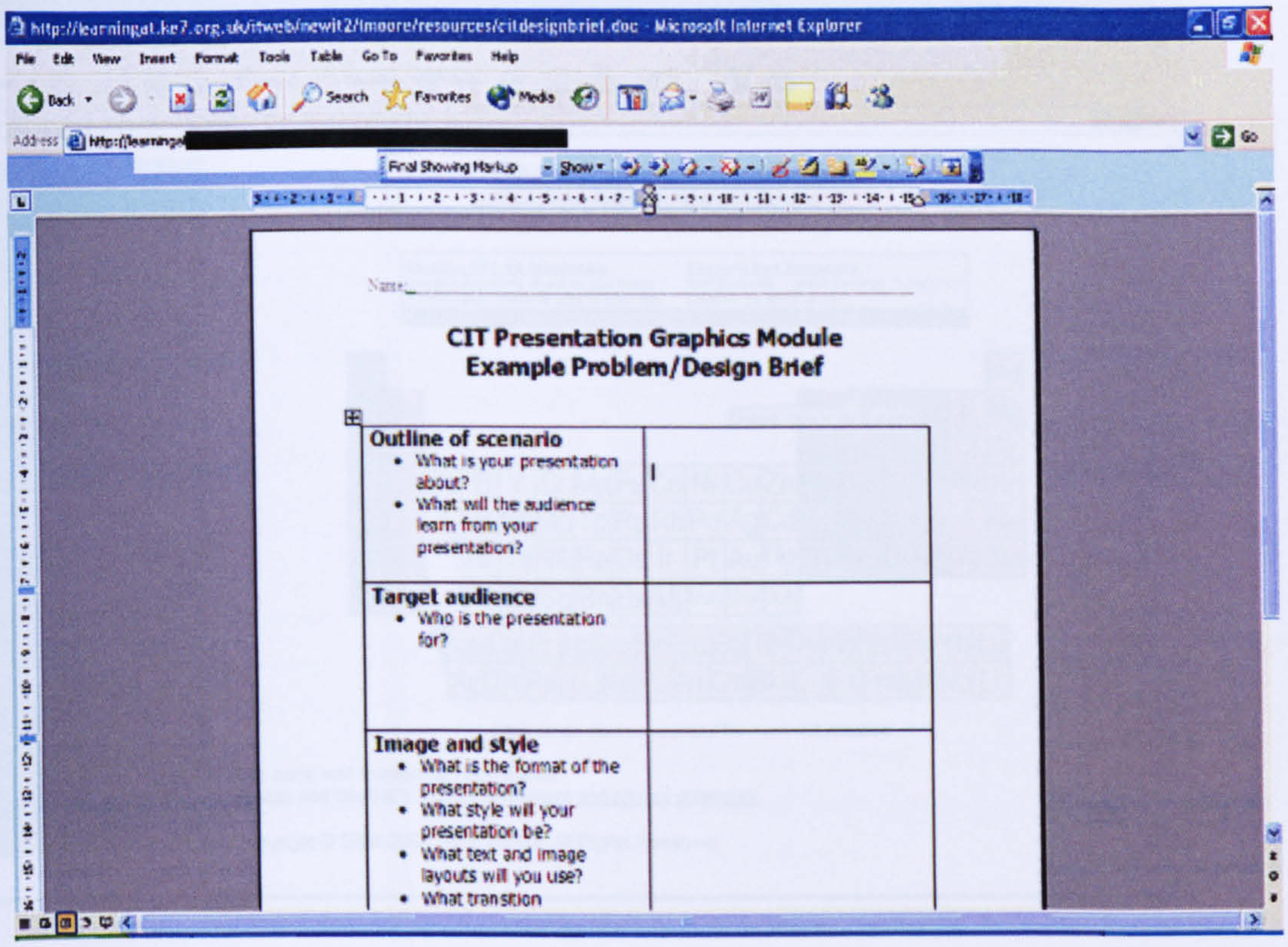


Figure 5.7 Developing Pupil Interactivity with Online Resources

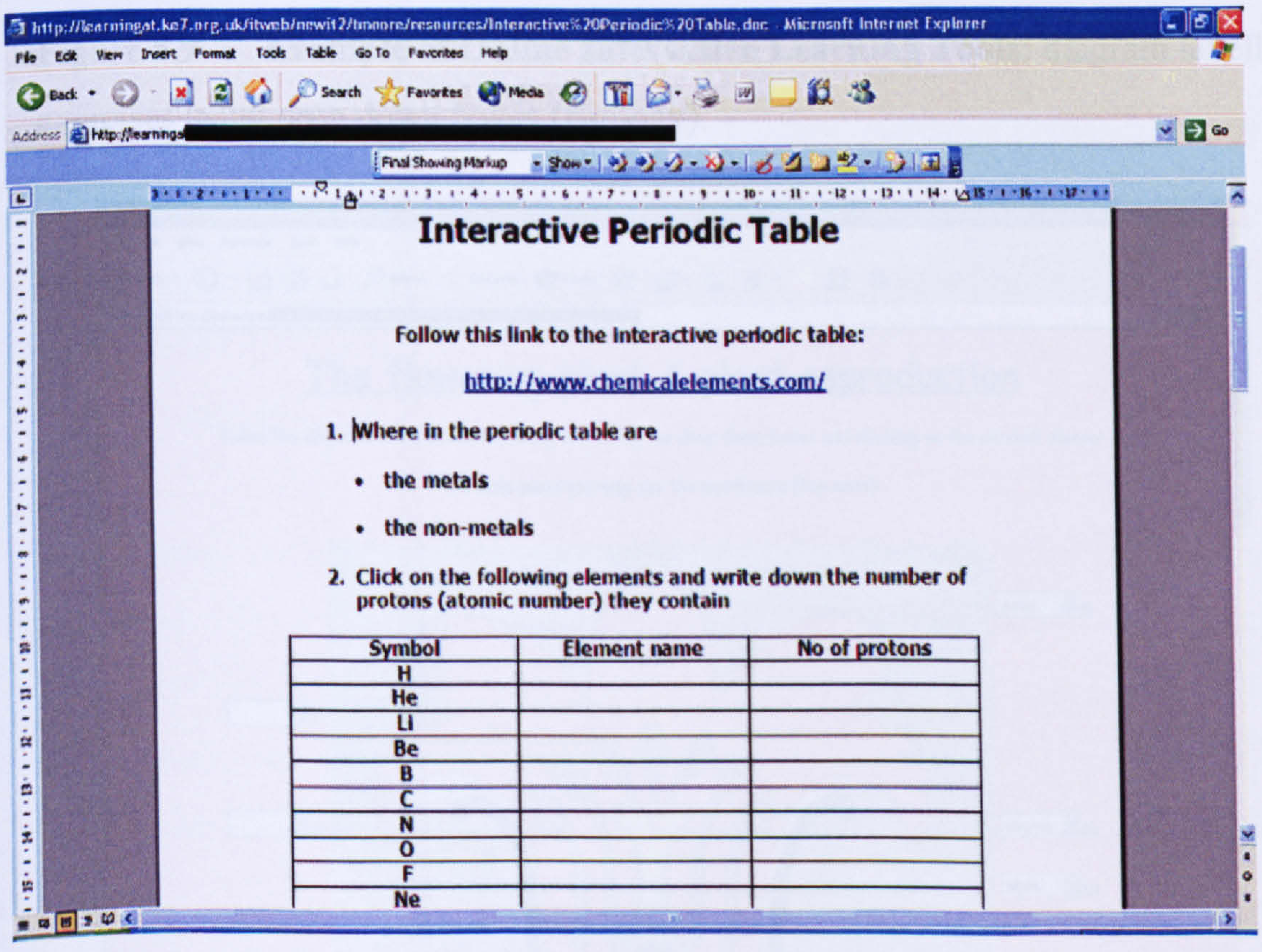
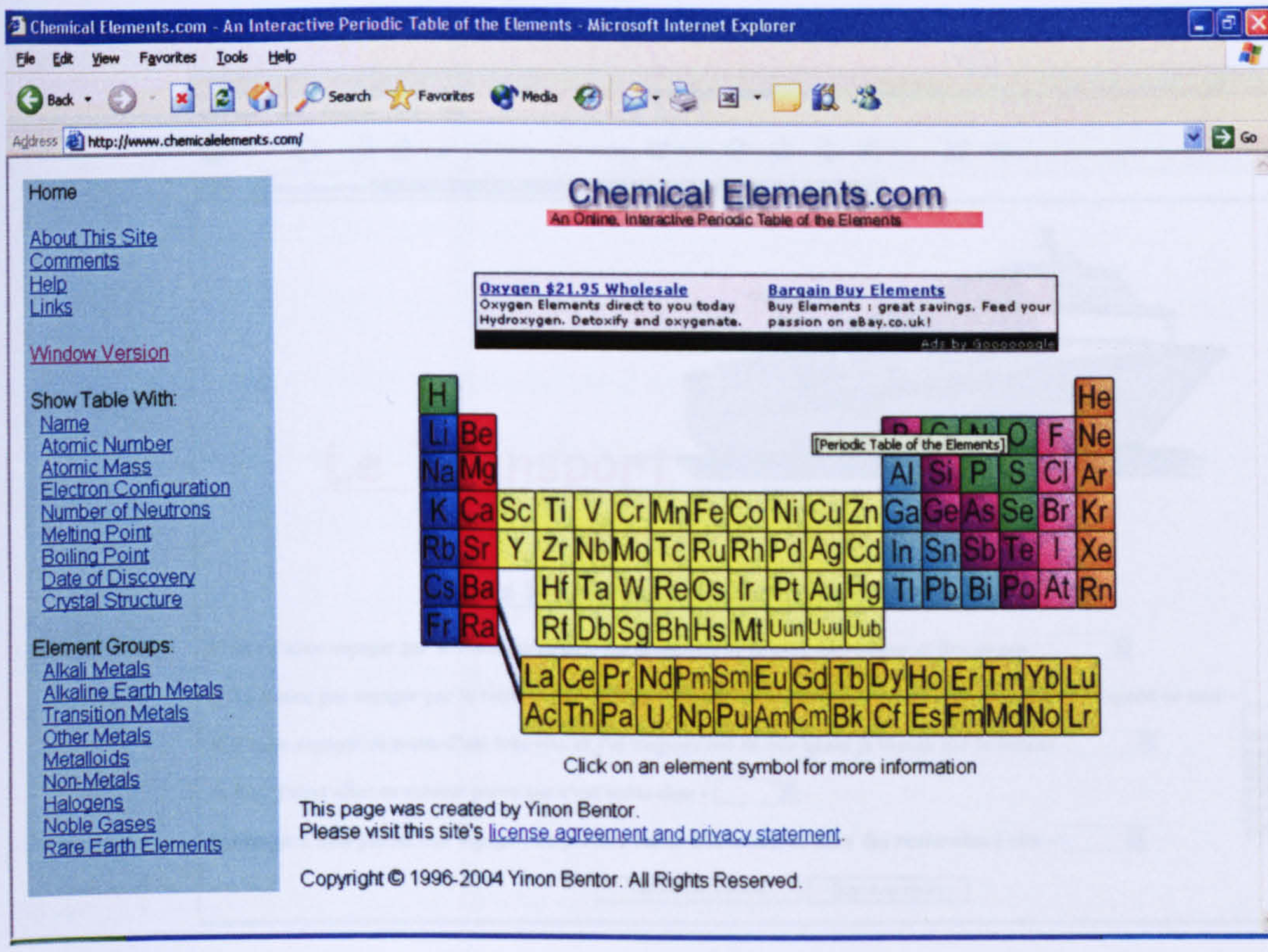
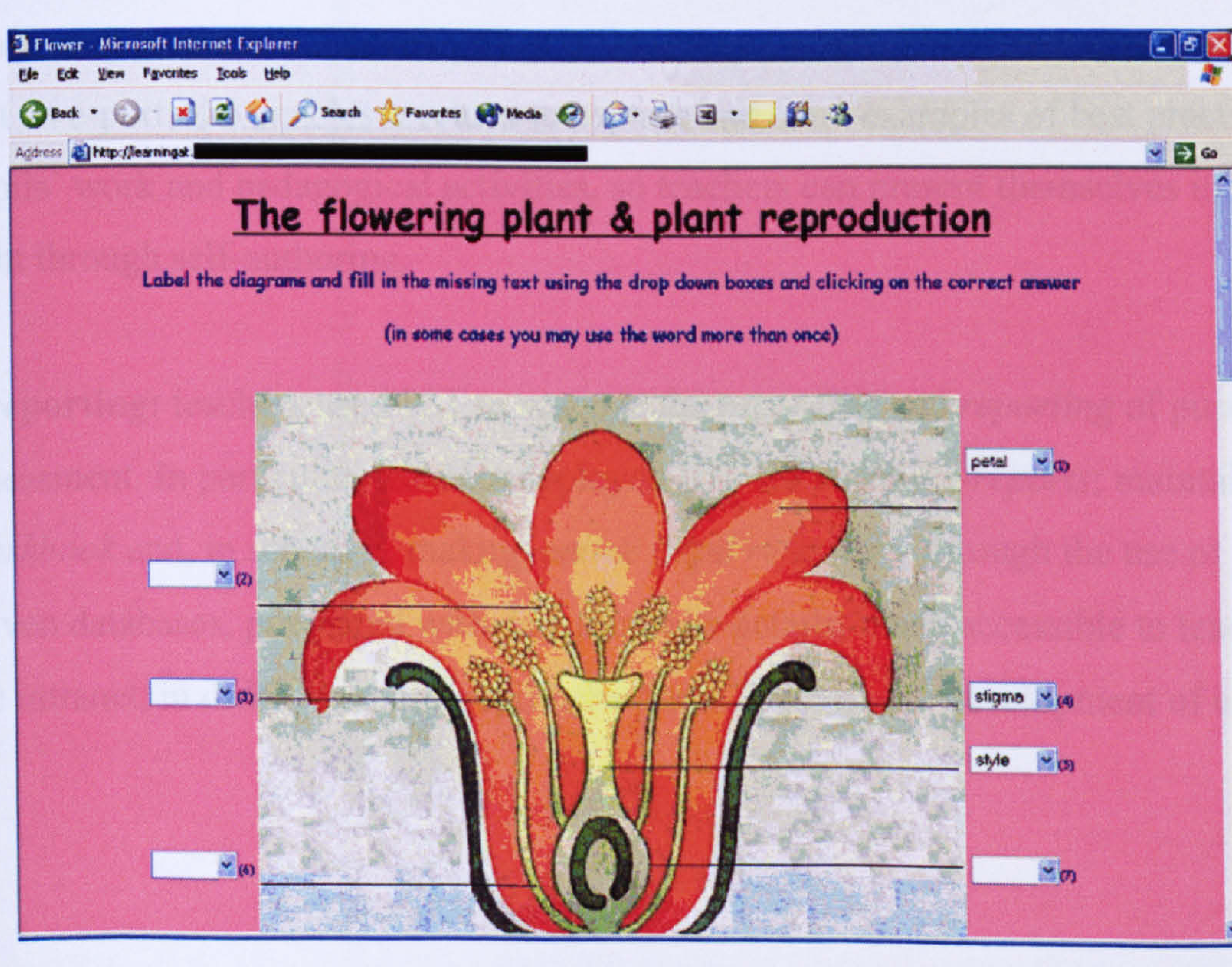


Figure 5.8 Example of Hyperlinked Page

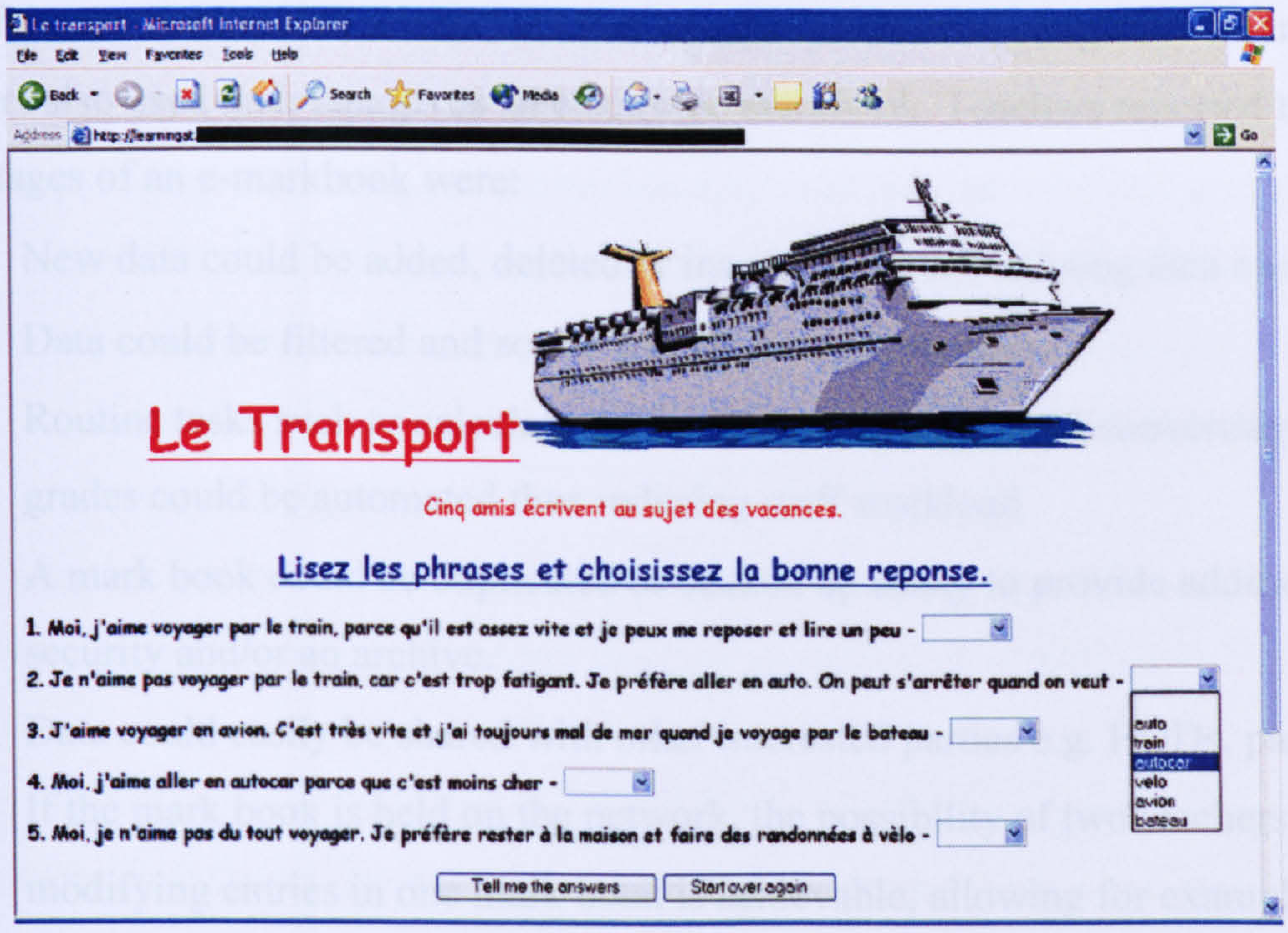


Figures 5.9 and 5.10 are from the school's intranet site and illustrate the kind of pedagogical applications teachers have developed across curriculum subjects (school F).

Figure 5.9 Example of Online Interactive Learning Tools: diagram labelling exercises using drop down boxes (Biology).



- **Figure 5.10 Example of Online Interactive Learning Tools :** cloze exercises using drop down boxes (MFL French)



The examples illustrate the variety of activities that teachers have developed to create a flexible e-pedagogy: 'ICT gives flexibility, between video, power point presentation, simulation: gives greater scope for teaching. I can switch between these easily' (LX, school A, 31/05/02).

e-portfolio: some teachers had created an e-portfolio, to provide a record of their continuing professional development in an online format. The advantages reported were that an e-portfolio enables teachers to capture and store examples of best practice, pupils' work and pedagogical activities, so teachers can present themselves in their best light through self-authoring.

e-reporting: teachers used ICT to *manage* the *recording* and *reporting* of pupil assessment. In particular, teachers deployed ICT for writing *e-reports*; maintaining an *e-markbook* and, in school F, making *online pupil referrals* - through the use of web driven databases, populated with data of pupils details, made accessible to teachers on the intranet, in order to record pupil behaviour. Through the development of electronic reports to replace hand written versions, teachers had changed their practice regarding the use of ICT for commenting on pupils' progress to parents.

e-markbook: in school F, all teachers had laptops for electronic registration and some teachers also used their laptops as an electronic markbook. Teachers reported that the advantages of an e-markbook were:

- New data could be added, deleted or inserted between existing data easily
- Data could be filtered and sorted for particular purposes
- Routine tasks such as calculating averages, percentages and converting marks to grades could be automated thus reducing staff workload
- A mark book could be duplicated or backed up easily to provide additional security and/or an archive.
- Data could easily be shared with other interested parties e.g. HODs, parents
- If the mark book is held on the network, the possibility of two teachers modifying entries in one mark book is achievable, allowing for example, a student teacher and regular classroom teacher sharing the same mark book.

For a more detailed account of how teachers created an e-markbook, a precise step-by-step guide is reported in Younie and Moore (2005).

In relation to the impact of ICT on pupils, teachers referred to three specific concepts that pertained to: one, pupil motivation and concentration, which was better when ICT was used. Two, the quality of pupil work improved with ICT, and three, classroom management, which was facilitated by ICT and consequently improved.

> Simulations using number, is fun and *motivational.* Maths is a marmite subject: pupils either love it or hate it, but games blur this boundary… (SU, school F, 19/06/02, and lesson observation, 30/05/02)

Teachers reported that ICT 'helped with discipline; pupils on PCs are focused' (LM, F, 14/06/02) and 'calms my lessons. For volatile groups, they concentrate on the screen in front of them' (LX, A, 31/05/02). ICT also enabled 'challenging top groups with open ended tasks' (ibid.). Similarly, 'ICT is invaluable for revision tests done through the intranet. Pupils treat like a computer game – it's the most powerful use of ICT in the classroom' (DD, F, 20/06/02).

Summary Pedagogy

This section has outlined how ICT has been used by teachers to support their professional practice, which includes activities that are routinely conducted:

- e-resources - developing resources using ICT
- e-pedagogy - creating interactive learning activities for subject teaching
- e-portfolio – capturing examples of best practice for professional development
- e-reporting - assessment, recording and reporting of pupil progress using ICT
- e-impact – pupils' enhanced motivation, improved quality of work, better classroom management

Those teachers that had ownership of a laptop were more likely to be involved in generating an e-pedagogy; particularly teachers in schools A, F and G.

The research identified five strategies or pathways, used to integrate ICT into the key jobs teachers need to do. By developing electronic versions of teachers' mark books, reports, teaching resources and examples of best practice, teachers can administer and enhance their professional practice. Through ease of access and up-dating of materials, teachers found that ICT provides support in managing the range of different jobs that they have to regularly perform. Teachers identified the advantages and recognised the outcomes for pupils that these ICT developments afforded.

School Leadership

This section examines the category of leadership and why this emerged as so important for teachers. The research found:

- The *role of the Headteacher* and senior leadership team were crucial to the implementation of ICT
- The *Head's vision* for ICT and the *leadership team sharing this vision*
- *Key strategic decisions* taken by leadership that facilitated ICT development, most notably, gaining TCT status, securing ICT expertise and a staffing policy that diverted finance into ICT
- *HODs*: leading from the middle with ICT
- *Change agents*: leading by example with ICT

Leadership: role of the Headteacher

The role of the Headteacher emerged as *very significant*: when ICT was supported there were higher levels of ICT integration, compared to lower levels where ICT was not actively supported by the Head.

When asked about leadership, 95% of teachers answered that it was 'hugely important' (KX, school F, 17/06/02); 'absolutely crucial' (TI, school D, 24/05/02); 'imperative' (TX, school D, 13/06/02); '...massive: single most important component' (SU, school F, 19/06/02).

It is the Headteacher who gives direction to the school, sets the agenda, key priorities and cultural values for the school: the ethos. This is 'vital; if leadership not right, it [ICT implementation] won't work' (MT, HOD, school D, 24/05/02). This highlights the importance of leadership since its absence was found to hinder ICT integration.

> Innovation won't work until people at the top support them; ICT is driven from the top here. This department would not have done what it has with ICT had it not been for the Head, without his driving force, he made it an issue. (DD, school F, 20/06/02)

Teachers clearly perceived leadership to be a significant factor effecting the integration of ICT. 'Head – vitally important, he drives it all' (QI, ICT co-ordinator, F, 30/05/02). Teachers reported that leadership was important for four reasons, because 1) it gives a clear signal that ICT is valued (school ethos); 2) ICT is a priority for the whole school and all teachers, which leads to 3) strategising ICT development across the whole school (ICT pathways); 4) ICT receives financial investment and commitment to resourcing the infrastructure.

Heads Vision for ICT

The four most ICT embedded schools all shared the fact that 1) the Heads had a vision of ICT; 2) the wider leadership team shared the vision, which resulted in 3) ICT becoming a whole-school priority, at a material and cultural level (infrastructure and ethos).

Where Headteachers had a vision about ICT, they were committed to creating developmental pathways for ICT. Two Heads had forged their school's identity around ICT and understood ICT as 'a global mega trend' (LX, Head teacher, school F, 11/07/02). ' The Head told us and told us, [ICT] was his *statement of faith*... that schools all around the *world* were developing with ICT' (DD, school F, 20/06/02).

Where Heads expressed a clear vision with ICT there was a correlating higher level of ICT integration in those schools.

> Leadership is really important, his style was *visionary*; innovative; a forward thinking leader, comes through with the technology. We are at *the forefront* and he is *pushing us forward with ICT.* (NF, school F, 14/06/02)

Heads that had a *vision* with ICT were *prioritising* ICT for whole school development and second, these schools had wider leadership teams with a *shared vision* for ICT. Leadership is 'very important. Lead from the front and set examples from the top. Messages very clear, unambiguous... Very ICT focused, well resourced, a rich provision here' (GN, Head Post 16, F, 11/07/02).

When ICT was not supported or led from the top, there was a marked absence of ICT integration across the school, which applied to *other* designated Technology Colleges *and* non-specialist schools alike. For example, at school D, the ICT Director and Co-ordinator (NL and TX) battled, what they termed an 'up hill struggle', as ICT was not pushed by any of the leadership team, although it was a designated Technology College: 'no vision from the top about ICT. If it's seen at the top of the school that ICT's important – it works, here ICT is shied away from. I don't get the *support from the top*' (TX, ICT co-ordinator, school D, 13/06/02).

The findings illustrate that gaining Technology College status was *not as crucial* as the *Head or leadership team* in effecting ICT integration. Similarly, school H, (in difficult and challenging circumstances) reported that leadership for ICT does 'not get enough direction, gets pushed down list of demands ...' (KX, school H, 28/05/02). Hence, leadership emerged as a critical factor effecting the implementation of ICT in schools.

Where leadership prioritised ICT, teachers also prioritised ICT. The four most important *outcomes* of a Head's vision about ICT were:

1. ICT was *valued* (importance attached to ICT), which was *shared* by the leadership team and disseminated to other strategic leaders in the school i.e. ICT co-ordinators, HODs, creating an ethos for all teachers to prioritise ICT (school culture).
2. The leadership team *prioritised ICT* as a whole-school focus and made *strategic decisions* and *pathways* regarding ICT development (e.g. through staffing structures; remunerating ICT representatives in each department: 'Staff know that if they embrace ICT, they will get support, be recognised and valued; there are resources and management points in the structuring of departments' (QX, Deputy Head, school F, 30/04/02).
3. *Financial investment*: committed money to ICT infrastructure: 'the Head would put ICT at the top of the list... he has a higher awareness of getting funding in and pursuing ICT initiatives' (QI, ICT co-ordinator, school F, 27/05/02).
4. Trusted staff to drive and develop ICT across the school; *distributed leadership* for ICT.

Specifically school leaders identified a *combination* of key factors that supported change, which were:

- Teacher training in ICT pedagogy and skills (CPD with ICT)
- Building up a whole-school vision for ICT use across the school that considered: investment in equipment, teachers' CPD with ICT, with support and follow up of the pedagogical and technological issues by collaboration with higher education institutions
- Facilitating equal access to ICT resources for teachers and pupils
- Establishing an intranet for administrative and whole school purposes (online curriculum resources, pupils' details, assessment records, parents and community interaction)
- Members of school governing bodies able to provide vision, direction and management for ICT
- Giving additional time to the teachers who were involved in ICT projects

- Providing an environment in which teachers can work together on Internet curriculum projects
- Identification of the ways ICT can support administration of the school and the provision of resources to enable this to happen
- The appointment of a specialist to manage the ICT resources in the schools or having financial resources to pay external ICT support services
- Support for professional development of teachers with specific responsibility for ICT

Head's leadership style: barriers hindering ICT

Where schools were not moving forward with ICT, three issues emerged that were specifically to do with leadership. First, the Head and wider leadership team did not value ICT, so it was not prioritised or actively supported (schools D, H and M; second, when the Head failed to make decisions with ICT, which obstructed ICT development, even if unintentionally, (school M); and third, a high annual turnover of staff, because of 'frustration' with the Head's management (school M).

> The Head has *not made the decision* to give the IT Company the contract – so, it's not done. Meanwhile staff can't access student details and get frustrated. The Head needs to take decisions or nothing can go forward. There's no progression; leads to frustration and people leave. There is a high staff turn over, 50% left last year. (NM, school M, 12/11/10)

As the ICT co-ordinator of school M reported, ICT development was seriously compromised by the Head's leadership style: particularly his failure to make decisions and *commit* to ICT. This compares with the Heads of school A, F, G, where the Heads saw ICT as the future and whilst these Heads didn't necessarily have the ICT expertise themselves, they believed in ICT and trusted others to take ICT forward. The Head's leadership is clearly important in the development of ICT in schools.

Leadership and networking ICT expertise

The Head of school F was involved in national ICT research through SLICT (Strategic Leadership in ICT), Microsoft and Toshiba projects and the TCT network and published papers (e.g. BERA September 2002). Most significantly the Head has a distributed approach to developing ICT expertise: '...it's about *networking teachers globally.* Networking very important, encourage other staff to become involved. Look for networks, new and expanding' (LX, Head teacher, school F, 11/07/02). Regarding ICT development, he reported

> ...it's a long process and fast process; it's not incremental, it's about taking leaps and risks. *Network beyond the school*: innovation and abandonment; abandoned involvement with the LEA in order to innovate; new networks: Microsoft, TCT network - spotted people and created leadership groups: Vision 20/20, the think tank of the TCT, networks in UK and internationally, enabled me to visit Australia. (LX, Head teacher, school F, 11/07/02)

This Head was also very clear that his vision for leading the school entailed *all* of the senior management team (SMT) *sharing the ICT vision*:

> Leadership is absolutely vital; SMT - all of them are committed to ICT; it won't be embedded unless SMT are using ICT everyday themselves. Leadership from the top vital, then develop leaders of ICT in the school with skills and knowledge, been vital to this school and other schools where ICT has been embedded. (LX, Head teacher, school F, 11/07/02)

The Headteacher's vision was to *materially* embed ICT across the school and create an *ethos* for ICT in the school: '...make teachers feel they have to use a computer each day: ICT is central to what the school does, everybody knows it is' (ibid.). When interviewed, teachers from school F stated that they felt they 'should be using ICT', indicating that the Head's vision had permeated the *culture* of the school. The Head's vision for ICT was clearly a distributed one, because

> Leadership from champions of ICT *can't be done by champions alone* though. Also, leadership from non-teachers, LRAs [learning resources assistants] role. Leadership – how you network, internationally, understanding socially and educationally mega trends. If not, you just acquire hardware. (LX, Head teacher, school F, 11/07/02)

The next section considers the key decisions made by school leaders that appeared to be critical to developing ICT.

Leadership: key decisions for strategic ICT development

A number of leadership decisions were identified as the most crucial to ICT development for the whole school; namely

1. Applying for Technology College status
2. Securing expert advice on ICT: networking expertise to build a technology infrastructure
3. Staffing policy: strategies to support ICT development
4. Finance: dedicated to ICT resourcing

As teachers observed, securing finance and ICT-using staff were two strategies that aided implementation: 'the Head's been visionary; known how to bring money in and got staff in who are keen to use ICT' (BB, HOD school F, 18/06/02). Clearly, one important decision was to bid for *Technology College status* as success secured the necessary funding to pump prime ICT resourcing: 'TCT status drove the development of the ICT infrastructure. One difficult decision well made. With this money, we put in flood wiring' (NW, deputy school A, 5/10/01). Significantly, the four most ICT embedded schools were *all* Technology Colleges (A, B, F and G). However, this is *not a sufficient condition*, as illustrated by school D, which was a Technology College, which had limited integration. However, Technology College status and consequent funding did appear to be a *necessary condition* for aiding implementation in the sample of schools in this research.

Second, schools needed to locate *ICT expertise* in order to make sound purchasing decisions regarding technology. As an ICT advisor reported, the two key factors affecting the way schools move forward is 'money and good advice about technology' (NM, school M, 12/11/01). This is essential, because ICT is 'different to other school innovations' and 'people don't grasp the *magnitude of how ICT is different* and *what needs to be known'* (ibid.).

Schools needed access to expert knowledge about technology and schools leading the way with ICT could secure appropriate expertise: 'we got good advice from universities' (NW, deputy school A, 5/10/01). The most ICT embedded schools *all* had internal ICT expertise *and* access to external networks of advice. However, in the low ICT integrative schools, expert knowledge about ICT was either absent, or there was not enough internal ICT expertise and leaders did not know how to access external networks of ICT expertise. The research found the government agencies assigned to offer advice on ICT fared badly in the interviews. 'Becta won't be drawn on advice, which teachers need' (NW, Deputy Head, school A, 5/10/01) and again similarly, 'Becta - no, they did not return my call; LEA - no; NGfL – no' (NM, ICT advisor, 12/11/01).

Third, leadership teams of the most ICT integrative schools all developed deliberate *staffing strategies* to support and promote ICT. Three specific strategies deployed by Heads to develop ICT were: 1) to appoint new teachers to the school with ICT enthusiasm; 2) to link promotion opportunities with developing ICT; 3) to deliberately appoint NQTs to keep staffing costs down and free money up for ICT investment (schools A and F): 'Head's deliberate decision to keep staffing costs low and avoid incremental drift on staff wages, this is a drain on money. We have 12-14 NQTs per year in the school' (UU, school A, 26/04/02).

Fourth, a key decision for the strategic development of ICT across the school related to finance. Essential to the most ICT integrative schools were Headteachers that had developed a *concerted and entrepreneurial approach to finance*, which targeted money into ICT as a priority. The Head's decision to *direct finance specifically into ICT* was identified by senior leaders as crucial to ICT development in schools A, B, F, G. The way to get whole school change with ICT was through 'money and equipment, (this) moves schools forward' (ST, deputy, school G, 13/07/01).

The research identified three financial strategies Heads used to develop ICT, which were: one, to dedicate money from capitation to ICT as a priority (this was a considerable amount if the school had successfully secured TCT status); two, to develop an entrepreneurial approach to attract money into the school through bids, for example, securing externally funded ICT projects: schools F and J had Microsoft and Toshiba projects: 'these companies put money into kit; laptops and software licensing deals worth £1000s' (QI, ICT co-coordinator, school F, 27/05/02). Third, Heads diverted money from staffing costs into ICT development.

The research found one necessary condition for developing ICT in schools was sufficient finance to build a viable and sustainable ICT infrastructure. This was achievable in the schools that had gained TCT status and thus been awarded additional funds specifically for technology. However, in the other schools this was more challenging and meant that whilst these schools did have some ICT, the amount was not enough, or too little to saturate to the level where ICT could become routinised. Routinised access, as opposed to organising access as a special occurrence, was found to be a condition that was necessary for teachers to habitually use ICT.

Leading From the Middle: HODS and the role of middle managers

Whilst the role of Heads and the school leadership team were recognised as important in prioritising ICT (for *whole school* development and strategising), it was the HODs (Heads of Department) who had a more immediate (daily) influence on teachers classroom practice and use of ICT.

> ...pressure generated to use ICT is from *middle management.* (UU, school A, 26/04/02)

> *Lead from the middle*, not just the top; need the top, because it creates the environment, but the middle is where it's creative, implemented, embedded. (QX, deputy school F, 17/06/02)

Teachers identified HODs as important for ICT development in two ways: 1) *Leading from the front*: leading by example, by role modelling practice with ICT, which gives a clear signifier that ICT was valued in the departmental practice of curriculum delivery, and 2) creating a *collaborative ICT learning culture* within the department, through sharing practice and providing just-in-time ICT training.

> HOD and Second in Charge (2iC): leading from the front; modelling, ideas bounced off all staff, momentum builds up... using ICT - we felt we *ought* to be. The culture of the department is a learning environment, *all learning ICT together*. Encouragement and advice coming from the top – focus on how to incorporate ICT into lessons. (NS, school G, 13/11/01)

As other teachers in this department went on to attest to, this resulted in the embedding of ICT into teachers' daily practice: 'we're encouraged to share; say if you need help; we're asked this regularly, every day' (DH, NQT, school G, 30/11/01) and '...now ICT is run of the mill, I do it all the time' (TD, NQT, school G, 1/07/02), which illustrated how ICT had become routinised and use was habitualised. What HODs affected was:

> just-in-time training for all teachers in the department; tailor made for individual teachers... being there as a trouble shooter. If I didn't know the answer, we would try to *work it out together.* (LN, HOD, school G, 28/06/02)

The key issues for implementing ICT were deeply understood by this HOD, who offered differentiated training to meet teachers' needs that was also collaborative; this was a department that was *creating knowledge together*; scaffolding each other's learning with ICT and engaging in joint problem solving. This was also observed in departments in school F and A.

The importance of middle managers to lead their departments and effect change with ICT was apparent, since '...if HOD's resistant to ICT, you've got *no change* and if HODs not doing it, then not modelling ICT use to other teachers...' (UU, school A, 12/06/02).

The issue of *within school variation* between departments' use of ICT, even when ICT access was held constant, can be partially accounted for by the failure or inactivity of the HOD to value and model ICT use. The research found that without the direction of the HOD, even in ICT rich schools, some departments did not develop ICT for subject teaching (e.g. school A, Geography; school F, Maths).

In addition to HODs, there were *other* key teachers that were identified as influential in implementing ICT in some schools, who were encouraged by the leadership team and seen as *change agents*. Schools A, F, G, J all actively utilised and cultivated ICT change agents: school A had an AST in ICT; school G had an inspirational middle leader, and school F had a number of ICT change agents, including the ICT co-ordinator, ICT intranet designer, ICT Training manager and departmental ICT reps.

The research found that all the change agents across the schools displayed the following characteristics: one, a *vision* of how ICT can improve teachers' professional practice; two, a deep pragmatic and sympathetic *understanding* of the environment and pressures teachers are working under and a desire to *support, collaborate* and effect change with ICT, through three, *'just-in-time' training* and four, through *role modelling ICT use.* All of which supported other teachers' learning and development with ICT.

Also crucially change agents acknowledge needing to pass on their ICT expertise, in order to 'avoid one person being critical to whole system, when X went, there were problems' (UU, school A, 26/04/02). Change agents are 'trusted people...opinion leaders with a reputation for ICT ...supporting networks of people in operation' (TQ, school F, 30/04/02). Change agents were found to offer distributed leadership for ICT through role modelling ICT use and offering just-in-time training.

Summary of Leadership

Leadership emerged as a significant factor affecting teachers' use of ICT. Schools with the most embedded use of ICT shared the following characteristics regarding leadership:

- **School leadership**: the Heads had a ***vision*** about ICT, which was *shared by the wider leadership team* and ICT became a *whole-school priority.*
- **School development plans prioritised ICT**: the leadership's commitment to ICT translated into funnelling *finance into ICT* (to create an infrastructure) and a *staffing strategy* that appointed and promoted ICT enthusiasts (teachers that valued ICT, which created an ethos of use).
- **Middle managers:** *HODs* created a 'pressure to use ICT' through implementing ICT themselves; encouraging a *departmental collaborative culture* with ICT through *support* and *training* for the department that actively engendered the creation of new pedagogic knowledge with ICT.
- **Key characteristics**: all the 'leaders' above (Heads, HODs, change agents) shared the key commonality of ***leading by example***; role modelling ICT use, which actively encouraged *and* demonstrated to other teachers how to use ICT.

A key outcome for schools with active leadership for ICT was the generation of a school ethos or culture for ICT. The following section examines the importance of school culture in relation to ICT implementation.

School Culture

This section explores the category of school culture, which emerged in phase 2 of the research and was found to explain the variation between schools regarding the different degrees of ICT integration. In particular, school culture covers the overarching strategies deployed by schools to develop ICT, which encompass material and cultural factors. Specifically this section examines:

Whole school strategies found to aid the integration of ICT:

- **TCT status:** successfully gained
- **Staffing:** strategies used to facilitate ICT development across the school
- **Change agents**: their strategic leadership role in the wider school context (e.g. ASTs in ICT)
- **Time:** strategically protected for teachers to develop ICT
- **Communication:** strategies to integrate ICT across the school
- **Pathways:** examples of routes used by schools to develop ICT

Factors hindering ICT development

- **changes of staff**: high rates of annual turnover
- **competing priorities**: Ofsted and effect on ethos
- **leadership not valuing ICT**: effect on ethos; message ICT not a priority

Department strategies to integrate ICT

- **Departmental meetings**; with ICT as a standing agenda item
- **Liaison roles**; ICT representatives in departments that regularly liaise with other key 'led ICT' teachers' (e.g. ICT co-ordinator)
- **Collaborative culture** for ICT development; through sharing resources and training between teachers within the department

A strategy was seen as both structural and procedural; it refers to a plan regarding implementation and how that is operationalised in practice. Schools deployed a range of strategies, some were similar across schools, while school F had some unique strategies that were particularly effective according to teachers. These strategies will be outlined and their outcomes in terms of implementation considered.

Strategies for Whole School ICT Development

The key strategies that school leaders reported as significant in aiding implementation were: a) gaining TCT status; b) having staffing polices that facilitated ICT; c) using change agents across the school; d) creating time for teachers; e) embedding online communication systems; and f) specific pathways linked to the most ICT embedded schools were: i) laptops for teachers; ii) involvement in international ICT projects and iii) school F uniquely had an on-site ICT Training Centre that provided professional development in ICT for all teachers.

Technology College Status: successfully gained

Teachers in Technology Colleges (now the Specialist Schools Trust: SST) reported this created a whole school pressure to use ICT. There was a *cultural shift* in awareness that emerged from the changed status, which exerted a push on ICT use. As teachers illustrated: '...we're a TCT college, so you feel you *should* be using ICT' (QE, school F, 14/06/02) and 'TCTs make ICT more important in a school, it has a higher priority' (QI, ICT co-ordinator, school F, 27/05/02).

95% of teachers in the TCT schools reported an *expectation* to use ICT, 'because we're a TCT it becomes explicit, because the hardware's there, so [we're] expected to use it' (SU, school F, 19/06/02). Also, 'as part of Technology College status, we're expected to train others schools' (QB, school G, 17/01/02), which illustrates a networking approach to generating and disseminating ICT expertise: 'we're part of the TCT network... with the message ICT is important' (ST, Deputy Head, school G, 28/06/02).

Gaining TCT status clearly affected teachers' perceptions of ICT; however, raised expectations use did not necessarily result in actual use. This was because other necessary conditions were absent. For example, in school D, there was a lack of access and leadership support for ICT, although a Technology College. Hence, expectations alone were not sufficient in implementing ICT use across teachers in a Technology College Trust school.

Another strategy deployed for developing ICT was staffing and how particular approaches to recruitment can enhance ICT across a school.

Staffing: strategies used to facilitate ICT development across the school

From across the sample of schools, four specific staffing strategies to enhance ICT were identified:

- **new appointments** to the school; had to be keen and knowledgeable ICT users, (explicitly adopted by schools A, F and G)
- **LRAs** (learning resource assistants); job description to work alongside teachers to produce online learning resources for departments and upload onto the school's intranet. One appointed to each department (school F)
- **ICT representatives**; each department has a teacher responsible to drive and develop ICT for each curriculum subject; ICT reps from across all departments, also meet regularly as a team (school F,G and H: latter only core subjects)
- **Change agents**; responsible for instigating and supporting teachers use of ICT across the school, for example, ASTs (schools A and F)

School F created LRA posts specifically to support the generation of e-learning resources, which involved adapting teachers' pedagogical activities online, uploading and maintaining the shared area on the intranet for that subject.

Another key strategy was the deployment of ICT reps to disseminate ICT use across the department. For example, the ICT rep would develop one ICT activity as a way of using ICT with all staff: 'I did a step by step guide; they asked 'can you come in with me?' Teachers said 'I would never have done this if you weren't here' (SD, ICT rep for Science, school F, 5/07/02). This staffing strategy of ICT reps was used across schools F. G, H and was commented on favourably by teachers:

> Development of ICT needs a person in every department responsible for it; to drive it, this is what we did and it works... very successful strategy, (the) person

> needs to be a driver, who can make things happen, have support from the top. (ST, Deputy Head, school G, 28/06/02)

Making teachers specifically responsible for ICT through the post of ICT rep was a key staffing strategy used by the schools, which was remunerated.

Similarly, schools utilised change agents who could promote and develop ICT across the staff, when the school took the following approach: one, there was recognition of change agents innovations with ICT; two, school leadership actively encouraged change agents; gave permission, freedom, and support to drive ICT; and three, gave remuneration for leading ICT (e.g. specifically in school A, F, G, H).

> ...innovative teachers are given scope to experiment, that's how those innovations become general school strategy... the motivation's there in the teachers, in the context of the college supportive to ICT. (NW, Deputy Head, school A, 5/10/01)

A successful complementary strategy to appointing staff specifically responsible for ICT, was to award teachers' *time* to develop ICT.

Time: strategically protected for teachers to develop ICT

Three strategies were identified across schools to 'protect time' specifically for ICT development. One, in the summer term, teachers were guaranteed ICT development time, in particular the use of Year 11 and 13 lesson time, when from May, these exam groups no longer required teaching. Two, (throughout the academic year) teachers were granted 'protected cover slots', that is, guaranteed 'free lessons' where teachers were not taken for cover. Three, a reduced teaching load, that is a lighter timetable for key teachers, for example, the ICT co-ordinator and intranet designer in school F, and ASTs in school A.

In schools A and F, the protected ICT time had tangible outcomes attached, so that teachers had to show evidence of their output. Allocating time for teachers to specifically focus on ICT was *crucial*: 'I developed the 'shared area' on the network for teachers' (SC, 2iC science, school F, 19/06/02). The corollary of no protected time was stunted or limited ICT development (school D and H).

The most ICT integrative schools used these three specific strategies to *designate and protect time* for staff to develop ICT. Where this did *not* happen, ICT was noticeably *less* developed and while this was attributable to a number of factors, time was clearly identified as a major factor preventing teachers from developing ICT.

Communication Strategies to Integrate ICT

ICT awareness as a corollary to implementation necessitated communicating to teachers' whole school ICT developments. The three most ICT embedded schools (A, F, G) all employed a multi-dimensional approach to communicating with teachers, using, for example, both electronic and hardcopies of newsletters, staff bulletins, notice boards, followed by email and school intranet site. In fact, from 2001 onwards, school F radically took the decision to *only* disseminate information electronically, however given that all staff had laptops, this quickly embedded ICT use. As one teacher illustrated, 'email: spread so widely and had an impact; it's transformed the culture of communication' (GN, Head of Post 16, school F, 11/07/02).

Whilst facilitating communication across disparate buildings and staff, email also generated synergy for ideas, which culturally embedded the Head's vision for ICT: 'here all staff have got email, so can talk, this stimulates ideas, communication between people' (SC, school F, 19/06/02).

Using email for sending essential information, alongside introducing electronic registers, made even 'reluctant' teachers have to use their laptops in school F. Making these strategic changes to the school's communication systems significantly embedded teachers' ICT use. As the Head argued '...make teachers feel they *have to use* a computer each day: ICT is central to what the school does and everybody knows it is' (LX, Head teacher, school F, 11/07/02). By transforming the culture of communication in school F to integrate ICT, the Head had developed a successful pathway, and the research found examples of other paths developed by schools to integrate ICT.

Pathways: specific routes used by schools to develop ICT

The research discovered specific *implementation routes* taken by ICT integrative schools, which were considered worthy of recording in order to map out paths for other schools. In school F there were multiple strategies for integrating ICT, which successfully differentiated the school's approach; namely

- A 5 year plan: long-term developmental paths for ICT
- ICT Training Centre and Manager: centring ICT CPD for all teachers
- KS4 ICT key skills course: for all pupils that was cross curricular and therefore involved all teachers
- KS3 e-learning base: redesigning classrooms and the curriculum for online learning (see appendix I)
- ICT: open access in social spaces, for teachers and pupils
- laptop initiative; as discussed previously
- international ICT projects; as discussed previously

As a leading edge school with a national reputation for ICT, school F had a clearly defined five year plan for ICT development. The most *unique* aspect of school F's ICT strategy was the introduction of an ICT Training Centre, complete with Manager. This post was pivotal to managing teachers' ICT development, which crucially became linked to teachers' performance targets: personalised CPD brought forth a unique culture of ICT training & accreditation, which was unprecedented in its reach and vision before NOF training.

Another strategy to embed ICT use at KS4 across the curriculum was with an accredited ICT key skills course, aided by the ICT representatives in each department. The key skills accreditation pathway was crucial in externally validating teachers' classroom use of ICT, and importantly did not entail additional work from teachers, as it was based on an 'existing ICT activity teachers were already doing and adapted it to meet the criteria for the EDEXL course' (QI, ICT co-ordinator, school F, 20/11/01). Perceptively observed, this strategy 'wouldn't work if it required more work of teachers' (ibid., 27/05/02).

Another key strategy to integrating ICT was to provide *continual open access* to ICT: ICT became part of the fabric of the school space; materially and culturally. ICT permeated the physicality of the school as computers were located in social spaces; clusters at ends of corridors, top of stairs and in the cafeteria (cybercafé). These machines were free to use at anytime by anyone.

Observations of these open ICT spaces revealed use before school (8.30am), break times (10.50am) and lunchtimes (12.30-1.30pm). The cybercafé was used all day, with 10 computers, managed by 2 LSAs (learning support assistants). Pupils were directed to the café when excluded from a lesson: 'come here and work solidly all day on the computer...pupils have their work on the intranet' (TD, LSA for cybercafé, school F, 17/06/02; observation cybercafé 10-11am, 17/06/02).

By ICT permeating the physical and social space of the school, beyond the classroom, there was a vision of open and continual learning, which was further developed through the Key Stage 3 e-learning base that involved redesigning classrooms for online learning. The school significantly re-engineered the KS3 site from traditional classrooms to an e-learning environment, with a reconfigured, modularised curriculum, which won a national ICT award from Research Machines for ICT innovation.

In utilising all of the ICT strategies above, in addition to participating in international ICT projects and *all teachers* owning a laptop with wireless connectivity, school F impressively *marshalled multi-frontier ICT initiatives*, which enabled it to become one of the leading schools for ICT in the country. It was the *multidimensionality of the strategies* that effectively enabled a material and cultural shift in the working practices of the school.

Summary: school F developmental pathways for whole school ICT integration

- A 5 year plan: move beyond ICT suites to department hubs and laptops for all teachers and class-sets for pupils
- ICT Training Centre and Manager: personalised ICT CPD co-ordinated for teachers on site
- KS4 ICT key skills course: accrediting ICT practice by teachers for pupils
- KS3 e-learning base: classrooms redesigned for online learning

- ICT: continual open access in social spaces
- Wireless laptops: all teachers have to use online registration, produce online reports and upload all pupil grades into the whole school database
- International ICT projects: global network of teachers' evolving ICT pedagogy

Of the above strategies successfully deployed by school F, some were also found to be used in other schools. In particular, school G utilised three whole school strategies for integrating ICT: 1) establishing an *ICT working party* across departments; 2) embedding ICT development into managers' roles (*staffing strategy*); 3) disseminating effective practice with ICT (*CPD strategy*): 'sharing good practice sessions for the whole school, classroom teachers run these 4 times a year, on the meetings schedule' (ST, Deputy Head, school G, 28/06/02). All these strategies were in common with school F.

The research found the most ICT embedded schools shared some *similar strategies;* each started with 1) the *Head's ICT vision*, which afforded the development of whole school strategies, namely the leadership team's joint commitment to ICT (*leading from the front* with ICT); 2) allocating *finances* to ICT, which resourced teachers' *time* and acquisition of an *ICT infrastructure;* 3) each strategy culminated in sharing good practice and 4) developing a whole school approach to CPD, which allowed the knowledge generated about ICT to be diffused, through the regular meetings cycle.

The findings illustrated a *dynamic interplay* between ICT initiatives that generated synergy and led to effective implementation. The multi-dimensional approach of pushing more than one ICT strategy simultaneously was arguably a strategic insight in itself. As one Head perceptively observed 'there's more than one way to get change' (UD, Head, school I, 29/05/01).

The most ICT integrative schools recognised that it is '...very difficult for individuals to effect change; you need teams' (NW, Deputy Head, school A, 5/10/01); hence the need to 'build up teams of people, led by leaders of teams, with consistent vision' (LX, Head teacher, school F, 11/07/02).

Whilst the most embedded schools deployed ICT strategies to engender integration successfully, it was noticeable that the corollary was also the case: the schools that had little ICT integration, did not have strategies; 'no whole school strategy to speak of here.' (TX, ICT co-ordinator, school D, 13/06/02). The research found specific local contexts hindered implementation, which affected a number of schools and are presented in the next section.

Factors Hindering ICT Integration

- Internal instability: different Heads and/or high staff turnover
- Ofsted failing a school; effect on ethos and staff morale
- Leadership team not seen to value ICT; message ICT not a priority

Just as ICT embedded schools could identify factors and pathways that had enabled the successful integration of ICT, so too could less developed schools specify exactly which factors hindered integration. For school H it was a *combination* of factors, which created a context of *instability*. In particular, *a high turn over of staff* caused a lack of internal stability, due to: one, being placed in special measures by Ofsted; two, having merged with two other failing schools and recognised as 'in difficult and challenging circumstances'; three, a succession of 6 different Heads in 6 years, alongside a 50% annual turnover of teachers and, four 50% of the teachers were supply staff: all factors that negatively effected ICT implementation. As the ICT co-ordinator stressed,

> ...staffing not stable, staff leave: supply teachers – high percentage. Strategy is there for ICT, *but* implementation is the issue. (WQ, school H, 23/05/02)

Staff fluctuation was *compounded* by the fact that the ICT co-ordinator had '*a heavy timetable*: I liaise with individuals, who then leave that department. When staff move on – back to square one...they get [NOF] trained and then we loose staff expertise; we get new staff who haven't had the training...' (ibid.). Implementing ICT is difficult, because the school cannot afford the ICT co-ordinator the *time* required and HODs have urgent daily concerns managing supply staff. HODs are 'under pressure from all directions; overload for staff in school, because in serious weaknesses by Ofsted' (ibid.).

However, interestingly, a lack of staff movement was *also* identified as a factor that hindered ICT development. 'HOD for Geography has been in post for 14 years and never appointed a new member of staff. If a department is static, you don't get change' (UU, school A, 26/04/02). The research indicated that a high (or low) fluctuation in teachers hinders ICT integration unless there are other measures in place specifically to address this, for example school F's rolling and personalised ICT training programme.

Another factor found to hinder implementation was when school leaders did not value ICT. As previously identified, Headteachers were shown to be important catalysts for ICT and school D attests to the converse: 'poor leadership...and communication problems' (MT, HOD Design, school D, 24/05/02) were attributable to the lack of ICT integration; as other HODs reported the 'difficulties of implementation - *Head not lead by example*' (TI, HOD MFL, school D, 24/05/02).

It is the *dynamic interplay between factors* that has emerged as important in understanding the different levels of ICT integration between schools, particularly where factors were similar across schools, but implementation so varied – as the two examples below illustrate. In school D, e-reporting led to an acrimonious atmosphere where a number of problems were combined – technical and managerial that culminated in bad feeling, with no support structures in place to facilitate its introduction, whereas school F offered 'training and mop-up sessions' for teachers completing e-reports. This serves to highlight that it is not 'e-reports' in themselves, since the two schools reported such different experiences of the same ICT process.

Second, a high turn over of staff was a key factor hindering ICT integration. Whereas school H had a context of instability compounded by *other* issues (a failed Ofsted), school F had a high turnover, but alongside a raft of ICT supporting strategies (pathways) that facilitated integration (an ICT Training Centre, bespoke CPD for teachers, stable leadership, Head with vision, HODs leading by example with ICT). So whilst *both* schools experienced a *high annual fluctuation* in teachers, the surrounding *conditions* (culture) were very different between the two schools, which explains the difference between them. Similarly the differences between schools (D and F) regarding the introduction of e-reporting illustrates that it is not the technology in itself, but rather the surrounding culture of the school that impacts on teachers ICT use.

The next section examines the research findings relating to the strategies that departments use to integrate ICT.

Departments: strategies for integrating ICT into subject teaching

In secondary schools there is an 'emphasis on departments, inevitable in a big school, you organise around departments' (SU, school F, 19/06/02), which are the working hub for subject teachers and form the *context* through which ICT is implemented.

> Science [department] – collective spirit – sustains innovation. MFL [department], sharing same mind set with ICT for teaching and learning, with lots of support from SMT. (QX, Deputy Head, school F, 30/04/02)

What emerged as influential at departmental level regarding ICT was one, departmental meetings, with ICT as a standing agenda item; two, ICT liaison roles, for ICT reps in department to liaise with other key teachers (e.g. ICT co-ordinator); and three, a collaborative culture for ICT development, through sharing resources.

Discussions of *departmental development of ICT* were formally embedded into meetings as an agenda item, which afforded 'time to discuss and feedback ICT developments and ideas; new ICT resources, new ICT packages, etc.' (BB, HOD school F, 18/06/02). Also 'ICT targets are set in department meetings - now put ICT on department agenda as an item' (WQ, ICT co-ordinator, school H, 5/11/01). Sharing ICT practice between teachers was also incorporated into department meetings, as was feedback regarding the liaison roles for ICT. School H developed ICT at departmental level by making ICT part of 'the performance management targets for one member of each department, [this] is now a vehicle for tackling ICT issues' (WQ, school H, 5/11/01) and includes a liaison role with the ICT co-ordinator.

Developing a Departmental Collaborative Culture: sharing resources

Getting the *department to work together* on ICT, within a supportive environment was a crucial factor that HODs developed for their staff:

> ...dedicated department; brilliant team; work together. Department – best support network, always pushing you to develop yourself and skills. (LX, school A, 31/05/02)

Teachers reported sharing best practice at departmental level created an internal momentum to use ICT, as this teacher nervous of using ICT illustrates; 'I was apprehensive at the start, but everyone in the department was involved... I saw the difference ICT made' (NS, school G, 30/11/01); also, 'watching other people in the department - being pushed by others...' (MI, NQT, school G, 13/11/01).

Making ICT resources available to other teachers was a key supporting factor: 'they'll show everyone; you see it on your desk and it encourages you to look at and use, and write your own to share' (KQ, school A, 11/06/02). Within a collaborative department, teachers were learning to use ICT by watching their colleagues, by being immersed in a community of practice that utilises ICT.

Teachers repeatedly reported that what *helped them most to integrate ICT* into their professional practice was sharing ICT ideas:

> ...sit down with colleagues, share ideas. Need *time to discuss*...not time on my own, but time *with my department.* (XX, school D, 26/06/02)

The findings illustrated *departmental cultures of learning* (to use ICT in the classroom for subject teaching) through sharing practice, alongside mutual peer support: 'you're clearly expected to contribute to resources in the department *and share*' (NS, school G, 13/11/01); 'equipment alone is not enough, *you need knowledge, a support mechanism* and training' (QI, ICT co-ordinator, school F, 20/11/01).

Similarly even in 'difficult and challenging circumstances' school H teachers still developed an informal culture between staff for learning ICT. It was the *same process of informal mutual support* and *exchange of knowledge*. In school D, which lacked leadership for ICT, teachers still collegially supported one another's ICT development: 'we discuss ICT activities, and over coffee' (IT, school D, 26/06/02).

The research illustrated that teachers entering a *departmental culture of ICT use* were socialised into its practice in a way that was pervasive and commanding, and was particularly powerful for teachers new to ICT and NQTs at the start of their careers. The theme of 'learning from others', notably the social dimension of teachers learning, sharing and creating new knowledge together emerged as a dominant factor explaining high rates of implementation. This collaborative approach clearly meant disseminating ICT expertise. Teachers reported it is fundamentally important to ensure that ICT knowledge is not held by one person:

> ...important – not got one person to champion ICT, not have 'lone ranger' model, or 'champion the wonder horse' model. There are a number of people; ICT reps in departments; web author; 'advanced ICT users' group; links with other schools (to share) good practice: (ICT knowledge) 'in and out' then. (QX, Deputy Head, school F, 17/06/02)

In school F, the pathway to share practice with other schools was via:

> ...open days, the school shares the ICT mistakes made, so other schools do not have to repeat them. If it's taken us 2 years to learn something, other schools can skip this 'painful' learning and move straight to where we are now; saves money, time and effort: met with over 200 schools. (QI, ICT co-ordinator, school F, 18/06/02)

Given the problem of high staff turnover in schools F and H, 'if dissemination is good, it doesn't matter if personal change, because knowledge is shared, because of publishing everything on the intranet... is the answer, it's very visible' (QI, ICT co-ordinator, school F, 27/05/02). To successfully embed ICT, schools need to move on from ICT expertise being held by a few crucial teachers: 'though there are key people in the school who drive it (ICT), but if they left the school, it would still continue now' (UU, HOD, school A, 12/06/02).

The category of school culture covers the overarching strategies deployed by schools to develop ICT, which encompass material and cultural factors. This category that emerged in phase 2 was found to explain the variation between schools regarding different rates of ICT integration. The next section considers what teachers reported about national government ICT initiatives and how they affected schools at the local level.

National ICT initiatives in schools

Teachers and school leaders in particular, reported that the three main advantages to a national ICT strategy were:

- the credibility government initiatives gave to ICT for whole school investment
- reinvigorating community links with schools
- the national NOF CPD programme prioritised ICT for teachers' practice

When teachers referred to the government's national ICT initiatives, the responses could be coded into *advantages* and *disadvantages*. The first advantage was the credibility this gave to schools that were *already* developing ICT prior to 1998. The national initiatives clearly legitimated an ICT agenda pursued by innovative schools (A, B, F, I and J). However, the governmental drives on ICT also created a pressure:

> ...the pressure is there to spend on ICT, because it's constantly changing and it's expensive. Pressure of using ICT is indirectly from the government; schools have to be competitive - they have to have the latest kit. (IS, Director of After School Study Support Centre, 2/07/02)

A second advantage was the opportunity to re-invigorate communities with ICT, as the push from government was not limited to schools, but also the wider community and two schools (F and J, both innovative 'Anytime, Anywhere Learning' Microsoft schools) actively developed community links through ICT. The Headteacher of school J, created a *connected learning community* in an *area of considerable social and economic deprivation.* This provided a model for bridging the digital divide, through facilitating collaboration and lifelong learning, through the school's laptop scheme that targeted low-income families. Also, by providing community ICT skills classes in this local primary school, these effectively educated parents and enabled local community regeneration (a more detailed account is provided in Younie, 2003).

The third advantage concerned the government funding of the national NOF training programme, which sent a clear statement that ICT use was imperative for serving teachers.

> NOF: this national initiative says ICT is important to teachers; the money and the fact it exists; it's set up and is in place, is an important message. (QI, ICT co-ordinator, school F, 27/05/02)

The only disadvantage raised by teachers was that the government's focused drive on ICT led to increased expectations that could not always be matched, given the challenge of expenditure, which was a funding issue. The research found significant funding disparities between the schools sampled, which are discussed in the following chapter.

Summary of findings from phase 2

Phase 2 focused on detailed data collection that further substantiated the categories that emerged from phase 1. Importantly school culture emerged as a significant factor in phase 2. Next the research necessitated that the findings were checked for validity, through a respondent validation questionnaire that constituted the third phase of research.

5.3 FINDINGS FROM PHASE 3: RESPONDENT VALIDATION

Respondent validation is the process by which the teachers, with whom the research was conducted, with an account of the findings and requests feedback on that account. The teachers were asked to consider to what extent they agreed or disagreed with each major finding, using a 5 point Likert scale questionnaire (see appendix E2). In addition to conducting a questionnaire, a sample of interviews were arranged to discuss the respondent validation findings in depth.

The sample for the respondent validation phase of research was carefully selected. Six case study sites were used for phase 3, 50% of the sample from phase 1 and 2. From these, a sample of 35 teachers were selected and sent the questionnaire. There were 27 respondents (77% response rate), with 12 postal returns of the questionnaire and 15 returning the questionnaire in a follow up interview. (See appendix G3 for details of the sample.)

Table 5.1 Phase 3 Sample of respondents

Case study sites	Sample sent questionnaire	Total returns	Non returns	Returns with follow up interview	Postal returns
6	35	27	8	15	12

The research findings (from phase 1 and 2) were presented to the teachers in text boxes (below) and the teachers' responses were recorded via a Likert scale and are represented in bar graphs, with figures and respondent percentages. Although 27 teachers responded in total, one teacher only used the text boxes providing a written response, but did not select a number on the Likert scale, so the figures responding read as 26.

Overall the phase 3 findings indicate a high degree of *agreement* with the research findings from phase 1 and 2. Respondents reported either agree or strongly agree with each major finding. Respondent validation rates for each theme were, in descending order:

Table 5.2 Respondent Validation Rates

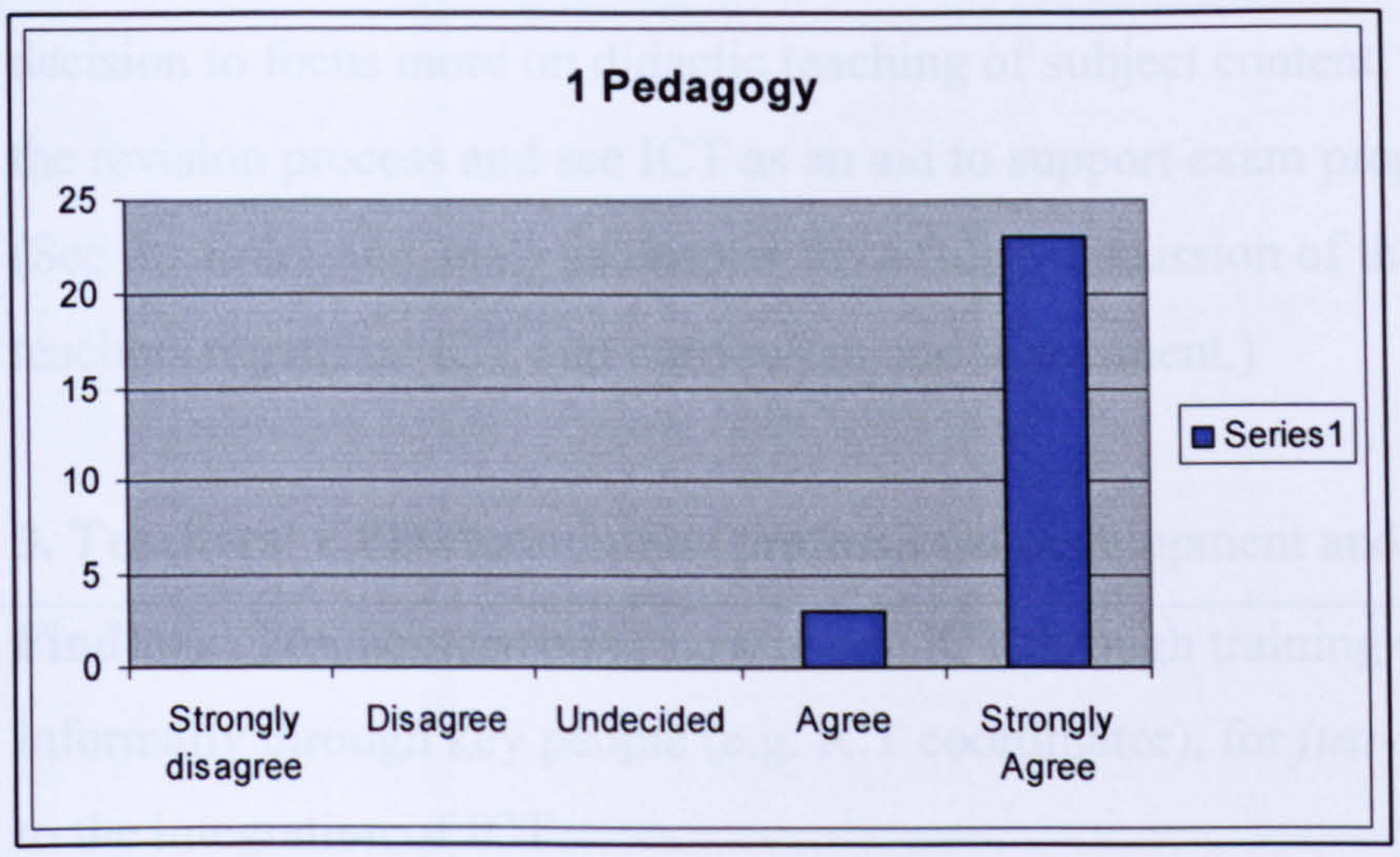
Research Category:	Rate of Agreement: Respondent validation
Pedagogy	100%
Technical Support	100%
Technology Resources	96%
CPD with ICT	96%
Leadership	96%
National ICT initiatives	50%
Curriculum and Assessment	38%

The questionnaire findings for each category are as follows:

1. Pedagogy

Findings: Teachers *sharing and disseminating new ideas* on how to use ICT for professional / classroom practice is critical to the integration of ICT.

Respondent validation: 23 out of 26 teachers strongly agreed with the above statement (88%) and, in total all teachers **100% agreed** that sharing practice with ICT is essential to implementation.

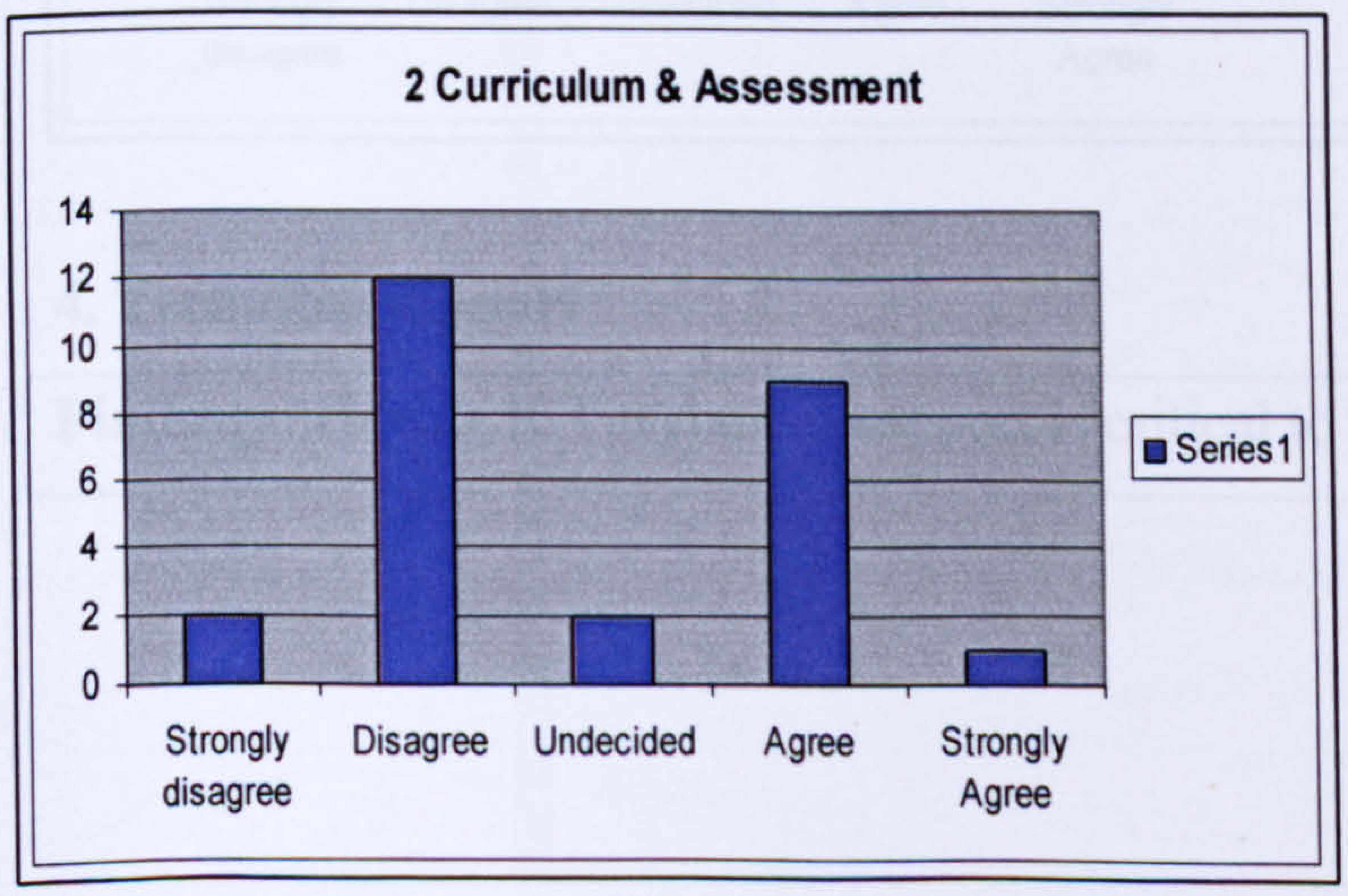


1 Pedagogy				
Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
0	0	0	3	23

2. Curriculum & assessment

Findings: Assessment strategies and pressure on grades make teachers stick to safe methods, rather than more innovative methods e.g. with ICT.

The issue of curriculum and assessment elicited the ***most varied range of responses***. Respondent validation: 10 out of 26 teachers agreed (38%) that curriculum content and assessment did not foster or encourage ICT use, due to the demand to meet attainment targets in exams and league tables. However, 14 out of 26 teachers disagreed, reporting that ICT could still be harnessed in spite of curriculum demands. 2 teachers (8%) were undecided.



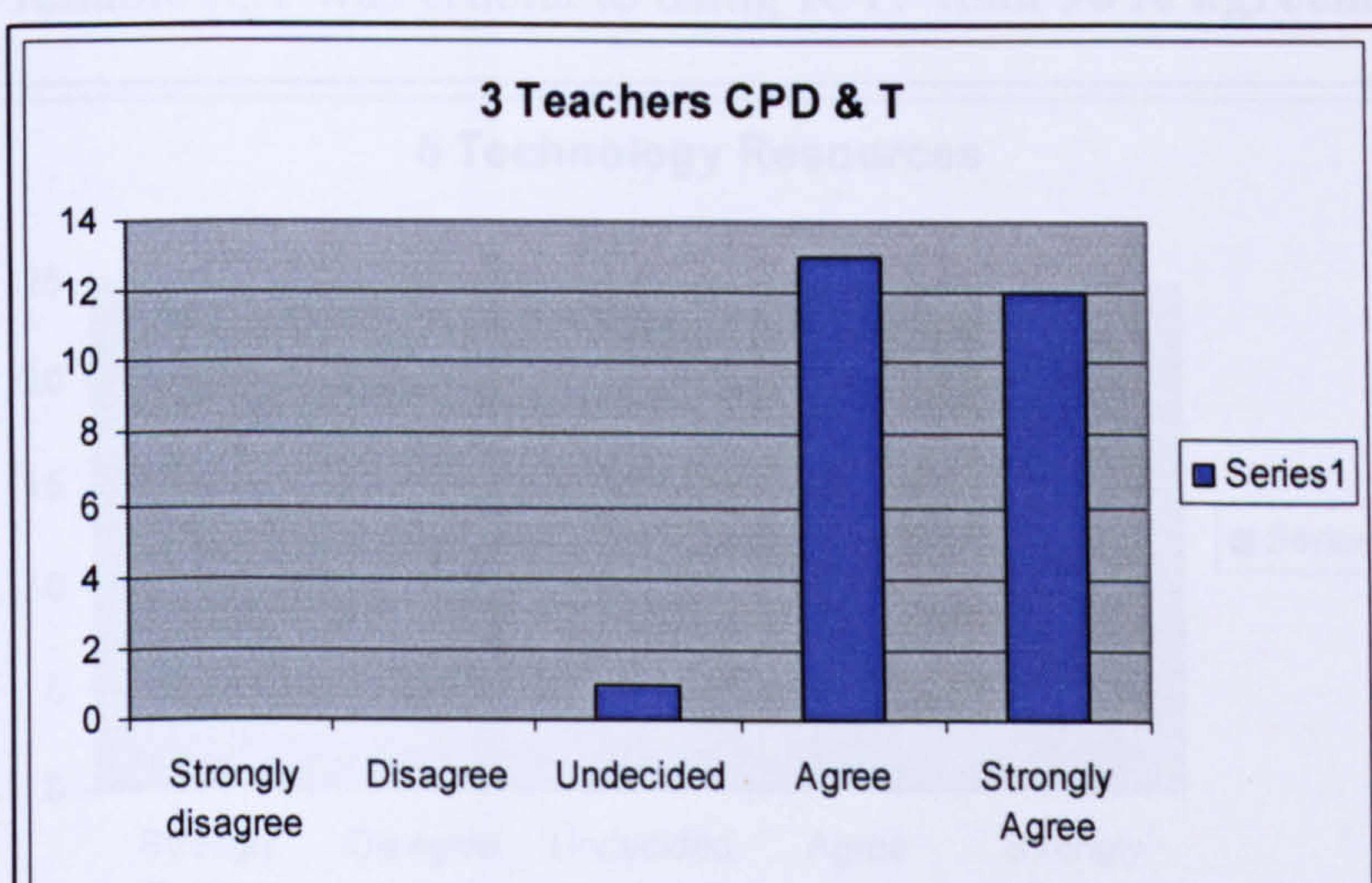
2 Curriculum & Assessment				
Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
2	12	2	9	1

This split in responses reflects the different paths or strategies that teachers took in relation to ICT and the external demands of the curriculum and assessment, in particular, the final exams taken at the end of Key Stage 4 (KS4). The findings illustrate that teachers tended to either 'avoid' using ICT with KS4 classes, as a deliberate decision to focus more on didactic teaching of subject content, or to 'integrate' ICT into the revision process and see ICT as an aid to support exam preparation and attainment. (See the following analysis chapter for a fuller discussion of these differences between teachers regarding ICT and curriculum and assessment.)

3. Teachers' CPDT(continuing professional development and training with ICT)

Findings: Teachers *learning* how to use ICT through training (external/in-house), or informally through key people (e.g. ICT coordinator), for *just-in-time* learning is critical to the integration of ICT.

Respondent validation: 25 out of 26 teachers agreed or strongly agreed with these findings: total of **96% agreement**.

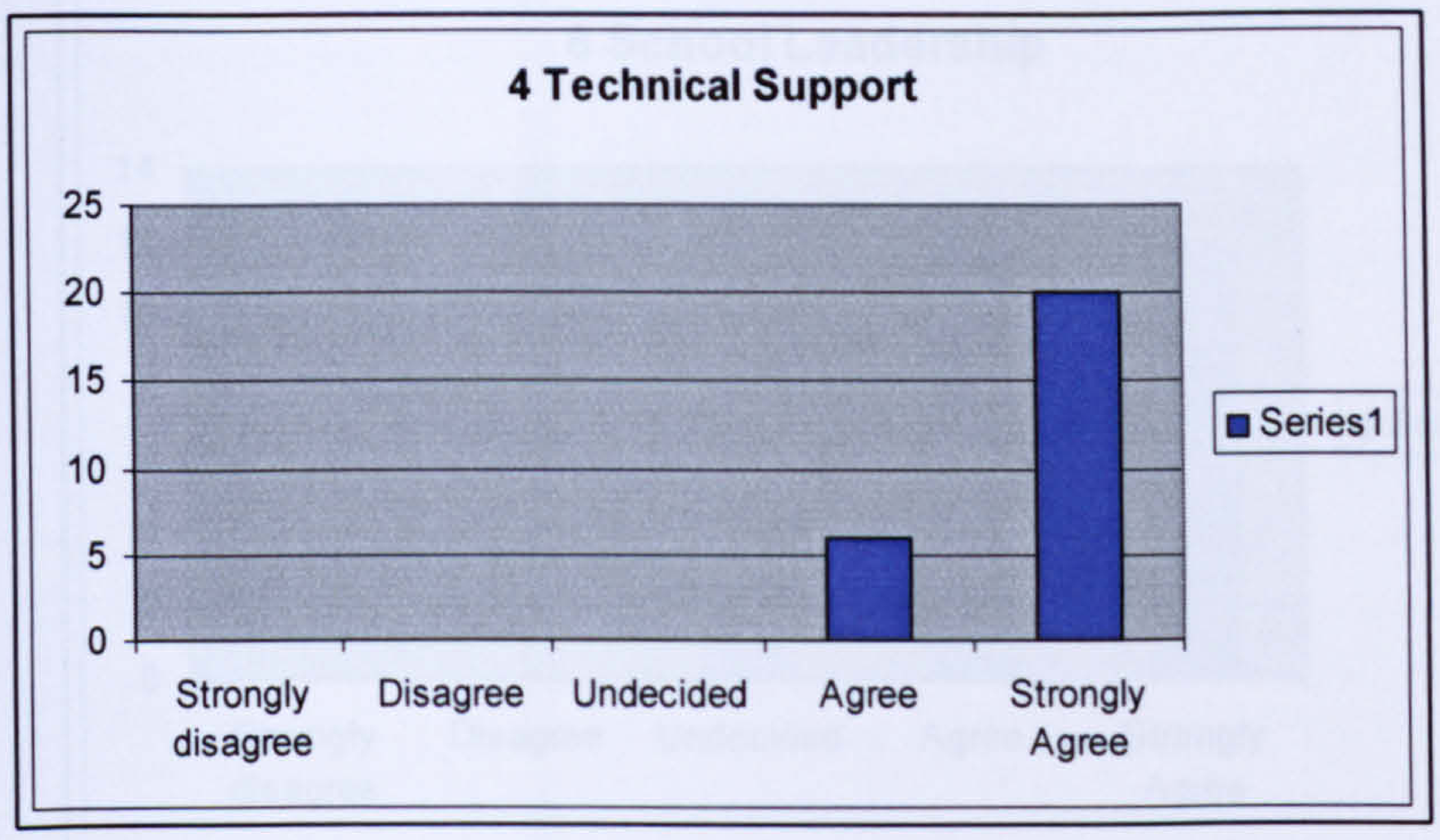


3 Teachers CPD & T				
Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
0	0	1	13	12

4. Technical support

Findings: Having ICT technical support is critical to the use and integration of ICT.

Respondent validation: **100%** of teachers responding agreed that having ICT technicians was crucial to teachers using ICT: 20 out of 26 strongly agreed (77%) and all remaining 6 agreed.

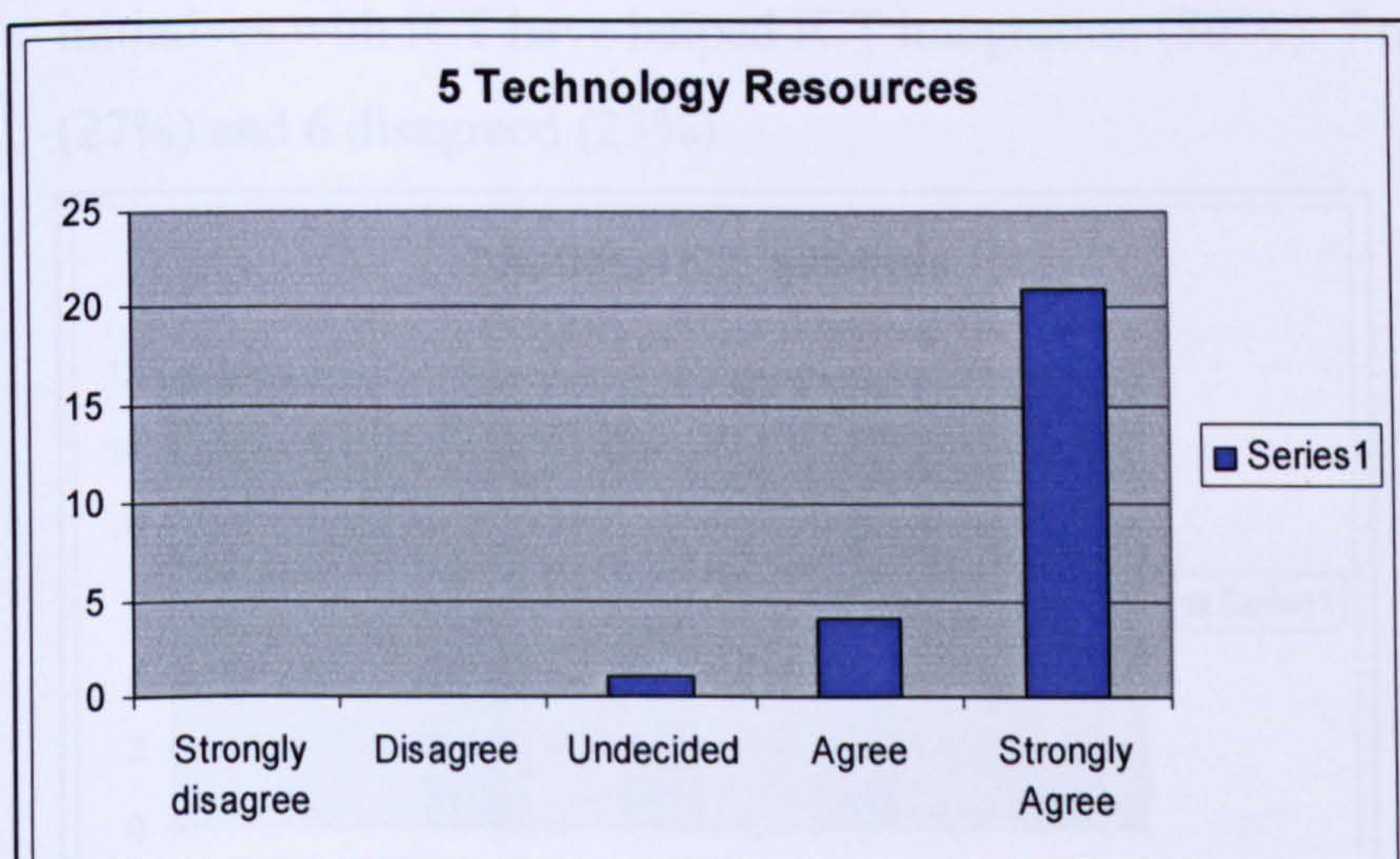


4 Technical Support				
Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
0	0	0	6	20

5. Technology resources (practicality ethic)

Findings: *Access* to *readily available* and *reliable* ICT is critical to the integration of ICT.

Respondent validation: 25 out of 26 teachers agreed or strongly agreed that access to reliable ICT was crucial to using ICT: total **96% agreement** with the findings.

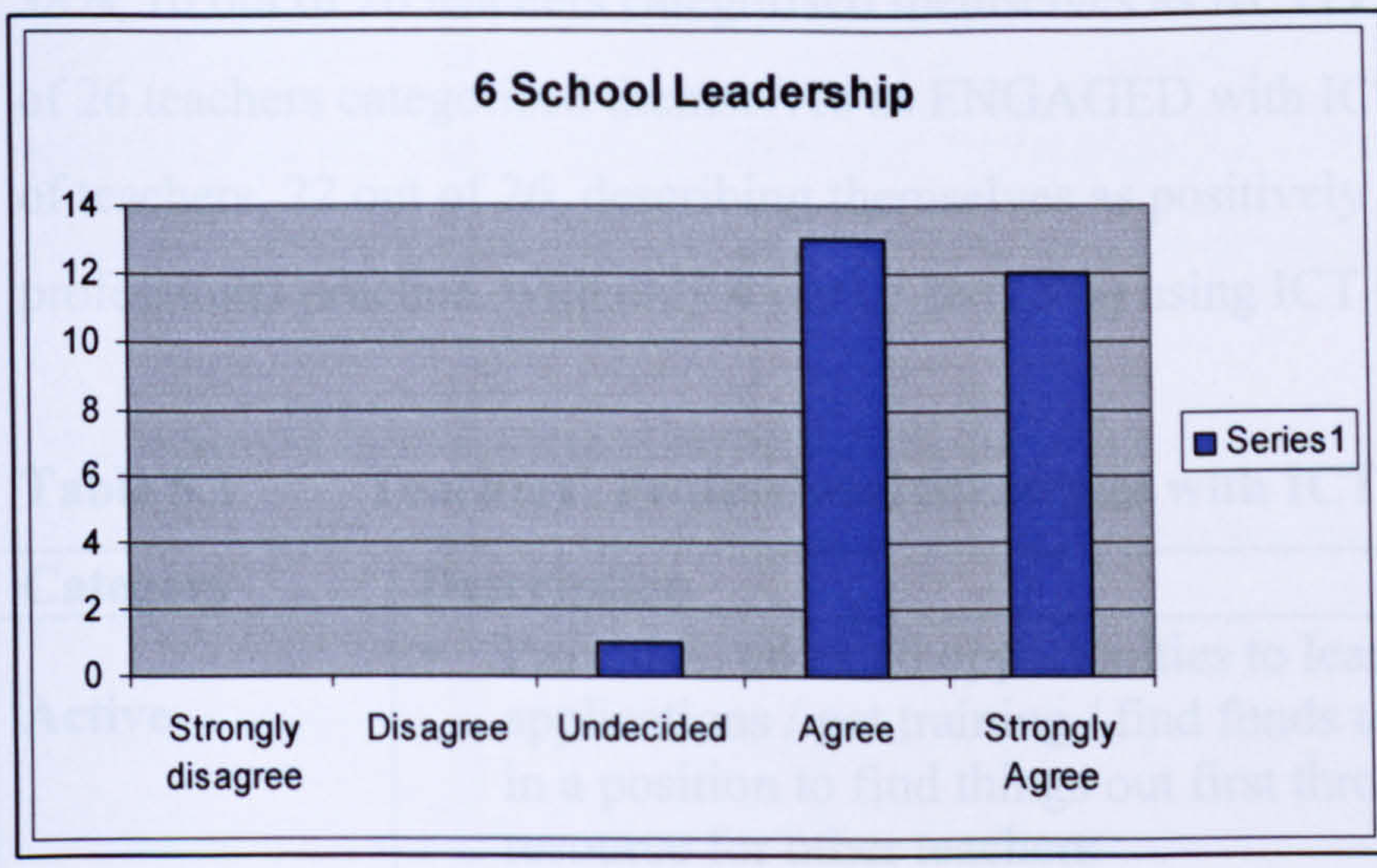


5 Technology Resources				
Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
0	0	1	4	21

6. School leadership (leading by example / modelling ICT use)

Findings: School *leadership and ethos* that promotes ICT use, is essential to integrating ICT into teachers' professional / classroom practice.

Respondent validation: 25 out of 26 teachers agreed or strongly agreed that leadership was crucial to using ICT: **96% agreement** with the findings.

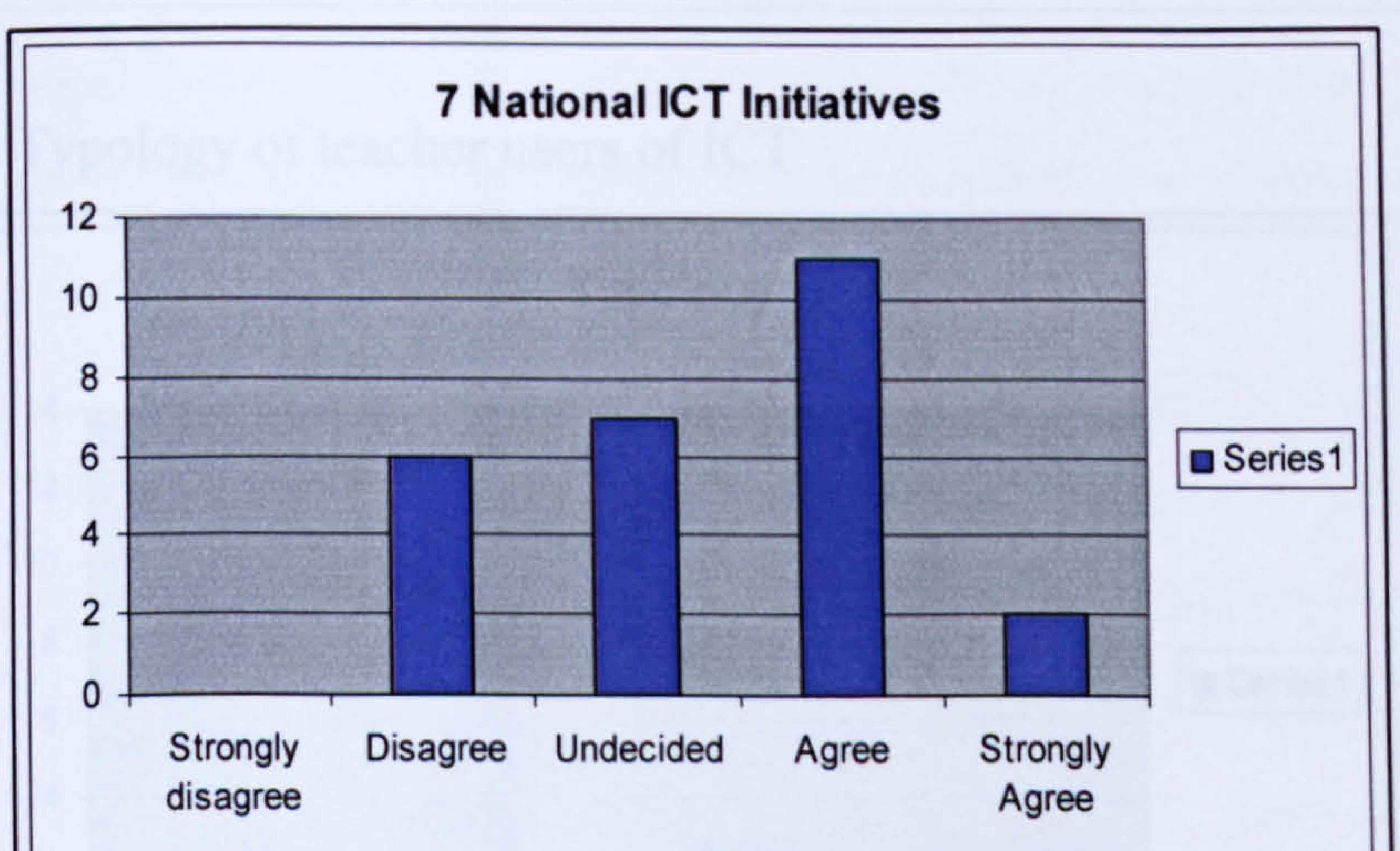


6 School Leadership				
Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
0	0	1	13	12

7. National ICT initiatives (e.g. NGfL, NOF, KS3 national strategy)

Findings: National initiatives have raised the profile of the need and importance of ICT for teachers' professional practice.

Respondent validation: 13 out of 26 teachers agree or strongly agree that national initiatives with ICT have helped ICT integration (**50%**). 7 out of 26 were undecided (27%) and 6 disagreed (23%).



7 National ICT Initiatives				
Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
0	6	7	11	2

Categorising teachers as users of ICT was the final part of the respondent validation.

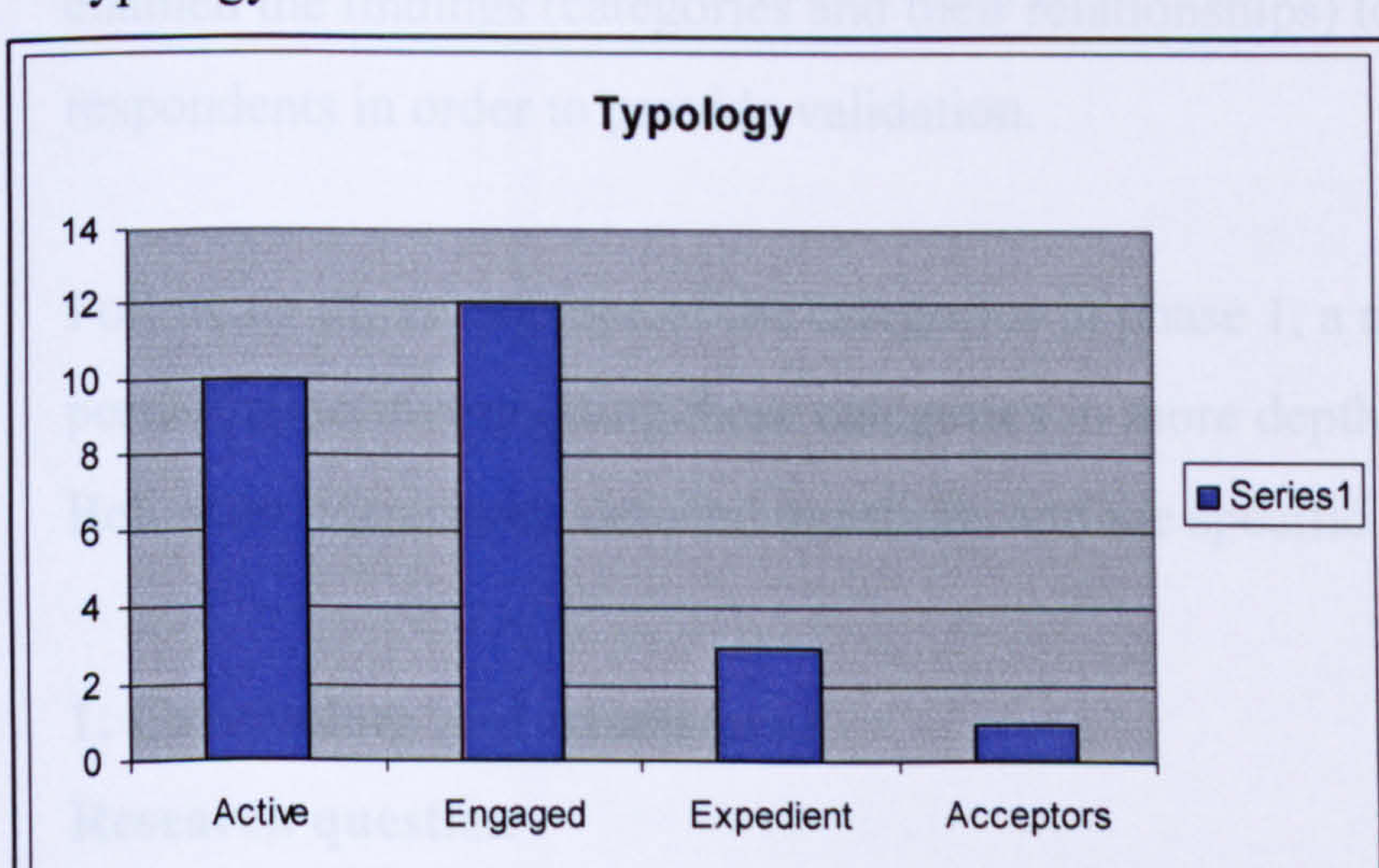
ICT Strategies used by teachers

How teachers categorise themselves and their professional practice in relation to ICT. 38%, 10 out of 26 teachers categorised themselves as ACTIVE with ICT. 46%, 12 out of 26 teachers categorised themselves as ENGAGED with ICT, giving a combined 84% of teachers, 22 out of 26, describing themselves as positively engaging with ICT for professional practice, with only 4 out of 26 (15%) using ICT because 'they have to'.

Table 5.3 Teachers' Professional Strategies with ICT

Category	Description
Active	• Proactive, takes all opportunities to learn about new ICT applications / get training / find funds to get ICT into school, in a position to find things out first through networks, is a resource for other teachers • Highly interested and motivated to integrate ICT
Engaged	• Makes time to learn about ICT • Willing to participate in ICT training / look at new ICT tools • Interested and motivated to integrate ICT
Expedient	• Accepts what ICT comes along and learns to use it • Uses what ICT is expected, does what HOD or ICT coordinator or school policy requires with ICT • Some interest in ICT
Acceptors	• Uses ICT, though professional focus is elsewhere • Does what is expected • Little or no interest in ICT

Typology of teacher users of ICT



Teachers professional strategies with ICT			
Active	Engaged	Expedient	Acceptors
10	12	3	1

The typology does not necessarily refer to essentialist stages for teachers, but rather refers to different levels of ICT use, which may enable teachers to see what the next level of use entails as a form of scaffolding. It is necessary to hold teachers' different positionings within this fluid as teachers change and move between them depending upon the particular demands of their context, which are subject to on-going change.

Summary of the respondent validation findings

Phase 3 of the research was concerned with *checking* the research findings with the respondents, to provide validation. The respondents reported a high degree of *agreement* with the research findings from phase 1 and 2. Respondents reported agree or strongly agree with each major finding at the rate of 100% for Pedagogy and Technical Support; 96 % for Technology Resources, CPD and Leadership, with 50% for National ICT Initiatives and 38% for Curriculum and Assessment.

5.4 SUMMARY: RESEARCH FINDINGS FROM ALL THREE PHASES

Phase 1 of the research was exploratory and found a number of themes (categories), which *emerged* as the most significant affecting teachers' uses of ICT. Phase 2 allowed these categories to be researched *in-depth*; for the categories' attributes and properties to be developed. Research was conducted until the categories were saturated and an understanding of the relationships between the categories was established. Phase 3 enabled the findings (categories and their relationships) to be checked with the respondents in order to provide validation.

Following the emergence of the categories in phase 1, a more detailed set of questions pertaining to investigating these categories in more depth was devised for phase 2. Below are these more detailed questions and the specific findings for each.

1. Curriculum and Assessment

Research question

How do national ICT policies interact with other educational policies such as those linked to the national curriculum and assessment?

Findings

a) The audit culture puts pressure on teachers to meet external measures of effectiveness through the public performance indicators of exams and inspection. These shape (influence and affect) teachers' use of ICT.

b) Assessment strategies and pressure on achieving grades encouraged teachers to stick to safe traditional methods, rather than more innovative methods with ICT.

2. Technology Infrastructure: Technical Support

Research question

In what ways, and to what extent, does the support of ICT technicians promote the integration of ICT into the professional practice of teachers?

Findings

Having *ICT technicians* for technical support was critical to the use and integration of ICT by teachers for professional practice; particularly sufficient numbers of qualified ICT technicians that were readily *available* to support teachers' *classroom* use of ICT.

3. Technology Infrastructure: ICT Resources

Research question

What ICT resourcing is available to teachers and what configurations of equipment and access affect teachers' use of ICT?

Findings

Teachers' access to *readily available* and *reliable* ICT was critical to the integration of ICT.

4. Teachers' professional development with ICT

Research question

What ICT training is available to teachers and how effective is it for embedding ICT within the professional practice of teachers?

Findings

Teachers tend to learn how to use ICT

a) informally through colleagues and

b) operating with a 'just-in-time' learning strategy.

5. Subject teaching and pedagogy

Research question

a) What facilitates teachers' integration of ICT into their classroom practice and subject teaching?

b) What characterises the culture and dynamics of departments where ICT is embedded into subject teaching?

Findings

Departments with teachers that worked *collaboratively* to develop ICT constituted more conducive contexts (cultures) for the integration of ICT into subject teaching: through *sharing practice* and the collegial creation of new ICT pedagogic knowledge; in short, through communities of practice active in relation to ICT, which were not subject dependent.

6. Cultures of teaching and managing change

Research question

What factors regarding the cultures of teaching are significant in affecting teachers' use of ICT for professional practice?

Findings

Other dimensions not included in previous research on ICT in education, such as school culture, communities of practice and the social dimension of teachers' learning / professional development are critical to the integration of ICT.

This enabled an understanding of the *variations* in integration between teachers, departments and schools, whereby the presence of a supportive school culture towards ICT, active communities of practice in relation to ICT and collaborative learning about ICT were critical to the integration of ICT into teachers' professional practice.

7. Leadership and school culture

Research question

What is the significance of leadership and school culture in terms of ICT integration within teachers' practice?

Findings

School *leadership* and *cultural ethos* that promoted ICT use was essential to whole school ICT development and the integration of ICT into teachers' professional practice.

8. The Management of Change and School Culture

Research question

What are the conditions required for developing ICT for whole school use, and how are the relationships between these conditions to be understood?

Findings

The conditions required were both material and cultural and pertained to ample and appropriate *technology*, which provided *access,* alongside *technical support* that ensured *reliability*, with hands-on *training,* a supportive *leadership* and *whole school ICT ethos*. It was the *combination* and *interconnectedness* of these factors that were critical to the integration of ICT, which led to developing an understanding of the *complexity* and *multidimensionality* of implementing ICT policy in schools.

The ability of the school leadership team to manage the multifarious factors involved in developing ICT was a requirement for successful whole school ICT implementation. School leadership teams with ICT vision and expertise (through communities of practice, both internal/situated and external/distributed) enabled the management of the multi-dimensionality of the relationships between the factors.

Inversely, failure to manage the multifarious factors inherent in whole school ICT policy implementation, explained *inter-school variation*, i.e. why some schools had less ICT integration (when other critical factors, like finance, were even). Schools with less ICT development had leadership teams, which lacked ICT vision, expertise and access and/or participation to a community of practice about ICT.

The following chapters, six and seven, will present a detailed consideration of the connections and relationships between the factors (categories) that emerged in the research. In accordance with the premises of grounded theory, this was achieved through the development of over arching concepts that linked the categories together.

The analytical process yielded the over arching concepts, which were then linked together to form a framework that enhances our understanding of the implementation process and its multifaceted nature. Chapter six therefore focuses on the factors teachers identified as aiding implementation and examines the relationships between these factors and how schools developed pathways to integrate ICT into professional practice. Chapter seven considers the importance of communities of practice as both the site and source of successful ICT implementation.

In addition, the following chapters analyse the findings alongside a consideration of the implications of this research, in particular, how it relates to prior research and the extent to which this research supports previous findings and extends prior research, thereby contributing to new knowledge in the field of ICT and education.

CHAPTER 6
CULTURAL CONTEXT OF CHANGE WITH ICT: ANALYSIS OF FINDINGS

6.0 INTRODUCTION

This chapter forms the discussion and analysis of the research findings, in particular by examining the categories that emerged and understanding how these are *connected*, through the formation of overarching concepts that link the key components together and form a framework for understanding the implementation process as experienced by teachers in the context of schools.

The categories that emerged led to the identification of key *factors* that affect implementation; understanding *how* these are connected led to the overarching concept of *multidimensionality*, which captures the dynamic and complex ways the factors interconnect. The development of a framework for managing the multidimensionality of the implementation process was conceived via a synthesis of the different *pathways* schools had forged and attempts to address previous research omissions regarding how schools can progress with ICT (Scrimshaw, 2004). Also importantly the research identifies that the high degree of variation in ICT integration, across different teachers in the same school and across different schools, can be accounted for by *communities of practice.*

This chapter therefore considers the *factors* that support teachers' implementation of ICT; the *relationships* between these factors; additionally, how external factors of a wider political audit culture affect implementation and how schools can develop *pathways* to aid ICT development. The significance of *communities of practice* for integrating ICT into teachers' professional practice is raised in this chapter, but considered in more depth in the next chapter.

First, the research identified the factors that teachers found to be significant for the implementation of ICT. These factors are considered in relation to previous research and how this investigation provides additional supporting evidence. However, omissions in prior research were also identified and how these findings may go some way to address these, in particular by identifying the ways in which the factors are interconnected. This attends to the dynamic, multidimensionality of implementation within the cultural context of schools, which has previously been under-researched. By considering the cultural dynamics of change as experienced by teachers in the school context, the research focused on the contextual space through which policy becomes enacted. The research therefore examined the organisational elements in schools that affect teachers' uses of ICT (cultural, social, material), which have previously been undervalued as prior research has tended to focus on either measuring the extent of ICT (large scale, quantitative research) or exploring individual teacher motivations and perceptions of ICT (very small scale, qualitative research). This research is positioned between these two and examines the cultural processes through which policy becomes enacted at the school level, through an analysis of the social and material factors that affect teachers', as collective groupings, take up of ICT.

The research found that the implementation of government initiatives with ICT was a complex, multifaceted process crossing macro, meso and micro stratas or agencies (DfES, LEAs and schools respectively) and that even by focusing on the school (as one strata) there was still a complexity inherent in the implementation process due to the way the factors, material and cultural, interconnected. This complexity is difficult to capture and present within the constraints of a linear narrative, hence in this chapter, the analytical themes identified (the factors, their multidimensionality, the significance of communities of practice) will be weaved and cross-referenced through out.

6.1 FACTORS EFFECTING TEACHERS' INTEGRATION OF ICT: UNDERSTANDING THE MULTIPLICITY *WITHIN* FACTORS

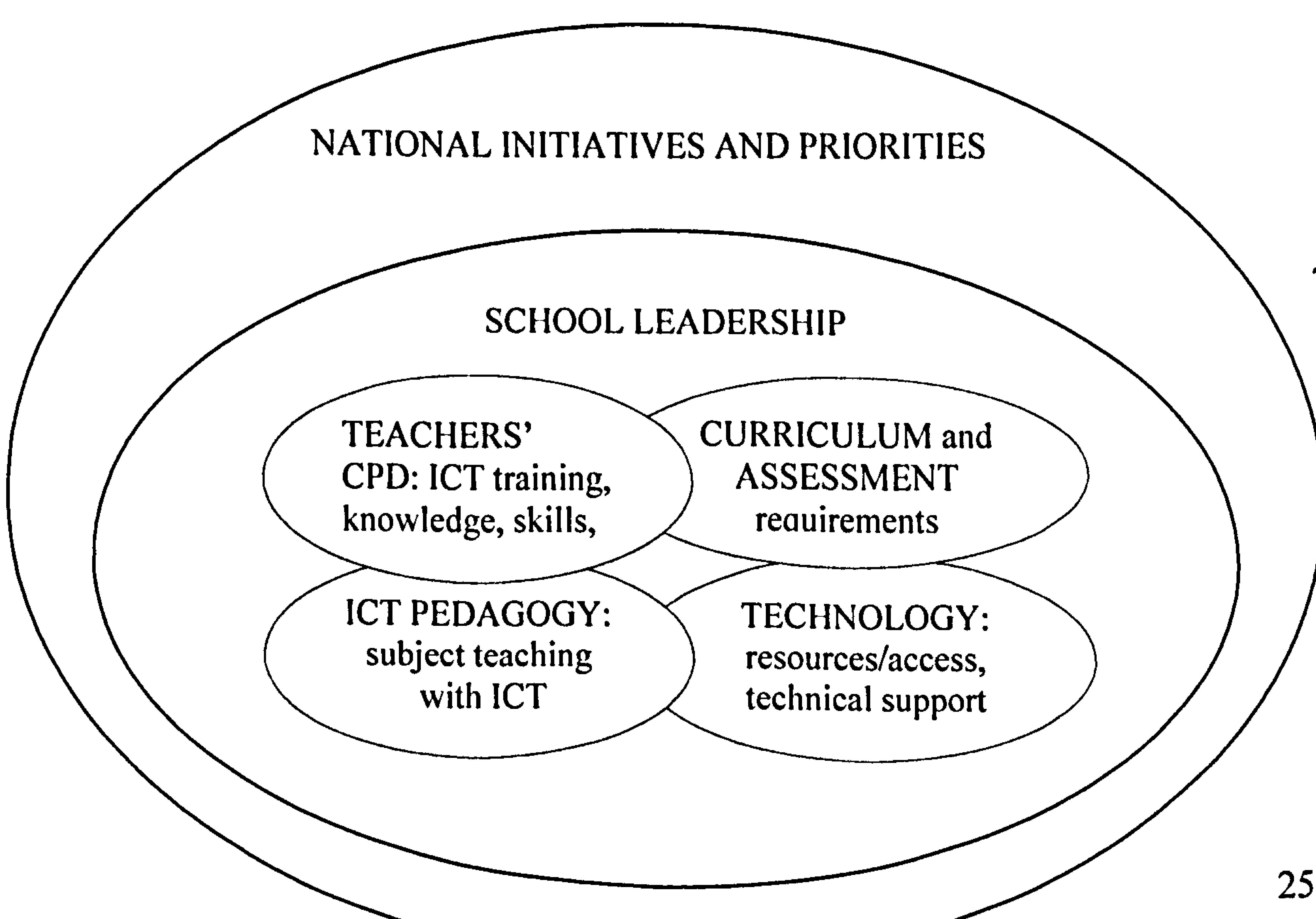
The research found, by the end of phase 1, a willingness among the vast majority of teachers to explore the use of ICT for pedagogical and professional purposes *which was coupled with* frustration at their own lack of pedagogic knowledge about how ICT aids learning. They reported that they were hampered by their lack of computer skills *and* the lack of regular and reliable access to basic resources, at times when their classes needed to use them. By the end of phase 2, teachers reported higher levels of ICT skills, but were still hampered by the lack of access to ICT resources. It is important to consider *how* teachers have increased their knowledge of ICT and to identify what factors aided their development and implementation of ICT. Then to consider how these factors relate to each other and whether any factors are *necessary* and/or *sufficient*, to implement ICT.

Analysis of the findings from phase 1 led to the emergence of specific categories, which were generated from the data according to the principles of grounded theory. The categories pertained to key factors teachers identified as shaping the implementation of ICT. Six were found to affect integration, which contained a multiplicity of issues within each and, which interacted with each other. These were:

1) Curriculum and assessment and how other national priorities interacted with ICT
2) Technology infrastructure: ICT resources and technical support
3) Teachers' CPD: ICT training
4) Pedagogy: the use of ICT for subject teaching
5) Leadership: senior school leaders, heads of departments and change agents
6) School culture: creating a supportive ethos for the implementation of ICT

These factors are visually presented below to situate both the separateness and interconnectedness of the factors, whereby there is an over arching relationship (multidimensionality) in which the sum is greater than the parts.

FIGURE 6.1: Factors Interacting to Effect Integration of ICT into Teachers' Professional Practice



It is important to understand how these factors coalesce to affect teachers' implementation of ICT. The research found the speed with which change was happening in the schools depended on this complex matrix of factors. These included the level of understanding in the school community of *pedagogy* related to ICT (the community is the professional body of teachers). *Curriculum and assessment* content and processes lagged behind innovative practice and consequently constrained implementation of ideas. Change not supported by curriculum and assessment requirements was seen to involve professional risk. Changes required to integrate the use of ICT into classroom practice, challenged teachers in many ways. This necessitated teachers having to review their dominant teaching style and commit themselves to professional development. Then there was also the *technology* itself, which differed from school to school, depending on finances, the amount of resources available and the technical skills of those responsible for it. The provision of adequate *technical support* and *ICT resources* was critically affected by the policies of *school leaders.*

Whilst this provides an overview of the factors and how they connect to form a more complex picture than (some) earlier research had considered, (e.g. Lagrange *et al.*, 2001), first it is necessary to consider the complexity found *within* each factor, before considering the wider complexity of the interrelationships *between* the factors.

Curriculum and Assessment

Teachers found assessment strategies did not encourage integration of ICT into the curriculum. Teaching was most likely to be focused on enabling pupils to score highly in assessments, rather than, for example, the higher-level cognitive skills, which may be promoted through the effective application of ICT in a range of contexts. The comment from one teacher, who was asked why he didn't use more ICT, sums up the views of many: 'in a heavily prescribed, content-led curriculum, didactic teaching works' (HI, HOD, school D, 20/05/00). This highlighted the pressure on teachers to achieve high grades for pupils through traditional methods in order to satisfy the demands of an external audit culture with national league tables. As another teacher commented on the converse:

> It is having a group without any exam pressure that has allowed me to experiment and so become more confident using the [ICT] tools available. (NS, school G, 28/06/02)

Technology Infrastructure: ICT resources, access and technical support

The issues teachers reported included problems with recruiting qualified technicians, difficulties maintaining equipment, slowness of connection, out of date equipment, expertise held by too few staff who move on and lack of access to ICT at a time and in a place convenient to the teacher. Teachers identified access to a computer as crucial to their use of ICT.

Teachers' CPD: ICT training

The teachers interviewed who were comfortably using a variety of technologies with pupils were supported by access to informal networks providing ideas, information and 'just in time' learning support. These networks included colleagues in school, subject specialist networks, web-based networks, family and friends. On a professional level access to such support appeared to be a critical factor supporting change, particularly from colleagues within the same department. Similarly, personal ownership of a computer was a factor many teachers cited as essential to their development.

ICT Pedagogy: factors affecting development and dissemination of new pedagogy

The majority of teachers involved in the research were convinced of the positive pedagogical outcomes of integrating ICT into the curriculum. However, teachers' practice with ICT was hindered by a lack of access, the quality of the technology in schools, the lack of technical support, and the fact that the use of ICT was not expected in some curricula or assessment situations. Sporadic access to the technology particularly prevented integration of ICT. The time required to familiarise teachers with the potential of the ICT resources available was not to be underestimated. Changes came on top of what was already full time work and so change in practice was slow. Where teachers had integrated ICT into their pedagogy, they were typically part of a department that collaboratively developed ICT for subject teaching.

School Leadership: whole-school development

School leadership was found to affect the rate and type of change teachers experienced with ICT in their school. Leadership affected how the school was structured, managed and financed in relation to ICT, in particular whether ICT was integrated into the whole school rather than dependent on pupils having keen teachers using ICT in their teaching in isolation to their colleagues. Drives to integrate technology into classroom teaching were affected by leadership in the following ways; how the school was financed, the vision of the headteacher, the existence and implementation of a whole school ICT development plan. There was also a critical role played by heads of department of curriculum areas who, by providing a subject specific lead with ICT, gave the necessary level of subject support required to facilitate change at the level of classroom practice.

Most importantly the factors that have supported and hindered ICT integration into teachers' professional practice across the curriculum have emerged with a striking *similarity* across the case study schools, and have revealed change as a multi-faceted and dynamic process.

Understanding the Findings in Relation to Prior Research

Given these findings, it is now necessary to consider these in relation to prior research; in particular, to consider to what extent the findings support or refute previous research and the degree to which the research addresses prior research omissions. This will involve examining the key factors of technology resourcing, teachers' CPD, teachers' pedagogical applications of ICT and leadership for ICT. These are analysed in terms of their material and cultural conditions and the multiplicity of issues inherent *within* each one, which affect the implementation of ICT into teachers' practice.

First, the research found that the most significant material barrier for teachers was the lack of access to ICT, despite NGfL funding to increase resourcing. Although this supports prior research (Mumtaz, 2000; Pelgrum, 2001; Jones, 2004), it was still a relative surprise four years on from the national roll-out of the NGfL. A lack of hardware as a barrier must be further analysed to also include additional sub-barriers, such as poor quality hardware, as found by BESA (2002), with the average UK school reporting a third of computer stock as ineffective for teaching the curriculum.

Another sub-barrier was the poor organisation of ICT resources. The least favoured by teachers were ICT suites requiring advanced booking, which was the most contentious and reported as hardly ever available. However, when booked, teachers felt *constrained* to use ICT for the *whole* lesson, although ICT maybe only required for *part* of a lesson. Teachers wanted seamless and flexible access to ICT in order to provide *variation* in lessons, not necessarily dominate the session. When ICT was seamless (anytime, anywhere access - particularly the teacher's usual classroom) teachers had pedagogical choice; as opposed to the architecture of the room (ICT suites) dictating the pedagogy. Laptops were the most favoured form of ICT for enabling access. The research therefore confirms the importance of teacher ownership of a computer and concurs with the research of Youngman and Harrison (1998), Loveless and Williams (2000), Loveless and Stevens (2002).

With respect to ICT resources, although limited, once access was affirmed, what teachers repeatedly requested to help them *use ICT more* was technical support. This confirms Veen's (1993) research and 'has been known about since the earliest experimentation in schools in the mid-1980s - the *lack of adequate technical support,* [otherwise] only the very keen teachers, who also have technical expertise, can use the software and hardware confidently with classes' (Leask and Pachler, 2005, p2).

It is important to understand that the research illuminated how a 'lack of access' was prohibiting practice rather than recalcitrant resistance among teachers. For example, Hennessy, Denney and Ruthven (2005) found that when teachers could not book a dedicated ICT room, the teachers had to rely on *opportunist access* to less advanced equipment, which resulted in 'extreme frustration at not being able to implement their ideas and plans for exploiting the potential of ICT' (p16). Hence, Hennessy *et al.*, (2005) rightly conclude that lack of use was attributed to factors beyond teachers' control (i.e. access) *rather than resistance*. The findings of this research concur with this analysis too; on two fronts, with a) finding teachers frustrated at a lack of access and b) not finding resistance as the reason for lack of use.

Although resistance was not found in this research, this may be because of the sample, though a fair size of 113, the teachers participating may be less likely to be resistant due to their willingness to be involved in the research. This does not mean, however, that resistance doesn't exist, but rather that it did not emerge in this sample. However, the teachers did express intense *frustration* at the *lack of access*. For example, in school H, teachers nearly came to physical punches outside the ICT suite, when names, which previously had been booked in, were tippexed out and access was prohibited by sabotage; rightly, indignation led to anger, which clearly illustrates the intensity of frustration felt by teachers when ICT access was denied.

A lack of access was reported as the most fundamental barrier to ICT use. *All* the teachers when asked, 'what would help you most to integrate ICT into your teaching?' unanimously replied *more access to ICT*, which supports compelling conclusions of previous research (Dupagne & Krendle, 1992; Hadley & Sheingold, 1990; Jones, 2004; Mumtaz, 2000; Opie & Katsu 2000; Pelgrum, 2001; Rosen & Weil, 1995; Winnans & Brown,1992). Conversely, where access was in place, this facilitated ICT use, with the most embedded and effective use observed in permanently connected classrooms used regularly by the same teacher.

Time: ICT CPD and temporality

Another factor found to hinder the integration of ICT relates to teachers' CPD with ICT and time. In the research, the lack of time for ICT implementation was identified as a specific inhibitor. Consequently, the findings support a number of earlier studies, which analysed a *lack of time* as a reason why teachers do not use ICT in their teaching (Dupagne & Krendle, 1992; Hadley & Sheingold, 1990; Jones, 2004; Mumtaz 2000; Pelgrum, 2001; Rosen & Weil, 1995; Winnans & Brown, 1992). What inhibited teachers was, one, a lack of time to develop lessons that incorporate ICT (*planning time*); two, the investment of time required to successfully integrate ICT into the curriculum (*time in lessons*), due to pressures of a content-led curriculum, and three, a lack of in-service training time to develop teacher ICT skills (*time for training*). This highlights an analysis of the multiple pressures that call on teachers' time, which require an understanding of the competing priorities teachers are subject to in their daily practices.

Whilst insufficient time for ICT was reported by teachers as a barrier, the research also found novel strategies being developed by teachers to create *more time*. These were analysed as; *formal* structures at a whole school level, to make time for ICT in meetings and *informal* strategies that arose organically, which interestingly were more prevalent in schools that did the former. For example, teachers talking in shared office spaces during breaks, formed discursive, alive spaces where ICT initiatives were lived, experienced, evaluated and became a 'way of life' (Wittgenstein, 1953).

Schools that activated a strategy for 'making time' within the existing 'meetings schedule' provided both a *material* space for ICT development and signalled a *cultural* recognition for ICT within that school. Creative ways of generating time for ICT development were found across schools that had an ethos of valuing ICT, and significantly these schools had more embedded use of ICT. In these schools, the senior leadership legitimised time for reflection and discussion, which Loveless (2001) found in her research and argues, in Wenger's (1998) terms, this allowed for comparison, conversation and breaks in rhythm.

The research found that the category of CPD contained a multiplicity of issues *within* it and that in addition to time as a sub-category, teachers identified the conditions conducive to aiding their learning about ICT for professional practice. Again, attention to the necessary material and cultural conditions required for learning about ICT were specified with respect to first, the best location and second, which model of training was most effective.

Across all schools, the location that was cited as the most effective for ICT training was teachers' own departments, especially when they received just-in-time training from other teachers, with ICT resources accessible (material factor), alongside support and knowledge of colleagues' ICT expertise (culture factor). A localised context where material and normative support were actualised was the most conducive to teachers' professional development and learning with ICT.

Similarly, the research identified that teachers' preferred model of ICT training was just-in-time, from colleagues. To understand the effectiveness of this factor, it is necessary to examine the multiplicity of issues inherent within this. This is because it was not individual teachers' CPD that was found to be critical, but rather the collective response of teachers to ICT as defined by a departmental culture, which was not necessarily related to the subject; rather just-in-time, collaborative learning reflected a characteristic of departments that had formed a community of practice in relation to ICT.

Just-In-Time Learning: teachers' preferred ICT training model

> ...'just in time' learning is the best way to learn, i.e. when you have the problem is when you need the training. (Leask, Litchfield and Younie, 2005, p5)

The research found *3 key characteristics* that made just-in-time training particularly beneficial for teachers, which were: one, it was *sought when required*; 'on demand' ICT training; two, it was *bespoke training,* which met teachers specific personalised needs and three, it was delivered *face-to-face.* This facilitated greater interaction, given that the learner sought that teacher for training, and *trust* was revealed as a presupposition inherent within just-in-time ICT training.

These characteristics were important, because of their *flexibility* in meeting a contextualised demand from teachers. Also the motivation and commitment to learn was clearly a pre-requisite that was in place. This was significant as it allowed *ownership* of ICT learning. However, an important point to note in the analysis was that this was *not* a solitary experience; teachers did not choose to read ICT manuals, but actively chose to find another teacher to provide JIT training, which then became a joint-endeavour of developing ICT skills between teachers, as learner and trainer; an interactive, discursive dynamic that highlights the social dimension of teachers' learning.

Teachers comfortably sought JIT ICT training from change agents or 'lead learners' with ICT in their departments, thereby collaboratively supporting one another's ICT development that encouraged mutual engagement with ICT. As confirmed by an NQT: 'we're always helping each other. If someone has done something [with ICT], we *share* it, and teach others what we've learnt' (MI, NQT, school G, 1/07/02). This was summarily echoed across those departments that had established a culture of learning or community of practice in relation to ICT; JIT training became habitualised to JIT learning in those departments. This attests to the social dimension of learning where the crucial aspects were support, mutual engagement and joint endeavour through sharing practice. Teachers were observed collaboratively developing ICT in departments, which had significance, because it generated momentum and energy, or to use Wenger's term 'social energy' (1998, p84).

In analysing the effectiveness of this preferred type of ICT training for professional learning, clearly one can identify the benefit of *scaffolding*, moving the learner beyond their zone of proximal development (ZPD), in relation to ICT (Vygotsky 1978, Bruner, 1960). This model of learning acknowledges that knowledge is socially constructed, whereby learning is de-centred and constructed through interaction and collegial discursive dynamics. The findings attest to the significance of *situated learning* (Lave and Wenger, 1993) and how learning was a characteristic of *participation in a joint endeavour* – an important dimension of a community of practice (Wenger, 1998).

The research found that teachers acquired most of their ICT skills when working alongside *others,* which the theory of 'situated learning' explains, and this supports Dawes, (2001) and Somekh's (1991) prior research. Crucially, the research illuminates that teachers' learning and professional development has to be conceptualised not as a solitary activity, but part of a joint activity, giving rise to situated learning through a collegial, discursive dynamic; in short, as participation in a community of practice.

There are a number of themes within this model of effective CPD for teachers, such as collegiality and collaboration that have been highlighted before by previous research. For example, Noss and Hoyles (1996) illustrated how teachers locate new ideas and make sense of their roles within the *complex social and cultural relations of their professional practice*. The importance of teachers' contextual relations is also observed by Hargreaves and Fullan (1991, p14-15), who stress the evolutionary nature of *teacher development* and *change* as a function of the pressure of ecological circumstances, pointing out: 'the process and success of teacher development depends very much on the *context* in which it takes place.'

The findings of the study support previous quantitative research that identifies the following significant factors as enabling 'accomplished' ICT teachers, namely; collegiality in schools; commitment and resources for teachers' professional development and learning; provision for ICT training, alongside access to sufficient technology (Becker, 1994; Hadley *et al.*, 1990; Pelgrum, 2001; Sheingold *et al.*, 1993).

Also previous qualitative research into teachers' professional development found the following elements greatly aided the process: *collegiality* (Becker 1994; Cooper and McIntyre 1996; Donnelly 2000; Fullan 1991) and *collaboration* (Underwood, Cavendish and Lawson, 1996), and arguably the most appropriate theories that have helped explain why this was the case, have been situated learning (Lave and Wenger, 1991). This research concurs with these prior findings and provides additional supporting evidence.

However, the wider political context for teachers is one permeated by performance management and an audit culture that focuses on exams, efficiency and accountability in the form of public league tables. Previous research on ICT has failed to adequately explore these contemporary pressures in relation to understanding competing demands placed on teachers and how teachers come to prioritise, or not prioritise, ICT.

This analysis thus attempts to go further in explaining the complex inter-relationships between the different factors, that is, the necessary and sufficient conditions; material and cultural, required to integrate ICT, and how communities of practice become established, when the above coalesce, to generate collaborative, situated learning with ICT.

The research found that teachers *mostly learnt* about ICT from *other teachers*. This supports Dalin's (1993) observation that for teachers, their colleagues are more trusted for new ideas than external deliverers. In fact, Fullan (1985, 1991) identified that teachers' colleagues are a *preferred source of knowledge.* This is why the departments that had a shared commitment to developing ICT could generate a community of practice, because *colleagues* were the *trusted* source of (new) ideas about how to use ICT for pedagogic practice.

As Williams *et al.,* (2000) also found, it was *colleagues* that teachers relied on to keep them informed of developments with ICT. Similarly, Rogers (2002) identified that a crucial factor in the successful integration of ICT was learning from other *teachers*, particularly when they experienced failures, which can be seen as constituting a *shared repertoire* of what works with ICT and what does not. Similarly Loveless, DeVoogd and Bohlin (2001) point to colleagues as the key to developing pedagogy: 'teachers are part of networked communities and need to be able to draw upon the experience, expertise and enthusiasm of colleagues in order to develop and share pedagogical practice' (p70).

In short, while previous research shows teachers are learning from teachers, this research goes further in identifying a community of practice with ICT, whereby development of ICT for pedagogic purposes entails assessment of what works and why, and conversely, why ICT fails, when it is for reasons other than technical failure. This accords with Bell and Gilbert's (1994, p494) argument that 'if all three aspects of *teacher development* - personal, professional and social development - are to occur', then there needs to be a collaborative environment where the teachers are able to receive support and feedback, and where they are able to reflect critically. Again, this was found in those departments that worked *together* towards developing ICT. However, this research goes further than Bell and Gilbert and argues that the process outlined was not a solitary experience of reflection on one's development, but was part of a *joint activity*, where support and feedback constituted an interactive dialogue that engendered critical reflection and formed the culture of the department, specifically in relation to ICT: a departmental discursive dynamic. Teacher development therefore needs to be understood less as an individualised activity and more as communally constructed joint endeavour.

> ...teachers need to work and learn together to establish new and high-quality professional practice in their schools. Research into innovative schools shows that schools where staff are mutually supportive of each other's developing knowledge and skills are more likely to be successful in tackling these challenges than those where knowledge about computers and computing is seen to be the province of a select few. (Leask and Pachler, 2005, p2)

The research findings also support Sheingold and Hadley (1990), who found that the two most significant factors concerning teachers' use of ICT were: 1) teacher motivation and commitment to their *own development as teachers* and 2) teacher experiences of *support*. Whilst this too was found, there was also *more than* this occurring in the research, particularly in those departments that had more fully embraced ICT, which was situated learning within a community of practice about ICT. Sheingold and Hadley's (1990) observations of teacher support and commitment were a pre-requisite that enabled teachers in this research to focus on ICT *together*, as a joint endeavour, to further their subject teaching, through appropriating ICT and thereby renewing teachers' development: a process of *mutual engagement* by the teachers in the department, in order to increase *departmental attainment*.

As departments are organised around curriculum subjects, increasing attainment is a central feature that defines departmental core business, because attainment forms the *basis* of measurement for performance management. Where departments had a strong belief that ICT aided learning, there was a strong commitment to using ICT in that subject, and those departments had developed a community of practice around ICT. Hence a shared (cognitive) component of teachers mutually developing ICT practice was identified. This is not to deny differences and an awareness of teachers' varying positionings within a community of practice regarding ICT use, however, harmony is not a pre-requisite of a community of practice, but rather acknowledged as a creative component (Wenger, 1998).

One consequence of effective professional development with ICT was teachers' pedagogical applications of ICT in the classroom. However, the research found a high degree of variation between teachers and schools regarding the pedagogical use of ICT.

Understanding Variation in Teachers' Pedagogic Use of ICT

The research investigated the extent to which ICT has been integrated into teachers' professional practice, with the findings illustrating *different levels of use* and exploring the strategies teachers used to implement ICT in increasingly sophisticated ways. This came to illuminate the high degree of *variation* in the integration of ICT between different teachers and schools.

The research supports Hennessy *et al's.*, (2002) findings regarding variation of use, whereby the Cambridge researchers found a more complex picture has emerged than is implied by some of the prior research (Lagrange *et al.*, 2001). One factor in this complexity is the considerable variation observed between individual *teachers, departments* and *schools* concerning different levels of enthusiasm and commitment to using ICT, with respect to classroom use, integration into schemes of work, and the technical skills of teachers.

Overall the findings of this research, across the curriculum subjects and across the schools, are in alignment with Hennessy *et al's.*, (2002) findings that subjects are experiencing a period of change and variation in their integration of ICT. It is a process, a continuum of change as teachers and schools learn to use ICT more.

> Collectively, our findings indicate that core subject practices are in a considerable *state of flux* as they begin to *adapt* and develop in response to the advent of a new cultural tool, and they highlight the over-simplicity of characterising dichotomies between assimilation and accommodation, or integration and resistance using ICT. (Hennessy *et al.*, 2002, p23)

The findings concur with Hennessy *et al.*, (2002) in that the process of implementation is far more complex than the simple dualisms suggested in earlier research, since levels of integration were very varied. It may be better to see implementation as a *process,* which is fluid, and for any analysis to keep movement and tensions in play. An analysis of change that conceptualises ICT integration as uncomplicated dichotomies is inherently reductionist and fails to capture the complexity of the process that defies essentialist readings of the situation, but rather refers to subtle, complex, situated interactions that characterise an organic community of practice. The essentialist dualisms of earlier research are rejected in favour of understanding teachers' positionings with ICT as dynamic and fluid, in constant movement and interaction with their material and cultural context, and are subject to on-going change through participation in a community of practice.

The variation between teachers in their use of ICT for pedagogical purposes needs to be understood as a process of learning, which involves discovery of ICT's potential that culminates in change in classroom practice. This research found this process to be multi-faceted and deeply entwined in a dynamic inter-play between factors that can be best understood as material and cultural, whereby attention to one or the other is not sufficient to engender implementation or change. There is the need for ample and appropriate technology alongside a culture of mutual support and training that encourages the pedagogical application of ICT for subject teaching; in short, a community of practice in relation to ICT.

The research found that the transformation of pedagogy is more likely to occur in those spaces where an active community of practice is located. Without the supporting material and cultural aspects identified in a community of practice, pedagogy is only likely to be made more efficient with ICT rather than extended or transformed. This relates to prior research that investigated different levels of use and models of pedagogic change with ICT by McCormick and Scrimshaw (2001).

Models of pedagogic change with ICT

McCormick and Scrimshaw (2001) contend that ICT can affect pedagogic practice in three ways; where existing practice is made more *efficient* or effective, where it is *extended* in some new way, and where it is *transformed*, and in the UK, government reveals a strong preference for the first; an 'efficiency' level of change (op. cit, p37).

In support of this, Hennessy *et al.,* (2002) found that ICT was largely enhancing practice, rather than *transforming* it and these findings are in line with other literature reviewed, which indicated that teachers have tended to 'assimilate' the use of ICT into *existing practices* rather than to 'accommodate' in terms of *changing their pedagogies* (Goodson and Mangan, 1995; Kerr, 1991; Watson, 1993). Consequently, teachers do seem to be using ICT largely to support and enhance existing classroom practice (Hennessy *et al.,* 2002; Noss and Pachler, 1999), rather than transforming pedagogy. This research would indicate a similar picture; overall teachers were enhancing practice to be a) more efficient and b) to extend practice - although some examples of transformation were evident, these were few.

So, while there is little evidence from this or prior research of the *transformation* of certain fundamental aspects of subject cultures (Hennessy *et al.,* 2005) and teachers' pedagogy (Mc Cormick & Scrimshaw 2001), the impact in the UK is severely constrained by a nationally prescribed curriculum and assessment framework: this constraint emerged as a repeated theme across the teacher interviews. However, despite this Hennessy *et al.,* (2005) did observe a process of *'pedagogical evolution'* as a gradual, but perceptible shift in subject thinking and practice. Whilst this was also case with this research, there were examples where a) *transformation* had occurred and b) where the process had been *expedient*, rather than gradual. For example, in school F, after one demonstration of a digital camera, the lens media teacher completely changed his practice and innovatively used computers for artistic work thereafter. This teacher even got the exam boards to change their assessment policy and accept digital portfolios from pupils. Significantly this example occurred in a school with a strong leadership drive on ICT that was resource rich, both materially in terms of its technology infrastructure, and culturally, with an on-site ICT training centre and staffing incentives to develop ICT. This again attests to the multi-dimensionality of factors and how they are interconnected in dynamic and complex ways to generate a school culture and context that effectively implements ICT.

ICT Leadership Framework: an integrated strategy for implementation

With respect to the contingent conditions that facilitate ICT implementation, one factor that emerged as necessary across all the case study schools was leadership, in particular leadership that supported the development of ICT as a whole school strategy.

The research led to the identification of an *integrated leadership strategy*, which identifies the key features of leadership that effectively integrated both the material and cultural factors necessary for whole school ICT implementation. The key components of the strategy were: 1) a *vision of ICT* – shared by school leaders and transmitted through whole school policy statements, which provided the following; 2) a *technology infrastructure* – school leaders long-term financial investment in ICT resources; enabling equability of ICT access across curriculum subjects; 3) *staffing strategies* – opportunities and support for the use of ICT, encouragement for innovation and risk-taking, through rewards of finance and status (e.g. establishing ICT representatives within each department that were remunerated; LRAs for developing e-learning resources for the school's intranet); 4) creating provision for ICT *development time* for staff across the school (e.g. through the school's meeting schedule) and by supporting teachers' ICT training (e.g. NOF).

The research also found the most ICT integrative schools had the distinguishing feature of a headteacher with a *vision* for ICT. Importantly this vision was *shared* with other school leaders and was exemplified in a whole-school policy for ICT development. However, the heads' vision in isolation was not enough; it was thus a *necessary*, but not *sufficient*, condition for ICT integration. Moreover where schools and departments had more embedded ICT, the significant factor was *distributed leadership* with a vision of ICT that encouraged active communities of practice around ICT.

Just as previous research had highlighted the need for numerous 'leaders' to integrate ICT into schools (Anderson and Dexter, 2000), so too does the present study. The research found the key characteristics of other 'distributed' leaders was their ability to *model* the effective use of ICT in their teaching, supporting the conclusions of Riel and Becker (2000) and Jacobsen, Clifford and Friesen (2002). Additionally this research found that other leaders' *vision* for ICT became *shared* by their colleagues, its development shared and shaped collectively. These leaders were identified as HODS, and other key ICT change agents or 'lead learners', such as ICT reps and ASTs with ICT.

Also, the ICT coordinator in most of the schools emerged as a significant leader ('lead learner' or change agent) who provided *training* and informal day-to-day *support* and *trouble shooting*, which endorses prior research from the NCET report (1995), EDSI (1997), Lawson and Comber (1999) and NGfL Pathfinders (2001). Lawson and Comber (1999) identified that a common feature of an ICT integrative school, was an enhanced role for the ICT coordinator, who possessed devolved powers typical of a distributed leadership system. Whilst this was found, it was supplemented by other 'lead learners' who additionally supported the promotion of good practice with ICT through out the school, for example, by HODs, ICT reps in departments, ASTs in ICT and LRAs.

To conclude, whilst having considered the key factors that significantly affect the integration of ICT into teachers' professional practice (from quality of ICT training, amount and quality of technology available, to leadership commitment) and the inherent multiplicity *within* each of these factors, it is essential to consider the relationships *between* the factors. This is because the most ICT integrative schools had developed numerous strategies, with a leadership team that understood that ICT had to be implemented on multiple fronts, materially and culturally, and that one route or pathway was not guaranteed to be successful, but rather there was a complex interplay between the factors that could not necessarily be mapped in any pre-given order. This is explored in the next section.

6.2 ATTENDING TO THE MULTIDIMENSIONALITY OF ICT IMPLEMENTATION: THE DYNAMICS OF IMPLEMENTING CHANGE AND THE RELATIONSHIPS *BETWEEN* FACTORS

The research investigated the conditions required for implementing ICT and considered whether any of these conditions were necessary and sufficient. The research found one necessary condition was clearly access to ICT, as a material factor, which had to be supported by an ethos of use as a cultural factor. Hence, *access alone* was *not sufficient*, as teachers' access to ICT did not guarantee use, unless teachers had participated in *training and* their *colleagues* in the same department, were using ICT. Thus while a number of factors had to be in place, both material and cultural, it is the multidimensionality of ICT implementation and the complexity of the connections between the factors, which is critical in determining the degree of integration.

Where teachers had classrooms permanently equipped with ICT (seamless access) teachers most regularly and routinely used ICT. Habitual, embedded use of ICT was found when there was: 1) *ease* of access, and, 2) *multiple access*, (teams of teachers having access simultaneously), which enabled teachers to a) innovate and b) to do so *quickly*. Once the 'practicality of access' was addressed, teachers could use ICT *together*, to communally build new pedagogic practice with ICT. The use of laptops, for example, although teachers' preferred 'resource strategy', did not necessarily, by lone virtue of ownership, lead to a change or transformation in pedagogy. It was only when laptops were *combined* with the cultural context of working in a department with colleagues that collaboratively developed ICT for classroom practice that pedagogy became extended and (sometimes) transformed.

Creating access to ICT was a necessary condition to integrating ICT use into teachers' practice; however, this material factor requires a supporting cultural context. It was when there was ease of *accessibility*, across a *team* of teachers that a *culture* of use was able to build. Whilst this highlights what was most significant in aiding implementation, the converse was also true. A lack of access, combined with a lack of technical support and unreliable ICT, were material factors that indicated a lack of cultural support and were clear barriers that hindered teachers' integration of ICT. Consequently, a complex picture of ICT infrastructure emerged in that inadequate access was compounded by other inter-related factors, which also acted as barriers to integration.

This inter-connectedness of factors was also noted by Jones (2004), who stressed the need for more research on this area. This research affirms the complexity of the relationships between the factors and argues that the relationships can be better understood as the interplay between material and cultural factors, thereby extending the current thinking on this.

CPD and the Multidimensionality of ICT Implementation

The NOF training initiative provides a clear example of the interplay between factors and the significance of interrelationships. Whilst NOF training can be seen as a separate factor, providing valued CPD in ICT, its effectiveness was greatly affected by *other* factors that interacted with the CPD process, like access to ICT resources and leadership support. Consequently the factors cannot be fully understood in isolation, but rather as existing in contingent, context- dependent relations to other factors that affect its success.

Further, NOF was not a singular phenomenon, rather its effectiveness depended on a number of other factors that therefore were; model of *delivery* (whether face-to-face or online; delivered by teachers known in the school who were approved trainers or unknown tutors), quality of ICT *equipment* teachers had access to for training and school *leadership*. In short, NOF as an intervention strategy *interacted* with the cultural context of the school, which was a dynamic relationship that shaped its effectiveness. In particular, what significantly shaped the impact of NOF training were *contextual, localised* school factors, such as the extent to which school leaders' supported the programme (TTA, 2002; Preston, 2004).

The research found schools that had little ICT integration before NOF - NOF did not help, because the material factors of ICT resourcing remained severely limited and insufficient access hindered teachers' ICT development. Similarly, NOF did not help leading schools, as teachers in departments with an active community of practice with ICT, already had the skills. Schools in 'difficult and challenging circumstances', and/or placed in special measures by Ofsted, meant teachers prioritised other demands above NOF. For example, school H's context, which was both the above, had teachers prioritising their Osfted action plan above ICT training, which resulted in 'an abysmal NOF pass rate' (WQ, ICT co-ordinator, school H, 2/07/02), compounded by a high turn over of staff, due to a poor Ofsted report.

The government's supposition that NOF ICT training would result in change in teachers' practice was logical, but flawed, on the grounds that change is far more complex than policy makers envisaged. Partly because change depends on a number of other factors within a complex matrix that also need to occur– like ensuring ICT access, reliability, technical support, leadership for ICT: in short, managing the multidimensionality and inter-connectedness of the factors, both materially and culturally.

Leadership: distributed, multidimensional and visionary

Another example that illustrates the interplay between factors is leadership. The research found that leadership emerged as a very important factor when it came to implementing ICT. The support and commitment to ICT from senior school leaders played a significant part in shaping a general school *ethos* towards ICT. In particular, what emerged as crucial was: a *vision* about ICT, from the Head and shared by school leaders, which enabled a whole-school ICT policy to be strategically implemented that emerged from an *ICT leadership framework,* which included a *distributed model of leadership*, which enabled other 'lead teachers' with ICT to promote and implement ICT across the school.

By having a vision, the heads gave; firstly, a clear, cultural signal that ICT was *valued;* secondly, this was *shared* by school senior leaders as important, so ICT thirdly became a *priority* for the whole school. Finally, ICT received *funding* to develop a school ICT *infrastructure*. The vision is shared and realised at a material level through investment in a robust and ample infrastructure; a necessary condition to ICT becoming implemented, but this can only be realised if the school leaders prioritise ICT, both culturally as important and of value, *and* materially commit to the vision in terms of financial dedication longitudinally.

Consequently, it was the leadership's vision of ICT that differentiated the most ICT embedded schools. As Dalin (1993, p10) observed 'an effective principal has *vision* - is able to involve teachers'. However, what comprises a vision can be further analysed into three constitutive components: cognitive, affective and behavioural. A vision was a *belief* that ICT enhanced practice (cognitive component); there was an active commitment or passion about ICT (affective component), which combined to ensure the vision was actualised and became practice (behavioural component). Consequently, the headteacher's ICT vision enabled the school (and all its constituents: teachers, pupils, admin staff) to implement ICT, due to investment in the material and cultural conditions necessary for ICT integration, which become exemplified in a whole-school policy for ICT.

Whilst the need for heads to have vision in order to effect ICT integration has been identified before, by Veen (1993), Costello (1997) and Yee (2000), the caveat to this, found in the research, is that the vision becomes more effective when it is *shared* and owned by other senior leaders. The key factor was that the vision was *disseminated*, particularly to the wider leadership team (deputies and assistant heads), and then to HoDs and other 'lead teachers'. As Comber and Hingley (2004) insightfully differentiates, it is a 'shaped vision' rather than a 'vision shared'; the former being a collaborative development, with equability of ownership among leaders, whereas the latter denies the strength of the mission as it remains the head's vision, not that shaped by other leaders.

Interestingly, leaders' vision alone was not a sufficient condition, but was found to be a necessary one for the implementation of ICT. In order to develop ICT across a school there had to be the financial commitment and that entailed believing in the value of ICT, therefore it was necessary that the school leadership were favourable in their support of ICT. Where this leadership support for ICT was absent in schools, there was a corresponding lack of systematic ICT implementation.

Whilst leadership was found to be a critical determinant, this did not necessarily lead to integration. Granted that without leadership, integration was not found, hence without support and vision for ICT from leadership, integration is unlikely to occur in schools. However, and this is an important point, *even with* good leadership and a highly ICT integrative school, integration was still found to be very patchy; not all departments were implementing ICT to same degree. The research found integration even in the most ICT integrative schools was highly variable and inconsistent; some departments were fully embedded, whilst others had very little. So whilst leadership provides opportunities, ethos and conditions conducive to integration, which is also crucially dependent on 'lead teachers' distributing the ICT vision, integration does not automatically occur because of leadership.

Whilst the research identified factors internal to schools, like leadership and how these are inter-related to affect the integration of ICT, these do not exist in a vacuum. Schools form part of the wider socio-political context with public sector regimes of accountability and an audit cultural that exerts pressure on schools to meet standards, which in turn produces an external set of factors shaping teachers' practice. National attainment targets and published league tables wield particular pressures on teachers, therefore the next section considers the impact of these external factors that shape teachers practice and affect ICT integration.

6.3 THE WIDER POLITICAL CONTEXT: EXTERNAL FACTORS SHAPING TEACHERS' PRACTICE

The political context in which teachers' work is framed by a broader public sector climate of accountability. Consequently this context for teachers is one permeated by performance indicators, implemented through standards regimes that are monitored through the external audits of Ofsted and league tables. Whilst politically this is meant to improve public trust in education (Sachs 2003), for teachers this pervasive audit culture results in a number of pressures in terms of conformity to external regulations and an emergent tyranny of inspection and standards, which actively shapes the context of teachers' work and consequent use of ICT.

The research found teachers' practice was shaped by the above conditions; in particular by 1) an externally prescribed *curriculum* that was seen as overloaded, 2) *assessment* formats that prioritised exams, and 3) pressures from Ofsted that placed competing demands on teachers. Consequently these external pressures imposed by government resulted in a number of *tensions* for teachers, most notably between conformity to external regulations (national priorities) and internal school demands, for example, resources, preferred practices and issues specific to the *local context* (immediate, situated priorities) of their school, such as difficult and challenging circumstances.

The dominance of curriculum and assessment

Previous research demonstrates how an education system that is politically centralised with a prescribed curriculum effectively inhibits innovation and how assessment formats actively and powerfully shape teachers' pedagogy. Agalianos *et al.,* (2001) argued that the neo-conservativism of educational policy from the 1980s onwards, with a focus on exams, efficiency and accountability, including a tightening regulation of the curriculum and standardisation, has 'discouraged teacher initiatives, risk-taking and innovation' (p494).

Similarly, Noss and Hoyles (1996, p164), analysis of Logo, as an example of an ICT innovation in education, concluded that 'logo has suffered the fate of incorporation into a canonical curriculum', which explained how teachers ended up assimilating logo into their existing practice in a rather conservative way.

> More widespread teacher interest in computing was too often dampened by the reality of existing curriculum and examination constraints, especially at secondary level. Early trials of micros in the classroom often proved frustrating and off-putting to those teachers new to computing but nevertheless brave enough to try their hand. (Boyd-Barrett, 1990, p14)

It is necessary to understand the *tension* between teachers' willingness to use ICT and the *constraints* of an externally imposed curriculum and assessments. For example, the tensions between the recognised pressures of an overloaded curriculum in Science and the pressure to incorporate the use of ICT was keenly felt by Hennessy *et al's.,* (2002) sample of teachers, where concern was expressed that increasing ICT use meant throwing out other parts of the curriculum in order to 'fit in' ICT. Hennessy *et al.,* (2002) found that teachers experienced both a pressure to use ICT and a desire to use ICT to change pedagogy, but, at the same time, a set of *constraints* on that use. The impression was that conformity to external regulations was 'severely undermining the use of ICT' (p20).

Arguably, assessment remains one of the most important conditions shaping teachers' pedagogy. Selwyn (1999b) asserted that for many teachers, subject pedagogy is dictated by the nature of the qualifications being taught and the final examinations. Recognising the tyranny of assessment as a constraining factor against ICT integration was raised by teachers across the schools in this research. There was evidence that pressure to conform to the audit culture in terms of securing exam results was a priority that shaped pedagogy.

An analysis of the findings identified three paths, which teachers negotiated in working through the *tensions* between ICT use for subject teaching and the constraints of external exams. The three different paths in relation to ICT use were avoidance, integration and embedded use, which need to be understood as situated responses by teachers. Importantly, all these teachers had previously demonstrated pedagogic use of ICT in non-exam classes and were therefore ICT competent.

First, with respect to avoidance, these teachers chose *not to use ICT,* in order to focus on exams via traditional pedagogic methods; these teachers had knowledge of ICT use for subject teaching, but felt constrained by external assessment and attainment targets. Second, there were teachers that chose *to use ICT* to prepare pupils for exams; these teachers believed that one, ICT aided learning and two, ICT greatly supported and enhanced revision. Third, there were teachers that chose to use ICT at *all times* and believed that ICT afforded new skills that are currently not examined; not directly in their subject, but that can enhance study of the subject.

For those departments that experienced good exam results without ICT, or little ICT integration across the subject, this became a defensive form of argument that protected those teachers from change. Since external priorities were met, this meant attainment outcomes had precedence over pedagogic applications of ICT and were used to *justify* not utilising ICT.

So whilst traditional assessment formats engendered conservativism in some teachers' practice (as good results could be attained without ICT), other teachers acknowledged that ICT also afforded new skills that were not assessed in their subject's final exams, and enhanced subject teaching. Teachers reported how ICT afforded 'information finding, independent learning, organisational skills' (QI, school F, 20/11/01) that cut across subjects and are arguably meta-cognitive skills, since they are not subject *dependent*, but rather engage notions of critical literacy, which can enhance subject understanding. Consequently, some teachers appreciated how ICT afforded new skills that crossed traditional subject barriers, like network literacy.

Consequently, teachers' uses of ICT were constrained by a heavily prescribed curriculum and an assessment system that failed to acknowledge ICT use in subjects or new knowledge afforded by ICT. The broader political context, which demands conformity to external regulations, is a powerful shaping influence on teachers working practices that can place constraints on innovation. As the NUT acknowledges:

> The National Curriculum is overloaded. Its prescription reduces access to new areas of knowledge and to teaching and learning which crosses traditional subject barriers. (National Union of Teachers, Education Manifesto, 2005, p2)

As the OECD report (2001) confirms, existing inflexible means of assessment (i.e. written tests of knowledge) place a stranglehold on the curriculum and act as a brake on imaginative uses of ICT. Hence, new assessment systems are needed to address emergent skills, knowledge and understanding that are afforded by ICT.

The Tyranny of Ofsted

Prior research omits to examine the way Ofsted can shape teachers' integration of ICT; in particular how whole school inspections impose pressures on teachers that diverted attention away from ICT. Three key issues emerged in relation to Ofsted, which can be understood as shaping teachers' practice through the punitive approach of inspection.

First, Ofsted was indicative of the broader political context in which teachers work, where 'surveillance and inspection go hand in hand, (whereby) regulation and enforcement...ensure its compliance' (Sachs, 2003, p7). This resulted in teachers' conformity to external regulations and constrained opportunities for innovation and ICT integration. This position was indicative of teachers who adopted an 'avoidance' path as discussed earlier.

Second, Ofsted cannot be characterised as a singular experience, but rather a force exerting multiple pressures shaping teachers' practice that not only encompassed tensions, but also contradictions. There were contradictions between a statutory requirement to use ICT (as a national priority) and localised demands that meant teachers had to juggle a number of competing priorities, which may or may not be ICT. Teachers experienced contradictions between having to use ICT, as demonstrated in a Scheme of Work (SoW), and an inspection process that prioritises department's *performance* based on exam results, whereby during an inspection teachers prioritised attainment and behaviour above ICT, and fulfilled the ICT brief as a cursory paper exercise. One ICT coordinator of a Technology College highlighted how departments identified ICT in their SoW as a pragmatic, paper requirement, but failed to actually implement ICT into classroom *practice.*

Third, Ofsted school inspections when operationalised at the local level, exerted a pressure that was unprecedented; the effects on staff were of *competing, multiple priorities*. If ICT was not a school priority, as defined by the leadership team in the school's development plan, prior to inspection, then ICT was not a priority for teachers either. Teachers pragmatically focused on the school's most urgent priorities in order to meet the demands of the inspection. For example, school H was placed in 'special measures' by Ofsted, which exerted a pressure on teachers that detracted attention away from ICT and hindered integration. Teachers had to focus on the Ofsted Action Plan as the most urgent in their allocation of priorities: it was imperative to meet these first. 'Ofsted is their priority, not ICT training (WQ, school H, 2/7/02); 'Ofsted inspection impinged on teachers' time and sense of priorities, so ICT...took a back seat (TQ, school F, 22/06/01).

The analysis contends that in a culture of punitive auditing (or, more benignly, Barnett's super complexity, 1997) teachers make rational choices and decisions about how to use their time, which gives priority to those issues deemed most important by virtue of the *consequences* of failing those priorities: falling assessment will effect a school's position in the league tables and Ofsted failure can result in school closure.

Prior research omissions

The research literature does recognise the pressures of an audit culture on teachers, but fails to examine the pressure of Ofsted and assessment and how this specifically relates to teachers integration of ICT.

Such pressures and constraints are important shaping influences on teachers' practice and affect the way teachers position themselves to policy changes, like ICT. This research therefore supports the findings of Stronach *et al.,* (2002) and Moore *et al.,* (2002) who identify how teachers position themselves in relation to education edicts and change. However, these are only ever conceptualised as individuated responses, which lack the multi-dimensional analysis that such complex situated responses require, and fails to understand that teachers often make sense of changes through a process of negotiation and interaction (discursive dynamics) as they create new meanings about change in a process of shared activity, as they construct relations of mutual accountability.

Moore, Edwards, Halpin and George (2002) discovered that teachers 'reposition' themselves in the face of rapid and extensive *educational change*. Moore *et al's.,* (2002) interviews with teachers indicated that responses to public policy were prompting teachers to become increasingly *pragmatic* in their practice. They identified two distinct forms of pragmatism: 'principled pragmatism', in which teachers felt able to affirm their pedagogic practice; and 'contingent pragmatism', adopted by teachers in 'oppositional orientation to reform' (p551). Whilst Moore *et al.,* (2002) did not explicitly examine ICT, it can nonetheless, be seen as an example of recent government policy, to which Moore *et al's.,* analysis can be applied. However, whilst this research also found high degrees of pragmatism in response to external impositions, particularly Ofsted and its regulatory frameworks, such situated demands defied an easy allocation of either 'principled or contingent' pragmatism.

Consequently, there are important criticisms: Moore *et al's.,* (2002) analysis falls subject to an over-simplified dualism that fails to capture the complexity of teachers' experiences as they engage with ICT. The problem is that teachers are overly conceptualised in an *individualised* relationship to change emanating from policy. The analysis fails to attend to the discursive dynamics of teachers' positionings in relation to policy changes, whereby teachers' learning (since learning is at the heart of change) is socially constructed through dialogue (joint endeavour) as teachers mutually develop new knowledge about pedagogical uses of ICT. Teachers' learning is not an individualised internal process and teachers' reactions are rarely an individual or isolated response to policy change. Given that teachers reposition themselves (most dramatically in this research) through engagement in a community of practice, this can be understood as a joint response, resulting from mutual engagement and accountability with ICT. Such an analysis identifies that the picture is more complex than the 'either/or' dichotomy of principled or contingent pragmatism, rather teachers engage and reposition themselves with ICT through participation in a community of practice that keeps tensions and movements in play in response to shifting contexts and priorities.

Similarly, Stronach *et al's.,* (2002) teacher sample acknowledged a plurality of roles, or 'typical engagements' and 'uneasy allocations of priority' (p11). In the fluidity of positionings, a 'growing professional uncertainty' was identified, 'as teachers tried to come to terms with a welter of recent innovations, the pressures of their respective audit cultures, threats to their preferred professional styles and external impositions' (ibid.). Such 'juggling' was expressed as a 'reworking of individual professional commitments' (ibid.). However, this research extends this analysis and would add that these 'reworking of commitments' are continually renegotiated in the context of a community of practice, not in isolation as an individual preference, but as part of a mutually accountable community of practice. In fact, a teacher's priorities can only be understood to be constructed through a collective discursive dynamic, as each teacher's priorities are negotiated *in relation to* the department and school's priorities, which are drawn up each year in the school development plan. Teachers' positionings and allocation of priorities are a *joint activity*, necessitated by accountability that is mutually worked out in practice, with sensitivity to the localised school context and burden of national edicts.

Consequently, it is here, in the space between the demands of external impositions and teachers' daily practice that tensions are thrashed out, and joint endeavour can be identified as a key feature of communities of practice. It is the socio-cultural space where teachers negotiate their shared purpose in the process of juggling such tensions.

> It is their negotiated response to their situation and thus belongs to them in a profound sense, in spite of all the forces and influences that are beyond their control. (Wenger, 1998, pp77-82)

The enterprise is joint 'in that it is communally negotiated', which is 'a process, not just a static agreement' and it is shaped by the participants 'as they pursue it', in the course of 'creating relations of mutual accountability' (ibid.).

The research found that the pressure of an audit culture, specifically Ofsted and current assessment formats significantly shape teachers' use of ICT. The actual *extent* of such shaping depends on the local context of each *school* (whether an inspection is due) and *department*, in relation to its exam performance and positioning with ICT; whether ICT is viewed favourably or not.

Overall, increased regimes of accountability and audit required by governments to improve public trust in education have resulted in regulatory frameworks that serve to constrain teachers' practices. Teachers mobilise a complex of differentiating positions in response to shifting contexts and priorities. Such positionings are fluid, plural and split, due to teachers experiencing a plurality of roles, 'typical engagements and uneasy allocations of priority' (Stronach *et al.*, 2002, p11). Consequently it is necessary to conceptualise teacher positionings as non-unitary, unstable, fragmented and shifting, in order to keep tensions and movements in play, as positionings depict dynamic and ambivalent aspects of situated performance. This research extends Stronach *et al's* (2002) analysis by advocating that such positionings are jointly negotiated through participation in a community of practice, in which teachers thrash out their mutually accountable allocations of priority.

Arguably, it is through discursive dynamics that teachers achieve 'active location in social space' (Coldron and Smith, 1999, p711); social space is defined as 'an array of possible relations that one person can have to others' (ibid), whereby the interplay between structure and agency is understood as partly given and partly achieved; for example, whilst school structures are inherited social structures, others are chosen or created by teachers through active participation in their community of practice (agency) through the discursive dynamics of joint enterprise and mutually accountability. Within communities of practice teachers' positionings are fluid, plural and split as they are continually negotiated in response to shifting priorities and changing contexts.

Consequently, in the wider political context of an audit culture of public accountability, with regulatory external impositions, teachers experience multiple and competing pressures and an uneasy allocation of priorities, which results in a fluidity of positionings as they respond to shifting contexts. Most importantly, this is not a solitary or isolated experience, but one that is situated in the social space of a professional community of practice in which teachers jointly construct 'relations of mutual accountability' (Wenger, 1998, p82).

Consequently, a critical factor affecting the integration of ICT was found to be the existence of a community of practice, which is discussed in the next chapter. However, before that it is necessary to examine how schools developed particular routes and pathways for implementing ICT, because some schools clearly had more successful strategies than others, and these would enable other schools to increase their level of integration. This then addresses Scrimshaw's (2004) rightful concern that schools need to know how to move from one level of integration to the next, which at present is an omission in the research literature.

6.4 PATHWAYS: DEVELOPING A FRAMEWORK FOR INTEGRATING MULTIPLE STRATEGIES FOR WHOLE SCHOOL ICT DEVELOPMENT

The research found there was variation in the degree of integration at the level of the school and this related to the presence or absence of the particular factors identified, like leadership support for ICT. Previous research has tried to explain variation in terms of (a) a collection of - usually separate - factors and (b) in terms of the individuated responses of teachers. This study takes these analyses an important stage further by examining the interrelationship between factors and in revealing that integration is strongly related to a whole school culture and teachers' collective responses rather than individuated responses.

School culture emerged as a significant factor that explained the high degree of variation found between schools regarding ICT integration. School culture captures the overarching strategies deployed by schools to develop ICT, which encompass both material and cultural conditions needed for ICT implementation.

Acker (1990) discovered that the key aspect of school culture, which made implementation of change smoother, was a collegial, collaborative style. Acker's research, however, concerned a primary school, which being *smaller* than a secondary is more likely to engender such a style. This research with secondary schools also found a collegial style aided change, particularly at departmental level. This is explained by the fact that secondary schools are organised around curriculum subjects.

What greatly aided ICT implementation was a whole-school approach to development. This was exemplified in a *whole-school policy* for ICT. In particular, whole-school *strategic planning* that built a supportive community of practice associated with using ICT within departments. This was achieved through offering opportunities for exploring ICT, in order to build teacher confidence and addressing any prior issues of uneven levels of access and experience.

Identifying Pathways: whole school ICT development

Scrimshaw (2004) rightly identified two gaps in research: first, how can schools less than exemplary in ICT use progress with ICT and move from one level to another; second, how can schools facing 'challenging circumstances' utilise ICT?

The ways schools can and do progress with ICT are explained by this research, which develops a framework for implementing ICT that attends to both material and cultural factors, thereby enabling schools, which are less than exemplary in ICT to develop.

This research found a number of successful strategies for implementing ICT across schools, but it is *not insignificant* that these schools were *not* in difficult and challenging circumstances or had a recently failed Ofsted; such are the pressures of an external audit culture.

In order for schools facing challenging circumstances to utilise ICT, much more needs to be done by way of alleviating the kinds of pressures these schools face such that they have to prioritise targets that may not be in their best interests, like league tables. For example, whilst this research had a school in challenging circumstances (also placed in special measures, with serious weaknesses), the pressures placed on teachers were so great that in a climate of competing priorities, those with the highest stakes win out, and in this case it was completing the Ofsted action plan, rather than systemically implementing ICT.

In areas of severe, inner city poverty, like school H, what constitutes achievement for these pupils maybe significantly different to other more affluent areas. Policy makers need to attend to broadening definitions of achievement, to take account of what these pupils are likely to attain, such that they can leave school with a sense of accomplishment, rather than that of failure in a system that only recognises GCSEs grade C and above. This school's pass rate was 4% in 2002, for 5 GCSEs grade C and above. For schools like this, the catchments are unlikely to succeed against such traditional criteria.

ICT Strategic Development: frameworks for understanding change

What the various arguments above lead to is the need for the development of a generalised framework that maybe adaptable for other schools. Such a framework takes paths from across the schools that were identified as successful by teachers. Of the paths identified, each of these was not a solitary route, but rather dynamically coalesced; the paths occurred in conjunction, more like a web of inter-connected paths; not a linear route. It was important to see the complexity of the relationships between the strategies and pathways. Hence,

> *Pathways* are the identification of successful routes and strategies developed by schools.
>
> *Processes* refer to understanding the process of change entailed in the pathways; how the strategies are operationalised and how strategies can change the culture of a school.
>
> *Communities of practice* refer to how the cultural dynamics of the different strategies can coalesce to form collaborative groupings of teachers that develop ICT.

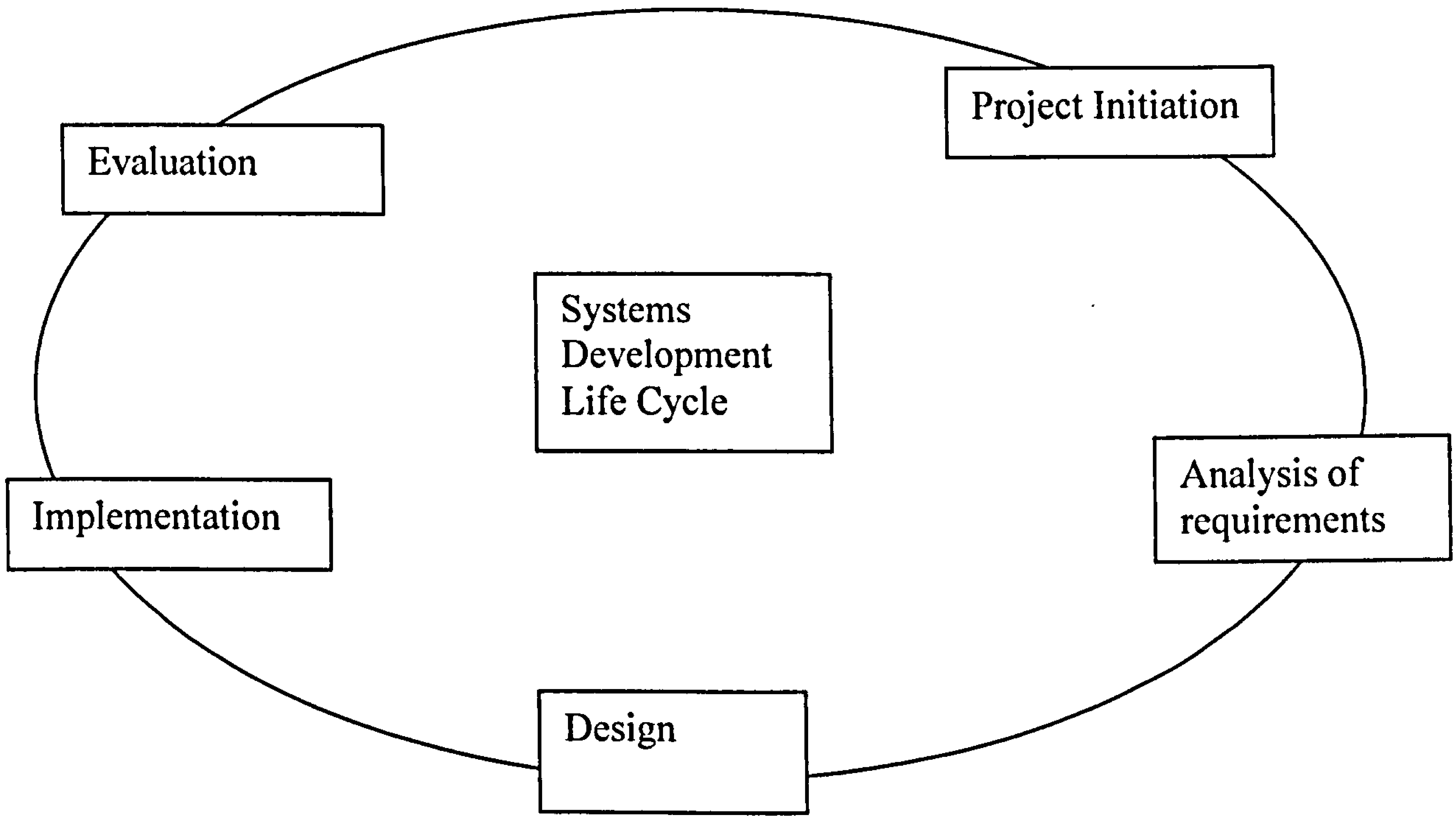
The paths discussed in this section were identified as particularly effective and powerful at instigating change with ICT. First the change engendered with ICT must be understood as a *process,* which was essentially about changing established work practices and to change that is to change *culture*; not simply re-structure as that only constitutes one part of change. As Fullan (1993, p49) asserts 'to re-structure is not to re-culture'. This suggested framework is essentially about changing school culture and earlier research indicated how impervious school culture can be to change: 'to renew the practice of the school was a more complicated process than we had thought...school culture is a complex phenomenon' (Dalin, 1993, p97 and p5).

School culture is understood as comprising both material and normative components. The material refers to physical changes, which include structural and procedural changes to 'ways of doing things' (e.g. email communication usurping paper); the normative refers to values and a commitment to ICT, which culminates in changed norms, at the teacher, department and school level, which are essentially shared and represent a collective positioning towards ICT. It is necessary to consider how the above can be operationalised within a school, which may be aided by developing a framework or cycle of processes that culminate in implementing ICT.

Information Technology: 'Systems Development Life Cycle'

In the discipline of Information Technology there is a model of implementation, entitled the 'Systems Development Life Cycle'. This model outlines the components and processes of a technology project, which could be taken and applied to schools.

Figure 6.2 Systems Development Life Cycle

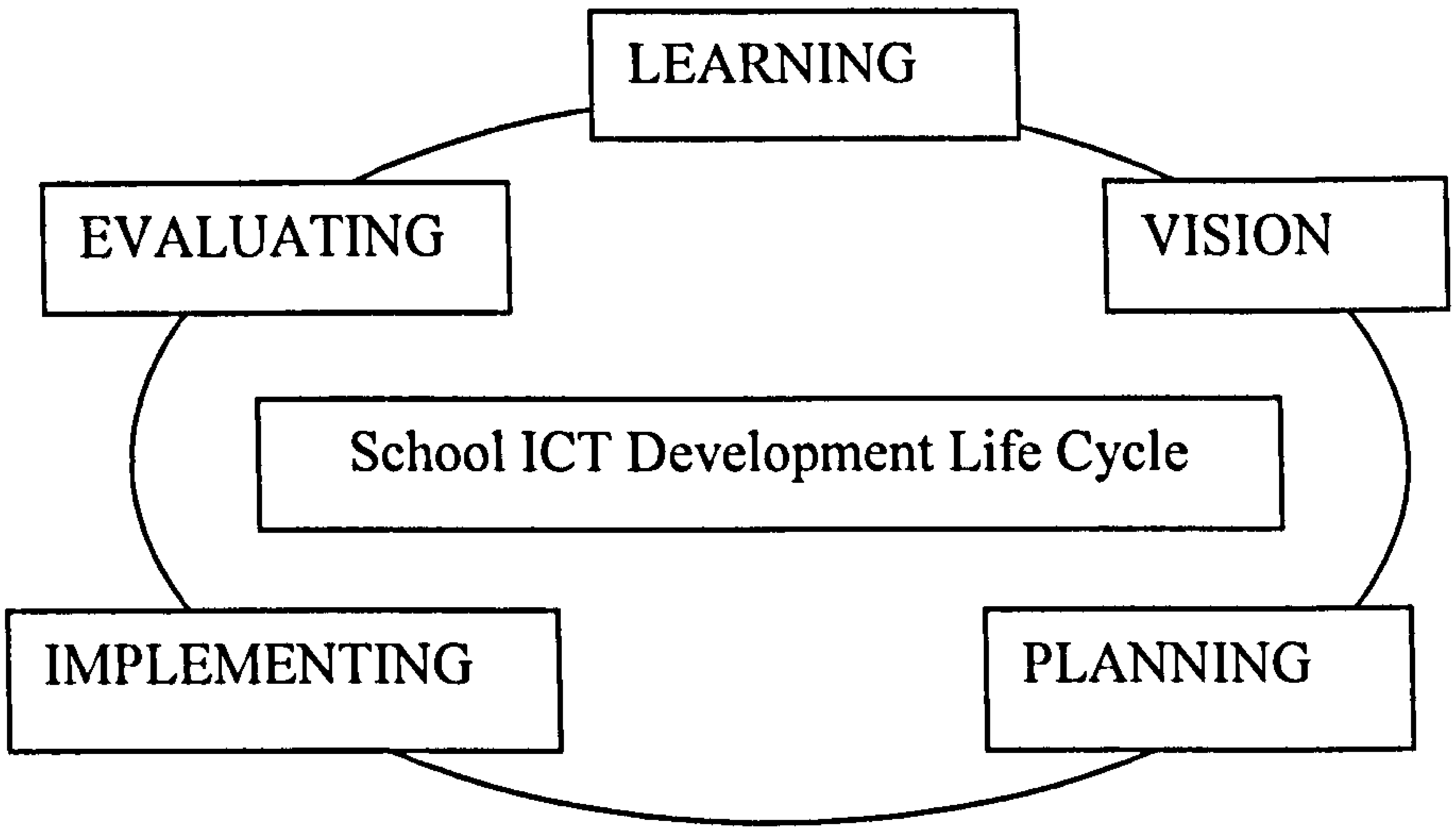


The terms and cyclical idea contained within this model were taken and adapted to provide a framework for understanding ICT development in schools. In the adaptation, the strategic process of ICT implementation was found to form an iterative *cycle* that entailed *vision, planning, implementation, evaluation* and *learning*. The latter then informed the vision and so the process informed itself and began again: *constant renewal.*

Whole-school ICT development: integrating multiple strategies

The figure below represents the adaptation of the Systems Life Cycle development to the school based scenario.

Figure 6.3 School ICT Development Life Cycle



The analysis deconstructs the constituent parts of the process of change. It is necessary to explain each component, and then examine the complex interplay between them, whilst holding movement, tension and play between them as crucial and organically vital.

The process is dynamic; it is lived, situated and organic rather than static, and some or all of the parts may occur simultaneously. It is not a linear process, there is no one starting point in the circle, it is possible to start from different points in the cycle; representing its cyclical nature, enabling growth and movement. The complex interplay between the parts constitutes a *process* and attends to the multidimensionality of change. Process is iterative, dynamic, multi-dimensional, cyclical, and fluid.

The importance of *vision* (as discussed earlier) was known to be critical if schools were to develop, however, this research highlights that it was a *shared vision* that was more significant for systemic change. In particular, 'lead teachers' having an ICT vision who were effective change agents with devolved powers from a distributed leadership model; such 'lead learners' with ICT were engaged in a cultural dynamic of winning the 'hearts and minds' of other teachers.

With regards to *planning*, one key decision was to secure *finance* for ICT in order to build a *technological infrastructure;* robust, reliable and ample to secure access equitably. The key strategic decisions regarding *finance* were to 1) secure *Technology College status*, which guaranteed money specifically to develop technology and represented significant funding, and 2) to have an *entrepreneurial* approach to securing further monies, through *bids and projects* and 3) to creatively divert existing funds; for example, staffing budget relocated to ICT.

An example of the strategic development of a technology infrastructure from school F was to start with ICT suites; move onto ICT hubs in departments (thereby giving responsibility and ownership to departments), then laptops for all teachers (opportunity to realise potential of ICT), then for lessons, class sets of laptops for pupils (to change classroom practice and pedagogy) and, outside of lessons, continual, open access to computers in social spaces. Consequently, ICT becomes *materially embedded* into the *culture* of the school.

The *implementation* part of the process (framework) was most successful when multiple strategies were marshalled simultaneously. In particular, a number of *key strategies* across the schools were identified as powerful and effective for instigating , maintaining and embedding change with ICT, which were 1) *staffing* strategies (devolving responsibility for ICT); 2) provision of *time* (teachers having protected time to develop ICT resources); 3) *communication* structures (all changed to be online) and 4) *ICT training* provided in–school, which links to the *learning* component of the strategic cycle of whole-school ICT development.

To provide sufficient detail in the framework of strategic development for ICT, it is necessary to discuss how each element of the strategy has a material and cultural component, which dynamically interact. For example, staffing: by ensuring a) new appointments were committed ICT enthusiasts, b) they were NQTs; this was cheaper and freed up money to redirect into ICT (material/financial element), which resulted in a growing *cultural capital of ICT knowledge* within the school, as incrementally each year, the ICT knowledge base of the teachers increased.

Similarly, where strategies were created to *generate time* for ICT development work, there were specific ICT outcomes required from teachers (e.g. e-resources on school intranet, i.e. material outcomes), which signalled culturally that ICT was a whole-school development priority. Again, moving *communication* online, meant materially it was impossible to conduct daily routine procedures without using ICT, hence culturally ICT permeated every level of the school's working practices and ethos: to use McLuhan's (1967) phrase 'the medium becomes the message'.

The *evaluation* component of the framework was not highly formalised at the time the research was conducted. Internally schools did monitor and evaluate their own ICT use and development. Within departments, evaluation was informal and on-going, and occurred in social, discursive dialogue, when teachers reflected on the effectiveness of ICT in their previous lesson, during break times. Also, more formally, in department meetings evaluation was implicitly part of the dissemination process, when teachers had identified the salient features of ICT activities and feedback in meetings how and why they were successful.

The *learning* component of the framework was an integral part of the whole process. What emerged as significant and powerful in effecting change with ICT was, 1) just-in-time training from colleagues; 2) sharing practices and resources, again from colleagues, which revealed the *social* and *situated* dimension of learning that was vital. Consequently, at a material level there was the provision of time for training and physical sharing of resources; culturally, teachers were mutually supportive and collaborative in jointly developing ICT for pedagogic practice.

The table below summarises the multiple components of the process in order to provide a framework for implementing ICT in school. This attempts to address Scrimshaw's (2004) observation of prior omissions in research regarding how schools can progress with ICT. It is important to note that it is the multidimensionality of implementing the numerous components that creates change.

Table 6.1 Strategies Whole School ICT Development: a Framework for Implementation

PROCESS simultaneously multidimensional dynamic /iterative	**Requirements**	**How to do it**	**Outcomes: impact on school ethos**	
			material culture	cultural *values*
VISION	**Leadership**	Distributed leadership: use of lead teachers / ICT change agents	ICT focus for whole school development / dedicated resources: money, staffing time	ICT *prioritised* as important; creates whole school ICT *ethos*
PLANNING	**Finance**	**External sources:** TCT; BIDS; e-learning credits; dedicated money for ICT.	ICT *infrastructure*; hardware, software, connectivity / resources; to provide *access* to ICT and maintain ICT *reliability*	Creates *expectation* to use ICT, because material resources are available, in sufficient quantities; normalises use, as part of the fabric of the school classrooms
		Internal sources; reallocation of funds to ICT (e.g. from staffing / library)	ICT *personnel*: ICT technicians; network managers; intranet designers; LRAs; to provide teachers with ICT *support*, and to *maintain* access and reliability	
IMPLEMENTATION	**Strategies**	New Appointments	NQTs cheaper; staffing *budget* diverted to ICT	Only appoint *keen* and *competent* ICT users; this increases *cultural capital of ICT knowledge* in teaching body, which incrementally increases year on year
	Staffing	LRAs: (Learning Resource Assistants); one attached to each department	Novel, specialised posts to support ICT development; Dedicated *time* to develop online learning resources;	*adapt/create* e-resources for intranet; *maintain* intranet e.g. hot links in interactive worksheets, links in interactive tests; ICT ethos for all learning resources becoming e-resources, engendering an online learning culture: e-pedagogy

	Change Agents	ICT representatives: one in each department	*Remuneration* and *time* for ICT development within each department; key person with dedicated ICT *responsibility* for dept as part of performance management objectives	Lead, develop, disseminate, evaluate ICT innovations and practices; driving ICT as a *priority* within departments. Liaise with other 'lead ICT teachers' in school; between and across departments
		ASTs: Advanced Skills Teachers with ICT	Provide CPD just-in-time ICT training	Lead ICT innovations, within and across departments Devolved/distributed leadership.
	Time	*Protected* time	Specific ICT outcomes e.g. e-resources / intranet site developed for online learning for each department. Tangible and identifiable results required from 'time investment'.	ICT is a development priority / valued.
	Communication	Change working practices – to online procedures	Online school administration: registers, pupil referrals, reports, staff bulletins, staff email for daily correspondence; database pupil progress and attainment.	ICT ethos: 'the medium is the message' (McLuhan, 1967)
EVALUATION	Time	*Time* for feedback on ICT use. Reflective of evaluation what does/not work.	Formal structures for ICT discussions and evaluation: department meetings-standing agenda item, feedback and analysis of ICT developments; whole school training days/after school sessions.	Discursive evaluation of what ICT pedagogical applications were successful / appropriate for the subject / outcomes for pupils.
	Comm.	*Communication*: multiple routes for dissemination	Informal evaluations; peer-to-per dialogue, habitual part of teachers practice, in shared social spaces	Sharing practice/resources; Variety of routes for disseminating ICT developments, then evaluating and feeding back on
LEARNING	CPD and developing CoPs	Lead ICT learners, *modelling*, leading by example; by SMT; HoDs; ASTs, ICT reps, LRAs i.e. change agents	just-in-time ICT training – peer-to-peer or small groups; bespoke, personalised learning, leads to effective situated learning	Learning is socially constructed through discursive dynamics; peer-to peer dialogues/demonstrations; joint enterprise, mutual engagement
			Sharing resources and practices	Collaborative activity; prioritises & values ICT development = community of practice (CoP)

- The table is a simplification that aids representation of the relationships between the different factors shaping the integration of ICT and whole-school development.
- It is important to stress and reiterate that the *process* is fluid and non-linear, which is compromised visually by the design of a table.
- Some paths or routes were developed simultaneously, while others were developed first, simply to *begin* the process. However, this does *not* set a *necessary precedent of order* for development. For example, although school F may have created an ICT infrastructure first, school G invested in training first; the point is a school can start development anywhere in the process, as long as ICT is developed on multiple fronts.
- Attending to the multidimensionality of ICT policy implementation aids the management of the change process at the local level of the school; understanding the complexity of the implementation process and the relationships and interdependency between the different factors shaping integration. Ultimately the factors are dynamically interrelated.

Having analysed the strategic development of ICT across schools in order to identify effective practice; it is necessary to apply this analysis to each school used in the research in order to map their implementation for comparability.

A comparability map of factors effecting ICT integration

Below is a table of the factors that shaped teachers' ICT use within each school. A tick represents a supportive factor for the school; a cross indicates a mitigating factor against ICT integration. Where schools had not reported on a particular factor, it was left unspecified.

Table 6.2 A Comparability Map of Factors Effecting ICT Integration

✓✓	Factor: positive, very active and substantial evidence of its presence in the school
✓	Factor: some evidence
-	Indeterminate / undecided
×	Factor: no evidence
××	Factor: a negative effect, mitigating factor against ICT integration

Table 6.2 A Comparability Map of Factors Effecting ICT Integration

Categories from data	**Leader ship** (Head)	**Leadership** (Senior Management Team; distributive leadership style)		**School culture**		**Dept culture**	**Pedagogy** (teachers usage, within depts)	**CPD** (ICT training)	**Technology infra-structure**
key factors	Head had ICT *vision*	Shared vision: supportive of ICT in *principle*	Role modelling with ICT: Supportive of ICT in *practice*	*TCT* status	Whole school *ICT ethos*	Dept ethos: value ICT	majority integrated ICT	ICT CPD supported by leadership/HoDs; ICT CPD provided in-house	Ample and appropriate technology and technical support
School									
A	✓✓	✓✓	✓	✓	✓✓	✓✓	✓✓	✓✓	✓✓
B	✓	✓	✓	✓	✓	✓	✓	✓	✓
D	✗✗	✗✗	✗✗	✓	✗	✗	✗✗	✗✗	✗
F	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓	✓✓
G	✓	✓	✓	✓	✓	✓✓	✓✓	✓✓	✓✓
H	✗	✓	-	✗	✗	✗	✗✗	✗✗	✗✗

How the six schools were selected

The schools used for the mapping exercise covered the range of stages of ICT development, from early to mid, late and advanced ICT development. These schools were chosen as the data collected from these schools could be mapped onto the factors this research found to be affecting integration levels. No school from stage 1, the earliest development, was selected as the schools matching this criterion were unable to provide sufficient detail to map, because they were too near the beginning of the journey of development, they could not specify how they were developing as they had only just begun the process.

It is interesting to see how the map for each school corresponds to the NCET criteria for assessing the stage of ICT development. Not surprisingly, the most advanced schools (A and F) mapped more closely to the factors that support integration. Whereas school H, in the early stages of ICT development, corresponded more closely to the negative factors on the map.

Case study descriptions of each school

The following descriptions of each case study school refer to: first; the level of ICT embeddedness, using the stages of development from 2 to 5 as outlined by the NCET (1996, p 23-24) criteria that covered early to advanced development; second the degree to which each school's ICT development progressed during the time of the study; third the socio-economic context for each school, which reflects the locality of the school and the nature of it's catchment area with respect to the pupils.

All the case studies were *secondary* schools and of *mixed gender*. The information regarding the profile of the *locality* and *student population* was collated from the Ofsted Report for each school. The level of ICT embededdness was established using the NCET (1996) criteria and selected according to the strategies outlined in the methodology chapter, for example, by interviewing the NGfL Regional Co-ordinator, whose expertise could help classify and select schools representing each stage of ICT development.

School A: ICT development was 'advanced, stage 5 and innovative', whereby ICT had 'significantly altered the school's functioning' (NCET, 1996, p24). This was a *city* school, in an *affluent* area, with *Technology College* status, age range 14-18, with 1900 students. Ofsted reported 'it was much larger than other schools; it was a comprehensive multicultural college, and a third phase specialist Technology College. Students came from areas, which were *above average in social and economic measures*. Students' attainment on entry to the college was well above average. The majority of students were white, though there were significant numbers of Asian origin. A smaller than average proportion of students were identified as special educational needs' (Ofsted, 2006, p3). The school was part of the European Network of Innovative Schools (ENIS) for ICT. Across the duration of the research, the school continued to develop ICT, within departments and at whole school level. For example, the Science department developed simulations and mind mapping software and the school developed a whole school student database of attainment.

School B: ICT development was 'late, stage 4 and embedded', whereby ICT 'experiences are shared and teachers were aware of different types of ICT use' ((NCET, 1996, p24). This was a *city* school, in a *less affluent* area, with *Langauge College* status, age range 11-18, with 1500 students. Ofsted reported that 'this school was a foundation comprehensive of above-average size. One in seven students came from a minority ethnic background. One in twenty students had English as an additional language. One in fifteen students was eligible for free school meals, which was below average. One in eight students had special educational needs. The school serves one of the less affluent areas of the city, where the tradition of further education was not well established. Attainment on entry was below average' (Ofsted, 2003, p7). During the research period, the school continued to develop ICT, for example, investing £40,000 in optic wiring to enhance the school's ICT infrastructure.

This school was predominantly white, which represents a contrast to the second 'stage 4 late ICT development' school, which was 80% ethnic majority in a more deprived inner city area and involved in a raft of other educational initiatives (see school G).

School D: ICT development was 'mid to late, stage 3 and transformative', whereby the school had an 'agreed ethos and commitment to ICT' (NCET, 1996, p23-24).
This was a *rural* school, in an *average* socio-economic area, with *Technology College* status, age range 11-16, with 800 students. Ofsted reported that 'students were drawn from a wide rural area around a market town. Although the catchment area was very mixed socially and economically very few students were eligible for free school meals. The students were very predominantly from white British backgrounds. The proportion with learning difficulties and disabilities was below average, although the proportion with a statement of special educational needs was average' (Ofsted, 2006, p 2). During the research period, the school did not significantly develop its ICT; it remained focused at maintaining its level rather than enhancing it. This school was selected as a 'mid-stage ICT development', which contrasted well to both the advanced and early stage schools.

School F: ICT development was 'advanced, stage 5 and innovative', whereby ICT had 'significantly altered the school's functioning' (NCET, 1996, p24). This was a *rural* school, in an *average* socio-economic area, with *Technology College* status, age range 11-18, with 1900 students. The school was a specialist technology college, a status granted in September 1998. It combined a former 11-14 high school and a 14-19 upper school following algamation in September 1999. In September 2004 it was designated as a training school. It was much larger than the average sized secondary school with a large sixth form. Around 95% of the students were from White British backgrounds and there were very few students from minority ethnic groups. 'The school's specialist technology college status has impacted well in a range of areas, including design and technology and ICT' (Ofsted, 2006, p2).

For the duration of the research, the school remained strongly committed to developing ICT across the whole school. A significant number of ICT initiatives were developed, from online registration, online reporting to parents, online pupil-deferrals for teachers, laptops for all teachers, whole school pupil database, wireless internet connectivity across the split-site campus and the development of an innovative e-learning base at Key Stage 3, which won an national award from RM.

The school was part of the national Microsoft 'Anytime, Anywhere Learning' Project and was selected as second 'advanced ICT school' that differed to school A: whereas the latter was city based, with above average attainment, mixed ethnicity and affluent locality; school F, was rural with below average attainment, predominantly white and average socio-economic catchment. This represented differentiation between the two advanced ICT schools selected.

School G: ICT development was 'late, stage 4 and embedded', whereby ICT 'experiences are shared and teachers were aware of different types of ICT use' (NCET, 1996, p24). This was an *inner city* school, in a *deprived* area, with *Language College* status, age range 11-16, with 1200 students. Ofsted reported 'students came from the inner city where there was a *high level of deprivation.* As a result, the college's socio-economic circumstances were below average. The percentage of students eligible for free school meals was close to the national average. The percentage of students speaking English as an additional language was around 60 per cent, which was very high compared to most schools. Approximately 20 per cent of students were 'White British', 47 per cent were of Indian background, 20 per cent other Asian and the remainder of Black British and mixed heritage. The percentage of students with special educational needs was close to the national average. The overall attainment on entry was below average' (Ofsted, 2003, p 7).

Osfted also reported that the school had been awarded specialist college status in modern foreign languages and internationalism, and had 'support from the 'Excellence in Cities' initiative and was involved in other national and local initiatives' (ibid.). During the research, the school was replicating the success of ICT development in the newly built Languages block by installing Interactive Whiteboards and providing training in this for other departments across the school.

This school was selected as an example of 'late-stage ICT use', which contrasted well to the other stage 4 school (see school B), as school G was involved in other educational initiatives, which reflected the ethos of the leadership regarding *external partnerships.*

School H: ICT development was 'early, stage 2', where 'ICT use was co-ordinated, but not all the teachers were equally convinced about ICT' (NCET, 1996, p23). This was an *inner-city* school, in an area of considerable *socio-economic deprivation*, age range 11-16, with 700 students. Ofsted reported that 'when the school was inspected, it was judged to require special measures because it was failing... The school has been beset by difficulties since it opened. In the past, attempts to improve the standard of education were exacerbated by difficulties in staff recruitment and retention and by the lack of continuity in leadership' (Ofsted, 2005, p3).

The locality of the school served an area with 'high levels of social and economic deprivation. Many pupils had significant educational and social disadvantage. It was smaller than average, the majority of pupils were of white British heritage. At 38 per cent, the proportion of pupils eligible for free school meals was well above average. The proportion of pupils identified as having special educational needs was well above average. The school has experienced significant problems with staff recruitment and retention in recent years; there have been seven principals in the eight years' (Ofsted, 2005, p2). During the research period, little ICT development was witnessed, due to the pressures of satisfying the Ofsted action plan, which were seen as a priority given the notice of 'special measures'.

This school was selected as a contrasting 'early-stage ICT use', alongside the fact that it faced 'difficult and challenging' circumstances as an inner city school in an area of considerable deprivation. (School J also shared these socio-economic characteristics, in a different locality, but was not selected as it was a primary school and all the schools for consideration in this map of analysis were secondary.)

Overall, a balance between school types was sought, most importantly from early to advanced ICT development; a further balance was also sought between urban and rural, large and small and type of catchments with respect to socio-economic status.

How the variables in table interact to influence change

First, the research identified those factors that teachers reported to be influential in effecting ICT integration. The research subsequently identified that these factors were both *material* and *cultural*; for example, teachers reported the need for technology resources, which were material, but also leadership support for ICT and an ICT ethos within the school, which is cultural. The way in which schools developed these factors were identified as *pathways* and that schools that were successful had *multiple* pathways or strategies dedicated to developing ICT (see table 6.1). In addition the research also identified the *processes* of implementing these strategies and discovered that the process was complex and *multi-dimensional*; that is the factors or variables identified (in table 6.1) could be implemented in any order, that there was no single, determinant way. This was because the factors interacted multi-dimensionally, like a living web of connections, rather than a linear path.

This analysis did not conceptualise the change process as a straight line or path, which led to the development of the metaphor of cartography and *mapping*, which aimed to capture the idea of multiple routes to the same place (an ICT integrative school) as a dynamic, active, alive and fluid process as the factors can interact in so many different ways (see section 8.2 for a fuller discussion of the process of mapping that attempts to capture the landscape of change in schools and table 6.2 that identifies the extent, or presence, of each factor known to affect ICT, for each school across the sample). It is not possible to determine in advance which factor or combination will work in which setting, as schools are complex social settings and what works in one, may not work in another, which is why the research highlights the need to attend to the cultural specificity of each school and their particular circumstances.

In order to understand more fully the way the variables or factors required for ICT integration may interact, the research discovered that the *process* of integration could be initiated by any factor, in any order, and link to any other factor, which led to the identification that the process is *iterative* and *cyclical*. The factors or strategies could then be conceived as a cycle of development (see figure 6.3). In this cycle, each component/process is highlighted and it is possible to start anywhere in the cycle;

whether that is with *vision, planning, implementing, evaluating or learning* with ICT. The point is that the process is dynamic (lived, situated and organic) rather than a static occurrence. The cycle represents the idea of growth and movement, which is open and able to keep tensions and performance in play and is not predetermined. For example, integrating ICT may start with the head's *vision* (leadership), or start with *implementing* technology hardware, or *planning* and *evaluating* teachers' CPD with ICT.

The following section illustrates by way of examples how these processes of interaction between the variables, both material and cultural, may be played out. To re-iterate, the focus of the research was predominantly on the processes within schools, which interacted to affect ICT development and integration. To understand one factor, like the quantity of *technology*, it was necessary to understand many factors, like enhanced *financial* aid attained as a Technology College, and, crucially, how these various factors are then linked.

To expand, as in the example above, this issue of technological infrastructure and finance, also links to *leadership*, as the decision to bid for Technology College status, and hence more money, was undertaken by school leaders. In turn, school leadership, if pro-ICT, then provided overall *support for ICT*, which was also a factor shown to influence the success (or not) of NOF training and *teachers' ICT CPD*. Where the school leadership team endorsed NOF ICT training programmes, it was more likely to be successful, a finding which is supported by the national evaluations of NOF (TTA, 2002; Preston, 2004). This illustrates how CPD is linked to leadership and how the factors are dynamically interrelated. (For a fuller discussion of the multidimensionality of the interactive relationships between the factors see section 6.2 in chapter 6).

Hence, the factors or variables interconnect and affect one another in an iterative relationship; for example, leadership, if supportive towards ICT, means ICT is more likely to be developed and valued, which generates both a school culture and ethos that is pro-ICT; financial commitment to ICT provides a technological infrastructure, which is a material variable needed, which can then generate the need for ICT training, to work the technology purchased (for example, IWBs), which links back into the ethos of valuing ICT for professional practice.

Interestingly, an earlier version of the map did initially contain 'national policy', that referred to Ofsted and, national curriculum and assessment requirements, however, the data pertaining to this was not easily identifiable as a factor that either aided or hindered ICT integration, due to the fact that teachers within the schools had mixed responses on this. The teachers had developed different strategies regarding the external demands of the curriculum and assessment, which was to avoid ICT (for exams at key stage 4), or integrate and embed ICT (into exam revision); see the respondent validation graph for curriculum and assessment, which shows the mixed responses and highlights the differing effect of this factor and how the range of mixed responses complicate 'one specific reading' for this in the map for table 6.2. This also links to the immediate discussion after the map (table 6.2) that attempts to highlight the problem regarding the representation of the data in a table, as it fails to capture the *complexity* inherent within the *relationships* both within and between the factors, in short, precisely how the variables interact, as the process is more akin to building a web with multiple routes (possibilities for interaction) rather than a linear path with determinate interactions.

Problematising the representation of the data: insufficient depiction of the complexity

The table 6.2 represents the factors teachers reported as most prominent in shaping ICT use. However, the table is overly simplistic and arguably too reductionist; it fails to capture the complexity of the situation for each school. Each factor is reduced to a key point that fails to engage with the subtly of variation that is incorporated by it, that is the multiplicity *within* each factor and fails to represent the multidimensionality *between* factors.

Take, for example, the head's vision: out of all the schools, heads of school A and F had the most *prominent* ICT vision, yet whilst the head of school A had a clear *vision* for ICT and was *supportive* of ICT in principle, she did not, however, *model* ICT use. The head of F enacted all three (was visionary, supportive and modelled use), whereas the head of school D did none, although a Technology College. Similarly, the distributive leadership component that referred to leading by example, is over simplified, within a school some senior leaders did model ICT use and some did not; consequently the analysis represents what was observed to be the case for the majority, which formed a generalised culture of use amongst senior school leaders.

Also, it is overly simplistic to categorise a school as more or less ICT integrative, because there were pockets of integrative practice within a school, rather than the whole school or every department being fully embedded in ICT practice. For example, school A had international ICT status as part of the European Network of Innovative Schools (ENIS), but there were some departments that had embedded ICT use (science) whilst others had very little (Geography). Similarly school G, with respect to ICT infrastructure had a fantastic new block with a highly integrative MFL department, with ample ICT, whilst for the rest of school there was not sufficient ICT and hence little integration. Consequently, the research found a great deal of variation between departments within the *same* school, as well as across different schools.

Departmental Culture: dynamics of effective implementation

The departments with most ICT integration were all found to have specific *strategies* that aided teachers' use of ICT. These departments had the following cultural dynamics:

1. A departmental *planning policy*: to integrate ICT into schemes of work (in ways that satisfied the National Curriculum and assisted in meeting learning objectives, whilst ensuring use was selective and appropriate)

2. *ICT Training*: to take account of and build up teachers' levels of technological expertise and confidence (leading role taken by HODs, ICT reps, ASTs, who all displayed devolved or distributed leadership with ICT)

3. *Evaluation*: critical reflection, to constantly evaluate the contribution of ICT and its role in enhancing classroom practice (this formed part of an on-going discursive dynamic; formally in department meetings and informally in shared social spaces).

These findings support Hennessy *et al.*, 's (2005) observations for successful ICT integration in departments regarding the deployment of an ICT policy, training and evaluation. However, this research indicated that it is the combination of the three strategies that is crucial, generating a culture around ICT use, sufficient to establish a community of practice, since one strategy in isolation, namely inserting ICT into a Scheme of Work (SoW), was not sufficient to guarantee that teachers did use ICT. For example, a teacher from school D identified that in satisfying Ofsted criteria, ICT had been inserted into their SoW, but this was a paper exercise only; operationalised solely at the point of lesson observation during inspection: not *before* or *after*. Such honesty highlights how embedded ICT practice, rather than isolated uses, forms a continual part of an active community of practice with ICT, as it is a lived experience that continues, irrespective of Ofsted (and pressures of an external audit culture) - for teachers the cultural dynamics of their department constitutes their daily, situated practices and become a 'way of life'.

As Dalin argued (1993, p113) changes in the school culture have to with values and norms, and 'the first rule is to *live the norms*'. Or, to take Wittgenstein's (1953) assertion of the importance of culture as shaping habitualised practice, such situated experiences become a '*way of life*'. Consequently, a community of practice is the locus of change that captures the multidimensionality and complexity of interconnectedness between the strategies. The significance of communities of practice for integrating ICT is discussed in the next chapter.

6.5 SUMMARY

The research identified a number of factors upon which ICT integration is contingent. Although each factor revealed a range of responses from teachers, from positive to negative, the main finding was that the vast majority of teachers wanted to use ICT and saw its potential. This begged the question; what facilitates teachers' realising this goal and what hinders it? The analysis found that some factors were necessary, like school leadership in implementing ICT, although on its own it was not sufficient. More importantly, what emerged was the need for the key factors to be developed alongside one another as they were inextricably interconnected in complex and dynamic ways, not in any pre-determined order; rather it was the combining of both material and cultural factors that facilitated ICT implementation.

The research found there was variation in the degree of integration at the level of the school and this related to the presence or absence of the particular factors identified, like leadership support for ICT. Previous research has tried to explain variation in terms of (a) a collection of - usually separate - factors and (b) in terms of the individuated responses of teachers. This study takes these analyses an important stage further by examining the interrelationship between factors and in revealing that integration is strongly related not to an individuated, but a collective response, which is defined by departmental culture, but not necessarily related to subject culture. These departmental cultures share the characteristics of 'communities of practice', the practice in question being ICT, not the curriculum subject.

So, more specifically, the research examined teachers' integration of ICT and identified the key factors that supported and hindered teachers' use and found the *barriers* to using ICT for *subject teaching* in secondary schools included *a lack of time* and *training*; lack of adequate *access* to technology; *unreliability* of equipment, and pressure from national assessment strategies and an emphasis on delivery of a content-led statutory curriculum.

Clearly what the research demonstrates is that is it a *combination* of factors that are critical to the integration of ICT, and managing the multidimensionality of the factors, namely abundant *technology*, which provides *access,* alongside *technical support*, with hands-on *training*. Consequently, the research led to developing an understanding of the *complexity* and *multidimensionality* of implementing ICT policy in schools, which can facilitate managing change at the local level and enable schools to become more ICT integrative. An understanding of the multidimensionality outlines *how* schools can *progress,* by attending to both the material and cultural aspects of policy implementation.

However, a critical additional finding was that even where schools had developed successful pathways, such as school A and F, which were nationally recognised as leading edge with ICT, even within these highly integrative schools, integration was still found to be very inconsistent and varied.

The research found that even within schools that had implemented multiple pathways and provided the necessary material and cultural conditions conducive to integration, (ICT leadership, ethos and infrastructure) integration was still very patchy between departments. So although the most ICT integrative schools had provided departments with the necessary material and cultural conditions, integration did not automatically occur. Rather, where ICT was found to be fully integrated in departments, there was also a community of practice, which emerged as the *critical* determinant shaping the degree and extent of ICT integration.

The next chapter considers in detail the significance of communities of practice for integrating ICT into teachers' professional practice.

CHAPTER 7
THE SIGNIFICANCE OF COMMUNITIES OF PRACTICE FOR INTEGRATING ICT

7.0 INTRODUCTION

The research found that even within the most ICT integrative schools, integration was still patchy; across departments ICT integration was inconsistent and highly variable. Yet these ICT-rich schools have provided departments with the necessary material and cultural conditions for implementing ICT; visionary leadership, supportive ICT ethos, ample and appropriate technology, yet these conducive conditions still did not automatically lead to integration. Where integration was found (within and across schools) there was also consistently found to be a community of practice, which marshalled all of the conditions above, hence such conditions are necessary, but not sufficient: without teachers in departments mutually engaging in developing ICT as a joint enterprise, which critically led to the most embedded uses of ICT. Correspondingly, the absence of communities of practice in departments, even in the most integrative schools, explains that even with the necessary conditions in place, such conditions are not sufficient.

Consequently, the research found even in the most ICT integrative schools, integration was not consistent, hence whilst necessary factors like leadership provided opportunities, ethos and the conditions conducive to integration, integration does not automatically occur because of it. Rather the critical determinant was found to be the existence (and corresponding absence) of a community of practice in relation to ICT, which were found within departments in schools that also provided the necessary material and cultural conditions for enabling integration. However, having the necessary enabling factors did not inevitably lead to integration. Unless departments activated communities of practice in relation to ICT, ICT was unlikely to be systematically used and developed.

This chapter therefore outlines the significant of communities of practice in the implementation of ICT. Communities of practice and the intersecting relationships between them, from government level down to school level are identified and in particular how communities of practice in schools form the nexus of change with ICT. The chapter explains that for an ICT community of practice to be realised, there are particular material and cultural conditions that need to be in place, which are outlined and pertain to the importance of leadership for ICT and ICT resourcing. At the heart of a community of practice for ICT was teachers' situated learning within departments, which led to the collaborative development of an e-pedagogy. In addition to identifying departmental communities of practice, which were situated and real, the research also identified distributed and virtual communities of practice, which were particularly beneficial to headteachers and the strategic development of whole school ICT.

7.1 UNDERSTANDING ICT INTEGRATION AS PARTICIPATION IN A COMMUNITY OF PRACTICE

The most pertinent framework for analysis was derived from Lave and Wenger's concept of a 'community of practice' (1991), which was furthered developed by Wenger (1998). Wenger's model provides an analysis of the constituent parts of a 'community of practice', which he describes as 'a special type of community'. Wenger outlines three dimensions of practice which are the property of a community: mutual engagement, joint enterprise and shared repertoire (1998, p72-85). Evidence of all three dimensions were found in the departments that had integrated ICT the most. This led to the identification of those departments as constituting a community of practice in relation to ICT, which emerged as the most significant explanatory factor that accounted for departmental *variation* regarding ICT integration. The dimensions are as follows:

Mutual Engagement: this involves all members of the group working together and engaging in shared work practices. Members build up relationships through working together and 'connect meaningfully...to the contributions and knowledge of others' (Wenger, 1998, p75-6). The teachers constituted members that worked together in a department, with the shared work practices of teaching their curriculum subject using ICT.

Joint enterprise: this involves members negotiating their joint endeavour. The participants create their shared purpose in the process of pursuing it. 'It is their negotiated response to their situation and thus belongs to them in a profound sense, in spite of all the forces and influences that are beyond their control'; the enterprise is joint 'in that it is communally negotiated' (Wenger, 1998, pp77-82). Joint enterprise is 'a process, not just a static agreement'. It is shaped by the participants 'as they pursue it', in the course of 'creating relations of mutual accountability' (ibid.).

Clearly teachers create their shared purpose in the delivery of their subject using ICT as a joint enterprise. Mutual accountability exists on two levels: at the level of teachers in the department being responsible for the departments overall attainment levels (e.g. Year 11 GCSE results), and also at the level of developing ICT activities to enhance that, whereby ICT resources are developed and adapted jointly. ICT resources are created *by* teachers *for* teachers: for use by *each other*: mutuality.

Similarly teachers developing ICT is a 'negotiated response to their situation, in spite of all the forces and influences that are beyond their control', for example, the national curriculum and the pressures of external performance measures, imposed by government 'beyond their control'.

Shared repertoire: this includes the routines, words, stories and actions that have been developed by the group in the course of working together. This shared repertoire is, however, dynamic: it 'reflects a history of mutual engagement' - colleagues bring with them their own repertoires and are continually shaping new repertoires as they work with one another (Wenger, 1998, pp82-84).

Teachers created repertoires as they worked collaboratively (e.g. teaching Year 9 heart function) and built *specific repertoires around ICT* as they developed ICT communally, sharing what worked in their class and what did not (e.g. Year 9 CD-ROM animated simulation of heart function, with an online interactive test, with a class set of laptops worked well with pupils).

Wenger (1998) acknowledges the inherent ambiguities in any group of individuals who bring their own unique histories and cultures to their shared work practices. To create shared meanings and mutual empathy, the group needs its own stock of shared stories, experiences and jokes. Wenger also acknowledges the importance of differences and conflicts as creative components of community of practice in general.

Again, teachers in the departments had started to build their own histories of teaching with ICT. For example, teachers exchanged differences between teaching Year 9 bottom set, compared to top set and how ICT can be used to calm down noisy afternoon bottom sets by closing the curtains and using PowerPoint presentations. Similarly, Year 7 MFL teachers had a shared repertoire of developing games on the IWB for pupils' interactive oral exercises and how effective this was for generating engagement and what to do when the IWB crashes and malfunctions.

The usefulness of this model, as with all models, lay in providing a framework that could be used to analyse the complexity of ICT implementation and identify the cultural dynamics of those departments that clearly had embedded ICT use.

Relationships Between Communities of Practice: within and beyond the school

Having outlined Wenger's (1998) constituent parts of a community of practice and recognising that teachers as a professional grouping within a department could be seen as constituting one, it is important to note that communities of practice in relation to ICT could also be found beyond the school. There are groups of professionals at government policy level and regional level working to implement ICT and these can be seen to form a community of practice in relation to ICT too.

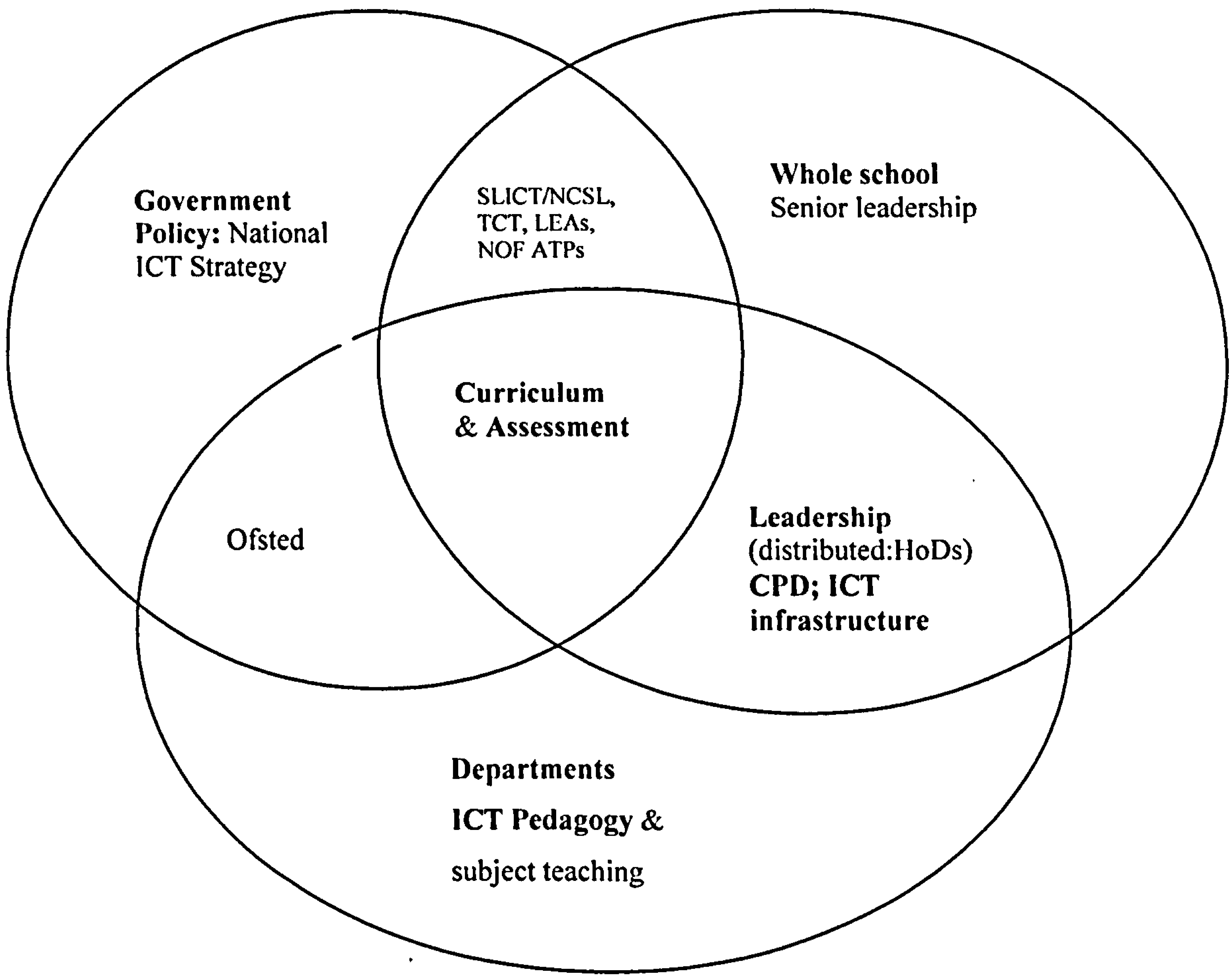
The process of implementing government policy on ICT, this process is mediated through a number of strata: from macro agencies (DfES), meso agencies (LEAs), down to individual schools and teachers at the micro level. Each of these stratas, which are actively working to incorporate ICT into education, can be conceived as entailing a community of practice in relation to ICT. There are groups of professionals at government policy level, regional level and school level, within these strata, developing

ICT and these operate with a degree of separateness. Yet these separate communities of practice are also connected to each other in the implementation process and their relationships are best represented in a Venn diagram (see figure 7.1).

Each circle in the Venn diagram represents a community of practice, which is defined by their socio-cultural activity in relation to ICT and education. Each has its own focus, norms, values and ways of articulating and representing the world, ways of perceiving ICT and in that sense constitute a culture and community of practice. The relationships between the communities of practice are *dynamic* and *multidimensional.*

The need to develop more *active inter-relationships* between these communities of practice is an important finding from evaluating the implementation of the national ICT strategy. The government's national ICT strategy was an ambitious, multi-agency initiative that was unprecedented in its scope and vision. However, the multi-agency approach inevitably fractured the roll out of the national strategy, because ICT expertise and leadership within and between agencies was largely absence or underdeveloped at the time (DfES, 2001; Ofsted, 2001). Leadership at regional and national levels between education and commercial ICT sectors was insufficiently joined up, which heightened the need to develop more *effective operational relations between* the different groups operating at macro, meso and micro levels. A key lesson has been the urgent need to build networks to mange the multi-agency aspects of the national strategy in order to share and develop ICT expertise, in short to develop cross-organisational communities of practice.

Figure 7.1 Relationships between Communities of Practice



The research identified that one, *communities of practice* were found to be operating as situated and real, *and* distributed and virtual. Second, the *relationships* between different communities of practice were a *factor shaping* the implementation of ICT in schools; that is the *intersecting* of communities of practice generated a space and an opportunity to open up and engage with ways of using ICT in a productive dialogue that formed the discursive dynamic at the heart of communities of practice. Third, in the *local* contextualisation of national policy for ICT, the most significant relationships were between departmental communities of practice and whole-school leadership teams. Fourth, what differentiated the departments (in relation to ICT integration) was the strength of the *community of practice* between the teachers, in relation to ICT.

Departments could have strong a community of practice in relation to their subject teaching, but little in relation to using ICT for subject teaching. The analysis identified, the stronger a community of practice in relation to ICT in a department, the greater the ICT integration.

Interestingly, Triggs and John (2004) also explored the relationships between intersecting communities of practice, in their case between researchers and practitioners so that effective pedagogy with ICT could be understood and developed.
Triggs and John (2004) argued that their InterActive Education Research Project brought into 'being a new space where teachers and researchers could work together...to find ways of using ICT' (p426) and in this they illustrated how micro, meso and macro communities interconnected to create settings for improved professional development, the purpose of which 'was to challenge the linearity embedded in much of the professional development processes associated with ICT' (p426).

Triggs and John (2004) argued that the intersecting of communities of practice created a productive dialogue between researchers and practitioners that 'enabled professional knowledge to be generated and transformed' (p438). However, interestingly, Triggs and John (2004) hypothesised that secondary subject departments 'might be catalysts in creating communities of practice around ICT' (p436), but that the project teachers 'resisted this'; rather the teachers' engagement was 'directed outward from school' (p436) to meetings with university-based researchers.

In relation to this study, Triggs and John's (2004) research reflects interesting areas of commonality regarding a multi-layered analysis of communities of practice (from macro to micro) and interestingly areas of difference, regarding the locale of communities of practice with respect to departments, which did not emerge in the ways they had originally anticipated. This perhaps illustrates the organic and unpredictable nature of communities of practice such that their engendering is contingent upon an array of factors that cannot be prescribed apriori.

With respect to this research, departments clearly formed the location and nexus for communities of practice that enabled professional knowledge to be generated and engendered the pedagogical development of ICT.

7.2 DEPARTMENTS GENERATING COMMUNITIES OF PRACTICE: THE LOCUS OF CHANGE

This section considers the ways in which departments generate communities of practice in relation to ICT and how these form the locus of change. This will involve an analysis of factors internal and external to departments that facilitate the creation of communities of practice.

First, within secondary schools, the most prominent patterns of ICT integration were found at *department level*, rather than at an individual teacher level. ICT tended to be used, or not used, *within* departments, which reflected a general culture of practice towards ICT between teachers. This is not to deny subtle variations between teachers, but overall, it was possible to categorise departments along a continuum as either, integrating or not integrating ICT.

This is not to deny a more complex picture, where in some departments, sole ICT innovators were operating; however, their solitary existence in a department *did not in itself* guarantee that colleagues would integrate ICT. The lone ICT enthusiast was not a sufficient condition for colleagues within the same department to embrace ICT. Something more had to be in place, namely a *collective endeavour* with ICT, where ICT was jointly *valued* and this could be *operationalised* with sufficient/ample technology (material culture was accessible). When ICT became a shared activity between teachers, a community of practice could be identified.

In the departments that could be identified as having a community of practice *with ICT*, common characteristics were found that were evident across each department, even in different schools. These were, first, an ICT supportive *leadership*, was central to driving ICT within the departments and this came from the HOD (or lead ICT teacher/change agent, but usually the HOD, though not exclusively so); significantly these leaders were 'structurally' and materially empowered to realise their vision for ICT (given money and resources), *because* ICT was also *supported* by the *school leadership team* (responsible for allocating resources). HODs clearly had a *vision* with ICT, which became shared with teachers within the departments. Second, HODs *modelled ICT use* and *led by example*; giving a clear cultural signal that ICT was valued. Third, HODs *provided JIT training*, proactively in department meeting/training times and on demand, when requested by teachers. Fourth, HODs actively encouraged a departmental culture of *sharing practice with ICT*, through multiple dissemination mechanisms. Fifth, all of the above *actively combined* to strongly support teachers' professional learning with ICT, and consequently ICT practices evolved as 'shared histories of learning' (Wenger, 1998, p87).

The above analysis illustrates how factors internal and external to departments *interacted* to facilitate a community of practice for ICT. For example, factors *internal* to a department, like the role of ICT leadership from the HOD, and interacted with factors *external* to the department like the school's ICT resourcing and senior school leadership. This highlighted the interplay between factors within and beyond the department that affect a department's positioning towards ICT.

Departmental Communities of Practice and the Locus of Change

Departments are situated in the school structure between the (upper) senior leadership team and (lower) individual classroom teachers, forming an organisational unit that engenders professional groupings of teachers that form collective responses to policy initiatives.

.The research found that across secondary schools the 'locus of change' was often the department. However, this was not exclusively so. For example, the Key Stage 3 (KS3) Learning Base at school F, was cross-curricular rather than department based and formed a unit of change. However, this was in an advanced ICT school where there was shared culture about ICT in operation beyond department level, and the KS3 team of teachers could be identified as a community of practice organised around a Key Stage.

Significantly, with the exception above, the research found that it was communities of practice in departments that formed the locus of change with ICT in secondary schools.

Departments: leading from the middle to generate communities of practice

The distinguishing cultural dynamics of the departments with the most embedded use of ICT was clearly a supportive and collaborative approach to the development of ICT, which could be identified as a community of practice in relation to ICT. This is taken to mean a *culture of activity with ICT* that is independent of the curriculum subject, since the distinguishing features were found to be in operation across different subjects.

It is necessary to analyse the specific cultural dynamics of the most ICT embedded departments, because ICT was habitually used as normative practice in these cases. Interestingly, teachers in these departments could all recall their recent history that did *not* involve ICT, which therefore meant there was an emergent *narrative and shared history* of incorporating ICT into departmental practice as a joint endeavour (Wenger, 1998).

Such departments had a distinctive, collaborative learning culture where teachers learned together through just-in-time training, as teachers created new knowledge collegially about what works with ICT and what doesn't. These teachers demonstrated 'mutual engagement' with ICT and 'connected meaningfully...to the contributions and knowledge of others' (Wenger, 1998, p75-6).

In the most ICT embedded departments, there was a *culture of activity* with ICT, a *shared repertoire*, which was an expression of the department's collective mind or pedagogic identity and positioning to ICT. The research found three key components regarding the cultural dynamics of these departments: one, ICT was *valued collectively* (affective component); two, teachers *jointly believed* ICT enhanced professional practice (cognitive component) and three, teachers *communally developed and used ICT* (behavioural component).

In short, the above can be seen to constitute a community of practice around ICT (since the three specified components are shared and collegially enacted), which further develops what Desforges (1995) argues is necessary for educational change. Desforges (1995) argues that successful change in education pays particular attention to the 'features of organisations which are essential to the sustenance of learning', which are: 'visionary leadership and dense communication networks affording many opportunities for discussion of ideas' (Desforges, 1995, p397).

Communities of Practice: cultures of collaboration

Dalin (1993, p100) argues 'it is very hard to describe a culture. What we can see is how people are *behaving*'. In the communities of practices identified, one behavioural element that emerged very strongly was the mutual supportiveness between teachers as they shared their resources and discussed collaboratively how to develop ICT *for* their department; their joint pedagogic purpose of enhancing subject attainment for their department and their mutual accountability.

Those departments that displayed attributes of a community of practice, demonstrated a *'culture of collaboration'*, which Nias *et al.,* (1989) identified as openness, trust, interdependence and valuing individuals, and in the research, departments with these were found to be more likely to develop and integrate ICT. Similarly, increased *collegiality* within subject departments, resulting from a sense of shared purpose in producing plans and appropriate resources for delivering the curriculum, was found by Cooper and McIntyre (1996) and Donnelly (2000), which this research also found aided ICT implementation.

However, it was only in those departments where ICT was embraced by the HOD *and* the senior management team (SMT) of the school; where the latter's support in *conjunction* with the HOD was crucial, because of the cultural endorsement of the *value of ICT* from the school leaders. Again this illustrates the multidimensionality of the factors and their dynamic interconnectedness. For example, it was found that collegiality *within* departments *interacted* with the wider school ethos on ICT from senior leadership. This highlights the interconnectedness between factors and how they affect communities of practice. Hence, combined leadership at SMT and department level were necessary conditions for teachers to embrace ICT and develop a community of practice, but only *if* there was also access to ample technology. Where leadership of the school strongly supported ICT there was a significant investment in ICT, which ensured sufficient technology, such that the conditions at a material level were right to allow a community of practice to develop. However, sufficient materiality regarding ICT was not enough to ensure that communities of practices did develop in each department, if it was without leadership and support from the HOD (or equivalent ICT leader in the department, like an AST in ICT or ICT rep).

This outlines the multi-dimensional relationships between material and cultural factors, which need to co-exist and be in place for integration to occur beyond a haphazard inconsistency and move into systemic implementation - that is routine and regular use of ICT by teachers. What clearly facilitated implementation was the emergence of an active community of practice. Departments that worked collaboratively constituted more conducive contexts for the integration of ICT into subject teaching. This is important as it can help explain the high levels of variation found between teachers and departments within the same school and across different schools. Within the same school, variation can be accounted for by HODS that do not value ICT and therefore do not engender a culture of ICT pedagogy within their subject, although other departments in the *same* school may do. Hence, even in the most ICT integrative schools, where the necessary material conditions (abundant technology) and cultural conditions (supportive senior leadership) are in place, variation was still found at departmental levels that was accountable in terms of an active or absent community of practice in relation to ICT for subject teaching.

The research, having identified communities of practice as the locus of change, also needs to outline how these are engendered, in order for other schools to consider developing. As Scrimshaw (2004) observed, prior research studies fail to specify the steps and procedures teachers and schools need to take, in particular the multi-dimensionality of strategies, which provide the necessary materiality and cultural ethos for ICT, which includes the situated learning within a community of practice to effect change with ICT. For example, with respect to ICT for pedagogical purposes, what emerged as key was teachers belonging to a department that had the following characteristics or cultural dynamics, in short, a community of practice: i) *leadership* with *vision*, which provided direction and valued ICT, which resulted in a shared departmental *ICT cultural ethos;* ii) leadership that gave *JIT ICT training* and encouraged sharing ICT resources, which resulted in an ethos of mutual support and collaborative learning; iii) *technology infrastructure*, which gave necessary and sufficient materiality, to enable teachers to pedagogically engage ICT in the classroom; iv) departmental *communication strategies* that were sufficiently dense and developed to share ICT ideas, through the formal meeting structures (e.g. as a standing item on the agenda) and informally, through shared social spaces (discussions over coffee / lunches in offices): a discursive dynamic around ICT.

The multi-dimensionality of the above strategies engendered a community of practice in relation to ICT that clearly shaped teachers' mutual engagement, joint enterprise and shared repertoire with ICT. This was analysed in different departments across different schools, which suggests that it is the existence of a community of practice in relation to ICT that is the key factor in explaining how these teachers became pedagogically accomplished with ICT. Where teachers in other departments were not using ICT, clearly they could not draw on the inextricably connected social, material and cultural relations identified in those communities of practice that had effectively embedded ICT. It was both the *existence* of communities of practice where ICT was embedded *and* the *absence* of the very characteristics that form a community of practice (cultural dynamics) that were *missing* in the cases where ICT failed to be used.

Characteristics of Departmental Communities of Practice

Below is a summary of the characteristics of departments that had embedded use and were identified as having a community of practice. The characteristics were:

1) *leadership* that provided clear vision and commitment to using ICT across the department, i.e. ICT direction, which was manifested by:

   a) HODs that *modelled ICT use* (led by example); culturally signifying that ICT was valued.
   b) HODs providing *JIT training*, i) proactively in department training sessions and ii) reactively on demand, when requested by teachers.
2) HODs activated *sharing ICT practice* between teachers, which engendered departmental collegiality and collaboration (i.e. mutual engagement, joint enterprise, shared repertoire.) This was achieved through the following strategies:
   a) Formally: in department meetings; as a standing agenda item, this enabled the dissemination and evaluation of ICT developments.
   b) Informally: dialogues in shared office spaces, during non-contact times, engendering a colligate discursive dynamics in relation to ICT.
   c) sharing ICT resources; variety of distribution mechanisms, so teachers could adapt, evaluate and feedback at department meetings, in an iterative process of ICT development for subject teaching.
3) the cyclical dynamic of this discursive, iterative process engendered discovery, learning, and ownership, whereby ICT practices evolved as shared histories; highlighting the social dimension of teachers' learning.

The above characteristics signify the cultural dynamics of those departments that actively implemented ICT into their pedagogic practice and could be identified as a community of practice in relation to ICT. It is significant that this occurred at departmental level, as this reflects the core organisational unit within secondary schools. At the heart of departmental communities of practice was teachers' learning, as a joint enterprise, reflecting mutual engagement and engendering a departmental shared repertoire.

Engendering Change With ICT: situated learning within a community of practice

The analysis of a community of practice as critical to implementing ICT led to the further identification that teachers' learning about ICT is really an issue of *re-learning* (since these experienced teachers have already learnt their craft: the skills of teaching their subject). What ICT integration challenges is the re-learning of their subject teaching in a different way, which may supplement, extend or transform their pedagogy, to use McCormick and Scrimshaw's (2001) three-tiered analysis.

To illuminate, the 'learning process' can be seen to involve a discovery process, which is complex and cyclic. It may involve a re-discovery of a teacher's values. Change with ICT was best achieved when teachers were part of the discovery process, which happened with just-in-time training. The change process is a learning process, dependent on practical experiences (as teachers learn new ICT applications and apply them to their professional practice), feedback and discussion (interactions about what works) and mobilisation of a steadily growing number of participants. The concept of community of practice is important, because moving from the periphery to the centre of the community involves learning, whereby Lave and Wenger's (1991) conceptualisation of the process of learning, de-centres the learning process, from a simple 'internalisation' model to a socially constructed process.

Re-learning in the context of a community of practice is about *discovery*, learning and *renewal*, in a community of colleagues through discussion, interaction and possibly contestation, which leads to a sense of *ownership* regarding changes with ICT: 'discovery depends on a gradual development of a sense of ownership among users towards ideas and new practice' (Dalin, 1993, p15). In fact, Dalin (1993) argues that change can only occur 'when the individuals involved trust each other and gradually open up and discuss realities'(p14) and he argues that the motivation and involvement of staff do not develop automatically; 'they develop gradually as we open up, trust each other, and feel membership in the group' (ibid.). Arguably this occurred in communities of practice observed in the research and attest to the fact that

> changes in the culture of a group take time. There must be a gradual process of developing openness and trust, which helps a group to become more sensitive and effective as a group. (Op. cit. p112)

Teachers' ICT learning was situated within the collective, cultural dynamics of departments, which changed the culture of the department towards ICT, hence the research identified change as involving *learning;* so changing schools and changing practice is a learning process, and as Dalin (1993) perceptively argued, 'ad hoc and piece meal efforts at change are inadequate. What is needed is *systemic change* that involves a fundamental cultural change' (p1-2).

The research indicates that change (ICT integration) does not necessarily occur when it is *imposed.* Schools have been systematically re-structured in light of educational reforms for decades, but as Fullan (1993, p49) astutely observed, to '*re-structure is not to re-culture*'. Culture is about teachers and their values and changing values is not easy, because it is not possible without teachers' *ownership* of those proposed changes. Through mutual engagement and joint activity, the collaborative element engenders shared ownership:

> If the teachers involved in the change process do not master the new practice, it is more difficult for them to develop a sense of ownership. The ability and possibility of teachers to master new practice is vital for their motivation and for the success of the learning process. (Dalin, 1993, p14)

Whereas mastery has often been seen as a grasp of *technical* skills, this research highlights that it is more than that; it is collaborative learning as a *joint* activity, to learn *with* each other - *for* each other; to draw on the strengths of the participants in the community of practice: 'change is a collective process, one that demands partnership and collaboration' (Dalin, 1993, p20).

What is important to note is that the change process does not start with 'stating the objectives' as Dalin (1993) claims is often advocated by management strategies, rather change starts with *growing uneasiness about practice.* Loveless' (2001) research into ICT was fuelled by that very observation. The view that there maybe something better was clearly part of the vision that leaders and change agents had about ICT. However, implementing vision requires a multiplicity of approaches; the development of simultaneous strategies both material and cultural that culminate in a dynamic that creates change. So, what were the dynamics within departments with active communities of practice that created change?

What effective departmental strategies engendered was clearly a collaborative culture for ICT. The cultural dynamics of departments with communities of practice for ICT for their subject teaching were: sharing ICT practice, engendering collegiality to develop ICT that is communally negotiated, with mutual accountability, which clearly accords with Wenger's (1998) dimensions of a community of practice.

With respect to sharing ICT practice between teachers within departments, three specific strategies emerged that enabled this, which activated 'shared histories' of collaborative learning and developed a, departmental 'way of life' with ICT (Wittgenstein, 1953), in short, a *culture*. The first strategy was formally: in department meetings; as a standing item on the agenda, for information/resource sharing, discussion, reflection and evaluation. A second informal strategy was talking in between meetings; in teachers' social spaces that afforded a *collegial discursive dynamic* that was teachers' evolving histories and narratives with ICT; their shared, lived experiences with ICT use. This was where stories were told, repertoires were created and learning was shared; teachers' ICT practice engendered into *collective memory;* the growing of roots/routes, though not necessarily determinate in any way, which came to form a creative, collegiate, discursive dynamic. Third, teachers actively shared resources, through a variety of dissemination *mechanisms*, so teachers could comment on, adapt and improve the resources: as a constitutive, joint, iterative process of learning to integrate ICT into practice, which engendered collaborative resource development and formed part of the department's joint enterprise.

The only other research to consider the importance of learning within a community of practice, albeit not departments in secondary schools, was Loveless (2001), who examined a primary school through the lens of Wenger's (1998) concepts of participation and reification. Participation refers to the interaction between active, collaborative, social relations in practice and reification as the abstraction of experiences into 'things'. Loveless (2001) argues that the reification of ICT in education can be seen in its presentation in the National Curriculum Statutory Orders and QCA schemes of work. Interestingly, Loveless' research discovered how actual ICT use was 'being created and experienced through active, collaborative and exploratory practice rather than followed from the reified abstraction of ICT' in official documents (2001, p258). This research strongly supports this and found that Wenger's (1998) duality between participation and reification tipped the balance towards participation, in that it was also engagement with activities and interactions that promoted the development of practice with ICT. Crucially it was this that effected teachers' pedagogy with ICT, which is examined in more detail below.

7.3 PEDAGOGY AND ICT: SITUATED COMMUNITIES OF PRACTICE

What emerged as significant regarding the development of an e-pedagogy was a departmental community of practice. The development of e-resources amongst teachers, as a joint enterprise, engendered an ethos of sharing and support and modelled best practice. This strategy was most prominent in those departments that could be identified as having developed a strong community of practice with ICT, irrespective of the curriculum subject taught. What differentiated such departments was the high level of *collaboration* amongst teachers who were creating new knowledge *together* about how to use ICT in the classroom (a communally constructivist approach to pedagogical change with ICT, which there is not the scope in this context to expand upon (see Holmes, *et al.*, 2001; Leask and Younie, 2001; Scrimshaw 2001).

Importantly pedagogical development appeared to be aligned to the *strength* of the community of practice in relation to *ICT*; that is, the extent of the activities of the department in terms of enhancing classroom practices with ICT. Other departments may have had strong communities of practice in relation to teaching their curriculum subject, but not in relation to ICT – for that subject.

Subject Cultures and ICT Pedagogy: the significance of departmental communities of practice

The research literature reports that some curriculum subjects lend themselves more readily to ICT than others and that this explains the variation in ICT use. Hence subject affinity to ICT is an explanatory factor that accounts for why ICT may be more integrated in some than others.

Hennessy *et al.*, (2002) argue that in fact little research has analysed how and why subject cultures differently affect teachers' use of ICT. Two studies (Goodson and

Mangan, 1995; Selwyn, 1999a) suggest that subject cultures are an important influence in explaining teachers' use of ICT, with respect to the history and heritage of the subject and how closely the cannon of the subject affiliates itself with technology. However, it is arguably the case that subject cultures are insufficient, as an analytical tool, to account for the change found in this research, because there is too much variation between the *same subject cultures* in *different schools.*

In this research, the subjects that demonstrated the most embedded use of ICT were science and MFL, and this was the case in three different schools (A, F, G): these two subjects repeatedly led the way. Whilst this could be accounted for through Goodson and Mangan's (1995) analysis, at the level of the subject, there are two fundamental weakness with this; first, it fails to account for differences between Science and MFL departments *beyond* this case study sample, which do not uniformly show an integration of ICT. Second, these subjects across all the case study schools do not show uniform developed use of ICT either. So, reference to the subject's alignment to ICT alone cannot stand as a theoretical explanation regarding variation in ICT integration between subjects.

The weakness of analysis at the level of curriculum subjects is that it fails to explain variation between different schools regarding the 'same subject'; how it is that across different schools some subjects have greatly integrated ICT in one school and not in another school; how it is that some science departments have significantly embedded ICT use, and other science departments, do not engage with ICT for subject teaching: it cannot be the subject alone that accounts for ICT use. For example, Hennessy *et al.*, (2002) found that science teachers tended not to integrate ICT, whereas in this research, two of the schools (A and F) both extolled science departments where ICT use was exemplary across all the teachers, but the explanation for these findings cannot be explained by reference to the *subject* of science, since in other schools science had not integrated ICT much (schools D, H, G). However, analysis can be offered at the level of 'a community of shared practice', that is teachers' culture and shared ICT practices at department level, rather than the specific *subject* taught within those departments

Whilst the research literature identified that some subject's 'cultural heritage' maybe more aligned to ICT than others (Selwyn 1999a), this research found that a subjects supposed affinity to ICT, is not *enough* to generate change on its own as a shaping factor: it cannot be the *subject alone* that accounts for the greater integration of ICT. Therefore what other factors (necessary and sufficient conditions) were analysed as being significant? This appeared to be the relationships between the teachers in the department, whereby the sharing of pedagogic activities with ICT, led to a greater use of ICT. This can be identified as a community of practice in relation to ICT use for pedagogic practice.

The *variation* between the same subjects in different schools in the research findings, suggests that it is *not* the subject that accounts for ICT use, because

i) Subjects that have been identified as more *aligned* to ICT (e.g. science) *varied* too greatly *between the schools* e.g. some science departments had high ICT integration (A and F) whilst others had little, even within a Technology College; for example, school D's science department had little integration. Even in a school that specialises in technology, there was still little use of ICT in science.

ii) Even with an aligned subject like science, there was *variation* within the *same school* (e.g. school A's Biology department, had the 'most integrated ICT I've ever seen' (ICT advisor 22/11/02), yet this was not the case in the same school for Chemistry or Physics: so neither the school nor the subject's heritage can explain the variation.

iii) Maths as a subject has a clear alignment to ICT and yet these departments were not found to be using ICT in as an integrated a manner as the science and MFL departments of the same schools.

iv) What can account for these findings, with regards to the *lack* of take up in Maths in all the schools, and Chemistry and Physics in school A, is a less developed community of practice in the department in relation to ICT. School A was ICT rich and had the necessary material conditions (technology infrastructure) and cultural conditions (supportive leadership) and yet some departments still had little ICT integration.

v) What can account for the departments with the most embedded use of ICT was an active community of practice in relation to ICT. The research found that it was the departmental culture which generated a community of practice for ICT, rather than the curriculum subject, which accounts for variation rather than the subject and its supposed alignment to technology.

vi) However, it may be the case that some subjects *may* lend themselves to this kind of departmental organisation more than others, so that departmental differences in terms of ICT integration, may be partly explained by a combination of subject culture – and the degree to which the subject content - lends itself to the integration of technology. This may be the case with MFL and Science as it was these departments *across* schools that displayed the most embedded use of ICT. (Although there were also schools where these subjects had little integration.)

Subject Teaching and Pedagogical Change with ICT

The research was conducted in a period of transition, as government policy on ICT was becoming operationalised at the local level in specific contexts. Prior research has revealed that changes in teachers' pedagogical thinking have tended to be slow and measured (Kerr, 1991; Hennessy *et al.,* 2002) where teachers' commitment to incorporating ICT was tempted by a 'cautious, critical approach to harnessing its potential' and 'a gradual process of pedagogic evolution appeared to be taking place' (op. cit., p1). This was also the case with this research and the majority of teachers; however, it was not exclusively the case. Where the most advanced examples of an e-pedagogy were found, the research identified an active community of practice in relation to ICT, which harnessed the crucial factors (material and cultural) that enabled such a development, such as ample technology, technical support and an ethos of collaborative ICT development. Communities of practice explain variation in ICT implementation more adequately than reference to the subjects' supposed cultural heritage and alignment to ICT.

7.4 LEADERSHIP: DEVELOPING A DISTRIBUTED COMMUNITY OF PRACTICE

In addition to identifying communities of practice in departments as situated and real and forming the locus of change, the research also identified other *types* of communities of practice, most notably distributed and virtual. The most prominent examples were found among headteachers. For example, the heads of the most ICT integrative schools were part of the Technology College Trust 'leadership network' (entitled VISION 20/20), which sought to connect heads at a national and international level. In short, this specialised group may be analysed as convening a community of practice in relation to school leadership and technology development. Notably this was a *distributed* community of practice that occasionally met face-to-face, engaged in school visits to witness exemplary ICT practice, including overseas visits, and communicated online; all of which facilitated vision building through sharing practice and encouraged a whole-school approach to ICT management and strategic planning.

The research found that effective school leaders were part of a wider ICT network beyond the school *and* understood the interrelationships between factors such that deployed multiple strategies for ICT implementation. However, such leadership strategies do not emerge in a vacuum, but rather through professional dialogue with other leaders: a collegiate, discursive dynamic. Yet research has shown headteachers are notoriously alone at the top.

The research literature on leadership identifies that first, school leaders are relatively isolated and second, effective school leaders embracing and supporting ICT 'are in short supply' (Comber and Lawson, 2003; Earley, Evans, Collarbone, Gold and Halpin, 2002). This may be due to the fact that opportunities for headteachers' professional development were very limited, particularly prior to the NCSL and the Strategic Leadership in ICT (SLICT) course launched in 2000. The headteacher of the lead case study school F was an early participant in SLICT.

The SLICT programme effectively provided headteachers, in their relatively solitary position, with an opportunity for professional development that specifically focused on developing a whole-school approach to ICT policy and strategic planning. This was achieved through a NCSL training model that incorporated a residential component and encouraged participants' communication between meetings, via a specially designed online environment (Lawson and Comber, 2004).

Essentially the structure of the model was to encourage sharing good practice, to establish contacts and 'networks for future collaboration, to consider and discuss practical steps for short- to medium-term initiatives and to engage in the setting of a 'vision' for longer-term developments' (op. cit., p150). This was achieved through visiting schools exemplifying good practice in the leadership of ICT and attending workshops that engendered discussion and reflection. A common thread throughout each element of the course was the opportunity to develop a discursive dialogue with fellow school leaders; regarded by the participants as a particular strength of the programme.

The online discussion element aimed to maintain momentum between the intermittent residential events and workshops, which clearly concurs with Wenger's (1998) notion of social energy. The strategies identified in the SLICT model and praised by the participants may be identified as strategies for *encouraging a distributed community of practice*, which aids isolated school leaders to develop strategic whole-school approaches to ICT development.

As the SLICT evaluations found, this model has had a 'significant and positive effect, increasing knowledge and understanding of the potential of ICT for both managerial and pedagogic developments [and] manifested itself in a recognition of the need for a whole-school approach to ICT development' (Lawson and Comber, 2004, p151). Hence, Lawson and Comber (2004) rightly identify those elements that enable school leaders to professionally develop, notably sharing practice, and yet, Lawson and Comber stop *just short* of recognising these activities as a community of practice, albeit a distributed one.

What distributed communities of practice would appear to afford school leaders are *transformational spaces* that enable an engendering of a discursive dynamic, which through sharing their practice, enables participants to think, reflect, evaluate and learn; for leaders to examine possibilities and thrash out actualities, whilst considering their specific school contexts regarding the pragmatics of implementing ICT.

The discursive dynamic of exploring possibilities with colleagues maybe an exciting fusion of creatively engaging with ideas that may, through support and articulation, enable potentialities to be realised, from their interactive conception, through to situated practice. Perhaps it is the creative space in communities of practice that affords a place for exploring novel ideas that exerts a freedom of expression away from the everyday constraints and pressures of schooling. Whilst these have to be worked out in practice (ideas and possibilities alongside contextual constraints) it is the germination of something *different* from that 'which is' that enables change to begin to come to life in a way that may lead to situated innovation amongst participants. Perhaps distributed communities of practice (like SLICT and VISION 20/20) allow a fracture in time and space from daily restraints to engage in expanding possibilities; a 'what if' philosophy of ICT development.

Consequently, communities of practice, whether these are distributed and virtual, or situated and real, may afford particular transformational spaces for the germination and creation of exciting new possibilities, which can culminate in the implementation of situated innovation with ICT. As Wenger (1998) argues 'a well-functioning community of practice is a good context to explore radically new insights without becoming fools or stuck in a dead end' (p214).

Loveless (2001) goes on to develop the concept of 'fracture' in relation to a community of practice, which arises from tension, anxiety and uncertainty in dealing with new ICT initiatives; such 'fractures' were 'experienced as challenging uncomfortable or frustrating, yet often led to changes in working practices' (p249). However, this research revealed practice had developed more from success and enthusiasm rather than fractures, which is not to deny the creative potential inherent in the latter. Interestingly, Loveless (2001, p243) similarly identified leadership, particularly vision and modelling as important factors affecting the community of practice in the primary school she researched.

Leadership and Activating a Community of Practice: school F case study

This research supports that of Lawson and Comber (2004) who identified *a distributed model of leadership* when examining effective leadership and whole-school ICT development. This was found in the most integrative schools, but was markedly more developed in school F. The headteacher was a participant in multiple distributed communities of practice (SLICT, VISION 20/20) and he actively encouraged an *in-school,* situated version of Vision 20/20. The focus was exactly the same; time to develop ICT, engage in 'futures thinking', innovate and provide opportunities for teachers (in their first five years of teaching) to push the boundaries of ICT capability across the school.

This was visionary of the head and clearly activated a distributed model of leadership, whereby the leading of ICT was pushed through the organisation at numerous levels within the school. This supportive head *recognised* the efforts of leading ICT practitioners (change agents) through rewards, in terms of finance and status; for example, appointing and remunerating ICT reps, ASTs in ICT and LRAs. This signalled a strong whole-school cultural ethos for ICT, which was actively supported with investment in the necessary (material) ICT infrastructure and activated a *distributed model of leadership* throughout the school.

7.5 SUMMARY

The research found that even in the most ICT integrative schools, which had the necessary material and cultural conditions conducive to integration, (distributed ICT leadership, supportive ethos and infrastructure) integration was still very patchy and varied considerably between departments. So although the most ICT integrative schools provided departments with the necessary material and cultural conditions, integration did not automatically occur. Rather the critical determinant was a community of practice in relation to ICT, because in every instance where integration was found (within and across schools) there was also consistently found to be a community of practice for ICT, which marshalled the necessary conditions (material and cultural) to develop ICT communally. Within each community of practice, there were teachers mutually engaging in developing ICT as a joint enterprise, which critically led to the most embedded uses of ICT. Correspondingly, the absence of communities of practice in departments, even in the most integrative schools, explains that even with the necessary conditions in place, such conditions were not sufficient, as ICT remained undeveloped in those departments. What more is needed, in addition to the necessary conditions, is a community of practice that actively and collectively develops ICT.

Within a community of practice, a key factor regarding implementation was the role of situated learning about ICT alongside *colleagues*, with opportunities for discussion and reflection. This accentuates the importance of the social dimension of teachers' learning and participating in a *community of practice* that enables dialogue, analysis and evaluation of new skills and knowledge, which constituted a departmental *discursive dynamic and culture* of ICT use.

In relation to prior research, much has been concerned with measuring the extent of ICT, which has identified specific technological factors, pertaining to technical support, access and training, however, very little research has analysed the role of situated learning and significance of belonging to a community of practice in relation to ICT; in short the *cultural dynamics of change* with ICT. Even where situated learning has been researched, in small scale qualitative studies, these have focused on individuated teacher responses, rather than teachers as professional groupings situated in active communities of practice negotiating their collective, mutual response to policy implementation.

This research offers the following contributions to new knowledge in the field of education and ICT implementation:

- First, *communities of practice* were found across the particular locations and time frames of the multiple case-study sites, which were identified as significant in affecting and effecting change in teachers' practice with ICT.

- Second, communities of practice (professional groupings of teachers) formed the *locus of change* regarding ICT implementation and were either situated and real, or distributed and virtual.
- Third, *distributed* communities of practice were significant in specifically enabling school leaders to develop ICT – strategically within their school.

The next chapter draws the research to a conclusion by considering the most important findings. This will involve a discussion of the contribution of the research to new knowledge in the field of education and ICT and suggests questions for further enquiry. The following chapter will also propose recommendations to policy makers, school leaders and practising teachers.

CHAPTER 8
CONCLUSIONS

8.0 INTRODUCTION

The research focused specifically on identifying the processes of government ICT policy implementation in schools and understanding *how* teachers come to integrate and embed ICT into their professional practice.

8.1 IMPLEMENTING GOVERNMENT ICT POLICY IN EDUCATION

The aim of the research was to examine the processes of policy implementation with respect to ICT in schools from 1997-2003, a period that encompassed Labour's seminal national ICT strategy, with NGfL and NOF. The research examined the implementation of government policy on ICT with a view to analysing the factors that affect policy uptake at the local level of the school. This was because despite significant investment of £3.54 billion in government ICT *initiatives* (with the NGfL and NOF), and government *policy intervention* (with Curriculum 2000 and statutory ICT orders), there was an identifiable *gap* between legislative requirements *and* the reality of what was happening in schools: the 'reality-rhetoric gap', identified by researchers and government agencies alike (DfES/Becta 2001, 2002; Loveless, 2005; Ofsted 2001, 2002, 2004; Opie and Fukuyo, 2000).

The research was undertaken to clarify: what factors influence the implementation of government ICT policies in schools and aid the integration of ICT into teachers' professional practice? This necessitated the identification of local factors that were influential in schools regarding the implementation of national ICT initiatives. The research entailed exploring *teachers' experiences* of implementing ICT and identifying the key issues pertaining to the integration of ICT and concomitant changes in teachers' professional practice.

Understanding the Process of Policy Implementation as Multidimensional and Dynamic

The research found government ICT policy initiatives had variable impact, as significant *differences* between schools were found, which necessitated an account of the disparities. The research identified the factors that contributed to the effectiveness of ICT implementation. It also identified those factors that had limiting effects, such as current curriculum and assessment formats, and the varying effectiveness of school leadership, quality of ICT training, amount of technical support, access to ICT resources and the robustness of the school's ICT infrastructure.

On a positive note, the research findings indicate that policy aims can be achieved by school leaders, if an awareness of the *complexity of the implementation process* is maintained, which necessitates an understanding of the fact that it is a fluid, non-linear, reiterative process in which the factors are dynamically inter-related: ICT needs to be implemented on multiple fronts, both *materially* in terms of an ICT infrastructure and *culturally* in terms of generating an ethos that values ICT for classroom practice. Attending to the multidimensionality of ICT policy implementation aids the management of the change process at the local level of the school. This allows for an understanding of the ways in which teachers interpret policy and engage in implementation of ICT at the local level, most significantly through communities of practice.

Attending to the complexity of policy implementation, with its multifarious factors and its consequent multidimensional nature is important. Any analyses of change that conceptualise ICT implementation in terms of over-simplified dichotomies, of either, assimilation and accommodation, or integration and resistance are inherently reductionist. Such analyses fails to capture the complexity of the *process* that defies essentialist readings of the situation, as it is more subtle and complex, and is better understood as situated interactions between teachers, which may form a community of practice in relation to ICT. The essentialist dualisms of earlier research are rejected in favour of understanding *teachers' positionings with ICT* as dynamic and fluid, in constant movement and interaction with their material and cultural context, and are subject to on-going change.

The Significance of Communities of Practice in Relation to ICT Policy Implementation

The research focused on teachers, not as individuals, but as professional groupings, which yielded communal or departmental positionings to shifting pressures and priorities as a joint negotiation and response to external government policies. What emerged as significant was the development of a 'community of practice' in relation to ICT policy implementation.

The research yielded an interesting *pattern* of implementation regarding how teachers integrated ICT policy. Where successful implementation was identified, it was located in those schools and subject departments that had active communities of practice *in relation to ICT*. Communities of practice were identified as professional groupings of teachers that were committed to developing pedagogical applications of ICT that were not dependent on the subject. Rather communities of practice were collaborative, joint enterprises between teachers mutually engaged in exploring the use of ICT for professional practice that involved sharing resources and developing ICT collegially.

The research found that what differentiated departments, irrespective of the curriculum subject taught, was the *collaboration* amongst teachers who were creating new pedagogic knowledge *together* about how to use ICT for their subject teaching; through *sharing* practice (ideas and resources) and providing 'just-in-time' learning of ICT applications for each other collegially. However, one caveat in the findings was that two subjects emerged as the most frequent and likely to engage with ICT for subject teaching; these were MFL and Science. To what extent this is to do with a) the nature of those curriculum subjects and b) the pedagogical preferences regarding the teaching and learning of those subjects, is a matter for further enquiry.

However, the subject alone is not enough to explain why some areas integrate ICT and others do not; reference to the subject's *alignment to ICT* cannot stand as an explanation regarding variation in ICT integration between subjects. A subject's supposed affinity to ICT, is *not enough* to generate change on its own as a shaping factor, because not *all* the science or MFL departments were integrating ICT, only in some schools was this case, not all schools in the sample.

The weakness of analysis at the level of curriculum subjects, is that it fails to explain *variation* between different schools of the *same subject*; how it is that across different schools specific subjects have greatly integrated ICT in one school and not in another. For example, some science departments had significantly embedded ICT use and other science departments had not engaged with ICT for subject teaching: it cannot be the subject alone that accounts for ICT use. However, analysis can be offered at the level of 'a community of shared practice', that is teachers' shared practices and culture at department level, rather than the specific *subject* taught within those departments. It cannot be the *subject alone* that accounts for the greater integration of ICT, rather it appeared to be the relationships between the teachers in the department, whereby the sharing of pedagogic activities with ICT, led to a greater use of ICT. This can be identified as a community of practice in relation to ICT use for classroom practice.

Most research has failed to capture the complexity of teachers' experiences as they engage with ICT. The problem is that teachers are overly conceptualised in an *individualised* relationship to change emanating from policy. Consequently the analysis fails to see teachers negotiating, *through mutual interaction,* their response to change. Such analysis fails to attend to the discursive dynamics of teachers' positionings in relation to policy changes, whereby teachers' learning (since learning is at the heart of change) is socially constructed through dialogue (joint endeavour) as teachers negotiate new meanings about ICT for professional practice and create new knowledge about pedagogical uses of ICT for their subject.

Given that teachers reposition themselves (in relation to educational change) through engagement in a community of practice, *research that has conceptualised the process as individuated responses, has lacked the multi-dimensional analysis that such complex situated positionings require.* This analysis identifies that the picture is more complex than the 'either/or' dichotomy of assimilation or resistance; rather teachers engage and reposition themselves with ICT through participation in a community of practice that keeps tensions and movements in play in response to shifting contexts and priorities as teachers create new meanings about change in a process of departmental/situated activity.

Key Findings and Recommendations

In relation to **curriculum and assessment** the investigation revealed how:

- assessment strategies and pressure on attainment resulted in teachers at Key Stage 4 choosing either, not to use ICT for exam preparation or, to use ICT as an aid to support attainment, therefore, to a certain extent
- an audit culture puts pressure on teachers to meet external measures of effectiveness through the public performance indicators of exams and inspection, which, in turn, shape (influence and affect) teachers' use of ICT.

Teachers tended to adopt either an avoidance strategy of not using ICT for final exam classes or an integration strategy where ICT was used to support exam classes. Teachers in the latter category did request that assessment strategies should take account of the skills and knowledge afforded by ICT in different subjects across the curriculum and develop assessment formats that enable pupils to demonstrate learning gains with ICT. This could encourage the 'avoidance' teachers that stuck to didactic teaching of subject content for external exams to explore the use of ICT to facilitate learning and teaching in their subject. This leads to recommendation number 1. Those responsible for assessment strategies may wish to consider:

- whether current assessment formats measure achievement in such a way as to encourage schools and teachers to integrate ICT into subject teaching
- definitions of achievement in the light of learning opportunities offered using ICT and to consider new modes of assessment that take account of multi-modal learning with ICT.

In relation to schools' **ICT infrastructure** and **technical support**, the research found that:

- having *ICT technicians* for technical support was critical to the use of ICT by teachers; particularly sufficient numbers of qualified ICT technicians that were readily *available* to support teachers' *classroom* use of ICT.

This suggests that access to ICT technicians ameliorates teachers' concerns over ICT failure in a classroom setting, as technical unreliability discourages teachers' pedagogical integration of ICT. This leads to recommendation number 2. Those responsible for whole school ICT development may wish to consider:

- ways to secure *funding* for employing sufficient numbers of qualified ICT technicians in order to provide support for teachers' classroom use of ICT;
- the *recruitment* and *retention* of ICT technicians through an accredited professional development programme, specifically for technicians, for example, Becta's Technical Framework or CISCO's Networking qualification.

In relation to schools' **technology resources**, the investigation revealed that:

- teachers' access to *readily available* and *reliable* ICT was critical to the integration of ICT.

The research indicated that teachers were a) willing to learn how to use ICT professionally (pre/post lessons) and b) integrate ICT into classroom practice, if teachers could a) learn on their own *computer* and b) had *access* to ICT in lessons that was *reliable*.

The research suggests that ICT integration required teachers' possession of portable technology. Teachers needed *ownership* (exclusive and permanent access to a machine) with portability, which afforded flexibility. Since context shapes teachers' requirements for ICT, it is important not to be prescriptive in the *type* of technology, as the research indicates that ought to be the prerogative of the teacher who can best determine their ICT equipment needs in accordance with their local specificity. The research also suggests that for pedagogical application, i.e. use in the classroom with pupils, teachers critically needed readily available access to reliable ICT. This leads to recommendation number 3. Those responsible for equipping schools with ICT resources may wish to consider:

- ways to secure and prioritise funds for teachers' ownership of portable ICT and,
- having *access* to *reliable* ICT resources at the time of need for teachers to use with pupils. This is an ideal, which is yet to be realised for all teachers across all curriculum subjects.

In relation to **teachers' professional development**, the research illustrated that:

- teachers learnt most effectively how to use ICT *informally* through *colleagues*,
- operating with a *'just-in-time'* learning strategy.

This suggests that teachers need time for *collegial* professional development and leads to recommendation number 4. Those responsible for teachers' continuing professional development and ICT training may wish to consider:

- creating and protecting time for departments to provide informal, collegial, just-in-time learning with ICT.

In relation to **pedagogy and subject teaching**, the research highlighted that:

- departments with teachers that worked *collaboratively* to develop ICT for subject teaching constituted more conducive contexts for the integration and embedding of ICT: through *sharing practice* and the collegial creation of new ICT pedagogic knowledge; in short, through communities of practice *active in relation to ICT*, which were *not subject dependent.*

(New is taken as a *relative* term with specific reference to the teachers' previous, situated pedagogic knowledge; not 'new' in any absolutist terms, which would require an identification of Rorty's (1991) 'sky hooks', i.e. reference terms for measuring newness beyond an immediate localised context.)

The research suggests that teachers collegially need opportunities to develop and disseminate learning outcomes from their professional development with ICT with respect to the pedagogical application of ICT for subject teaching. This leads to recommendation number 5. Those responsible for teachers' integration of ICT into subject teaching may wish to consider:

- ways to facilitate the widespread dissemination of new pedagogical practices for teachers on how to use ICT to support subject teaching, which is critical to integration of ICT across the curriculum.
- policy makers may wish to consider what incentives there are for teachers to change practice.

In relation to **communities of practice**, the research indicated that:

- a key factor influencing the take up of ICT was the community of practice within which the teacher operated.
- other dimensions not included in previous research on ICT in education, such as school culture, communities of practice and the social dimension of teachers' learning / professional development are critical to the integration of ICT.
- the above enabled an understanding of the *differences* in ICT integration between teachers and departments within the *same* school and across *different* schools: *inter and intra-school variation.*

The research revealed that the presence of a *supportive school culture* towards ICT, *active communities of practice* in relation to ICT and *collaborative learning* about ICT were critical to the integration of ICT into teachers' professional practice. Teachers need opportunities (time and space) to reflect and develop their practice *collegially*, as communities of practice in relation to ICT for subject teaching, as a joint endeavour, not isolated experience. When teachers experienced this, teachers were more likely to *embed* ICT use into professional practice. As Ofsted (2001) had pertinently observed:

> There has been little or no systematic *networking* of leading teachers and schools to ensure a sound basis for supporting the development of effective subject pedagogy using ICT. As a consequence, teachers with particular interests and expertise too often operate in *isolation* and lack the stimulus of *professional dialogue.* (Ofsted, 2001. p21) (emphasis added)

This leads to recommendation number 6. Policy makers and school leaders responsible for integrating ICT, may wish to consider ways to:

- stimulate, encourage, and sustain communities of practice in relation to ICT.

In relation to **leadership and school culture**, the research revealed that:

- School *leadership* and *cultural ethos* that promoted ICT use was essential to whole school ICT development and the integration of ICT into teachers' professional practice.

The research highlighted leadership teams that modelled ICT use had a whole school ICT focus and developed *whole school strategies* that encouraged the *material* and *cultural* integration of ICT through: providing ICT *resources, technical support*, which secured technical *reliability* and actively endorsing ICT *training*. A school wide ICT ethos was more likely to *engender* ICT use as the necessary material *and* cultural conditions were in place to facilitate ICT integration. This leads to recommendation number 7. Those responsible for whole school ICT development may wish to consider:

- promoting a *school culture* that encourages teachers to use ICT for professional practice, by
- modelling ICT use, whereby leaders (and other key change agents, like Heads of Departments) integrate ICT into their professional practice.

In relation to the **management of change** and **school culture**, the research revealed that:

- the ability of the school *leadership* team to manage the *multifarious* factors involved in ICT policy implementation, both material and cultural, was a requirement for successful whole school ICT development.
- school leadership teams with ICT vision and expertise (through internal and external/distributed *communities of practice*) enabled the management of the multi-dimensionality of change, that is, the dynamic inter-relatedness between the necessary material and cultural conditions for integrating ICT.
- inversely, failure to manage the multifarious conditions required for whole school ICT policy implementation and, account for the multi-dimensionality of change with ICT, explained *inter-school variation*, i.e. why some schools had less ICT integration (when other critical factors, like finance, were even).

Schools with less ICT development had leadership teams that lacked ICT vision, expertise and access/participation in a community of practice about ICT.

The research suggests that the complexity involved in implementing the government's national ICT policy, which is multidimensional, requires ICT vision and expertise that may not be internal to the school, which therefore requires access to an external network of ICT expertise; a *distributed community of practice*. This leads to recommendation number 8. Policy makers may wish to consider ways of:

- enhancing schools' internal ICT expertise, needed for managing the multifarious factors of ICT policy implementation at the local level,
- enhancing external ICT expertise (operational relations across multiple agencies e.g. DfES, LEA, ICT suppliers and schools: macro, meso and micro respectively), through
- encouraging, stimulating and sustaining *situated* and *distributed* communities of practice in relation to ICT leadership (i.e. enhancing expertise), to support implementing the government's national ICT strategy.

8.2 CRITICAL REFLECTIONS ON THE RESEARCH METHODOLOGY

The research was undertaken following a grounded theory approach that utilised multiple case studies, in which data was collected using mixed methods. However, there are some important limitations that need to be considered regarding the disadvantages of; first, grounded theory and second, the use of multiple case studies.

First, on critical reflection, grounded theory did not lend itself to precise planning. This was because it started out as an exploratory investigation that used 'theoretical sampling', which meant that it was impossible to predict in advance the eventual *size* of the sample. Due to its *emergent design*, which is a core tenant of a grounded theory approach, this made the ability to *plan all aspects* of the research in advance very difficult. Similarly, because of the need to exhaust the similarities and differences between the emergent categories, that is to saturate the categories, this took time and exactly how long could not be predicted, hence it was hard to anticipate when the research was to be completed.

Second, with grounded theory it was important to be aware of the tendency within this approach to separate the explanation of the situation being studied from broader factors, such as political, social, economic contexts, which may have been vital to explaining the phenomenon. Within a grounded theory approach there is the predisposition or inclination to focus on the particular cases at the expense, or to the exclusion, of other broader, yet significant contextual factors than may impact on the particular cases under study, for example, globalisation or immigration; hence it is necessary to be aware of this predilection when using a grounded theory approach.

Third, the use of grounded theory is open to the critique that it is overly 'empiricist'. The use of fieldwork data as the source of a final analysis and framework can be seen to rely far too heavily on the empirical data, that is, 'expecting to find an explanation within the accumulation of data' (Denscombe, 2003, p128). Consequently, this inductive approach can be accused of being rather naïve about the complex relationship between theory and data collection and the way it expects researchers to approach the data without the use of prior theories and concepts. Grounded theory is then open to the critique that it is 'inherently limited by its dogmatic exclusion of other kinds of theory and alternative strategies designed to generate theories from data' (ibid.).

Similarly, the use of multiple case studies is open to a number of criticisms that warrant consideration. The first is that by attending to the *processes* within the case study settings and attempting to understand how these are interrelated, the danger was not to pay due attention to the *outcomes* of these; the results and end-products at times had restricted attention due to focusing on unravelling the complexities of each given situation and school. Second, by relying on qualitative data and interpretive methods, the findings did not produce measurable end-products that the more rigorous positivist, quantitative methods could have done. This links to the third critique, and arguably the most vulnerable point of criticism regarding the use of case studies, which is the charge, or lack of ability, to credibly make generalisations from the findings. Consequently, the case study approach may be charged with producing 'soft data', which is limited in its usefulness of applying the findings to other situations.

A fourth difficulty with the multiple case study approach and use of mixed methods was a pragmatic one regarding *boundaries*, that was deciding what sources of data to incorporate in the case study and which to exclude. On the technical side regarding this issue, and with hindsight, a critical reflection was that the interview data tended to be prioritised over other types of data, like photographs and observations that had been recorded. Importantly, a number of limitations have surfaced in this evaluation of the research methodology, which has warranted attention and consideration regarding the overall research.

One further and very significant issue concerns the 'generalisability of findings'. This relates to both grounded theory and case studies. Inherently, these approaches explore and develop theories rather than evaluate or test them in relation to the general population (of schools). The research, however, has generated possible hypotheses that lend themselves to further research using approaches orientated to the generalisability of findings.

Further Research

There are three areas emerging from the research, which may warrant further enquiry concerning leadership, communities of practice and the multidimensionality of policy implementation.

First, further research is needed to develop models of leadership in relation to implementing ICT, in particular further work is needed to explore distributed leadership. To further our conceptual understanding of leadership, research should be done to develop models, building on the knowledge of, for example, 'learning-centred leadership', in which leaders model behaviour and instigate in others distributed leadership through 'dialogue, monitoring and modelling' (Southworth, 2005). This could be supplemented by exploring West-Burnham's (2005) four-quadrant model for driving initiatives, which may yield an interesting synthesis of ideas for managing multidimensional initiatives in schools.

Second, the research identified the importance of communities of practice in relation to embedded use of ICT in departments. This aspect could initiate four further areas of investigation concerning 1) comparative research between departments with and without communities of practice; 2) the sustainability of existing communities of practice; 3) specific characteristics of highly active communities of practice with ICT and, 4) teachers' positionings within communities of practice that explore the dynamics of participation.

Firstly then, further research into the surrounding cultural context of communities of practice is needed to understand what supports or militates against the development of communities of practice in schools. There is the need for comparative studies of how communities of practice evolve and become maintained in different departments and subject areas. Specifically what characterises the surrounding contexts in which communities of practice become *realised.*

Research needs to be done in order to understand the ways in which communities of practice maybe fostered or constrained; identifying what are the opportunities and constrictions in the organisational structures of schools and departments regarding communities of practice. This necessitates identifying the material and cultural conditions needed for departments to develop communities of practice. For example, the research could explore the differences between cultures of departments that have communities of practice and those that do not. Given that departments with them were characterised by a collegiate culture, in departments where this was not the case, could these be identified as hierarchical or anarchic, as other research on educational cultures by Becher (2001) indicates - with his analysis of academic tribes and territories in higher education. Comparative research into school departments may identify the necessary surrounding cultural conditions, which can foster the emergence of communities of practice.

Second, in relation to understanding existing communities of practice, further research is needed to understand the processes of their sustainability; how do collegiate norms and values get maintained when membership changes. How does the culture inherent in communities of practice reproduce itself, which in turn requires an understanding of the relational dynamics and processes in which these are created and sustained.

Third, further research is needed to explore the specific characteristics of highly active communities of practice with ICT. For example, how communities of practice may vary in their strength, from stronger to weaker, which can be understood as varying levels of ICT activity and integration – or passivity and non-integration. This necessitates examining the processes that would enable communities of practice to become stronger.

Fourth, further research is needed on the way teachers are differently positioned in communities of practice. It maybe illuminating to investigate dimensions of identity and teacher positionings when examining; what the importance is of teachers occupying different roles within a community of practice. For example, within an established community of practice, not all members may operate with same level of commitment to developing ICT within the department; some teachers may occupy a central position and others may be more peripheral; what are the processes that would enable a teacher to move from the periphery to the centre. This necessitates researching the dynamics of participation of teachers in established communities of practice.

The third area for further research concerns the multidimensionality of ICT implementation in schools and models of whole-school change; research is needed to develop more sophisticated models that can capture the complexity of the processes involved, whilst attending to and keeping in play, movement, tension, fluidity, fractures and flows that create complex interactions in the process of policy implementation.

8.3 THE COMPLEX CULTURAL LANDSCAPES OF SCHOOLS: METAPHORS FOR UNDERSTANDING CHANGE

Previous research and much Becta research fails to account for the *cultural dimension of change*. The research shows that it is necessary to move away from overly technical, financial, micro-political and individuated teacher accounts of change, which privilege such factors and instead attend to the *culture* in which the processes of change are situated. It is more about understanding the complex *cultural landscapes of schools* – which encompass the material, social, political, and economic, but are not reducible to any one in particular. Rather, there is a complex interplay between these factors with all their attendant tensions, disparities and occasional contradictions.

This led to an interest in developing a metaphor for understanding the process of ICT policy implementation and change in schools; in particular creating novel metaphors to capture the complexity of the process and attendant multidimensionality (Younie, 2005b). Metaphors can be useful literary devices that help to encapsulate and illuminate the research findings.

Previous metaphors developed in the research literature on ICT and indeed this research, have included 'pathways/pathfinders' (DfES 2001, 2002). This metaphor partially captures the notion of schools creating routes to becoming ICT integrative schools. However, the use of the term 'path' masks the complexity of the process of change with ICT, by privileging both singularity and linearity with its connotations. 'Path' maybe a misleading term, because it assumes a 'step-by-step' process to achieving change, which fails to attend the divergent nature of change, which maybe more analogous to multiple intersections, like Spaghetti Junction. The terms 'routes/roots and maps' may be better as they implicitly indicate multiple routes, mis-directions, blind alleys, parallel processes and varied directions to the same place: an ICT integrative school. The dynamic process of engendering change with ICT is re-iterative, organic, fluid, without linearity, and in constant movement between all the necessary material and cultural factors required for integration.

Consequently, the development of a *cartography metaphor* aimed to highlight how the processes of implementation maybe analogous to creating maps, for orienteering, whereby multiple routes may lead to the same place, though crossing different terrains, in varying weather conditions. For example, it was harder for teachers to make headway against the Siberian winds of Ofsted if a school had been placed in special measures. Understanding the contours and climates of different terrains is like considering the cultural contexts of different schools. Where the terrain is impassable, it maybe necessary to *build bridges* and *cross boundaries*, to create communities of practice that engage in building knowledge together about what does and doesn't work for ICT integration.

However, this is not to deny the local specificity of the cultural dynamics of change, since transferability must be problematised, i.e. one map does not fit all; rather each school needs to find its own *routes* and be their own creative cartographers. However, schools can draw on the *roots* of others' experiences of the terrain of change management with ICT. Charting what works in particular circumstances under particular conditions can be a creative knowledge building process; like generating maps for territories in order to successfully navigate change.

Consequently; one way to understand how schools are creating change with ICT is through the metaphor of '*cultural cartography*', where schools can draw on the maps of other schools, but need to adapt them to the cultural specificity of their school. Secondly, there are leading schools, forging new frontiers where there maybe no maps; hence they are engaged in an '*imaginative cartography*'. This can be achieved through communities of practice, which afford 'situated innovation' through 'transformational spaces'. These affordances may carve new terrains of educational possibilities with ICT, where pioneering teachers engage in collaborative discursive dynamics that collegially develop ICT as a joint enterprise, as teachers experience relations of mutual accountability in their communities of practice.

Teachers were creating both situated and distributed communities of practice in relation to ICT. Communities of practice can create their own cultural cartography (maps for ICT policy implementation) and can share these (as wider distributed communities of practice), which can be a creative process like charting territories of possibilities with ICT, and the *applicability* of the ICT distributed knowledge lies with the *recipients* in their interpretation and adaptation of the knowledge to their own localised specificity.

Towards a Cultural Cartography for Understanding Change in Schools

The research identified the importance of communities of practice, but these need to be understood as part of a wider process regarding the cultural dynamics of change; the idea of mapping the complex contextual dynamics of schools led to the metaphor of cultural cartography and in examining the uniqueness of the metaphor, a search for the term was conducted. Reference to cultural cartography was found in America, though only in relation to Geography; in the UK only one reference was located in Health and no references at all in relation to Education. The metaphor of imaginative cartography was conceptualised completely independently, however, reference to this term was found in sociological discourse, although again - not in Education. Consequently, there appears to be scope to explore the explanatory value of the cartography metaphors in the field of educational change and technology and further research is recommended.

Critically, whilst the research identified key factors in the implementation of ICT, these were unfortunately separated out and represented in a rather atomistic manner. Consequently, the recommendations appear as individualised factors, however, it was not the case that if schools implement each factor, ICT use inevitably or automatically follows, because what the research found was far more complex. What is needed is a fusion of the recommendations, which could be contained in the concept of cultural cartography and provide a *broader synthesis* that enables educators to understand the more complex landscape of change in schools.

The one reference to cultural cartography found in Healthcare, by Pinder, Petchey, Shaw and Carter (2005), examined the use of pathways in the NHS and argued that a critical and processual understanding of pathways might contribute to a more informed appreciation of their potential (and their limitations) as mechanisms for healthcare policy implementation. However, Pinder *et al.*, (2005) also argue rightly that care pathways are predicated on a biomedical and essentialist model of the patient, which depicts 'a simple, idealised pathway… with single start- and end- points, without turnings or crossroads, or choice of routes' (p. 765), which 'systematically omit the plasticity of circumstances and lived experience' (p. 775), thereby simplifying the complexity of the process in an overtly reductionist way. This is also arguably the case with pathways in education, which omit the cultural dynamics and multidimensionality of the school context, which frames, shapes and interacts with teachers' daily, situated experiences as the space through policy is actively interpreted, negotiated and enacted. In critiquing the deployment of pathways, Pinder *et al.*, (2005) propose the use of cartography and argue it is important to differentiate between maps as objects, from map-making and map-ping as the creative process: contrasting the tool and practice. By mobilising the metaphor of cultural cartography, it is possible to move to understanding mapping and map use as processes of knowledge construction and approach dialectically as an interplay between maps as objects, the practice of map-making (the compiling of maps) and the process of reflecting on that practice (mapping) (Pinder *et al.*, 2005, p. 761). Whereas maps may be represented as 'consensual, orderly and discretely bound' (op. cit., p. 774), map-making and mapping are revealed to be both 'contested and imprecise' (ibid.).

Maps can be better understood as cultural objects, since critiques have exposed the contingent, arbitrary and mechanistic nature of the map. Since, 'there is no such thing as a purely objective map, one that reproduces a pre-existing reality. Choices always have to be made about what to represent and how, and what to leave out' (King, 1996, p.18, cited in Pinder *et al.*, 2005, p.760). Consequently, maps come to be increasingly understood as socio-cultural and political constructs, rather than mirrors of nature. This alerts us to attend to Ouroussoff's (2001, p.37) warning regarding the inability of rationalist frameworks to capture the subtle, imaginative and symbolic ways people have found to deal with inconsistencies and contradictions (cited in Pinder *et al.*, 2005, p.764).

There are tensions inherent in any attempt to fix processes and meanings that are always open-ended and contingent, hence Pinder *et al.*, (2005) develop the notion of a *process cartography,* which is conceptualised as 'open-ended, on-going, always leading to the next instance of mapping' – 'we know *as* we go, not *before* we go' (p. 775). This is precisely the point with an *imaginative cartography* where teachers in an active community of practice with ICT can engage with situated innovation in transformational spaces and attempt to capture the cultural dynamics of their experiences and performative processes. This, however, does not deny Scott's (1998) assertion that any social process or event will inevitably be far more complex than any schemata we can devise prospectively or retrospectively to map it, but rather alerts us to the need to be flexible and approximate, to keep movement and tension in play, because circumstances are subject to on-going change: ambiguous and contingent. There is the need to respond imaginatively to the inevitable unpredictabilities - hence the need to focus on cartography 'as process always in the making' (Pinder *et al.*, 2005, p.776).

As the education agenda with ICT enters a new phase of development, with schools moving from *access* to *building capacity* (DfES, 2005), an active cartography may help to capture the processes and their attendant multidimensionality. From this research, the findings of phase 1 and 2 indicated that teachers needed access, but, by the end of phase 2, teachers were starting to move to capacity building, most constructively through communities of practice. The mobilising metaphors of an imaginative and cultural cartography may provide a critically reflective way of understanding the processes inherent in active communities of practice, which are situated within the wider, complex, dynamic context that is schools, which constitutes the space through which teachers enact policy.

Summary: conclusions of the research

With the advent of the new Labour government in 1997, there was a wave of government initiatives designed to embed ICT use within schools, in particular the National Grid for Learning and NOF ICT training initiatives, which combined to form the first ever National Strategy for ICT in the history of UK schooling. However, evidence suggested that these ICT initiatives were not being embedded consistently or fully across schools (DfES, 2002; Ofsted, 2004). The research addressed this problem in order to gain a better understanding of why the implementation of ICT has been so 'patchy' (Becta, 2005).

The research acknowledged that implementing the government's National Strategy for ICT was a complex process and not a direct translation from policy to practice. Hence it was necessary to examine how policy becomes enacted through macro, meso and micro agencies; paying particular attention to schools as they form the space and context where policy is actually implemented in practice. However, schools are complex social settings that frame teachers' daily practice, therefore the research needed to examine this cultural context through which teachers mediate government initiatives and translate policy into practice at the delivery end.

To date, there have been very few studies on the cultural context of ICT implementation in schools. Rather prior research has focused on either measuring the impact and extent of ICT, as much previous large scale, quantitative research has done, or individual teacher motivation and perceptions of ICT, with which previous small scale qualitative research has done. Instead this research examined the organisational factors (cultural, social, material) in schools that affected teachers' uses of ICT, which hitherto has received little research attention.

The research identified key factors that supported and hindered teachers' use and found the *barriers* to using ICT for *subject teaching* in secondary schools included *a lack of time* and *training*; lack of adequate *access* to technology; *unreliability* of equipment, and pressure from national assessment strategies and an emphasis on delivery of a content-led statutory curriculum.

Importantly, what the research found was that is it a *combination* of factors that are critical to the integration of ICT, and managing the multidimensionality of the factors, namely abundant *technology*, which provides *access,* alongside *technical support*, with hands-on *training* and supportive *leadership.* These were identified as the necessary material and cultural conditions for implementing ICT. Consequently, the research led to developing an understanding of the *complexity* and *multidimensionality* of implementing ICT policy in schools, which can facilitate managing change at the local level and enable schools to become more ICT integrative. An understanding of the multidimensionality outlines *how* schools can *progress,* by attending to both the material and cultural aspects of policy implementation.

The research discovered there was considerable *variation* in the degree of integration of ICT *between schools* and this related to the presence or absence of the particular factors identified above, like leadership support for ICT. Previous research has tried to explain variation in terms of (a) a collection of - usually separate - factors and (b) in terms of the individuated responses of teachers. This study takes these analyses an important stage further by examining the interrelationship between factors and in revealing that integration is strongly related not to an individuated, but a collective response, which is defined by departmental culture, but not necessarily related to subject culture. These departmental cultures share the characteristics of 'communities of practice', the practice in question being ICT, not the curriculum subject.

In addition to the variation in ICT integration between schools, the research also found significant variation *within* schools. Even when the material and cultural conditions conducive to integrating ICT were in place, that is, even within the most ICT integrative schools, integration was still found to be very patchy; not all departments were implementing ICT to same degree; some were fully embedded, whilst others either did very little or none. Therefore even in technology-rich schools integration was highly variable and inconsistent. Consequently, integration does not automatically occur even when all the necessary material and cultural conditions required for integration are instigated across a school; such conditions are simply not sufficient, albeit necessary.

Rather the critical determinant was the existence of a community of practice; where integration was found, there was an active community of practice that developed ICT. These communities of practice were able to marshal the material and cultural conditions that the school provided in order to embed ICT into departmental practice, which in turn was not dependent on the subject taught, but rather a collaborative culture within that department. Crucially, these communities of practice generated a space and an opportunity to open up and engage with ways of using ICT, through a collegiate interactivity that engendered a productive dialogue and fusion of ideas; in short, a creative and discursive dynamic that formed the heart of these communities of practice. Consequently, what communities of practice may afford teachers are transformational spaces for the germination and creation of exciting new possibilities, which can culminate in the implementation of situated innovation with ICT and the embedding of ICT into teachers' everyday practice.

8.4 FINAL REMARKS

The research confirmed there is no simple translation of government ICT policy into teachers' professional practice. Findings from this research point to the importance of communities of practice; the social dimension of teachers' professional development and specific aspects of school culture (leadership, vision, shared ethos, training, ICT infrastructure) as critical to the integration of ICT. The research also indicates that these factors, particularly communities of practice, accounted for *variations* in the extent of integration between teachers and departments within the *same* school and across *different* schools, which can explain *inter* and *intra*-school variation in ICT policy implementation.

The findings point to positive aspects of policy implementation when an awareness of the complexity of the implementation process is maintained by school leaders and ICT is developed on multiple fronts: materially and culturally. *Managing* such multifarious complexity can be aided by ICT expertise afforded through *distributed* communities of practice external to the school. The thesis concludes that *embedding* government ICT policy within schools may depend on departmental, *situated* communities of practice, which are not dependent on the curriculum subject, but a collegial culture. Policy makers and school leaders may consider ways to stimulate, encourage and sustain communities of practice, which allows teachers to actively engage in the creation of new knowledge about ICT for professional practice.

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LIST OF ABBREVIATIONS

Both education provision in the U.K and ICT as a subject have developed their own shorthand in the form of specialised terms, acronyms and abbreviations. A list of those used in the thesis is included here for reference.

ATP: Approved Training Provider: An organisation approved to provide ICT training for teachers under the NOF national training programme. The training is funded by NOF (New Opportunities Fund) through allocations to schools. The training offered is quality assured by the TTA on behalf of NOF.

Becta: British Educational Communications and Technology Agency: A government agency assigned with responsibility for over seeing the implementation of ICT policy initiatives in education.

BERA: British Educational Research Association: A national academic association for educational research.

BESA: British Educational Suppliers Association: The national association of educational suppliers.

CD-ROM: Computer Disc-Read Only Memory: A computer disc that stores information that is 'read only'.

CPD: Continuing Professional Development: The term given to serving teachers' training needs.

Digital camera: A camera that stores photographs in digital format.

DfES: Department for Education and Skills: Government ministry assigned with responsibility for education policy in England and Wales.

EDSL: European Community Driving License: An internationally accredited computer training qualification.

EDSI: Education Departments' Superhighways Initiative: A national research report on the use of ICT in education; evaluating 28 pilot projects across the primary and secondary school sector and further education (1995-1997).

e-mail: Electronic Mail: The sending and receiving of messages via the Internet. Users who subscribe to the Internet are given unique addresses, which enable them to send messages to, and receive messages from, other users.

Hardware: A general term for referring to computers and, often, other peripheral devices such as printers that connect to computers.

ICT: Information and Communications Technology: The range of tools and techniques relating to computer-based hardware and software.

Infrastructure: The cabling and network components that enable computers to exchange information.

Internet: The worldwide 'network of networks' connected by telephone communication systems. The Internet enables the transfer of information such as text, pictures, databases and e-mail, and provides other services such as news.

ISP: Internet Service Provider: A commercial company, LEA or other institution, which provides 'gateway', access to Internet services.

Intranet: A restricted network that uses the style and search facilities of the Internet on information held locally within the network itself. An intranet usually has its own connection to the Internet in order to receive information.

Listserv: List Services, which are automated emailing lists.

LEA: Local Education Authority: local government agencies responsible for schools; regionally based and superseded by LAs (Local Authority) in 2006, when local authority education was amalgamated with local social services provision, to provide co-coordinated children services.

Managed Service: A service provision which looks after an entire segment of a school's ICT infrastructure and use, including the hardware, software, communications, links to the intranet (if any) and to external networks, as well as the provision of Internet and e-mail facilities. Such services are to be quality assured by the BECTa on behalf of the DfES.

NCSL: National College for School Leadership: Launched in 2000, the government set up the NSCL to address the specific continuing professional needs of headteachers and school leaders. A range of qualifications accredited by the NCSL have become established, including the National Professional Qualification for Headship (NPQH), which has since become a requirement for all new and serving headteachers.

NCET: National Council for Educational Technology: The government agency assigned with responsibility for educational technology in schools, superseded by Becta from April 1998.

NGfL: National Grid for Learning: Launched in March 1998, this was the government's key initiative for improving ICT provision in schools, developing a wide range of digital resources for teaching and learning and equipping teachers to be effective users of ICT.

Network: A network connects computers together so they can share the use of software and peripherals such as printers and access to the Internet. A school network is likely to be a LAN (local area network). A network connecting different buildings on a large campus or various schools/homes is a WAN (wide area network).

NOF: New Opportunity Fund: The funding body, which provided a national ICT Training programme for serving teachers and librarians, launched in April 1998.

Ofsted: Office for Standards in Education: The government agency assigned with responsibility for school inspections in England and Wales.

QCA: Qualifications and Curriculum Authority: A government agency assigned with responsibility for the national curriculum and qualifications in schools in England and Wales.

RM: Research Machines: A commercial ICT company that has specialised in providing hardware to schools and ICT training programmes for serving teachers.

SLICT: Strategic Leadership in ICT: An ICT professional training programme for headteachers accredited by the NCSL.

Software: The applications (or programs) which run on computers.

TTA: Teacher Training Agency: government agency assigned with responsibility for initial teacher training in England and Wales; superseded by the Training and Development Agency (TDA) in 2005, which has the above remit and additional responsibility for schools development, including serving teachers' continuing professional development.

APPENDICES

APPENDIX A	National Reports on ICT in Education
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APPENDIX A NATIONAL REPORTS ON ICT IN EDUCATION

Below is a shortened chronology of key reports that illustrates the development of ICT in education. Given the constraints of space, the table reflects the most significant policy documents and initiatives; the reports in bold are those referred to in chapter two.

1989	TROTTER REPORT	**TROTTER REPORT** Information Technology In Initial Teacher Training
1991	NC	NATIONAL CURRICULUM orders for ICT
1993	IMPACT 1	**IMPACT 1** REPORT Watson
1995	NCET	NCET REPORT Training Today's Teachers in ICT
1997	DfEE EDSI REPORT	**EDSI REPORT** *Preparing for the Information Age: Synoptic Report of the Education Departments' Superhighways Initiative.* Department for Education & Employment. London: HMSO
1997	DfEE	DfEE Survey of Information Technology in Schools 1996
1997	McKINSEY REPORT	**McKINSEY REPORT** *The Future of Information Technology in UK Schools.* McKinsey & Company: London.
1997	STEVENSON REPORT	**STEVENSON REPORT** Information and Communication Technology in UK schools
1997	SCAA REPORT	**SCAA** (School Curriculum and Assessment Authority) 'Information Technology, Communications and the Future Curriculum' International Conference Report
1997	OFSTED	OFSTED REPORT Information Technology In English Schools: a commentary on inspection findings 1995-6
1997	**DfEE (NGfL)**	**DfEE (NGfL)** *Connecting the Learning Society: National Grid for Learning; The Government's Consultation* Paper. London: HMSO
1998	**DfEE (NGfL)**	**DfEE (NGfL)** *Open for Learning, Open for Business.* London: HMSO
1998	**BECTA (NGfL)**	**BECTA (NGfL),** *Connecting Schools, Networking People: ICT Planning, Purchasing and Good Practice for the National Grid for Learning.* Coventry: Becta
1998	**DfEE (TTA) 4/98 ITT NC for ICT**	DfEE Teaching: high status, high standards - requirements for courses of initial teacher training. **Circular 4/98.** (Teacher Training Agency) (1998) Initial Teacher Training National Curriculum for the use of ICT in Subject Teaching (Annex B). London: TTA
1998	**BECTA REPORTS**	Becta 'ICT in Schools Research and Evaluation Series' First Phase Nos 1-10 (see list below)
2000	**DfEE/ QCA** Curriculum 2000	National Curriculum 2000 – ICT as a discrete subject was awarded core subject status and the *integration of ICT into other subject areas* was made *statutory.*
2001	**OFSTED**	Ofsted (2001). ICT in Schools: The Impact of Government Initiatives; An Interim Report April 2001. London, Ofsted. HMI 264

2001	DfES / Becta	NGfL Pathfinders: Preliminary Report on the roll-out of the NGfL Programme in ten Pathfinder LEAs.
2002	DfES	Transforming the Way We Learn: A Vision for the Future of ICT in Schools. London, HMSO.
2002	**OFSTED**	Ofsted (2002). ICT in Schools: Effect of Government Initiatives; Progress Report April 2002. London, Ofsted. HMI 423
2002	**TTA**	The New Opportunities Fund: Training for teachers and school librarians in the use of ICT; Progress review and lessons learned through the central quality assurance process in England.
2003	DfES	Fulfilling the Potential: Transforming teaching and learning through ICT in schools. London, HMSO.
2004	**Preston**	The Full Evaluation of the English NOF ICT Teacher Training Programme (1999-2003). Oxford, MirandaNet.
2004	**OFSTED**	ICT in Schools: The Impact of Government Initiatives Five Years On. London, Ofsted. HMI 2050
2005	**OFSTED**	Embedding ICT in Schools - a dual evaluation exercise. December 2005. London, Ofsted. HMI 2391
2005	DfES e-Strategy	Harnessing Technology: Transforming learning and Children's services. London, HMSO.

Key Evaluation Reports on Government ICT Initiatives in Education

Becta's 'ICT in Schools Research and Evaluation Series' First Phase: Nos 1-10

1. ImpaCT2 – Emerging Findings (DfES/0812/2001, Becta 2001)
2. NGfL Pathfinders – Preliminary Report (DfES/0813/2001, Becta 2001)
3. Computers for Teachers – Evaluation of Phase 1: Survey of Recipients (ISBN 1 84185 656 8, Becta 2001)
4. Using ICT to Enhance Home-School Links (ISBN 1 84185 655 X, Becta 2002)
5. Young People and ICT (DfES/0250/2002, Becta 2002)
6. Total Cost of Ownership (TCO): A Review of the Literature (web site only)
7. ImpaCT2 – The Impact of ICT on Pupil Learning And Attainment (DfES/0696/2002, Becta 2002)
8. ImpaCT2 – Learning at Home and School: Case Studies (DfES/0741/2002, Becta 2002)
9. ImpaCT2 – Pupils' and Teachers' Perceptions of ICT in education (DfES/0742/2002, Becta 2002)
10. NGfL Pathfinders – Synoptic Report (DfES/0743/2002, Becta 2002)

APPENDIX B ETHICS: INFORMED CONSENT

INFORMED CONSENT FOR RESEARCH

I would like you to participate in a study about the use of ICT by teachers. I want to investigate ICT implementation in education and understand how teachers come to use, or not use ICT in their professional practice.

Potential benefits from this study include providing an opportunity for you to:

- **reflect** on your professional practice with ICT in the classroom and to consider what factors help or prevent you from using ICT.
- to **work collaboratively** with a researcher regarding your professional development with ICT in the classroom.
- to enhance your **understanding** of the factors supporting and hindering teachers' use of ICT for teaching and learning.

To participate, you must agree to be interviewed either individually and/or in a small group, and to complete a questionnaire. There is also the possibility of classroom observation which is open to negotiation through mutual consent by yourself and the researcher.

Participation in this research is optional and should you initially agree you also have the right to withdraw at any time thereafter. Your participation in this study will not affect your standing in the school or the classroom. **Furthermore, your participation in this study is not in response to financial or other inducements.**

I will assign a number for your data and keep your data separate from this consent form. From then on you will be known only by your number. This will prevent anyone else from knowing your results. Therefore, all data will be anonymous and confidential.

I will also make my results available to you when I am finished with my study. If you are interested, contact me at the School of Education, De Montfort University, Leicester LE1 9BH, 0116 255 1551, email syounie@dmu.ac.uk **or contact my advisor** Dr James Atherton, School of Education, De Montfort University, Bedford MK41 9EA, 01234 793156, emailjamesa@dmu.ac.uk. **You can also contact us if you have questions about the study after you have participated.**

If you have read and understood these instructions, and you do not have any questions about them, please sign your name below.

If you do not understand these instructions, or you have questions about them that you want me to answer, please ask me now.

I volunteer to participate in this study entitled: The Integration of Information and Communications Technology (ICT) into Teachers' Professional Practice: the cultural dynamics of change.

Print participant's name here ....

Sign participant's name here ....

Sign researcher's name here ....

Date ....

Participant's number ....

APPENDIX C

INTERVIEW QUESTIONS

C-1 Interview Questions Set 1: researcher's prompts and probes

C-2 Interview Questions Set 2: teachers

C-3 Interview Questions Set 3: headteachers

C-4 Interview Questions Set 4: ICT Co-ordinators

C-1 INTERVIEW QUESTIONS SET 1: researcher's prompts and probes

Teacher Interview

The following questions will form the basis of our interview. The questions in bold are the main questions, the others are subsidiary/follow up questions. The interview may take place across two meetings, lasting approximately 30 minutes each. Thank you in advance for your time.

A. Personal information

1. Name
2. Gender
3. School
4. Years working in education
5. Years at this school
6. Title and responsibilities

B. Perspective on ICT innovation

7. **How would you define the main ICT innovations that have occurred?**
8. What are its main advantages/disadvantages?
9. Who is responsible for ICTs implementation here?
10. Whom does it affect?
11. How does it affect you?
12. What would happen to the school without it?
13. Is it dependent upon any single person or people to continue?
14. Could the resources needed for it be better used on something else?

C. Perspective on ICT value and use

15. **What do you consider to be the value and use of ICT for classroom practice?**
16. How do you use ICT in the classroom? (E-mail? WWW? PowerPoint? Etc.)
17. What role does ICT play in the school?
18. Are there incentives for more staff ICT use?
19. Do you feel under pressure to use ICT more?
20. What are its most positive/negative aspects and impacts?
21. Do you have a computer at home? Do you use it for preparing work?

D. History of ICT Implementation

22. **What, in your opinion, are the key issues for implementing ICT use in the classroom?**
23. Who initiated the ICT implementation?
24. Can you describe the characteristics/qualities of those who embraced it first/last?
25. What problems occurred in its implementation and how were they overcome?
26. Was there resistance to its adoption?
27. How was staff development handled?
28. Was it sufficient?

E. Maintenance of ICT

29. **What strategies/structures are in place to implement/maintain ICT use?**
30. What support is in place to keep it working?
31. How adequate is this support?
32. What expansions in ICT are planned or are needed?

F. School Culture

33. **How was the adoption/take up of ICT in the school communicated to you?**
34. How important is leadership in instigating change?
35. Are there any other key personnel involved, and how important are they?
36. How would you describe the culture of the school/dept in relation to ICT?
37. Have the innovations with ICT happened alongside other initiatives? Has ICT helped?
38. How do you see ICT affecting the ways staff work in your department?
39. Is ICT used for school administration?

G. Pupil use

40. **What work with ICT, if any, do you do in the classroom?**
41. Do you teach directly any ICT skills? If so, which and how often?
42. What is the general level of pupil ICT skills?
43. When can Pupils access computers in the school?

H. Professional Development with ICT

44. **Please describe the professional development activities that you have participated in.** (Where CPD was initiated, where it took place, was there any follow-up, incentives, or support; and if the knowledge gained was applied in practice.)
45. Specify how/where you have gained knowledge about ICT uses relevant to your teaching.
46. Describe any formal or informal learning and support systems in your school that help you learn more about ICT uses (e.g., mentoring in classroom, peer-coaching).
47. Are you planning any further training in ICT over the next 6 months?

I. Concluding ideas

48. **What would help you most to integrate ICT use in the classroom?**

Thank you very much for your time in participating in this research. Please do not hesitate to contact me if you have any queries regarding the research. My full contact details and that of my supervisors are on your copy of the ethical consent form. Thank you again, Sarah Younie, De Montfort University, email: syounie@dmu.ac.uk.

C-2 INTERVIEW QUESTIONS SET 2: teachers

Teacher Interview

The following questions will form the basis of our interview. The questions in bold are the main questions, the others are subsidiary/follow up questions. The interview may take place across two meetings, lasting approximately 30 minutes each. Thank you in advance for your time.

A. Background information
1. Name
2. Gender
3. School
4. Years working in education
5. Years at this school
6. Title and responsibilities

B. Perspective on ICT innovation
7. **How would you describe the main ICT innovations that have occurred?**

C. Perspective on ICT value and use
8. **What do you consider to be the value in using ICT for classroom practice?**

D. History of ICT Implementation
9. **What, in your opinion, are the key issues for implementing ICT use in the classroom?**

E. Maintenance of ICT
10. **What strategies/structures are in place to implement/maintain ICT use?**

F. School Culture
11. **How was the adoption/take up of ICT in the school communicated to you?**

G. Pupil use
12. **What work with ICT, if any, do you do in the classroom?**

H. Professional Development with ICT
13. **Please describe the ICT professional development that you have participated in.** (Where it took place, was there any follow-up, incentives, or support; and if the knowledge gained was helpful/applied in practice.)

I. Concluding ideas
14. **What would help you most to integrate ICT use in the classroom?**

Thank you very much for your time in participating in this research. Please do not hesitate to contact me if you have any queries regarding the research. My full contact details and that of my supervisors are on your copy of the ethical consent form. Thank you again, Sarah Younie, De Montfort University, email: syounie@dmu.ac.uk.

C-3 INTERVIEW QUESTIONS SET 3: Headteachers

Headteacher Interview

This interview centres on ICT innovation. The interview requires an hour. The questions are treated as open ended, and pursued according to the types of responses obtained.

A. Personal information
1. Name
2. Gender
3. School
4. Years working in education
5. Years as a Head
6. Years working at this school

B. Perspective on ICT innovation
Definition
7. How do you define the school's major innovation(s) with ICT over the past years?

History
8. Who initiated the ICT implementation?
9. What were the characteristics of those who embraced it first/last?
10. What problems occurred and how were they overcome?
11. What staff development was done?

Value and Use
12. What role does ICT play in the school?
13. What are its most positive/negative aspects and impacts?
14. Who gains the most/least from it?
15. How dependent is the school on ICT?

Maintenance
16. What special resources are required to maintain it?
17. What support is in place to keep it working?
18. How is this support paid for?
19. What else would be done with these resources if ICT disappeared?
20. How dependent is it on a single person or small group of people?
21. Can it work at other schools?
22. Will it be here three years from now?
23. What expansions in ICT or its support are planned or needed?

Teacher and student use
24. How effective are teachers with ICT?
25. What are the most common uses?
26. What percentage of teachers have computers at home?
27. What home school links do you have?

D. Professional Development

28. Please describe the professional development activities that you have participated in. (where CPD was initiated, where it took place, was there any follow-up, incentives, or support; and if the knowledge gained was applied in practice.)
29. Specify how/where you have gained knowledge about ICT uses relevant to your headship work.
30. Describe any formal or informal learning and support systems in your school that help the staff learn more about ICT uses (e.g., mentoring in classroom, peer-coaching).
31. Are you planning any further training for yourself in ICT over the next 6 months?

E. Concluding ideas

32. How could ICT be used more effectively?
33. Do you have a vision for ICT & the school in the future?

Thank you very much for your time in participating in this research. Please do not hesitate to contact me if you have any queries regarding the research. My full contact details and that of my supervisors are on your copy of the ethical consent form. Thank you again, Sarah Younie, De Montfort University, email: syounie@dmu.ac.uk.

C-4 INTERVIEW QUESTIONS Set 4: ICT Co-ordinators

ICT Co-ordinator Interview

The following questions will form the basis of our interview. These questions act as a supplement the teacher interview questions, in appendix B. This interview focuses specifically on your management role and your perceptions of innovation and change in your school. The interview will last approximately 30 minutes. **Thank you** in advance for your time.

A. School ICT strategy
1. What is the school strategy in relation to ICT integration across the curriculum?
2. How was the strategy formulated?
3. Who was involved in drawing up the strategy?
4. What do you see as the short and long term priorities of the strategy?

B. School structures
5. What structures do you have in place to implement ICT across the curriculum?
6. Have you utilised existing structures, if so in what way?
7. What structures have you had to develop?

C. Leadership
8. How important is leadership in instigating change & in maintaining the momentum of change?
9. Are there any other key personnel positions in this specific change process?
10. How have you formalised the processes and procedures for ICT integration across the curriculum? What are the specific issues?

D. Culture
11. In relation to the culture of your school and its departments, have you adopted a particular style to foster change?
12. Could you describe that style?
13. How does that style relate to the broader culture and department cultures of your school?

14. Finally, do you have any documentation that would help me to understand your process of change?

Thank you very much for your time in participating in this research. Please do not hesitate to contact me if you have any queries regarding the research. My full contact details and that of my supervisors are on your copy of the ethical consent form. Thank you again, Sarah Younie, De Montfort University, email: syounie@dmu.ac.uk.

APPENDIX D

OBSERVATION FORMS

D-1 Observation Form 1: classroom lessons

D-2 Observation Form 2: whole school - outside of classroom

D-1 OBSERVATION FORM 1: classroom lessons

Classroom Observation Form 1

This form provided a codified observation record that was systematically used across schools in the multiple-site case studies.

Background data

1. School	
2. Date	
3. Name of teacher(s)	
4. Classroom	
5. Year of pupils	
6. Subject(s)	
7. Level (if appropriate)	
8. Number of pupils	
9. learning Support Assistants	
10. Other non-students	
11. Organisation of classroom (rows, small groups, etc.)	
Notes – background information	
Additional material to collect	

Organisation of lesson — Extent of activity: 0 = none, 5 = to a high degree

12. Teacher lead	
13 Groupwork	
14. Pupils working in pairs	
15. Pupils working individually	
16. Pupils presenting own material	
Notes: pedagogic organization of *work*	
Additional material to collect	

Interaction / communication — Extent of activity: 0 = none, 5 = to a high degree

17. Teacher giving information	
18. Teacher directing questions and answers session - factual recall	

19. Teacher directing conversation - general discussion session	
20. Pupils directing discussion with pupils or teacher	
21. Teacher stimulating reflections or other critical analysis	
Notes: pedagogic organization of *teacher/pupil interactions*	
Additional material to collect	

Use of ICT Extent of activity: 0 = none, 5 = to a high degree

22. Teacher using ICT	
23. Pupils using ICT individually, initiated by teacher	
24. Pupils using ICT in collaborative tasks, initiated by the teacher	
25. Pupils using ICT individually, initiated by themselves	
26. Pupils using ICT in collaborative tasks, initiated by themselves	
27. Pupils interacting via ICT initiated by the teacher	
28. Pupils interacting via ICT initiated by themselves	
29. Pupils creating by using ICT (visual arts, presentations, etc.)	
30. Use of open tools (word processing programs, spreadsheet, etc.)	
31. Using Internet or CD-ROM for collecting information	
32. Use of learning programs, games, or other interactive programs	
33. Use of e-mail, chat room, or forum	
Notes : *pedagogic use of ICT*	
Additional material to collect	

Additional observation notes

D-2 OBSERVATION FORM 2: whole school - outside of classroom

Whole School (Outside-of-Classroom) Observation Form 2

This form was used to record general observations about ICT and the whole school, namely the environment, displays (e.g. on staff ICT CPD) and the school's culture (ethos and values). The schools' cultural values were taken to be reflected in the materiality of the displays in open spaces, classrooms, staffrooms, teachers' offices, corridors, and materials the school produced about itself.

Background data

1. School name	
2. Date	
3. Time	

Observation: to what extent? 0 = none existent, 5 = high degree
(ICT Materials - are defined as any available information/ text about ICT: hardware, software, resources, training, etc)

4. ICT materials displayed in reception / entrance area to the school	
Notes	
Additional material to collect	
5. ICT materials displayed in Head Teacher's office	
Notes	
Additional material to collect	
6. ICT materials displayed in teachers' offices/work spaces	
Notes	
Additional material to collect	
7. ICT materials displayed in staffrooms / teachers' social areas	
Notes	
Additional material to collect	
8. ICT materials displayed in pupils' library	
Notes	
Additional material to collect	
9. ICT materials displayed in pupils' independent learning / study areas	

Notes	
Additional material to collect	
10. ICT materials displayed in pupils' social spaces / open areas	
Notes	
Additional material to collect	
11. ICT materials displayed in corridors	
Notes	
Additional material to collect	
12. ICT materials for visitors to take	
Notes	
Additional material to collect	
13. Additional areas worthy of note, which are specific to individual schools	

APPENDIX E

QUESTIONNAIRES

E-1 Questionnaire 1: phase 1 online

E-2 Questionnaire 2: phase 3 respondent validation

E-1 QUESTIONNAIRE 1: phase 1 online

ICT QUESTIONNAIRE

Dear Colleagues,

Please could you help by completing this questionnaire about the use of Information and Communications Technology (ICT) in education (ICT is defined on the back page). As technology becomes integrated into classrooms, your responses about what you hope to achieve with ICT will provide invaluable information about what will help teachers to use ICT effectively. Schools and teachers responding will not be identified, but please give these details so I can contact you again if necessary.

The questionnaire should take about 15 minutes to complete. Please return it to the nominated person in your school or submit it online if you are using the web version.

Thank you for your time.

Sarah Younie Email: syounie@dmu.ac.uk

Instructions: Please answer questions relevant to you. Please tick the boxes and provide fuller explanations as you wish. Leave answers blank if you do not know the answer.

A Background information **CODE: (OFFICE USE ONLY):**

A.1 Name of School:

A.2 Local Education Authority: select from list below

A.3 Type of School:

Primary	Middle	Secondary

A.4 Approx. No of Pupils on Roll:

Less than 100	101-300	301-800	801 and above

A.5 Your Name (This will only be used if there is the need to contract you to obtain further information)

A. 6 Gender

Male	Female

A.7 Your responsibilities: tick all that apply

Classroom Teaching	Subject leader	Senior Manager

A.8 Number of Years Teaching Experience:

0-2	3-5	6-10	11-20	20+

A.9 Age

20-29	30-39	40-49	50+

A.10 Do you have access to a computer(s) linked to the internet in?

Your home	Your classroom	School library	Staffroom in school	School computer room	No easy access

B Use of Electronic Networks:

B.1 Define your use of the Internet for personal use and with pupils:

	Never used	Novice: you have logged on to the internet but not used it much	Some experience; you have investigated the use of the Internet	Very experienced; you have extensively investigated the use of the Internet
Personal:				
Pupils:				

B.2 Please comment on the following national electronic networks? (*Tick all those that apply*) For your information the URLs of all the sites are provided at the back for you to keep.

	Do you use this site?		If yes, to what extent is it of value to you professionally? Please add further comments below.				If no, is this because you (tick for 'yes', leave blank for 'no')		
	Yes	No	Very *valuable* (see B6 below)	Quite valuable (see B6 below)	Not very valuable (*see B6* below)	Don't find it *valuable* (see B6 below)	don't know *of the* site	don't have enoug h time to look	don't have easy access to Internet
Teacher Training Agency (TTA)									
Virtual Teachers College (VTC)									
National Grid for Learning (NGfL)									
Qualifications and Curriculum Agency (QCA)									
Department for Education & Employment (DFEE)									
Office for Standards in Education (OFSTED)									

Comments: If you do not find these sites of value please give any reasons (e.g. difficulty in finding what is relevant to you and in finding what is new to you)

B.3 What have you found useful on these sites?

	Yes	No	Not tried
General information from government			
Teaching resources			
Information on examinations/ syllabi/ curriculum			
Inspection information			
School Performance Tables			

Other: please specify and include comments about how they could be improved

B.4 What types of non-government websites (and particular content) do you find of professional use?

C Factors supporting and hindering teachers' learning about new practice with ICT .

C.1 In general do you use or know how to use ICT in your teaching?

Yes to some extent No

C.2 In general do you use or know how to use ICT for the administration you have to do?

Yes to some extent No

C.3 How have you gained your current knowledge of the use of ICT? Tick all those that apply.

Through training/courses provided by a teacher at your school	
Through training/courses by providers other than school	
From networks of family, friends, colleagues	
I have little current knowledge	

Other - please specify

C.4 Who has paid for your training?

	Tick all those that apply.	Please rank the order of contribution (1-5) with 1 indicating the highest
Yourself		
School		
Local education authority		
Other government agency e.g. Initial Teacher Training		
New opportunity fund		
I have not received any training		

Other- please specify

C.5 What factors have particularly helped you use ICT in your teaching purposes?

	Tick all those that apply.	Please rank the order of helpfulness (1-8) with 1 indicating the most helpful
Supportive network in my department /school		
School policy, which encourages ICT use		
Access to computers / equipment		
Access to technical support		
Training		
ICT is particularly useful in my subject		
Supportive network outside of school e.g. family		
Personal motivation to improve your skills		
I don't use it		

Other - please specify

C.6 What factors have hindered your use of ICT in your teaching? (Personal /school / classes)

	Tick all those that apply.	Please rank the order of hindrance (1-7) with 1 indicating the factor which most hinders you
Lack of supportive network in school / department		
Your school doesn't encourage ICT use		
Lack of access to equipment / computers		
Lack of access to technical support		
Lack of skills training		
ICT doesn't help children learn in my subject		
I am not interested using ICT		

Other -please specify

D Pedagogy: how is ICT used to support the curriculum

D. 1 What subject areas do you teach?

D.2 Please answer the following about the use of technology in your subject/s. Tick all those that apply.

Different types of technology	Could this help you teach more effectively and/or improve pupil learning in your subject?			Have you got access to this?			Do you want training to use this technology?		
	Think so/yes	no	Don't know	yes	no	Don't know	yes	Not relevant	Trained already
Electronic / interactive whiteboard									
Video conferencing									
Email									
Internet									
School intranet									
Data projector / LCD/									
Software packages /CD ROMS									
Integrated learning systems									
European schoolnet									
Specialist websites in your subject/s									
Data bases									
Word processing									
PowerPoint									
Spreadsheets									
Data logging									

Are there any other applications of ICT you would like to use, which support improvement of pupils' learning in your view? And any other training you need?

D.3 In your experience does the appropriate use of educational ICT have a positive affect on pupil motivation to learn?

Yes No Don't know

Any comments

D.4 How do you or would you organise pupil access to web sites in your subject?

		Don't know
Download to the school's Intranet		
Interactive worksheets (see last page)		
Live access to the web		

Other, please specify

D. 5 Are there any other points you wish to make about the use of ICT in teaching?

E Management strategies: helping or hindering teacher and pupil use of ICT.

This section is about whole school management issues. Only those with whole school responsibility for ICT need to fill this in. ***Only one response is required per school.***

E.1 In increasing the amount of ICT in your school, which of the following have you used to fund resources?

School budget	
Parent Teacher Associations/appeal to parents	
LEA	
Special central/local government grants e.g. Specialist school/Technology College status, NGfL / Standards fund	
Recycled computers from elsewhere	
Supermarket voucher schemes	
Industrial sponsorships	
Lease	

Other, please specify

E.2 If more money was available from government to support ICT development for your school, how should the money be spent? Please rank the following: 1-11 with 1 being most important.

	Ranking	Don't know
Training for teachers in Skills		
Training for teachers in Pedagogy		
Hardware: new computers and up grading existing		
Hardware: peripherals e.g. subject specific needs, interactive whiteboards, videoconferencing, LCD projectors		
Software packages/licenses		
Technical support		
Networking infrastructure for the school		
Networking infrastructure for the local community		
Content development for the school intranet		
Content development for the local regional intranet		
Content development for the Virtual Teacher Centre and government sites		

Other -please specify

E.3 What factors hinder or prevent change with ICT in your school?

Lack of resources for training	
Lack of funding for hardware	
Lack of well qualified technical support	
LEA not supportive	
Lack of innovative teachers	
Lack of evidence with regards to gains in learning for pupils with ICT	
Teachers not convinced of learning gains to be achieved from ICT	

Other -please specify

E.4 What strategies are used in your school to prevent pupils accessing inappropriate material?

Use filtering software e.g. net nanny	
School policy about Internet access and supervision	
Pupil contracts	
Internet connection in supervised areas where screens can be seen by teachers	
Internet connection in areas supervised by video cameras	
No strategies are used, pupils have open, unsupervised access	

Other -please specify

Are there any other points you wish to make about the use of ICT in teaching?

Information, which you may find useful, related to references in this questionnaire.
Definition: ICT

ICT stands for Information and Communications Technology. The 'C' for 'communications' indicates new uses of technology to support communication between people especially using computers. Computers can be networked, or links made via the internet, email, video conferencing and other software. Other technology, which supports communication, is also categorised as ICT, such as television, radio, faxes, video, cameras and other equipment. ICT is more than just another teaching tool. The use of ICT has significant potential for improving the quality and standards of pupils' education. ICT also has great potential for supporting teachers in their classrooms and in their professional training and development.

Definition Interactive worksheets

The interactive worksheet is a worksheet which includes URLs i.e. web site addresses. The worksheet can be paper based which requires pupils to type the web site address into the computer. Or, an interactive worksheet can be online in which case the web site addresses are hyper linked to allow pupils to transfer directly to the web site.

URLs for Government sites
NGfL = http://www.ngfl.gov.uk/

DfEE = http://www.dfee.gov.uk?

TTA = http://www.teach-tta.gov/uk

VTC = http://vtc.ngfl.gov.uk/

E-2 QUESTIONNAIRE 2: phase 3 respondent validation

PHASE 3 - RESPONDENT VALIDATION OF RESEARCH FINDINGS: CONFIDENTIAL
Thank you for your participation in this research. Now the data has been collected from all the teacher participants, the findings are presented below. Please consider the responses and the extent to which you agree or disagree with the findings. Thank you for your time.

Instructions: please complete each question by circling the number you most agree with.

School		Name		Subject	

1. PEDAGOGY - teachers' professional community of practice and communication; creating new knowledge for and with each other.

FINDINGS: Teachers *sharing & disseminating new ideas* on how to use ICT for professional / classroom practice is critical to the integration of ICT.

1 strongly disagree	2 disagree	3 undecided	4 agree	5 strongly agree
Any comments: (e.g. how do you learn about new uses for ICT for professional / pedagogical purposes?)				

2. CURRICULUM & ASSESSMENT

FINDINGS: Assessment strategies and pressure on grades make teachers stick to safe methods, rather than more innovative methods e.g. with ICT.

1 strongly disagree	2 disagree	3 undecided	4 agree	5 strongly agree
Any comments: (e.g. little incentive/reason to make changes & use ICT, which might jeopardise teachers' performance on existing criteria i.e. successful results?)				

3. TEACHERS' CPD&T – continuing professional development and training in ICT

FINDINGS: Teachers *learning* how to use ICT through training (external/in-house), or informally through key people (e.g. ICT coordinator), for *just-in-time* learning is critical to the integration of ICT.

1 strongly disagree	2 disagree	3 undecided	4 agree	5 strongly agree
Any comments: (e.g. what type of training/professional development has been most helpful and why? e.g. What would encourage you to change practice & why?)				

4. TECHNICAL SUPPORT

FINDINGS: Having ICT technical support is critical to the use & integration of ICT.

1 strongly disagree	2 disagree	3 undecided	4 agree	5 strongly agree
Any comments: (e.g. what type of technical support works best: teacher support/technician availability?)				

5. TECHNOLOGY RESOURCES: 'Practicality ethic'

FINDINGS: *Access* to *readily available* and *reliable* ICT is critical to the integration of ICT.

1 strongly disagree	2 disagree	3 undecided	4 agree	5 strongly agree
Any comments: (e.g. what type of ICT do you use most often and why?)				

6. SCHOOL LEADERSHIP very important: leading by example/modelling ICT use

FINDINGS: School ***leadership & ethos*** **that promotes ICT use, is essential to integrating ICT into teachers' professional / classroom practice.**

1 strongly disagree	2 disagree	3 undecided	4 agree	5 strongly agree
Any comments: (e.g. Are you more likely to use ICT if school policy encourages it and managers lead by example?)				

7. NATIONAL ICT INITIATIVES (e.g. NGfL, NOF, KS3 national strategy)

FINDINGS: National initiatives have raised the profile of the need and importance of ICT for teachers' professional practice.

1 strongly disagree	2 disagree	3 undecided	4 agree	5 strongly agree
Any comments: (e.g. which national initiatives have you been involved with? Have they been successful & why?)				

TABLE of teachers' professional strategies with ICT.

QUESTION: Which do you see yourself as? Please indicate with a tick.

Category	**Description**	**Where would you put yourself?**
ACTIVE	• Proactive, takes all opportunities to learn about new ICT applications / get training / find funds to get ICT into school, in a position to find things out first through networks, is a resource for other teachers • Highly interested and motivated to integrate ICT	
ENGAGED	• Makes time to learn about ICT • Willing to participate in ICT training / look at new ICT tools • Interested and motivated to integrate ICT	
EXPEDIENT	• Accepts what ICT comes along and learns to use it • Uses what ICT is expected, does what HOD or ICT coordinator or school policy requires with ICT • Some interest in ICT	
ACCEPTORS	• Uses ICT, though professional focus is elsewhere • Does what is expected • Little or no interest in ICT	

Any other comments or points you would like to raise? Your comments are confidential.

Thank you for your time. If you have any queries regarding the research please contact: Sarah Younie, De Montfort University, Leicester, LE1 9BH: email syounie@dmu.ac.uk.

Data Protection Act 1998: The information given on this form will be stored in a database. It will be used for the purposes of research. The information will be used in an anonymised form and it will not be possible for individuals to be identified in any report or other publication arising from the research.

APPENDIX F

INTER-JUDGE RELIABILITY: ACADEMIC PEER REVIEW

The research yielded a number of conference papers and publications during the period October 1999 to September 2006, which can be identified as an example of inter-judge reliability.

Publications

Younie, S. (2006a) 'Implementing Government Policy on ICT in Education: lessons learnt', *Education and Information Technologies*, Vol 11, Nos 3-4, pp 385-400.

Younie, S. and Moore, T. (2005) 'Supporting Teachers' Professional Practice with ICT' in (eds) M. Leask and N. Pachler *Learning to Teach in the Secondary School Using ICT*. London: Routledge. ISBN 0-415-35104-9 pp 17-40

Leask, M., Litchfield, P. and Younie, S. (2005) 'Using ICT In Your Particular Subject' in (eds) M. Leask and N. Pachler *Learning to Teach in the Secondary School Using ICT*. London: Routledge. ISBN 0-415-35104-9 pp 4-16

Younie, S. (2002) 'Research using IT', *Educational Research,* Vol. 44, No 2.

Younie, S. (2001) 'Developing a 'Cognitively Flexible Literacy': from an industrial society to the information age', in *Issues in Teaching using ICT* (ed) M. Leask, London: Routledge. ISBN 0-415-23867-6 pp 206-222

Leask, M and Younie, S. (2001) 'Building On-line Communities For Teachers: ideas emerging from research', in *Issues in Teaching using ICT* (ed) M. Leask, London: Routledge. ISBN 0-415-23867-6 pp 223-232

Younie, S. (1999) 'Technophilia: Technophobia', *International Journal of Cultural Studies* Vol. 13, No.3, pp 540-542.

Conference Papers

Younie, S. (2006b) 'Implementing Government Policy on ICT in Education: lessons learnt'. *International Federation of Information Processing* (IFIP), WG 3.1, 3.3, 3.5 Joint Conference, Alesund University, Norway, 26-30 June 2006.

Younie, S. (2006c) 'Implementing Government Policy on ICT in Education: the significance of communities of practice'. *British Educational Research Association* (BERA), Annual Conference, University of Warwick 6-9 September 2006.

Younie, S. (2005a) 'Teachers' Collaborative Learning to Develop an e-Pedagogy'. *Information Technology in Teacher Education* (ITTE), Annual Conference, University of Dundee 12–14 July 2005.

Younie, S. (2005b) 'Routes/Roots and Maps: a Cultural Cartography of Creating Change with ICT'. *Information Technology in Teacher Education* (ITTE), Research Conference, University of Cambridge 9-10 December 2005.

Younie, S. (2003) 'Region\re\generation\ - Laptops As A Catalyst For Community Change'. *Computer Assisted Learning* (CAL) International Conference, Queen's University Belfast Northern Ireland, 8-10 April 2003.

Younie, S. (2002a) 'Situating Government Policy on ICT in Education in the context of Post Fordism: economic efficiency and learning gains; conflating agendas?' *Information Technology in Teacher Education* (ITTE) Research Conference, University of Cambridge 9-10 February 2002.

Younie, S. (2002b) 'Why NOF ICT training worked successfully for some teachers and schools and not others?' *Information Technology in Teacher Education (ITTE)* Annual Conference, Trinity College Dublin, Ireland 16-18 July 2002.

APPENDIX G

SAMPLE OF SCHOOLS AND TEACHERS: PHASE 1, 2 AND 3

G-1 Sample of Schools and Teachers: phase 1

G-2 Sample of Schools and Teachers: phase 2

G-3 Sample of Schools and Teachers: phase 3

G-1 SAMPLE OF SCHOOLS AND TEACHERS: phase 1

Phase 1 EXPLORATORY Sample - October 1999-2001

no	Names CODE	School CODE	Position/ Curriculum subject	gender	ethnicity	No. of interviews for phase 1
1.	LX	F	Head Teacher	M	W	1
2.	QX	F	Deputy Head	M	W	2
3.	NC	F	HOD ICT	M	W	2
4.	QI	F	ICT	M	W	2
5.	KX	F	ICT	M	W	1
6.	BE	F	Learning Resources manager	F	W	1
7.	QE	F	Eco Centre manager	F	W	1
8.	LQ	A	ICT Network manager	M	W	1
9.	EN	A	ICT Technician	M	W	1
10.	BD	A	Assistant Principal	F	W	1
11.	NC	A	MFL, AST	F	W	1
12.	NT	A	HUMS Sociology, AST	M	W	1
13.	KX	A	HOD Science, AST	F	W	1
14.	LT	A	HUMS History, AST	M	W	1
15.	KM	A	English	F	W	1
16.	DP	A	ICT	M	W	1
17.	XC	A	Design	M	W	1
18.	BT	A	MFL	M	W	1
19.	SI	A	HOD Biology	M	W	2
20.	UU	A	Science, Biology	M	W	1
21.	QN	D	Head Teacher	M	W	1
22.	NL	D	HOD ICT	M	W	3
23.	MT	D	Design Technology	F	W	2
24.	IT	D	MFL	M	W	1
25.	QO	D	Art	F	W	1
26.	MD	D	DT	F	W	1
27.	UX	D	DT	M	W	1
28.	UG	D	DT	F	W	1
29.	HQ	D	HOD Hums	M	W	2
30.	TI	D	HOD MFL	F	W	2
31.	LD	D	Science	F	W	2
32.	TQ	D	ICT Network Manager	M	W	3
33.	AZ	D	Science	F	E	1
34.	NI	D	English and Drama	F	W	1
35.	KX	D	Drama	F	W	1
36.	NT	D	HUMS RE	F	W	1
37.	TI	B	Head Teacher	M	W	2
38.	KE	B	HOD MFL	M	W	2
39.	KD	B	HOD ICT	M	W	2
40.	OI	B	HOD HUMS	M	W	2
41.	KD	B	Art	M	W	1
42.	EC	B	ICT	M	W	1
43.	NT	B	Music	M	W	1

44.	CE	B	HOD Music	M	W	2
45.	SB	B	HOD Geography	M	W	1
46.	NN	B	MFL Japanese	F	E	1
47.	NI	B	MFL	M	W	1
48.	GG	B	MFL	F	W	1
49.	BQ	B	RE	F	W	1
50.	KT	C	Head teacher	M	W	1
51.	LX	C	HOD ICT	F	W	1
52.	MI	C	History	M	W	1
53.	XQ	C	HOD Design	M	W	1
54.	EI	C	Librarian	F	W	1
55.	BL	C	HOD Art	F	W	1
56.	AA	C	Art, part time	F	W	1
57.	BB	C	English	F	W	1
58.	NG	C	Geography	M	W	1
59.	JK	C	Science	M	W	1
60.	JO	C	School Press Officer	M	W	1
61.	QX	E	Deputy	M	W	2
62.	KN	E	Reception teacher	F	W	1
63.	KD	E	Nursery teacher	F	W	1
TOTALS	Data protection code	**6 SCHOLS**	**63 RESPONDENTS**	Majority female	Majority white	**81 INTERVIEWS**

G-2 SAMPLE OF SCHOOLS AND TEACHERS: phase 2

Phase 2 FOCUSED Sample - October 2001-April 2003

no	Name Code	School Code	Position in school	Curriculum subject	gender	ethnicity	No. of interviews
1.	LX	F	Head Teacher	English	M	W	1
2.	LM	F	Deputy Head	Maths/ICT	F	W	1
3.	QX	F	Deputy Head	ICT	M	W	2
4.	UN	F	Assistant Head	Science/ICT	M	W	1
5.	QI	F	HOD ICT	ICT	M	W	4
6.	KX	F	Classroom teacher	Maths/ICT	M	W	2
7.	GN	F	Head of Post16	English	M	W	3
8.	TP	F	Classroom teacher	Maths	M	W	1
9.	DD	F	Classroom teacher	History	F	W	2
10.	QS	F	Classroom teacher	Art	M	W	2
11.	QE	F	Classroom teacher	Science	F	W	2
12.	TQ	F	Training manager	CPD	F	W	2
13.	DL	F	AST	Science	M	W	1
14.	BB	F	HOD	Science	F	W	1
15.	SC	F	2nd in CHARGE	Science	M	W	1
16.	SD	F	Classroom teacher	Science	F	E	1
17.	EX	F	HOD	Design	M	W	2
18.	TD	F	LSA	Cyber café	F	W	1
19.	SU	F	Classroom teacher	Maths	M	W	1
20.	QN	F	Classroom teacher	Music	M	W	1
21.	DE	F	Asst Head KS3	Geography	F	W	2
22.	NF	F	Classroom teacher	MFL	F	W	3
23.	DI	F	Asst Head KS3	Maths /PE	F	W	1
24.	TI	F	KS3	Hums / RE	F	W	1
25.	ST	G	DEPUTY HEAD	MFL/ICT	M	W	4
26.	LN	G	HOD	MFL	F	W	2
27.	TD	G	NQT	MFL	F	W	2
28.	DH	G	NQT	MFL	F	B	2
29.	MI	G	NQT	MFL	F	W	3
30.	NS	G	Classroom teacher	MFL	F	W	3
31.	QB	G	Classroom teacher	MFL	M	W	2
32.	NW	A	Deputy Head	ICT	M	W	1
33.	HL	A	Deputy Head	Humanities	F	W	1
34.	SI	A	AST ICT	Science	M	W	2
35.	UU	A	Classroom teacher	Science	M	W	2
36.	EB	A	Classroom teacher	Science	M	W	2
37.	KQ	A	Classroom teacher	Science	F	W	2
38.	LX	A	Classroom teacher	Science	F	W	2
39.	WQ	H	HOD	ICT	F	W	3
40.	KX	H	Classroom teacher	English	M	W	2
41.	CQ	H	Classroom teacher	Maths	F	W	1
42.	NI	H	Deputy head	ICT	M	W	1
43.	NL	D	HOD	ICT	M	W	1
44.	MT	D	HOD	Design Technology	F	W	1

45.	AZ	D	Classroom teacher	Science	F	W	1
46.	XX	D	Classroom teacher	Science	F	W	1
47.	UX	D	Classroom teacher	Science	F	W	1
48.	TX	D	2ND in CHARGE	ICT	F	W	1
49.	TI	D	HOD	MFL	F	W	2
50.	IT	D	Classroom teacher	MFL	M	W	1
51.	NI	D	HOD	Drama	F	W	1
52.	EE	J	Head	primary	M	W	1
53.	FS	J	Deputy head	primary	F	W	1
54.	HN	J	Yr6 teacher	primary	M	W	1
55.	LM	J	Lap top co-ord	primary	F	W	1
56.	LI	J	Yr6 teacher	primary	F	W	1
57.	EX	J	ICT co-ord	primary	M	W	1
58.	NM	M	HOD ICT	ICT	F	W	1
59.	TC	HEI	NGfL regional co-ordinator	ICT	M	W	1
60.	BS	HEI	NOF ATP provider	ICT	F	W	1
61.	IS	L	Head	Key skills	F	W	2
62.	BM	N	Deputy Head	Humanities	F	W	1
TOTALS			**62 RESPONDENTS**				**98 INTERVIEWS**

Total number of respondents

Phase 1 had 63 respondents and phase 2 had 62, giving a total of 125, however, 12 teachers from phase 1 were also used in phase 2, therefore there were 113 respondents altogether.

Total number of case study sites

Teachers from across 12 case study sites were interviewed, of which 11 of these sites were visited by the researcher and used for the research.

G-3 SAMPLE OF SCHOOLS AND TEACHERS: phase 3

Phase 3 RESPONDENT VALIDATION Sample - May to July 2003

no	Teacher Code	School Code	Sample sent Questionnaire; RETRUNS	RETURN Questionnair	RETURN Questionnair	Position in school	Curriculum subject	gender	Ethnicity
1.	UN	F	Y	Y		Assistant Head	ICT / Science	M	W
2.	QI	F	Y	Y		HOD ICT	ICT	M	W
3.	KX	F	NO		NO	ICT	ICT	M	W
4.	GN	F	NO		NO	Head of Post16	English	M	W
5.	DD	F	Y	Y		Teacher	History	F	W
6.	QS	F	Y		Y	Teacher	Art	M	W
7.	QE	F	Y	Y		NQT	Science	F	W
8.	TQ	F	Y	Y		ICT Training Center manager	CPD	F	W
9.	DL	F	Y	Y		AST	Science	M	W
10.	BB	F	Y	Y		HOD	Science	F	W
11.	SC	F	NO		NO	2nd in charge	Science	M	W
12.	SD	F	Y	Y		ICT rep	Science	F	E
13.	EX	F	Y	Y		HOD	D& T	M	W
14.	QN	F	Y		Y	HOD	Music	M	W
15.	QC	F	Y	Y		Teacher	Science	M	W
16.	ST	G	Y		Y	Deputy Head	MFL	M	W
17.	TD	G	Y	Y		NQT	MFL	F	W
18.	MI	G	NO		NO	NQT	MFL	F	W
19.	NS	G	Y		Y	Teacher	MFL	F	W
20.	SI	A	Y	Y		AST	Science	M	W
21.	UU	A	Y	Y		Teacher	Science	M	W
22.	EB	A	Y	Y		Teacher	Science	M	W
23.	KQ	A	Y	Y		Teacher	Science	F	W
24.	LX	A	Y		Y	Teacher	Science	F	W
25.	WQ	H	Y		Y	HOD	ICT	F	W
26.	MT	D	NO		NO	HOD	D& T	F	W
27.	AZ	D	Y		Y	HOD	Science	F	W
28.	XX	D	NO		NO	2nd in charge	Science	F	W
29.	UX	D	Y		Y	Teacher	Science	F	W
30.	TX	D	NO		NO	HOD	ICT	F	W
31.	TI	D	Y		Y	Teacher	Science	F	W
32.	IT	D	NO		NO	2nd in charge	MFL	M	W
33.	NI	D	Y		Y	HOD	Drama/ English	F	W
34.	LD	D	Y		Y	Teacher	Science	F	W
35.	IS	L	Y		Y	Head	Key Skills	F	W
			27 total returns	15 returns	12 Postal returns				

APPENDIX II FINDINGS: ONLINE QUESTIONNAIRE

A database was created for recording the questionnaire responses, however, 5 questions failed to record data. For each question that had an error, the problem was that there were no responses recorded in that field in the database. Of the 5 questions that were null and void, 3 constituted distinct questions (C 4.6, C 5.10, D 4.1) and 2 were subsidiary questions (C5.11and D 4.2) (see appendix E). The subsidiary questions offered the teachers the opportunity to respond to the inquiry *'other -please specify'* in the form of an 'open text box', which related to the previous question.

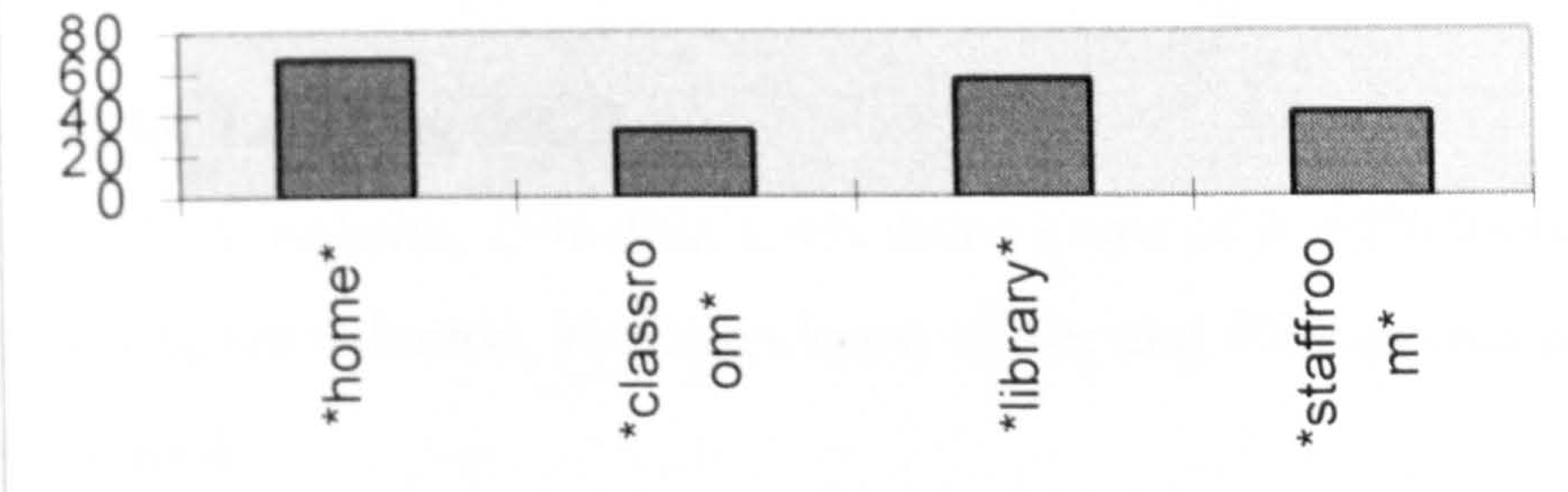
The questionnaire findings are presented as percentages, which were calculated from the findings from the database which were put into a spreadsheet. For each question the percentages should add up to 100%, however, for some questions this is not the case. Where there are instances of question totals not adding up to 100%, this was because the teacher did not answer that question and it is not possible to know why that was the case. However, data from the earlier interviews suggests that some teachers had little experience of ICT and the Internet at the time and consequently these teachers may have been unable to answer *all* the questions.

Findings from the Questionnaire Section A: background information

This section recorded the *professional profile* of the teachers and is discussed above in relation to the analysis of the sample completing the questionnaire. The last question of this section concerned teachers' access to computers.

A.10 Do you have access to a computer linked to the Internet?

80% of those responding had access to a computer linked to the Internet at home. 79% had access through the school computer room, 68% through the school library, 48% in the staff room and 38% through a classroom in which they teach.



Findings from the Questionnaire Section B: use of electronic networks

B.1 Define your use of the Internet

53 % had extensive experience of the use of the Internet for personal purposes, 43% considered they had some experience and 4% had little experience.

27 % had extensive experience of the use of the web for curriculum purposes with 73% having some limited experience. Of the total, 19% had little or no experience. This indicated that there is a huge task to be done in the training of teachers in the use of ICT for curriculum purposes. It should be remembered that many of those responding were working in schools that had more ICT resources than was the norm for schools in 2000.

B.2 Please comment on the following national electronic networks. (Teachers were informed that the urls of all the websites are provided at the back of the questionnaire.)

Teacher Training Agency (TTA)

39% used the TTA website, 43% didn't, 11% didn't know of it. With respect to how valuable teachers found the TTA website, there was a nil return in the database, so no data was recorded regarding this aspect.

Virtual Teachers College (VTC)

30% used the VTC website, 50% didn't, 13% didn't know of it. 21% found the website quite valuable, 2% not valuable, 20% didn't know of site and 11% reported 'not having enough time to look'.

National Grid for Learning (NGfL)

64% used the NGFL website, 25% didn't, 4% didn't know of it. 45% found the website quite valuable, 4% not valuable, 9% didn't know of site and 4% reported not having enough time to look.

Qualifications and Curriculum Agency (QCA)

48% used the QCA website, 36% didn't, 4% didn't know of it. 36% found the website quite valuable, 0% was recorded for the response 'not valuable', 5% didn't know of the site and 11% reported not enough time to look.

Department for Education & Employment (DfEE)

73% used the DfEE website, 16% didn't, 2% didn't know of it. 30% found the website quite valuable, 7% not valuable, 4% didn't know of the site and 2% not enough time to look.

Office for Standards in Education (OFSTED)

68% used the OFSTED website, 23% didn't, 2% didn't know of it. 29% found the website quite valuable, 7% not valuable, 4% didn't know of site and 14% not enough time to look.

With respect to the government websites above, the findings reflect the following **amount of use**, which may indicate the importance attached to each website: DfEE 73%, OFSTED 68%, NGfL 64%, QCA 48%, TTA 39%, VTC 30%. However, with respect to the **amount of value** teachers attached to each of these sites, the findings are surprisingly different: NGfL 45%, QCA 36%, DfEE 30%, OFSTED 29%, VTC 21% and TTA nil return, however, the last result was due to an error in recording the data for this field in the database.

B.3 What have you found useful on these sites?

Of those who found government sites helpful, 74% reported they found the access to government information useful for general information, 61% for information about examination syllabi, 58% for inspection information, 42% for teaching resources and 37% for school performance tables.

Findings from the Questionnaire Section C: factors supporting and hindering teachers' learning about new practice with ICT.

C.1 In general do you use or know how to use ICT in your teaching?
Findings - 75% of teachers reported that they used and knew how to use ICT in their teaching, 20% reported some use and only 2% reported that they did not know how to use ICT in their teaching.

C.2 In general do you use or know how to use ICT for the administration you have to do?
Findings - 68% of teachers reported that they used and knew how to use ICT for administrative purposes, 22% reported some use of ICT for administration and 6% did not know how to use ICT for administrative purposes.

C3.1 How have teachers gained their current knowledge of the use of ICT?
Teachers report that they have gained their current knowledge of the use of ICT through *training courses* and *networks of family and friends*. This latter way of gaining ICT knowledge is referred to as *'networked relations'*, and was reported in Leask and Younie (2001).

C3.1 Training; **38%** of teachers reported gaining their current knowledge of the use of ICT through **training courses, provided by teachers at their school.**

C3.2 Training; **60%** of teachers reported gaining their current knowledge of the use of ICT through **training courses, provided by people who were not teachers** at their school.

C3.3 Training; **78%** of teachers reported that they gained their current knowledge of the use of ICT **through networks of family and friends.**

C3.4. Few teachers reported having little current knowledge of ICT, only 9%. Nearly 60% refuted having little knowledge.

C3.5. The question 'how have you gained your current knowledge of the use of ICT?' had the response **'other - please specify'**, as an open text box for teachers to respond.

Findings: those teachers who reported gaining current knowledge of ICT through **'self taught'** methods, confessed to having a keen interest in ICT and enjoyed reading **ICT manuals.** The teachers reported 'playing' with technology as a 'hobby' and actively sought to learn new ICT applications. These teachers could be classified as 'innovators' and 'early adoptors' of ICT from Roger's (1983) model of innovation diffusion. Those teachers completing the 'open text box' mostly reported *'self taught'*, *'initial teacher training (ITT) courses'*, and other teachers reported, through their *first degree* or *postgraduate degrees*, however, the latter answers only came from those teachers who had recently been in higher education.

C4.1Training costs: who has paid for teachers' ICT training?
The funding bodies that have been identified are *teachers* themselves, the *school*, *regional education bodies* (LEA), and *government national initiatives*, such as TTA ITT (Teacher Training Agency Initial Teacher Training) and NOF (New Opportunity Fund). From this range, **teachers report *themselves* as having made the most contribution to funding their ICT training,** with **31%** of teachers claiming this. Consequently, teachers themselves have made the most contribution, with little funding from regional or government level. However, it must be stressed that this questionnaire was conducted in the summer term of 2000, which was *before* the roll out of the national NOF ICT training programme. For the majority of schools used for the sample in phase 1, the NOF ICT training for teachers was introduced in September 2000.

C4.2 Training costs: **19%** of teachers' reported the **school** as making the most contribution to funding their ICT training.

C4.3 Training costs: only **4%** of teachers' reported the **LEA** as making the most contribution to funding their ICT training.

C4.4 Training costs: **22%** of teachers' reported other **government agencies** as making the most contribution to funding their ICT training.15% of teachers reported ITT, as making the most contribution to funding their ICT training.

C4.5 Training costs: only **7%** of teachers report **NOF** as making the most contribution to funding their ICT training in July 2000, however this can be explained by the fact that the schools had not started the official roll out of the NOF programme.
C 4.6 In answer to 'Who has paid for your training?' the response (C 4.6) had 'I have not received any training'. This question was null and void, as no answers were recorded in the database.

C4.7 This was an open text box response to the question of 'who has paid for your training: other - lease specify'. **Other funding bodies** identified by teachers were from **industrial sponsorship**. One teacher reported IBM, another Microsoft and one from CBT. The numbers receiving industrial sponsorship in this sample was very small.

C5.1 Factors identified by teachers as most supportive to using ICT in teaching: When interpreting the data, the researcher combined the ranking of 4 & 5 scores together (from the Likert scale), in order to say that the most supportive (factor) was *a total of these two scores*. For example, a total % for C5.1 was 36% + 14% which were combined to make 50%. Similarly, the lowest two scores of 1 and 2 were combined (from the Likert scale) to calculate the least importance given to a factor.

C5.1 Factors identified by teachers as most supportive to using ICT in teaching: teachers identified a **supportive network in their school** as a major factor helping their use of ICT, half the teachers reported this **50%**. 18% did not rank this as most helpful.

C5.2 A school policy that encourages ICT use was identified by **43%** teachers as helpful to them using ICT in their teaching. 23% said it was not.

C5.3 Access to computers and equipment was identified by **63%** teachers as supportive to them using ICT in their teaching. Only 16% said this was not.

C5.4 **Access to technical support** was identified by **32%** teachers as supportive to them using ICT in their teaching. 23% said it was not and ranked this factor with scores of 1 and 2.

C5.5 **Training** was identified by **31%** teachers as supportive to them using ICT in their teaching. 25% ranked this with a score of 3, i.e. of mid importance, whereas 20% said it was not of importance, giving a ranking 1 and 2 for this factor.

C5.6 **62%** of teachers stated that ICT was particularly **useful in their subject**. 11% ranked ICT as some use in subject teaching and 16% said it was not useful.

C5.7 **A supportive network outside of school** was identified by **30%** of teachers as helpful. 16% of teachers reported this as of some importance (a score of 3) and 27% did not rank this highly, giving scores of 1 & 2. Although in the phase 1 interviews, this factor of a supportive network outside school, was reported as having higher importance when teachers discussed gaining ICT knowledge for professional practice.

C5.8 **Personal motivation** to use ICT was cited by **88%** of teachers as a supportive factor in their development of ICT for professional practice. Only 2% of teachers gave this a score of 3, i.e. of mid importance and again, only 3% of teachers did not cite this as important, giving a score of 1 or 2. **Teachers' personal motivation to use ICT appears as a significant factor supporting ICT use.**

C5.9 **91% of teachers reported using ICT**. 70% reported using ICT in their teaching, giving a difference of 21% between those who use it outside of the classroom (for preparation and administration) and those who use ICT for teaching inside the classroom: this difference maybe because of problems of ICT access at school. In fact, only 40% of teachers reported having ICT (computer) access at school, although 80% of teachers did have access to ICT (computer) at home. This does raise the issue regarding the role of national providers (government) in addressing how to increase teachers' access to ICT. Importantly, policy makers did identify this issue and the government introduced the 'Computers for Teachers Scheme' in 2000, which was developed in response to the success of the Becta 'Portables for Teachers Project' (Youngman and Harrison, 1998).

C5.10 The question 'I am not interested in using ICT' and **C5.11** 'what factors support your use of ICT for teaching? Other - please specify', unfortunately there was a nil return for these questions due to a problem with the data recording in the database. However, these questions were addressed in the interviews and observations of phase 1. Most teachers were interested in using ICT and reported more access to ICT for use in lessons.

C5.12 This was an open box text response to the question 'do you want to use more ICT in your teaching? When teachers were asked if they wanted to use more ICT in their teaching, teachers reported yes, but they were faced with a number of factors inhibiting ICT use. Teachers reported: *'insufficient machines in school'; 'the access to computers is the limiting factor'*.

Questionnaire Section D: Pedagogy - how ICT is used to support the curriculum.

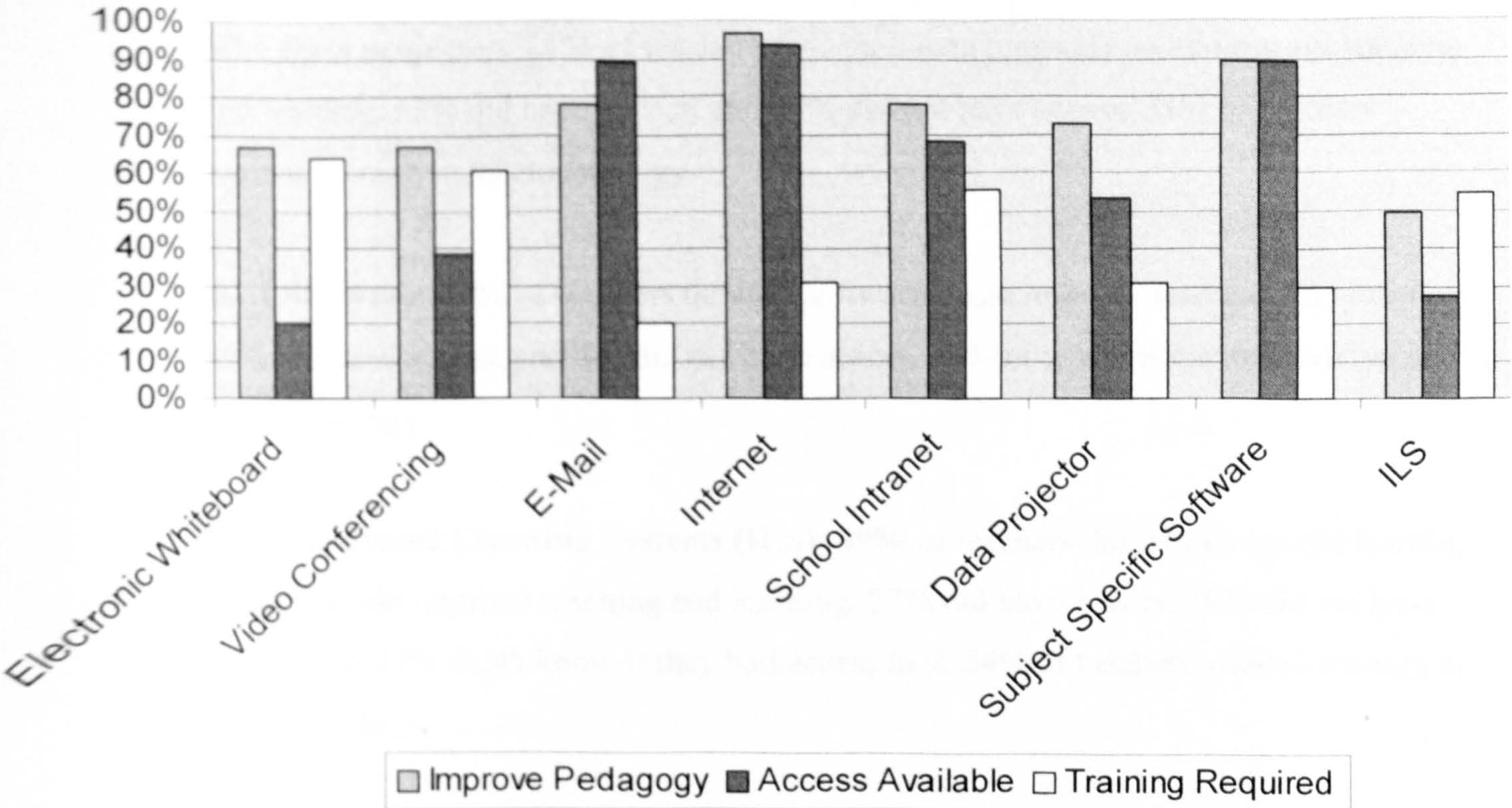
D.1 What subject areas do you teach?

The teachers responding came from all subject areas. The sample of teachers taught the following subjects; 15% IT, 11% Science, 11% Modern Languages, 10% Maths and the remainder of the sample were spread across the other subjects though in smaller percentages.

D.2 The use of Internet technology in teaching: Teachers were asked their views on interactive whiteboards, video conferencing, email, Internet, school intranet, data projectors, software, integrated learning systems (ILS). The graph below show teachers' desire to have the technology and the numbers responding that had access in July 2000.

Graph of teachers' views on ICT

Teachers' views about: whether various forms of technology support teaching and learning; whether teachers have access to this technology and whether they wish to have training in the technology.



D2.1 Electronic Whiteboards: 67% of teachers thought that interactive whiteboards could improve teaching and learning. 20% did report access, and 64% did not have access. 64% of teachers wanted training in this technology.

D2.2 Video conferencing: 67% of teachers thought video conferencing could improve teaching and learning. 38% did have access, and 48% did not have access. 61% of teachers wanted training in this technology.

D2.3 Email: 78 % of teachers thought email could improve teaching and learning. 89% did have access, and 4% did not have access. 20% of teachers wanted training in this technology.

D2.4 Internet: 96% of teachers thought the Internet could improve teaching and learning. 96% did have access. 31% of teachers wanted training in this technology.

D2.5 School intranet: 78% of teachers thought a school intranet could improve teaching and learning. 68% did have access, and 15% did not have access. 56% of teachers wanted training in this technology

D2.6 Data projector: 73% of teachers thought a data projector could improve teaching and learning. 53% did have access, and 28% did not have access. 31% of teachers wanted training in this technology

D2.7 Software: 89% of teachers thought software could improve teaching and learning. 89% did have access, and 4% did not have access. 30% of teachers wanted training in this technology.

D2.8 Integrated Learning Systems (ILS): 49% of teachers thought integrated learning systems could improve teaching and learning. 27% did have access, 28% did not have access, and 37% didn't know if they had access to it. 54% of teachers wanted training in this technology.

D2.9 Educational websites: 91% of teachers wanted training in this technology, that is the ICT skills to navigate a sophisticated educational website, in order to locate curriculum resources, seek international ICT projects, including finding partner schools to work with, access recent ICT research, and online forums to discuss ICT ideas with other teachers.

D2.12 This was an open box text response to the question 'are there any **other applications of ICT** you would like to use, which support improvement of pupils' learning in your view? And any other training you need?' The teachers responded mainly in relation to software: *'Assessment software for pupils and a greater range of software for staff record keeping'. 'Training in net-meeting and multimedia software'.*

D3.1 The majority of teachers reported that in their experience, the appropriate use of **ICT has a positive effect on pupils' motivation.**

D3.2 This was an open box text response to the question 'In your experience does the appropriate use of educational ICT have a positive affect on pupil motivation to learn?' The teachers responded with the following observations: *'[ICT] is great for motivation and self-esteem, as sometimes boys lack motivation. It improves my relationship with them'. 'In foreign language learning boys get much better motivated as soon as there is possibility of using ICT'.*

D4.1 This had an error and recorded a nil return. The question about *'organising pupils access to the Internet'* and D4.2 (an open text box), which again had no responses recorded in that field, due to problems with data recording.

D.5 This response was an open text box for teachers to record: 'any other points you wish to make about the use of ICT in teaching?' Teachers reported: *'ICT at its best is a liberating tool. ICT can enable children to develop their full potential in learning -it can be a motivating factor in lifelong learning'.*

Questionnaire Section E: School Leadership

This section concerned senior school leaders and *only* teachers with whole-school management responsibility for ICT were required to complete this section. Consequently the number of responses for this section was less than the previous sections, with 20 teachers completing this part of the questionnaire.

E.1 In increasing the amount of ICT in your school, which of the following have you used to fund resources?

10% cited no other source of funding than the school budget. Supermarket voucher schemes were cited by 90% of the participants and was the next most significant provider of resources. More than half reported support from national initiatives and regional educational authorities. 20% used recycled computers, 30% cited industrial sponsors. 45% leased computers.

E.2 If more money was available from government to support ICT development for your school, how should the money be spent? (Please rank the following in order of importance.)

If more money was available, priorities for development should be (in order of importance) training of teachers in ICT skills (18 responses, 90%), with the provision of hardware (including peripherals such as whiteboards, videoconferencing, LCD projectors) and technical support both being strongly favoured (17 responses each, 85%). Software and development of the school network came next (14 responses, 70%)

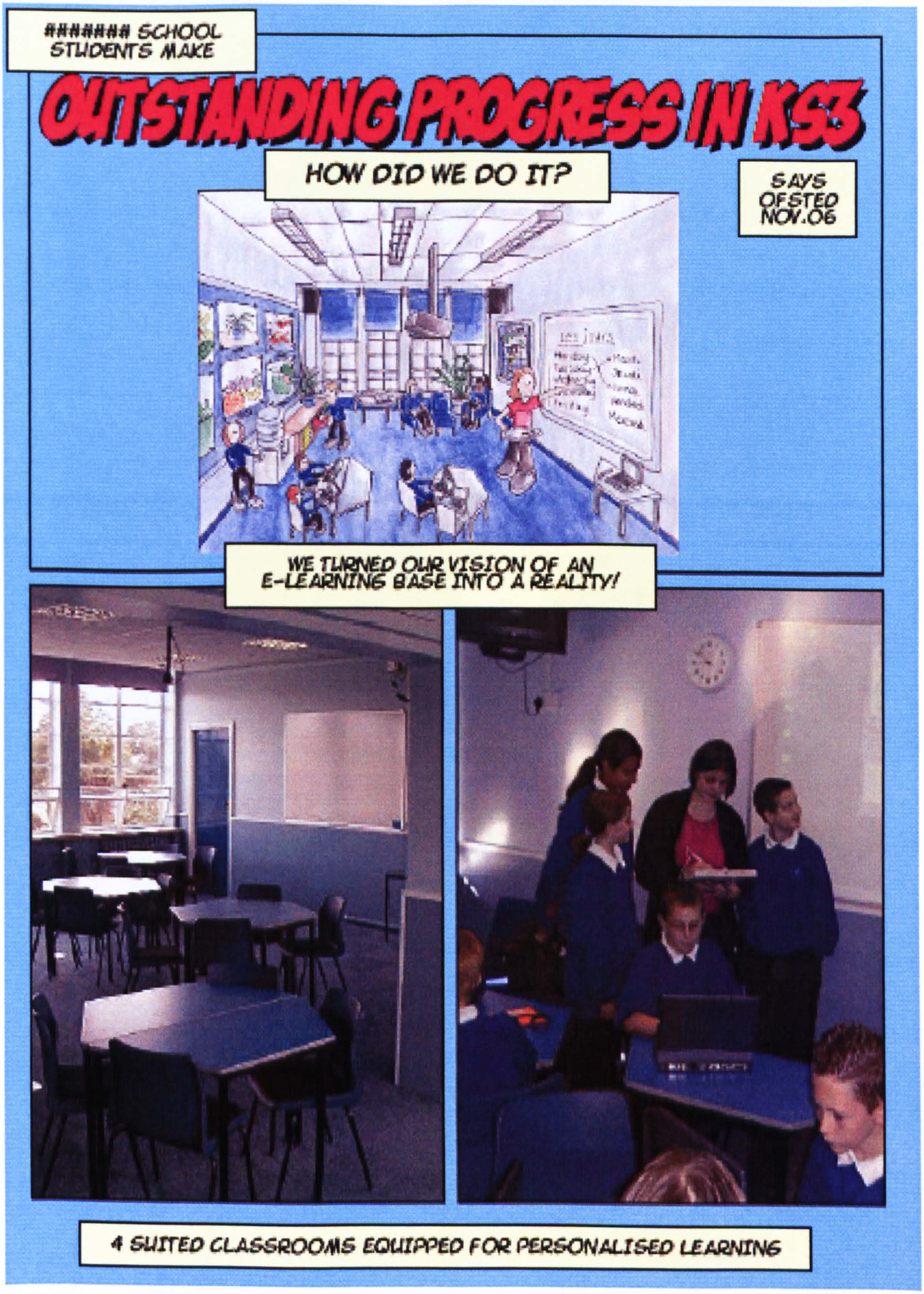
followed by the school intranet and developing networking in the community. Training in pedagogy had 11 responses, 55%. The lowest priority was given to putting money into the local and regional intranets and government sites with 9 responses, 45%.

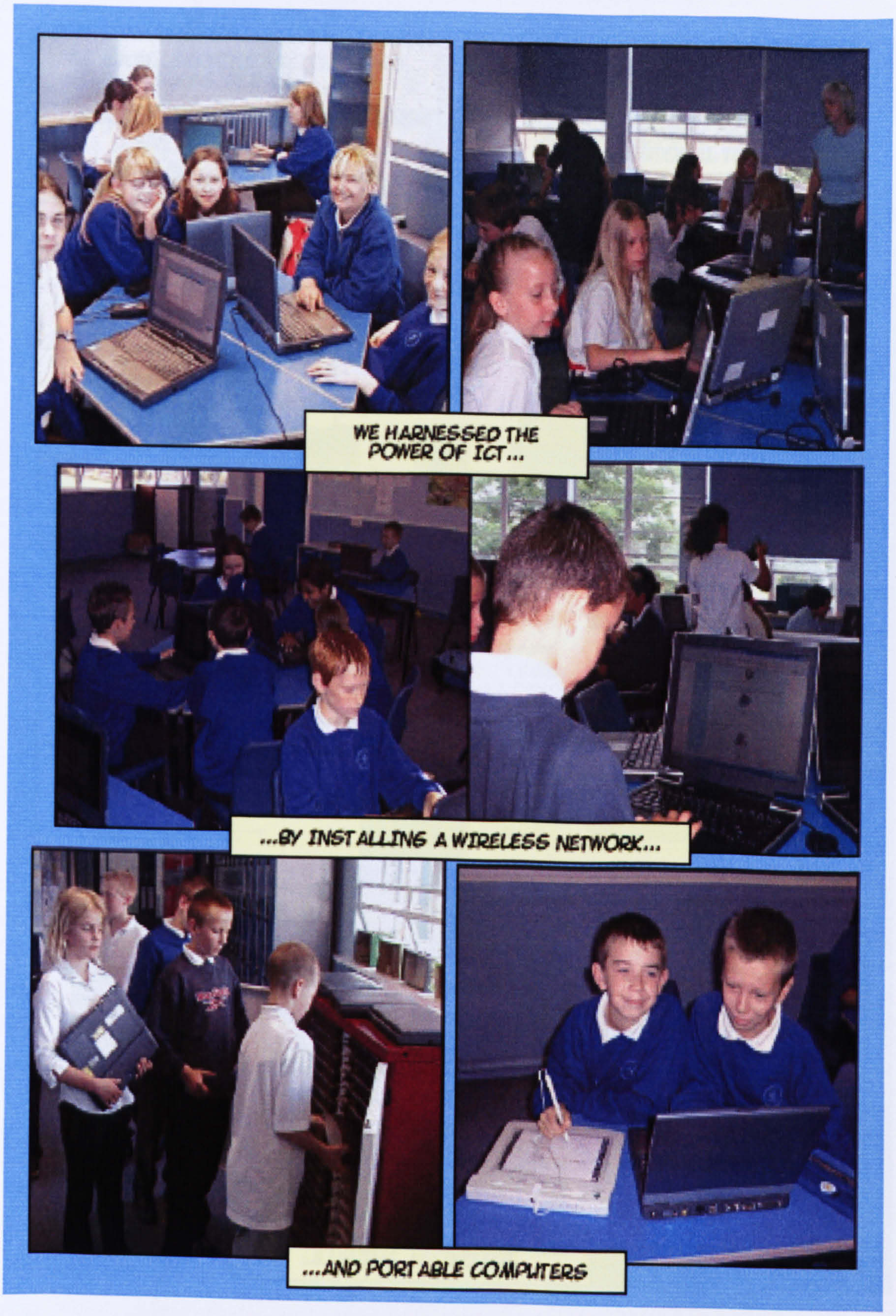
E.3 What factors hinder or prevent change with ICT in your school?

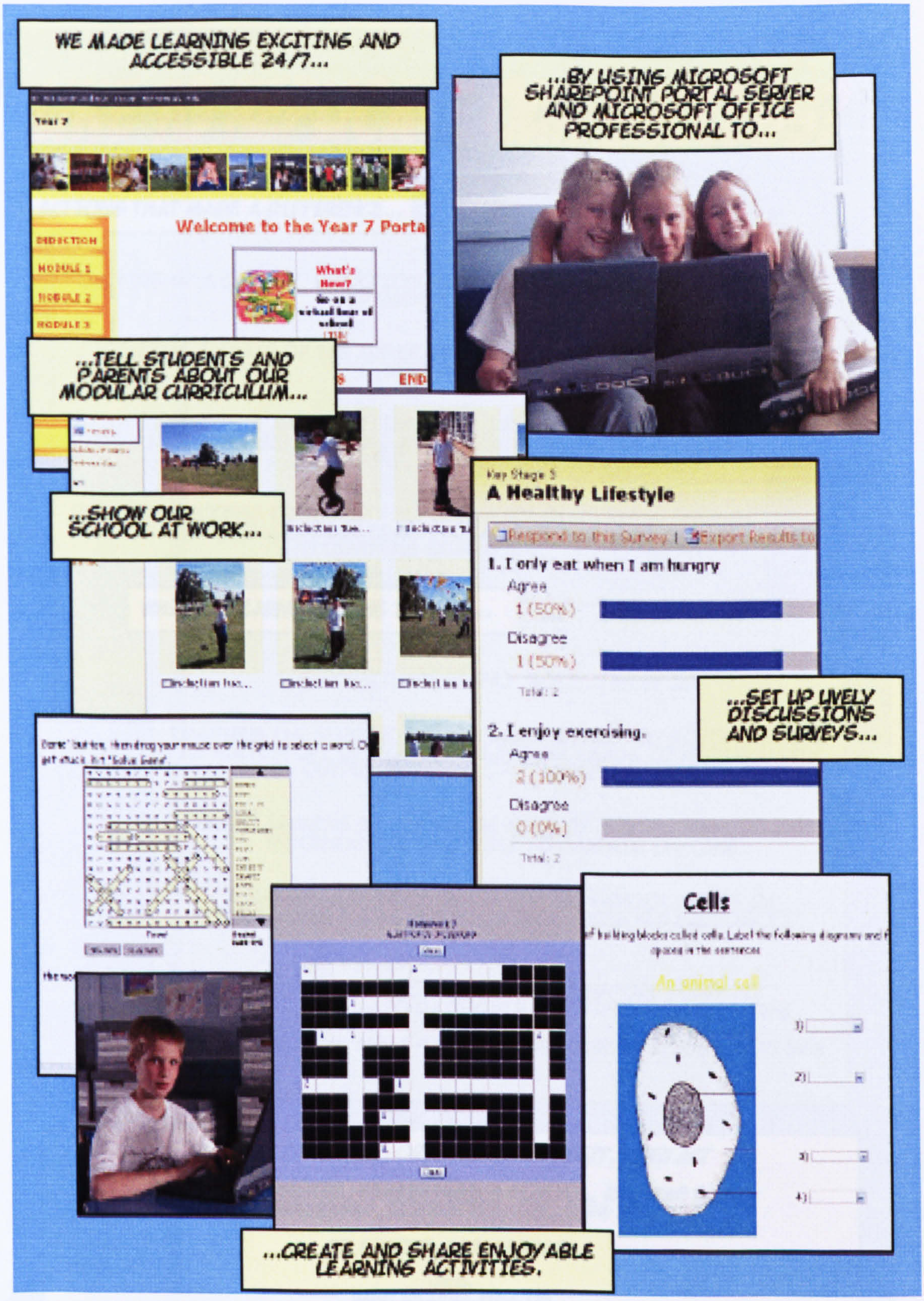
The lack of evidence or conviction about learning gains for pupils through ICT was cited by 50% and was placed last as a factor hindering change. The most significant factors were lack of funding for hardware 90%, lack of qualified staff 80%, lack of innovative teachers 75%. Lack of resources for training was considered an issue by 55% of the respondents.

The questionnaire was administered (electronic and paper versions) between April and July 2000 and the raw data from the database was examined from September to December 2000. The analysis of the questionnaire findings, conducted from January to March 2001, were also compared alongside the earlier interviews and observations from October 1999, and when completed this signalled the end of the phase 1 research.

APPENDIX I E-LEARNING BASE: ICT DEVELOPMENT SCHOOL F




WE HARNESSED THE POWER OF ICT...
...BY INSTALLING A WIRELESS NETWORK...
...AND PORTABLE COMPUTERS


WE MADE LEARNING EXCITING AND ACCESSIBLE 24/7...
...BY USING MICROSOFT SHAREPOINT PORTAL SERVER AND MICROSOFT OFFICE PROFESSIONAL TO...
Welcome to the Year 7 Porta
...TELL STUDENTS AND PARENTS ABOUT OUR MODULAR CURRICULUM...
...SHOW OUR SCHOOL AT WORK...
A Healthy Lifestyle
1. I only eat when I am hungry
Agree
1 (50%)
Disagree
1 (50%)
2. I enjoy exercising.
Agree
2 (100%)
Disagree
0 (0%)
...SET UP LIVELY DISCUSSIONS AND SURVEYS...
Cells
An animal cell
...CREATE AND SHARE ENJOYABLE LEARNING ACTIVITIES.

LIKE TO REPLICATE OUR SUCCESS?

ACTIONS THAT MADE A DIFFERENCE...

SETTING UP A CAREFUL INDUCTION PROGRAMME TO EASE KS2-KS3 TRANSITION

DESIGNING A STATE OF THE ART LEARNING ENVIRONMENT VALUED BY STUDENTS

INTRODUCING A MODULAR CURRICULUM WITH INNOVATIVE RAP (REVIEW AND PLANNING) WEEKS AND REGULAR PROGRESS REPORTS SENT HOME

PROVIDING ACCESS TO QUALITY ICT HARDWARE THAT CAN BE USED IN THE CLASSROOM ALONGSIDE TRADITIONAL RESOURCES TO ENHANCE THE LEARNING EXPERIENCE

WHAT WE LEARNED ALONG THE WAY...

STUDENTS ARE HIGHLY MOTIVATED BY ICT

TRAINING THE STUDENTS ON INDUSTRY STANDARD SOFTWARE SUCH AS MICROSOFT OFFICE PROFESSIONAL LEADS TO HIGH QUALITY OUTPUT AND DEVELOPS SKILLS FOR LIFE

HUGE LEARNING GAINS CAN BE MADE BY MAKING CURRICULUM INFORMATION AVAILABLE TO PARENTS ON-LINE

LEARNING CAN BE EXTENDED BEYOND SCHOOL HOURS BY PUBLISHING ACTIVE LEARNING RESOURCES VIA MICROSOFT PORTAL SERVER

YOU NEED A DEDICATED TEAM OF SUPPORT STAFF TO MAINTAIN AN UP TO DATE VIRTUAL LEARNING ENVIRONMENT AND CREATE EXCITING NEW E-LEARNING RESOURCES FOR STUDENT USE

TO FIND OUT MORE, OR, ARRANGE A VISIT, CONTACT

KEY STAGE 3 CENTRE, ############ SCHOOL, ####### ROAD, ###########, LEICESTERSHIRE, LE## ###.

TELEPHONE: ###########

WEB: WWW.######.ORG.UK

APPENDIX J USE OF DATA TO ILLUSTRATE A CATEGORY: SCHOOL CULTURE

The category of school culture emerged in phase 2 and examples of this from the data are presented below. Data extracts that illustrate school culture are taken from the following sources; a) observation record sheet; b) fieldnotes and analytical memos recorded after the observation; c) photos and d) school documents, for example, the school prospectus that highlights the significance given to ICT across the school. However, ethical issues pertaining to anonymity prevent inclusion of such a document, but are illustrated by the example of another school document shown in appendix J, which is anonymised and demonstrates the use of ICT in school F. This school document was produced for the schools publicity internally and for the local community and partners, for example, Microsoft, with whom the school had a project partnership.

Vignette: example of how the data from different sources (observation record sheets and photos) relates to the single category of 'school culture'.

First, school culture was a category that emerged in phase 2 and was coded from a range of sources; the following examples below relate to data collected from school F that illustrate this category. School culture is understood as a set of 'norms and values' that is, that ICT is *valued* by the school and ICT is *normalised* and *expected* to be used and developed. The next enquiry then would be, how is this demonstrated by a school? The answer is the school's values and ethoses are *displayed*, that is they are *visually present* around the school *environment* - that the school culture has a visual materiality to it. For example, this was found and coded in the photographs, school documents and whole school observations.

With respect to identifying that school F values ICT, it is possible to see this through the arrangement of computers around the school. The school has large ICT suites, (with leaflets (school documents) of its opening hours before and after school for sixth formers and the community), department hubs of desk tops and class sets of wireless laptops. In addition, and this is what differentiates school F from other schools, is an arrangement of computers in open areas around the school. For example, at the top of a stairwell in the Key Stage 3 centre, there is an arrangement of desk tops (see photo) and a cybercafé with computers (see photo), which provides open access to ICT in social spaces, which, by their very presence, encourage a culture of use. This data was cross-referenced with an *interview* and *observation* session in the cybercafé, in which the Teaching Assistant explained that pupils are sent to the café, if they are excluded during a lesson, to work on their own at a computer, as they can access their work on the school's network/intranet; in addition to open access during break and lunchtimes. (TD, interview in cybercafé, school F, 17/06/02; observation cybercafé 10-11am, 17/06/02). These data sources showed how the school provided *continual open access* to ICT, which pointed to a school culture that valued ICT.

Similarly, with wall displays along the corridor outside the school's ICT Training Centre, there were posters clearly illustrating Professional Development opportunities for teachers with ICT and Faculty On Demand Training (see photos), which reflects the range and richness of training available, again indicating a school that values ICT. This focus on ICT was then incorporated into the Whole School Development Plan and Performance Management process, which again was displayed in a poster along the same corridor (see photo). This reflects a school wide ethos for ICT that the leadership team clearly supports and endorses.

There were further wall displays of ICT in areas where the public enter the school by reception, which is an area that receives a lot of teacher/pupil traffic, and is a highly visible and public area (see photo of the school's Microsoft project 'Anytime, Anywhere Learning', which was by reception and another was outside the head's office). This was cross-referenced with data recorded in a 'whole school observation' (on 27/5/2002 and copied below) that found a folder/portfolio for visitors to browse, on the low table in the public waiting area by the Head's office, which contained all the school's ICT publicity – press releases, newspaper clippings of ICT developments and national awards presented for ICT (e.g. ICT Innovation Award from RM for Key Stage 3 e-learning base).

From the photos and whole school observations, ICT featured *prominently* in the school environment; in visual displays and the situating of computers around the school.

The schools' cultural values were taken to be reflected in the materiality of the displays in the open areas, classrooms, staffrooms, teachers' offices, corridors. ICT became part of the fabric of the school space; materially and culturally. ICT permeated the physicality of the school as computers were located in social spaces, alongside information displays about how to use ICT and where to gain training.

See below for the raw data sources: observation record sheet and photos.

Example of Whole School Observation Illustrating School Culture

Whole School (Outside-of-Classroom) Observation Form 2-COMPLETED COPY

This form was used to record general observations about ICT and the whole school, namely the environment, displays (e.g. on staff ICT CPD) and the school's culture (ethos and values). The schools' cultural values were taken to be reflected in the materiality of the displays in open spaces, classrooms, staffrooms, teachers' offices, corridors, and materials the school produced about itself.

Background data

1. School name	SCHOOL F
2. Date	27 MAY 2002
3. Time	ALL DAY SCHOOL VISIT (break times; lunchtime; across school day, when walking around the school environment, in between teachers' interviews and classroom lesson observations)

Observation: to what extent? 0 = none existent, 5 = high degree
(ICT Materials - are defined as any available information/ text about ICT: hardware, software, resources, training, etc)

4. ICT materials displayed in reception / entrance area to the school	**YES - 5**
Notes: YES, displays on the walls, with photos of ICT developments, eg the new ICT suite; presentation to teachers and pupils of ICT awards.	
Additional material to collect: NO	
5. ICT materials displayed in Head Teacher's office	**N/A**
Notes: Did not have access to head's office, as the head teacher interview was conducted in a small meetings room.	
Additional material to collect: NO	
6. ICT materials displayed in teachers' offices/work spaces	**YES - 4**
Notes: YES, a range of information; from CPD routes offered at the training centre, to sharing copies of power points (ppts) for lessons, which were paper copies available for staff to take, with the name of the teacher who wrote the ppt, if staff wanted an e-version.	
Additional material to collect: NO	
7. ICT materials displayed in staffrooms / teachers' social areas	**YES - 5**
Notes: In the staffroom there was a recent press cutting taken from the TES (Times Educational Supplement) about ICT training that was displayed on the staffroom board. Also CPD routes available from the school's ICT training centre and local Higher education Institutions, e.g. MA routes, etc.	
Additional material to collect: NO	
8. ICT materials displayed in pupils' library	**YES - 5**
Notes: Posters on the walls in the library about ICT.	

Additional material to collect: YES, collect leaflets that are available to pupils and take photos of wall display in library.	
9. ICT materials displayed in pupils' independent learning / study areas	**YES - 5**
Notes: Posters on the walls about using ICT e.g 'tips and hints' about saving pupil's work on the network / school intranet.	
Additional material to collect: YES, take photos of wall posters about using ICT.	
10. ICT materials displayed in pupils' social spaces / open areas	**YES - 5**
Notes: HARDWARE ACCESS; observed pupils using these desk tops before registration (8.30am) and during the morning break time. The pupils reported that they were using the computers to email homework back home.	
Additional material to collect: YES, take photos of arrangement of hardware in these social spaces, to show open access in public places around the school. For example, at top of stairwell in Key Stage 3 centre, an arrangement of desk tops.	
11. ICT materials displayed in corridors	**YES - 4**
Notes: YES, in the corridors outside the ICT Training Centre there were large displays of CPD routes available to staff and how these linked to the school's priorities.	
Additional material to collect: take photos of these displays	
12. ICT materials for visitors to take	**YES - 3**
Notes: Leaflets of opening times for the large ICT suite; open to public after school hours / community access and for sixth formers before and after school hours	
Additional material to collect: copy of leaflet collected	
13. Additional areas worthy of note, which are specific to individual schools	
FIELDNOTES 1) By reception and the public waiting area in front of the Head's office, on the low table there was a folder/portfolio for visitors to browse containing all the school's ICT publicity – press releases, newspaper clippings of ICT developments at the school and national awards presented for ICT (e.g. ICT Innovation Award from RM for Key Stage 3 e-learning base). 2) There were numerous displays on the walls around the school promoting ICT; both for pupils and for staff; giving a clear visual signal that ICT was valued. 3) CROSS – REFERENCE with PHOTOS taken of the visual displays around the school; including location and setting of computers in open/social spaces e.g. in cybercafé and top of stairwell.	

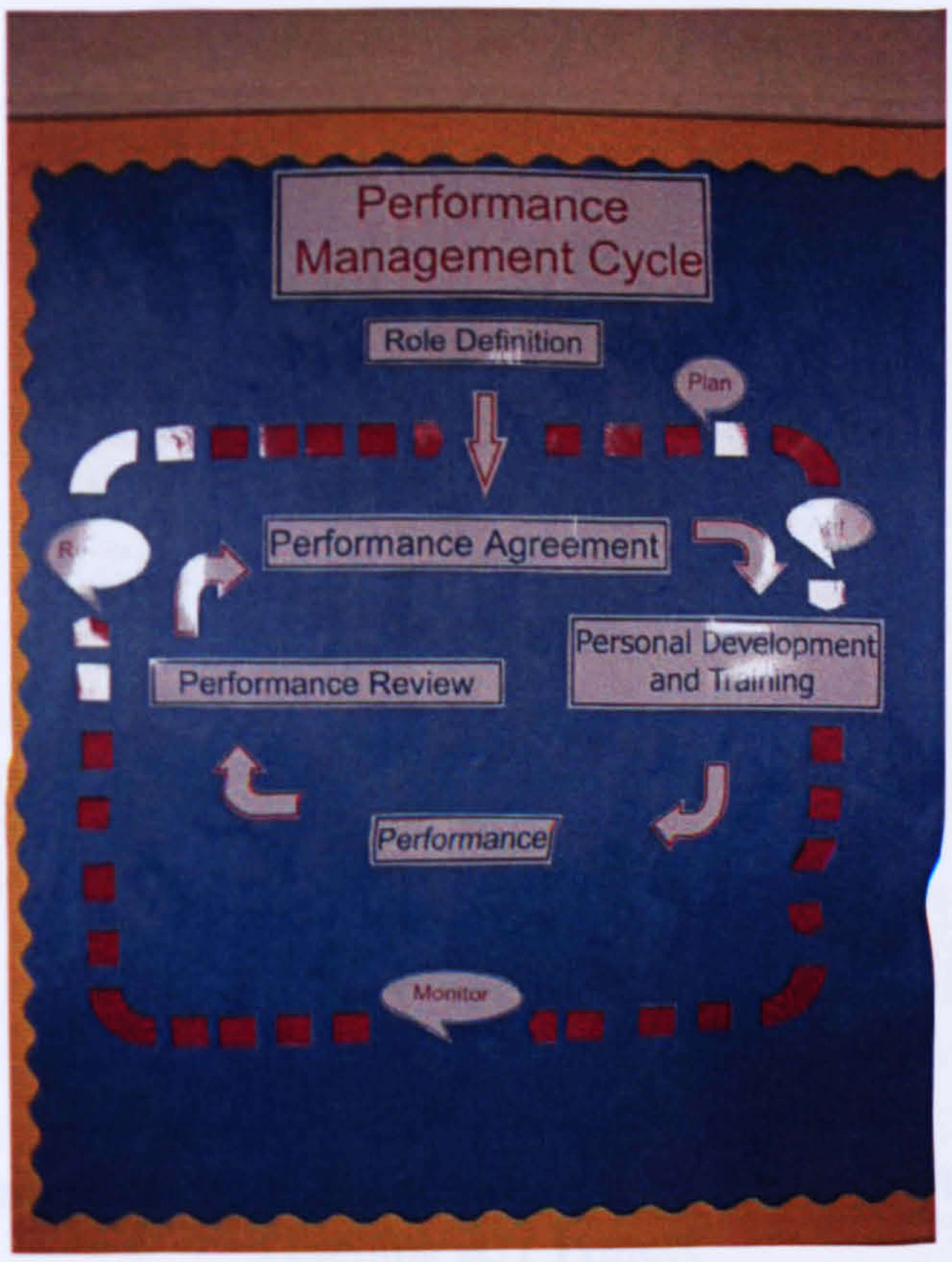
4) CROSS – REFERENCE with INTERVIEWS and answers to the question on school ethos, from teachers in school F and compare with other schools/teachers regarding school culture. See interview with Teaching Assistant in cybercafé too and use of computers and school intranet. 5) CROSS – REFERENCE with SCHOOL DOCUMENTS: the school prospectus, whole school ICT policy and publicity/press releases about ICT developments in the school, e.g. 'How to replicate building an e-learning base for key stage 3'. **ANALYTICAL MEMOS** Category 'school culture' that concerns a 'school ethos for ICT' can be seen in the observations of *displays* around school F. These are both *material* and *cultural*: materially ICT appears to be valued by the fact that computers are situated in social spaces that are public and open; for teachers' CPD there are displays of the numerous pathways and routes to gaining ICT accreditation for teachers, which reflects an encouragement to gain such accreditation, which shows ICT is *valued*, which is cultural.	

Examples of Photos that Illustrate the Category of School Culture

Cybercafé

ICT open access in social area: top of stairwell

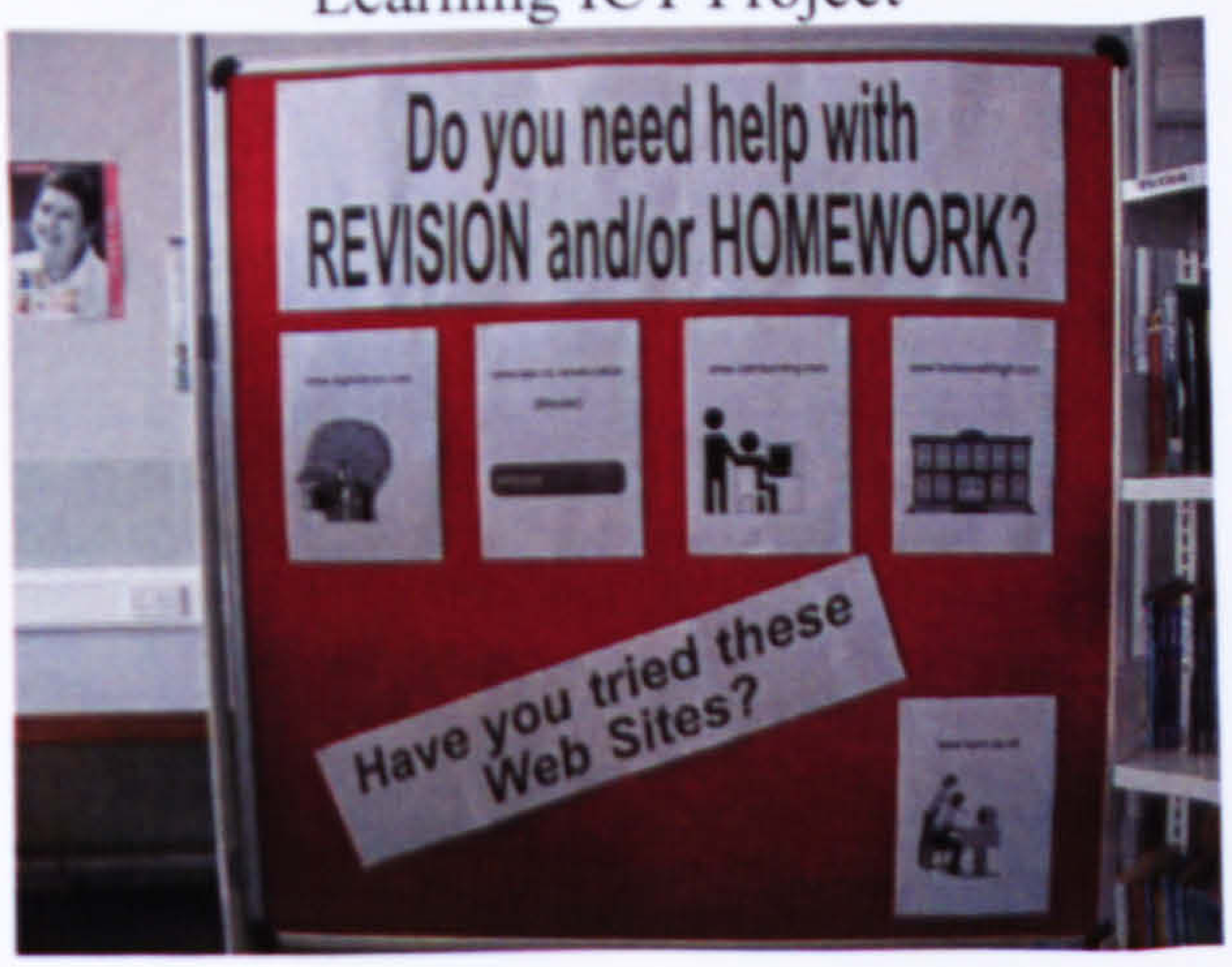
Poster on display in the corridor outside the ICT Training Centre: advertising ICT training for the spring term for teachers



Poster on display in the corridor outside ICT Training Centre: indicating how training fits into the whole school performance management cycle of professional development for teachers

Poster on display in the corridor outside ICT Training Centre: advertising bespoke Faculty On Demand ICT Training

Poster on display by reception illustrating the Microsoft Anytime Anywhere Learning ICT Project



Display board in the library promoting websites and the use of ICT to support revision and homework

A display about ICT in Art and Design in reception