The National Grid for Learning

and the professional development of teachers:

outcomes of an opportunity for change.

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Abstract

The National Grid for Learning (NGfL) is a flagship enterprise of the Labour Government. The primary aim of initiatives co-ordinated under the NGfL is to integrate Information and Communications Technology (ICT) into education. Since 1997, funding has made available up-to-date equipment for schools, relevant training for teachers, and educational content for teachers and pupils on the World Wide Web. The purpose of this drive is to increase the effective use of ICT in order to raise pupils' standards of literacy and numeracy, and to equip the future work force with skills which would ensure the competetiveness of the UK in an increasingly global, highly technical labour market-place. Previous innovation in the field of educational ICT had achieved patchy results. Teachers were perceived by some commentators as one of the chief obstacles to increased ICT use in classrooms.

This research was designed to study the effects of the changes taking place under the NGfL from 1997 to 2000, with a particular focus on the professional development of practising teachers. Through study of the responses to proposed and actual change of teachers in a linked group of schools, a model for understanding teacher uses of ICT was developed. This model was applied to a further eight primary schools in order to clarify factors which supported or were barriers to change towards ICT integration.

The research findings strongly indicate the importance of considering the situational factors in the work contexts of teachers as dominant in determining outcomes of change. The results also suggest that the change agentry of practising teachers is effective in promoting planned change once teachers are included as discussants in the change process. The findings indicate that NGfL aims can be achieved if an awareness of the complexity of the role of the teacher is promoted, and if teachers are enabled to evaluate and reflect on their own work practices and those of others. The establishment of communities of practice within schools, amongst schools and in the virtual environment of the Internet may all contribute to ensuring that the experiences of professionals are valued, and that the inclusion of beginners in opportunities for new practice is facilitated. Finally the research leads to the conclusion that a pedagogy of ICT is evolving as good practice becomes disseminated and embedded in the community of teachers as learners of ICT which is the teaching profession. This pedagogy, directed towards ensuring the educational effectiveness of ICT in schools, can enable the realisation of the potential of both new technology and young people.

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The National Grid for Learning and the professional development of teachers: outcomes of an opportunity for change

Lyn Dawes

Chapter 1

Introduction

The aim of this research is to study the introduction into schools of Information and Communications Technology (ICT). New applications of technology have the potential to support learning across the curriculum, and allow effective communication between teachers and learners in ways that have not been possible before. Between 1997 and the year 2000, which was the duration of this study, developments in computing made technology more accessible in use, less expensive, and better designed to address the needs of the classroom. Personal computers became more affordable and more popular, so that some children could expect to use higher specification equipment at home than at school. The UK government stated its determination to ensure that UK schools were equipped with the resources to use ICT to deliver the curriculum, and to ensure the familiarity of the future work force with applications of new technology.

Practising teachers were presented with a range of opportunities (such as training and access to equipment) to enable them to acquire ICT skills and understanding. The pressure for change toward integrating ICT into education did not take place in isolation, but in parallel with competing priorities, creating different tensions for different individuals. The essence of educational change is to do with transforming schools, which necessitates change of work practices by the teaching profession. Sustainable change in education requires teachers to change as individuals. People's responses to any sort of suggested or imposed change can not really be predicted: positive or negative responses depend on a complex set of factors. This research was designed to monitor the responses of teachers to ICT innovation in education. My

research is focused on the professional development of teachers in ICT because ultimately it is the contribution of teachers which ensures the educational effectiveness of new technology in schools. Without the endorsement of the profession, the aims of ICT initiatives might never be realised.

Background details to the study will be provided later in this chapter. Chapter 1 begins by setting out the questions the research is designed to address, then goes on to put them in the context of the ICT status of UK schools as the study began in 1997.

Research Questions

This research was undertaken to clarify the factors which support or hinder teachers' professional development as users of the range of new technology during its introduction into schools. The use of Information and Communications Technology (ICT) is integral to the delivery of the statutory National Curriculum. Therefore the question is not whether teachers choose to use ICT: they have no choice. More pertinent questions are to do with whether infrastructure, management systems and school ethos support the use of technology. Further questions arise from a consideration of how teachers are supported as learners - how they are enabled to generate uses of technology in ways that ensure that it will enhance their teaching and their pupils' learning. The study set out to assess key factors affecting the acquisition of ICT competence, and the translation of what in some cases were newly acquired skills and understanding into practice. The work of Stake (1967) in its structured evaluation of educational change provides a framework in which to consider the process of ICT innovation. Using this framework I will evaluate three aspects of the situation in schools:

A] Antecedents: existing conditions which may relate to the outcomes of change

B] Transactions: interaction between people, and between people and contexts

C] Outcomes of change

(see Chapter 3 for details).

The research was designed to address the following key questions:

1. What factors support the professional development of teachers in ICT?

2. What factors hinder progress?

3. What are the outcomes of the opportunities available under the National Grid for Learning (NGfL)?

The structure of this thesis

Chapter 1 introduces the background to the study by describing the ICT status of UK schools as the study began in 1997, and provides a brief history of ICT use in schools up to that time.

Chapter 2 provides an overview of the literature relevant to the study in the following fields: theories of learning are used to assess whether and how teachers-as-learners are supported by management structures. Most particularly the 'apprenticeship' based model of Lave and Wenger (1991) and others are used to examine relationships between teachers, learners, teachers-as-learners, pupils, and management structures. The adequacy of theories in dealing with the phenomenon of ICT innovations is evaluated. Literature dealing with computer use in schools is examined.

In **Chapter 3** the methodology employed to collect and analyse data is detailed. Teachers, ICT Co-ordinators and administrators were interviewed as they prepared to purchase hardware and establish electronic connections in the study schools. The sample schools includes a case study of a school as it set up a new networked suite of computers and appointed a new ICT co-ordinator, and an interview study of linked schools comprising a City Technology College and its feeder primary schools.

Chapter 4 summarises the findings of Phase 1 of the study. The research was conducted in two phases, which have overlapping characteristics but can be distinguished by a change in focus of data collection from schools. (Precise details of each phase is contained in Chapter 3).

Chapter 5: The findings are interpreted in the light of theoretical frameworks, looking at preliminary answers to the research questions. An emerging model of categories of 'Teachers as Users of ICT' is proposed to enable analysis of what supports and what hinders teacher uptake of technology. The model provides a framework for evaluating the professional development of teachers in the field of ICT.

Chapter 6 : Chapter 6 presents findings from Phase 2 of the study, in which the model described in Chapter 5 was used to collect and order data from teachers in a further eight primary schools.

Chapter 7 : Presents the findings of interview data in Phase 2 of the study in the context of documentary evidence.

Chapter 8 : In Chapter 8 findings indicating some outcomes of the NGfL initiatives are recorded. Issues arising from the literature reviewed in Chapter 2 are considered in the light of the research findings.

Chapter 9: Conclusions. A discussion of the theorietical implications of the research, implications for methodology, and discussion of the impact of the NGfL during its introduction.

The next section provides details of the background to the research. This includes a summary of the introduction of the National Grid for Learning in the UK, and a brief history of the progress of educational computing prior to 1997.

Background to the study

The ICT Status of UK Schools in 1997

The 1997 McKinsey report 'The Future of Information Technology in UK Schools' was developed by McKinsey & Company with the aim of 'producing an independent analysis of the issues, challenges and opportunities surrounding the use of information technology in UK schools, and of the options for policy makers in general'. McKinsey & Company is a consulting company, whose American practice had in 1993 carried

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out a review of IT in the USA for President Clinton's NII (National Information Infrastructure) Commission. The UK report advocated a cohesive strategy for the use of IT in education, and noted that new ways of communicating with computers could become important to schools, homes and communities.

As this study began in September 1997, UK schools were relatively well equipped in terms of the ratio of computers to students (McKinsey, 1997, p1) but many of these computers were obsolete. The pace of development of technology had not been matched by the ability of schools to purchase new equipment. Other factors hindered computer use: there was little or no technical support in schools, and educational objectives for IT were often unclear (Op. cit. p 25). At that time there seemed no co-ordinated attempt to help teachers to integrate technology into the curriculum or to achieve the level of skills and understanding they would need to ensure the confidence to use ICT in practice:

> 'There is evidence that many teachers lack the training, support, communications and therefore proficiency to be fully effective in the use of IT. Almost everyone we interviewed highlighted this as one of the most important issues'
> (Op. cit. p 27).

The McKinsey report itemised three critical areas affecting teachers' engagement with IT initiatives: teacher training, access to computers, and the development of communication networks for the exchange of ideas. In 1996 the Labour opposition's Tony Blair (then leader of the opposition) and David Blunkett (shadow education secretary) had commissioned Sir Dennis Stevenson (Chairman of Pearson) to report findings of an examination of the role that ICT should be playing in primary and secondary education. The Stevenson Report, which drew on the McKinsey report, was published in 1997, and has since become a foundation document for government policy making in educational technology.

The Stevenson Report added the C for 'Communications' to IT in order to stress this new and potentially powerful aspect of computer use. It concluded that the government would disadvantage the people of the United Kingdom in terms of global competitiveness, if steps were not taken to integrate ICT into education.

'We wish to see a society within ten years where ICT has permeated the entirety of education (as it will the rest of society) so that it is no longer a talking point but taken for granted - rather as electricity has come to be'
(Stevenson, 1997, p 4).

The involvement of teachers was highlighted as a significant factor which would affect the achievement of this aim of the report: teachers, Stevenson says, are 'crucially important' to ICT innovation.

'It is a sad contemporary reality that teachers are under respected and under revered. We do not make that mistake. 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, p 22).

It is possible that this statement contains the core of one problem that arises between teachers and a government desiring change. As Stevenson says, innovation was expected to benefit the children and the country - but not, particularly, teachers, except indirectly. Stevenson's description of teachers as 'under-revered' is offered in the report not with referenced evidence, but as a 'sad contemporary reality', that is, as received wisdom. Its accuracy can be gauged by considering evidence from other sources. The following quotation is from the president of the Girls' Schools Association, indicating that the status of teachers was unchanged in 1999.

'To be a teacher should be a source of pride. It is time to stop heaping blame on teachers and instead to celebrate their achievements. We should lose no opportunity to counteract the negative images that lead parents to say, when a careers adviser suggests teaching as a future path for a student, "Oh, I think she could do better than that-"
(The Guardian, 23.11.99)

In April 2000, evidence that a negative view of teachers persists appeared in a speech given by the government advisor Lord Puttnam to the members of the National Association of Schoolmasters Union of Women Teachers, reporting the image of teachers as 'whingers rather than winners, of long holidays rather than long hours, and of Mr Chips rather than microchips' (The Guardian 26.4.2000 p 9). The previous day (after members of the National Union of Teachers had disrupted a speech by Education Minister Estelle Morris), the Daily Mail leader column described teachers as

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'noisy, scruffy, chippy, boorish, truculent and self pitying'. A pervasive 'anti-teacher' stance can not be attributed to any particular social group, but is simply recorded by Stevenson as a common phenomenon. Yet teachers, the report reiterates, were crucial to the success of the innovations. However few would be consulted about the nature of the changes, and the focus of the change was on schools as institutions rather than individual professional development.

The Stevenson Report was seminal in its emphasis that teachers should have effective training for ICT, that they should have up-to-date computers for themselves and their classes, and that a network should be set up allowing teachers to exchange professional information.

Priority was given to ICT development in the UK partly because research evidence indicated the increasing importance of computer literacy in the employment market, in school learning and in administration. But partly the drive to increase ICT use in schools was 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' (Op. cit. p 6). ICT innovation thus had a visionary, futuristic quality.

The two key conclusions of the Stevenson Report were:
> 1) The state of ICT in our schools is primitive and not improving.
> 2) It is a national priority to increase the use of ICT in UK schools.
> (Op.cit. p 6).

Government Intervention

The Labour government was elected in May 1997. At the 1997 Labour Party Conference, the Prime Minister Tony Blair pledged that by the year 2002, all 32,000 schools in Britain would have multimedia computers and Internet connections, and that all teachers would receive training to ensure that they were competent and confident to teach using ICT. On October 8th 1997 the government launched its consultation document 'Connecting the Learning Society' (DfEE, 1997a) which detailed the proposals for the National Grid for Learning. The nucleus of the NGfL

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was to be the 'Virtual Teacher Centre' (VTC), a web site dedicated to education with links to other educationally useful web sites, information relevant to staff development, and a facility for online discussion between teachers. It would link schools, colleges, museums, galleries and other institutions, nationally and internationally.

Stevenson also drew on the previous Conservative government's 1995 'Superhighways for Education' initiative which committed £10 million to the establishment of initial pilot schemes exploring the role of the Internet in education. The NGfL proposals were designed to address the issues highlighted by the Stevenson report. In his foreword to 'Connecting the Learning Society' the Prime Minister Tony Blair says: 'His report identified two main problems - the need to train teachers and to create a market for high quality British Educational software' (DfEE 1997a: foreword). The report also indicated two other priorities for government: to publicly announce its determination to place ICT high on its agenda, and to make the cost of networks for schools easily affordable.

Direct government intervention in education is relatively frequent in the UK, though not all government directed change achieves its aims. The drive to integrate ICT into classroom practice was undertaken by a new and at the time popular government which committed large sums of money and consulted at all levels in order to determine how to proceed. Ultimately, however, the success or otherwise of the innovation might depend on what Boyd-Barratt (1991, p.3) called 'the power of curriculum compulsion.' Curriculum 2000 was implemented in September 2000, and this included an integral ICT component in all subject areas. The Office for Standards in Education (OFSTED) inspection system would ensure its 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.

Introducing the National Grid for Learning

Four complementary definitions of the NGfL can be found in government documents explaining its purpose and function to educators and the business sector as the initiatives were introduced.

'The Grid will be a way of finding and using on-line learning and teaching materials. It will be a resource for everyone in our schools'
(Tony Blair, Connecting the Learning Society: DfEE 1997a: foreword)

'The National Grid for Learning is both an architecture of educationally valuable content within the Internet, and a programme for the delivery of ICT infrastructure, services, support and training.'
(Open for learning, open for business: DfEE 1998 p 24)

'The Grid will provide curriculum support for schools and help teacher development, and will extend to lifelong learning whether home-based learning, further education or training for employment. It will link closely with our plans for study centres funded through the National Lottery and for the University for Industry. National and local museums and galleries will have an important part to play. We also intend that libraries will be an integral part of the Grid. In this way we will be able to make available to all learners the riches of the world's intellectual, cultural and scientific heritage. Through the Grid, we will train teachers, connect schools, provide content, remove barriers to learning'
(Kim Howells: Preparing for the Information Age: EDSI Report 1997b: Foreword).

'The National Grid for Learning - a framework for a learning community designed to raise standards, and improve Britain's competitiveness, and which embraces schools, colleges, universities, libraries, the home and the workplace.'
(Connecting Schools, Networking People: BECTa 1998b p 4)

So, the NGfL was conceived as a resource, an architecture, a programme, a means of removing barriers, and a framework. It was a way of organising resources which would enable schools and other institutions to access further digital resources through technology. Notably Kim Howell's description of the NGfL provides a glimpse of a vision in which all learners will have all information *available* to them. The task for education remained clear – to enable learning and development: new knowledge is not necessarily generated by providing people with freely available information.

The Education Departments' Superhighways Initiative (EDSI) report (DfEE 1997b) in which Howells' introduction is found lists seven features of institutions which the evidence indicates might affect the benefits gained from ICT use. Each of the seven features (such as 'quality of management' ' stance towards IT' 'dominant educational

and social philosophy') is subdivided into **'markers'** - issues that had been found to make a difference (such as 'a prior needs analysis' 'reliability' 'suitability for the educational purposes of the particular school' etc.). Thirty-two factors are identified here as just some of the influences which affect whether direct learning benefits can be gained from ICT use. Making information available is one step towards creating knowledge, but the EDSI report showed that many conditions had to be met in order to utilise the educational potential of ICT in institutional settings (see Appendix 6 for the full list of 'markers').

One of these conditions is, when considering computer use: 'the immediate obviousness to teachers of the educational potential' (DfEE 1997b p 29). It was evident that the involvement of teachers would be instrumental in unlocking potential benefits which ICT could offer to learners.

Launching the National Grid for Learning

The NGfL was conceived as a way of finding and using online learning materials, a network of networks and education services connecting schools, libraries, colleges, museums, the workplace, and homes. One aim of the NGfL was that it would harness technology in order to raise educational standards. To make this possible, public/private partnerships were envisaged, and industry was encouraged to develop a range of managed ICT services for schools. Economies of scale and competition were predicted to keep down the costs of such managed services. Funding for teacher and librarian training would be provided by the People's Lottery (DfEE 1997a p 3).

The timetable for the launch of the NGfL was:
• Consultation from October to December 1997
• Launch of a model of the Grid early in 1998
• Managed services available from Autumn 1998
• All schools, colleges, universities and libraries connected to the Grid by 2002.

A summary of the proposals for the NGfL found in 'Connecting the Learning Society' is:
• To link learning institutions through technology

• To provide networks and services for education

• To develop the ICT skills of teachers and librarians

• To promote industry partnerships which would enable competing managed services

• To identify and build on best practice, in the UK and in Europe

• To ensure equality of access to resources

• To develop high quality content available through the Grid

• To encourage development of relevant software

• To achieve targets such as 'by 2002 serving teachers should generally feel confident, and be competent to teach, using ICT within the curriculum'.
(DfEE 1997a p 24).

These ambitious and far reaching *proposals attempted to move educational ICT* forward on a number of fronts simultaneously. The emphasis was on ensuring that the infrastructure was upgraded and managed, and that existing inequalities were addressed. Specific proposals for teachers mainly emphasised training; teachers and librarians were identified as 'key intermediaries' requiring skills.

> 'A vital part of the programme for implementing the Grid will be the development of
> teachers' and librarians' skills'
> (DfEE 1997a p 5).

> 'The Grid must be useful. It must lead to the improvement of the skills and confidence of
> teachers, librarians and other key intermediaries'
> (DfEE 1997a p 14).

Only in the section of the document to do with the creation of the Virtual Teacher Centre is the wider education of teachers for effective ICT use stressed.

> 'The creation of a virtual Teacher Centre...the content drawn together centrally...a forum for
> creative ideas in the use of ICT in teaching, professional development and administration..'
> (DfEE 1997a p 17).

The aim of the NGfL for teachers, then, was that they would acquire the skills of network literacy, and that this would feed into the drive to raise standards.

'A definition of network literacy as the capacity to use electronic networks to access resources, to create resources, and to communicate with others. These elements of network literacy can be seen as extensions of the traditional skills of reading, writing, speaking and listening. This is of central importance and provides a link with the Government's focus on improving standards of literacy'
(DfEE 1997a p 10).

The DfEE document 'Open for Learning, Open for Business' set the NGfL proposals in motion. There had been 'over 900' responses to 'Connecting the Learning Society', and in these its content was 'enthusiastically welcomed'. During the consultation the requirement for teachers to have *skills* had been replaced by the recognition that the contribution of teachers (and librarians and others), their *expertise*, would be a key factor in ensuring NGfL targets would be met.

'The main messages from the consultation were [...] very strong endorsement for building up the expertise and confidence of teachers, librarians and others in order to realise the targets'
(DfEE 1998 p 5)

The support of the teaching profession was thus recognised to be essential if the NGfL aims were to be realised. However nothing in these documents implies that teachers might play a more important part in making ICT educationally effective than any other group involved in the use of ICT with pupils. The targets, found in Connecting the Learning Society page 24, depict networked schools, ICT literate school leavers, a facility for collection of electronic data from schools, and using ICT for assessment and examination: and the UK to build a strong private sector educational software industry, becoming a world leader in the export of learning services. Huge sums of money would be gained by business and industry. However, individual teachers would not be provided with personal computers, or tax concessions which would facilitate purchase, and their training would not be funded by government. Personal gains for teachers from the NGfL initiatives would remain in the realms of personal satisfaction in professional development in ICT, and the profession's usual altruistic pleasure of enabling pupils to develop. Motivation towards implementing NGfL drives might also be derived from a sense that the role of the teacher was highly valued, or that there was an ambient awareness that teachers would be key contributors to the achievement

of NGfL targets. Unfortunately neither of these was evident. The following is an extract from a co-authored paper.

'This renewed awareness of the influence of teachers reflects an uneasy history of technological adaptation by those in education (Cuban 1986). Teachers have long been seen by many advocates of educational computing as a principal barrier to widespread integration of ICT in schools; as Bryson and de Castell (1994) put it, a major 'nuisance factor' to the otherwise smooth succession to the information technology revolution. A host of reports have 'proved' teachers to be either 'technophobic' about using ICT (e.g. Rosen & Weil 1995, Brosnan 1997); resentful of the 'threat' the computer poses to their professional status (Callister 1986); or too rooted in out-moded pedagogic assumptions to change their ways (Gillman 1989, Finlayson & Perry 1995). Viewed from this perspective, teachers have long been seen by educational technologists to exhibit a range of obstructive behaviours from *incompetence to sheer bloody-mindedness*, doggedly resisting change in educational computing. The simplicity of this view is part of its attractiveness, whereas reality for teachers attempting to assimilate ICT into their practice has been a complex mix of lack of appropriate equipment, training, time, and genuine pedagogical purpose supported by research evidence. The number of schools using ICT to good effect is a tribute to the persistence of teachers in spite of adverse conditions'
(Dawes et al, 2000 p 1).

The Cost of the Learning Grid

Huge sums of money were committed to the NGfL. A programme of over £700m for the period 1998 - 2002 was invested in the infrastructure, services and content. £230 m of New Opportunities Funding from the National Lottery was committed to train serving teachers and school librarians. £50m was available for the digitisation of content for the Grid. This was a high-profile initiative the success of which could contribute to perceptions of the efficacy of the Labour government. To help achieve the goals of the NGfL, private sector initiatives were co-ordinated by declaring 1998 'UK NetYear'. In early 1998 the National Council for Educational Technology (NCET), re-organised and under its new name British Educational Communications

and Technology Agency (BECTa), began the task of co-ordinating content for the NGfL.

The financial commitment in the UK reflected a heightened sense of expectation surrounding the educational potential of the 'Information Superhighway', possibly influenced by initiatives in other countries. For example, the Canadian SchoolNet project set up in 1993 aimed to connect the majority of the country's 16 000 schools to the Internet. An integral part of the United States' National Information Infrastructure was a drive to connect all US classroom to the Internet by the year 2000, and more recently President Clinton's $2 billion technology initiative also focused on delivering the Internet to America's teachers and students. Member states of the European Union had begun joint action to strengthen national, regional and local developments in ICT in schools - 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 in their pursuit of knowledge ...'
> (European Commission, 1997 Section 7).

The provision of new technology and connections for schools was undertaken for a number of reasons, only some of which are to do with improving educational provision for children in schools. Economic growth based on corporate capitalism, the requirements of business and industry, the perception of a digital world order based on information flow amongst the new electronic networks, and the requirement that a new government make an impact on the electorate were all contributory influences. The Grid had to be a profitable venture to retain the involvement of businesses such as IT firms, and industries such as the telecommunications industry. So, for example, telecommunications corporations offering to wire schools 'free' expected to control connections to the Internet, and IT firms equipping schools did so partly to ensure that the children using their machines would become loyal future customers (Reguly 1997). The cost of 'unseen' elements of technology use such as upgrades, maintenance and repairs would also constitute a significant outlay for educational institutions, as would prospective financial tariffs for Internet connections (Van Horn 1994). However

based on such evidence as the EDSI report, drives to involve schools in the NGfL
initiatives stressed only the educational potential of ICT.

> 'It is the communications aspect of ICT which is broadening educational horizons and
> providing so many [...] benefits. The possibility of sending and receiving email [...] provides
> pupils with the chance of exchanging information with pupils from many other countries.
> [...] Resources available to both teachers and pupils need no longer be contained within the
> school walls'
> (BECTa 1998b p 6).

The effectiveness of the Learning Grid as an educational tool was initially hypothetical.
The huge amount of information it could deliver would be meaningless without clear
frameworks for ordering and making meaning from it (Lakoff, 1995): and possible
dialogues with people from all over the planet would still require a purpose. The
contribution of teachers would be to provide such frameworks and purpose: and this
would only be possible if teachers believed that ICT use would genuinely enhance
education in their classrooms. ICT applications such as email were not designed as an
educational tool, and it would take the energy and drive of the profession to adapt it to
help educate children.

The history of technological in schools provides a perspective on past innovations,
which informs the present and might provide some indicators about the future. The
next section provides an overview of the national context for ICT development, and
some indicators of change in schools throughout the 1980s and 1990s.

A brief history of technological innovation in schools

In the 1840's, the rapidity with which messages could be transmitted was limited by
the pace of fast horses or the speed of sailing ships. The telegraph and Morse code
were developed in 1844. In 1875, Bell invented the telephone. In 1956 the first
submarine telephone cable was successfully laid. The first communication satellite was
a balloon used in 1960. The first efficient civil communications satellite, Telstar, was
launched in 1962. Light wave (or fibre optic) communications systems were first
utilised in 1977. Global networking began with the first large-scale packet switched
network, the ARPANET, implemented in 1969 (Harasim, 1993, p 5). The range and

speed of computers has continued to develop, generating a range of utopian dreams and dystopian nightmares about the capacity of humans to live with, control and organise a 'wired world', which might enrich our collective cultural, political and social lives, or might create catastrophic divisions of advantage and disadvantage.

Even when personal computers were new and untested, hopes were high that their inclusion in education would address a range of problems.

> 'In the late 1970's...personal computers were still novelties...The growth of a school
> computer culture was still far from megachange... A headline in the Wall Street Journal
> reflected the doubts of sensible people interested in the bottom line. SCHOOLS BUY MANY
> COMPUTERS, it proclaimed, BUT BENEFITS IN CLASSROOMS ARE SMALL...It was
> not surprising that questions were asked: Where are all those computers we have heard so
> much about? What are they doing? Far from producing improvement, they seemed unable
> even to stop the deterioration' (Papert, 1993 p 37)

1981

A British opinion poll showed that 80% of those interviewed had not heard of information technology (IT) (The Times, 14.1.82).

> '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).

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 try and 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're pushed ahead with
> computers in schools. I want youngsters, boys and girls leaving school at sixteen, to actually
> be able to operate a computer'
> (quoted in Scaife, 1993 p 15).

16

£16 million was provided by the Department of Trade and Industry (DTI) 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, 1993 pp 15 – 20).

New information technology obtained full backing from American big business. Large companies such as Piedmont Natural Gas, American Broadcasting Corporation, Sears Roebuck and IBM began to develop their IT resources. The new technologies were predicted to have a radical impact on society, shifting the structure of investment and power (Hawkridge 1993 p 51).

> 'If we adopt Schiller's (1981) assertion, then information technologies such as the computer are developed and shaped primarily with corporate capitalism in mind. Thus although IT serves "nicely the world's business system requirements" (Schiller 1981 p 16) this 'construction' of IT could not be further removed from the fundamental requirements of educational systems. Put simply, the military and industrial origins of computerised technology confirm the fact that information technology is not, and never has been, constructed with schools in mind'
> (Selwyn 1998a p 10).

Schiller (1981) took the view that those in control would gain from the wave of business interest in IT, while significant portions of the population would not gain at all, and on the contrary would be further deprived of opportunities, power and resources by new technology.

1982

1982 was designated Information Technology Year by the Government to increase national awareness of IT.

The BBC Computer Literacy project was launched. This involved a book (60,000 copies sold) and TV programme (which reached 300 000 people), a course on the

programming language BASIC, and availability of BBC computers (12 000 were sold) (Hawkridge, 1983, p 57).

The Alvey Report (1982 p 62) suggested that school computer education of the 'wrong kind' and use of home micros might actually do harm - producing a generation of 'poor BASIC programmers' - and prejudice a student's chances of entering higher education.

1983

The Technical and Vocational Initiative (TVEI) provided further financial input which many schools used to purchase computers. TVEI schools on average had almost twice as many computers as non TVEI schools (Scaife, 1993 p 16). TVEI was an initiative which radically altered the control of British education, being imposed by central government without consultation with the Local Education Authorities or the teaching profession. (Leask, 1987).

1984

The curriculum subject Computer Studies was rapidly becoming the domain of boys, with a boy: girl ratio of 2.4:1 at the 1984 'O' Level entry, a male bias exceeded only by Physics at 2.7:1 (Scaife 1993)

> 'The microcomputer is a tool of awesome potency which is making it possible for educational practice to take a giant step backwards into the nineteenth century' (Chandler, 1984, preface).

> 'Cyberspace. A consensual hallucination experienced daily by billions of legitimate operators, in every nation....A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data. Like city lights, receding...'(Gibson, 1984, p51).

1985

The IT Skills Agency was set up by industry to monitor skill shortages in IT and encourage collaboration of industry, government and education. The DTI software subsidy provided £3.5 million to subsidise purchase of software for schools. Also, 'By 1985 it had almost become fashionable to pour scorn on the 'Micros for schools' scheme'(Scaife, 1993 p 18)(also O'Shea, 1985).

1986

'Alongside the almost exponential growth of computer studies there lay a second initiative which fought *against* that growth: the MEP which ran from 1980 to 1986. One of its major aims was to encourage the use of computers as aids to teaching and learning across the school curriculum...the physical obstacle had been the creation of 'computer rooms'...often the domain of the Computer Studies and Maths teachers. [...] Micros remained in the computer room under a watchful eye away from the 'incompetence at large' (Scaife 1993 p 17-18).

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.

Two 1986 studies indicated that computer use in primary schools was not widespread and was rarely integrated into classroom practice (Bleach 1986: Ellam and Wellington, 1986).

1987
Kenneth Baker announced Educational Support Grants of £19 million for the expansion of IT in schools (Scaife, 1993 p 20).

1989

The practical wisdom of teachers applied to new technology generated good practice. In a handbook for primary teachers which provides many examples of educationally effective uses of IT, Senior (1989) argues:

> 'It is important that the teacher considers the purpose behind the use of the computer to ensure that the usage is appropriate and that a computer is not being used as a substitute for a first-hand learning experience readily available from another source. I, personally, do not see any benefit in using several hundred pounds worth of equipment solely to test a child's ability to count to ten and receive a smiling face or a tune as a reward'(Senior, 1989 p 4)

It is interesting to consider suggestions by the Teacher Training Agency in 1999, in the light of Senior's opinion:

> 'A program that simulates multiple dice throws can save valuable time in the classroom' (TTA, 1999 p 15) ... 'Pupils can prepare a tape to tell other pupils about a class outing' (Op. cit. p 33).

It seems that almost despite such inappropriate ideas the drive to ensure that ICT is educationally effective goes on in the classroom ten years after Senior's book was published.

1990 - 1993

Research carried out in 1993 among a group of UK 23-years -olds born during one week in 1970, undertaken by the Institute of Manpower Services for the Adult Literacy and Basic Skills Unit, found that up to 10 per cent of young adults have literacy skills akin to those expected of children aged between 7 and 9. (The Guardian, 27.4.1993)

> '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 p 14).

But in considering the complexity of hundreds of obvious or subtle interlinked factors that might affect the integration of IT into classroom practice, other authors found the answer to the question 'What went wrong in the 80's?' easily answerable.

'This complex chemistry of teacher attitudes has probably been the major barrier to success'(Scaife 1993 p.19).

'This complex chemistry of teacher attitudes has probably been the major barrier to success'(Scaife 1993 p.19).

1994 – 1996

ICT development in schools hit a fallow patch at this time. Innovation was patchy and tended to depend on the enthusiasm of individuals. Little earmarked funding was available for IT, which remained largely the province of mathematics departments. The potential of the world wide web in education was merely a rumour since for schools with obsolete machines (that is the majority) there was little prospect of accessing the Internet. In fact teachers doing so would have found very little material directly related to their work. At this time the teaching profession was implementing the new National Curriculum in an atmosphere of some hostility from government and society. Many grew increasingly disaffected as the new system of Ofsted inspection coupled with such procedures as publication of SAT results began to take effect. The language of Ofsted – 'failing schools, failing teachers' was demoralising. In this environment IT integration was a priority for very few.

1997

In the year the new Labour government took office, the McKinsey and Stevenson reports were published, and the outline of the National Grid for Learning was under discussion, the National Council for Educational Technology published an information sheet: 'Teacher Education and IT'.

'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)

1998

In February 1998 the Teacher Training Agency (TTA) issued a National Curriculum to be undertaken by students in Initial Teacher Training (ITT) starting in September1998.

It has two sections. The first deals with pedagogical knowledge and understanding of effective ICT use in classroom contexts, and the second is concerned with personal ICT skills. This document would be used as a basis for training serving teachers. To enable teachers to evaluate their ICT capability and devise an action plan, the TTA in summer 1998 commissioned 'Needs Identification Materials' from a consortium of business and academic interests. Serving teachers were promised these materials by December 1998, and they finally arrived in schools in April 1999. The materials required the teacher to work through a CD-ROM (which takes about 40 minutes) or through paper-based material (a 60-page booklet). Subsequent People's Lottery New Opportunities Funding (NOF) funded training began in April 1999.

The drive towards ICT integration came at a time when other initiatives were underway. For example, from September 1998, primary schools have to timetable, resource and deliver a mandatory Literacy Hour. Whether for better or worse, this caused much upheaval, and absorbed the time and energy of teachers. Literacy Hour training, and that for the Numeracy Hour implemented in September 1999 gave no explicit indication of how literacy and numeracy could be supported through ICT. Instead of the initiatives combining creatively, they may have interfered to neutralise each other's effects somewhat.

This belief that teachers would reject new technology persisted.

> 'There is a wealth of evidence that teachers in general are not given to questioning practice, and are generally resistant to change[...] This resistance to change with our profession crosses age phase and subject boundaries [...] The practice of teachers is remarkably consistent over lengthy periods of time: maintaining the status quo is the norm' (BECTa, 1998c).

The hypothesis of the research

As the expensive, visionary and far-reaching NGfL initiatives were introduced, this research intended to foreground the views of teachers as they assessed the potential of the proposals for change, and began to implement them in their schools. The history of educational technology indicates that however well funded, the effects of the proposals would remain limited if the nature of the contribution teachers make to education was

underestimated. A range of response from teachers in relation to the Government's proposals was to be expected. The research is based on the belief that the teaching profession does not determinedly reject change out of hand, and that to have 'mixed feelings' about new technology may be a constructive stance, allowing evolution of good practice.

The hypothesis of this research is:

Opportunities provided by National Grid for Learning initiatives will allow teachers to integrate ICT into their practice, and enable development for individuals and the teaching profession.

This professional development will make it more likely that the NGfL aims for schools and for pupils are achieved.

Summary: Chapter 1

This research studies the impact of ICT on the professional development of teachers. The government's National Grid for Learning initiatives were designed to increase the standard of hardware in schools, to provide teachers with training which could increase the effective use of technology in classrooms, and to ensure relevant educational content on the world wide web. These initiatives were introduced into an education system which had not accommodated previous such drives especially well. The study was set against a background of change in education, and an important antecedent was that teachers were predicted to present a significant barrier to ICT use by pupils. This study was designed to investigate the place of ICT in the professional development of teachers as the NGfL initiatives were introduced, and to ascertain responses to opportunities for change. The research has the hypothesis that successful professional development in the field of ICT will ensure that the aims of the NGfL initiatives are met.

Chapter 2 provides a review of literature relevant to a discussion of these issues.

Chapter 2 Review of Literature

Organisation of Literature Review

This research concerns the professional development of teachers in the field of ICT, and their responses to current opportunities for change. The strands of literature most relevant to this work deal therefore with change as a phenomenon, with the understanding of teachers as learners, and with a consideration of the effects of technology's impact on society generally and education in particular. These strands are discussed under the following headings:

2.1 Innovation and change in education: factors which support or hinder teachers' professional development.

Professional development can be considered as the acquisition by teachers of new knowledge, in this case to enable the integration of ICT into classroom practice. This occurs through a process of individual and institutional change. Literature is reviewed which deals with aspects of change, particularly in educational settings.

2.2 Theories of learning: what theories apply to teachers as adult learners? By what process is professional expertise transmitted?

Theories of learning can contribute towards an understanding of the practical hurdles which teachers as learners may encounter. Drawing especially on socio-cultural theories of learning, the research provides a framework for understanding the process of professional development as *acquisition of professional knowledge. Literature in* this section also examines ways of understanding the different approaches of individual teachers to the learning opportunities presented to them.

2.3 Information and Communications Technology in society.

This section evaluates literature dealing with the impact of computers on society and thus creates a context for assessing the assimilation of computers into educational settings through the NGfL. Recent media publications providing ICT information for teachers are critically examined in order to ascertain what impressions of teacher/computer relationships they might create.

2.4 Evaluating the effectiveness of ICT in educational settings

A growing field of literature deals with the ways technology has been introduced into classrooms, and the ways that (for example) computers have been and are currently employed. A brief review reveals some innovative approaches, and shows that such practical experience can be usefully shared to increase the expertise held within the profession.

2.5 Summary

This summary of Chapter 2 highlights links between the four strands of literature.

2.1 Innovation and change in education.

Why Change Education?

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

The change towards the integration of ICT into classrooms creates the possibility of many other changes. Though there may be unwanted 'side-effects', the aims of planned changes such as this are to do with its perceived or intended benefits. The NGfL initiatives have partly been instigated in order to ensure that schools can fully participate in what has become known as 'The Information Age' (DfEE 1997a). World trade has historically dealt with commodities, consumables and artefacts: in the 1990s there is great interest in trading information, with its subsequent implications for increasing knowledge and the re-ordering of society (Haywood, 1995). The idea of information as currency was put forward in pre-computer times: in1936, the science fiction writer H. G. Wells conceived the idea of a "World Encyclopaedia" He anticipated that increased information flow would bring about improved rationality and justice (Wells in Cawkell,1987). In similar optimistic vein, Government hopes that access to the information resources of the Internet will enable pupils in school to acquire not just knowledge but a thirst for 'Lifelong Learning' (Howells DfEE 1997b). However, even information provision has become of secondary importance as the ways computers can support communication have developed. It is not just increased access to information but the **facility for communication** across boundaries of time

and space that have generated enthusiasm for computers across society, and a concerted attempt to harness their potential for education. The responses of society to information and communication technologies will be dealt with in section 2.3.

The introduction of ICT into classrooms involves many changes. Some of them are to do with practicalities, such as the provision of hardware and connections. Some are to do with training and awareness. Some of the changes are more subtle, and are to do with changes of mind. Changes are potentially threatening, perhaps especially so when they involve the introduction of highly technical and expensive machines which are widely predicted to alter the nature of teaching. Fullan emphasises the link between proposed change and the learning, or professional development, of teachers.

> '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 p 256).

The process of professional development, changing the teacher's experience in order to promote more effective practice, is synonymously referred to as 'teacher development'. To clarify this concept, the two key words 'professional' and 'development' require definition. The debate about whether teachers can call their work a 'profession' has continued for much of this century. Hoyle and John (1995) provide a thorough review of the fluctuations in thinking about this issue from 1915 onwards, arriving finally at a working definition of what it is that the term 'profession' refers to:

> 'The term 'profession', can refer to any occupation or to relatively distinctive occupations
> which despite problems in achieving total consensus, have distinguishing characteristics on
> which there is a high degree of consensus, including knowledge base, autonomy, and
> responsibility'
> (Hoyle & John 1995, p16).

The dictionary definition of 'development' includes its meanings of unfolding, growth, evolution, elaboration of a theme, and to 'convert land to new use so as to realise its potentialities'. Apart from this last usage, the nuances associated with the word are to do with improvement, a transition from a 'worse' to a 'better' condition. Since the

1970's there has been concern with whole school development or improvement (Berman, 1981). Efforts made to understand the reasons for failed innovations (Gross et al, 1971) resulted in a realisation that implementation of externally conceived change would inevitably require the collaboration of the teacher. Thus the study of *teacher* development set out to discover what happened to planned change once teachers became involved, resulting in one obvious conclusion that if teachers were involved earlier in the process, change was more likely to proceed as planned (Hargreaves, 1994).

According to Hoyle (1975) the root of the problem facing would-be innovators lies in the inertia inherent in social systems like schools. He 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 collaborative professional relationship between teachers. Thus teachers contribute towards the creative changing of schools, and are themselves changed (McCormick & James, 1983 p31). In contrast, Stenhouse (1975) envisaged the teacher engaging in individual study and classroom research, working against the inertia of the system to promote effective change. Either way, teachers are held to be essential in the process of change as agents involved in the conception and adoption of new practices.

Fullan and Hargreaves (1992) define teachers' professional development as heavily dependent on context or working environment; encompassing individual change in the areas of knowledge, skill development, and self understanding through reflection. The identification of precise factors influencing the professional development of teachers in ICT provides an underpinning framework for this research.

How does change happen?

Change in education is a process rather than an event. Educational institutions are complex and organic in their organisation, and as such they have what might be termed dynamic inertia: they change constantly, but remain essentially the same. The following sections look at theories of change and research describing change, especially the ways change happens, or does not happen, in schools.

27

The Sociology of Change: Teachers as "Adoption Units"

Rogers and Shoemaker (1971) describe a model for considering change in institutions. They maintain that change can happen because of a single, seminal event, but much more often it is a process which proceeds at two levels: within individuals, and within the institution. For the individual, increasing awareness of the nature and purpose of the proposed change allows decision making about the change to take place. The orientation of members of a group to a proposed change might facilitate or hinder the process. The conception of change as taking place within a group who might be thought of as 'members' of the change process (whether they agree or disagree with one another) relates strongly to the idea of a 'community' involvement in change, which will be developed in Section 2.2.

At the individual level, people pass from first knowledge of an innovation to a decision to adopt or reject, and on to confirmation of this decision. Adoption of new ideas is thus the result of a sequence of events and not random behaviour, and as such it is possible to clarify some of the factors which strongly influence that sequence. The Rogers and Shoemaker approach mainly depends on a consideration of interactions between members of the decision community and so tends to emphasise personal factors in decision making. For example, the holder of innovative ideas can be typified as a central, high - status member of the community: any particular individual's response to the innovation is dealt with in terms of relationship to the innovator. Additionally, specific personal qualities are considered: so, for example, one person might be characterised as generally averse to change, whilst a colleague is generally open to change. The research was designed to test whether an identification of personal factors such as 'aversion to change' was useful, in comparison with an identification of contextual factors experienced by teachers.

According to Rogers and Shoemaker (1971,p102) adopting an innovation proceeds in three stages which can be defined as:
1. Antecedents 2. Processes 3. Consequences.
These stages correspond to Stake's (1967) **three aspects of the educational process:** and as such provide a structure for the research.

1. Antecedents: any existing condition which may relate to outcomes of change

2. Transactions: interactions between people, and between people and contexts

3. Outcomes: interpreted in its widest sense.

Antecedents to change include states of dissatisfaction or awareness of seemingly better alternatives. In order for planned change to proceed, there must be some perceived 'need'. Identifying a specific need might be preceded by an idea of how the need might be met: it is a 'which came first...?' situation.

Next, the stages of the *Process* of change are defined by 'change agents', individuals who influence the decisions of others by having clear innovative ideas and strategies in mind. The effectiveness of the change agent depends on many factors, such as their social status, the management structure of the institution, and the attitudes towards change which they encounter. It is important here to distinguish flexible attitudes from more tenaciously held beliefs. An individual's attitude to a particular change can alter, and this has important implications for those wishing to ensure that the aims of change are realised. It is possible for attitudes to be significantly influenced by contextual factors. This point is further discussed in Chapter 3.

Rogers and Shoemaker categorise the 'adopters' of change and provide generalisations about the sorts of people that might fall in to their categories. For example, 'Early Adopters' might be expected to be better educated, less dogmatic, better motivated and have better access to communication channels than 'Late Knowers' (Rogers and Shoemaker, 1971 p107). These categories provide some insight into *the sorts of positions that teachers might find themselves in relative to the* proposals for introducing ICT into classrooms. It is interesting to note that Rogers and Shoemaker believe that:

> 'Perhaps the most important element in the decision function is the degree to which the
> adoption unit participates in decision making'
> (Rogers and Shoemaker, 1971 p 300).

That is, if 'adoption units' (teachers) are not party to decisions made on their behalf, they may find it difficult to be enthusiastic about an innovation. Fullan reinforces this idea:

> 'Those who introduce change treat teachers in precisely the same way as they criticise teachers for treating students. Curricula are often introduced in a way that ignore what teachers think and why'
>
> (Fullan, 1982 p 119).

The literature has many examples of educationalists noting that the views of teachers about prospective changes go largely unheard (Lortie,1975: Hargreaves, A. 1992). In these circumstances change is the imposition of the ideas of others; teachers dealing with real classes of children have often found the ideas of others to be impractical. The issues of what teachers think and why, and how their views are canvassed or ignored by change agents and others provide a strand of interview questions in this research.

As the change proceeds, there are planned and unplanned *consequences*: benefits may well be accompanied by drawbacks. The balance between advantage and disadvantage is not simply a product of what change takes place, but of how change happens. The history of change in education goes some way towards indicating what has been ineffective, and this information has perhaps armed ICT innovators with crucial knowledge about how to introduce current changes to maximum effect. One such crucial factor emerging from the literature is the consideration of 'teacher resistance' to change.

Teacher resistance to change

Perceptions of the effects of education as inadequate provoke drives such as the current push towards increasing emphasis on literacy, numeracy, and technical expertise. Society's ethos is reflected in what it expects of its schools. But teachers exist within the society which created them. They may be people who enjoyed school, who liked learning or their school institution, and therefore may wish to continue the cultural traditions in which they experienced teaching and learning.

> 'Future teachers do not teach the way we tell them to; they reproduce the way they were taught'
>
> (Cornu, 1995 p10).

The literature to do with education repeatedly emphasises what Hargreaves and Hopkins (1991) describe as a 'familiar phenomenon': that of teacher resistance to change (Leask and Pachler 1999: Barber1997: Papert 1993: Whiteside 1978). Studies of change in educational institutions have largely concluded that teachers are conservative, resisting change, and adept at neutralising what they see as bandwagon initiatives and ideas that seem to them impracticable (Hargreaves and Fullan, 1992: Boyd-Barrett 1991). Cuban in considering the history of technological innovation in education notes that faced with lack of change, critics tended to ascribe this effect to teachers.

> 'Teacher-bashing [...] produced a series of sharp critiques blaming intransigent teachers for blocking improvements through modern technology'
> (Cuban, 1986 p5).

Fullan (1982,p 107), without questioning the concept of teacher resistance, provides a view of the response of society to school change:

> 'If a new program works teachers get little of the credit. If it fails they get most of the blame.'

Hargreaves (1994) examines why teachers are seen to resist curricular change. He looks at 'the powerful conditions that sustain the culture of teaching' and argues for a view of curriculum change as a social process that encourages teachers to confront existing power relationships.

Desforges (1995) however argues that 'many' teachers adapt to their job by adopting a 'school work' style, focusing on completion of work, production rate, discipline, order, and the smooth running of activities. Work becomes an end in itself and learning is marginalised. Desforges, quoting Grossman (1992) continues:

> 'Common practice in schools is neither adequate to meet the demands of modern societies, whether these be in terms of knowledge, skills, ethics or moral development, nor is it consistent with contemporary theories of cognition and learning.'

The introduction of ICT ('anomalous experience' as Desforges puts it) is a change which has as yet unknown implications for many aspects of teachers' work. Implying that teachers with stubborn inevitability will put up barriers of resistance, neutralising or ignoring the opportunities technology offers, Desforges continues:

'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 p 391). Those wishing to match the pace of educational change with the pace of development of new technology particularly condemn of what they interpret as teacher resistance (Papert, 1980: Chandra 1986).

Those promoting the concept maintain that little has changed in schools since the Industrial Revolution. Teachers are seen as the 'nuisance factor' creating a stumbling block to reform and re-organisation - a barrier to progress (Brosnan 1997). The superficial similarities contemporary schools have to those of the past coupled with a history of failed innovations (Watson, 1993: Stevenson 1997) seem to be examples of teacher resistance to change. However, there are real and discernable reasons why innovations fail. For example, Cuban (1989) provides a detailed description of the introduction of televisions into schools in the Philippines, and the gradual attrition of use, which identifies with great clarity what went wrong. In this case, a misplaced faith in the efficacy of televisions as teachers was a profound error. Many subtle and obvious factors made television-as-teacher ineffective. Achieving a genuine understanding of the more subtle factors involved in adoption or otherwise of innovation requires a more thorough and sensitive investigation of schools (Nias et al 1989).

Hargreaves (1994) discusses the idea of what he calls the individuality of teachers as a 'psychological deficit'. His premises include considering teachers as perhaps preferring to remain 'in splendid isolation' in their classroom, and, 'It is possible that the kinds of personalitites attracted to teaching feel more comfortable in the company of children than in the company of adults.' Offering no evidence to support this, Hargreaves is willing to consider such 'personalities' as endemic in the profession. It is hardly unnatural to enjoy the company of children, though it is made to seem so here: and in reality more than half of teachers' work is undertaken in the company of other adults rather than in the company of children. Whilst using the term 'teacher resistance' without definition, Hargreaves does, however, note that in the context of change:

> 'Teacher resistance [may be] interpreted as a problem of the teacher, not the system. The teacher can all too easily become the scapegoat of unfulfilled change'
> (Hargreaves, 1994 p168).

Rudduck (1990) and Nias et al (1989) take the view that real change in schools is only possible if teachers are consulted, if they feel that prospective change has good purpose, and that they have control over what happens to themselves and their classrooms and schools. None of these provisos seems unreasonable, and indeed they work together to produce what Cuban (1986) describes as a positive force, the 'stability' in teaching practice. Rudduck says schools are 'properly conservative' (Rudduck, 1990 p 28) in their effective rejection of whimsical or faddish suggestions; but problems arises because there may be an inability to distinguish what could be wholesome change.

Legislation can ensure (perhaps superficial) change, but practitioners who are responsible for implementation of externally imposed ideas may adapt the innovation, thereby neutralising its force. Interpreting such behaviour as 'resistance' may be wrongly pejorative. The label of 'resistance' describes a 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. This research offers a new perspective on the concept of teacher resistance gained by discussing change with teachers. Stressing the evolutionary nature of teacher development, that is, change as a function of the pressure of ecological circumstances, Hargreaves and Fullan (1992, pp14-15) point out:

> 'The process and success of teacher development depends very much on the context in which it takes place.[...] Many factors may help or impede teacher development initiatives'

Findings detailing the factors which help teachers to integrate ICT, and those that impede professional development in this area, are discussed in Chapters 4 to 8.

This research involves a study of professional lives, and it is important to recognise that teachers are not a homogenous group of people. The teachers involved in the

study are at different stages of their career. Their attitudes and hopes and fears when confronted with change will be determined partly by the way their teaching careers began and have developed. To understand how teachers approach, for example, the offer of ICT training, or the offer of Internet access, it is important to consider at what point in their career 'trajectory' individual teachers are, and their perception of their professional lives as they find themselves intersecting with this innovation.

The work of Michael Huberman (1993) details the range of trajectories that teachers experience: he began by asking teachers to reflect on their careers, and if possible to try to discern some key themes. Huberman notes that there are many different scenarios or itineraries that teachers follow: from painful or easy beginnings, through self-doubt or stabilisation, to loss of enthusiasm or positive focusing and experimentation/renewal. There are many paths towards negative, 'bitter focusing' and disenchantment with teaching as a career, some of which involve the imposition of change. It is crucial to recognise that the introduction of ICT into schools may be regarded by some teachers as such an imposition, with potentially the same unhappy consequence. But change is not necessarily a negative factor for teachers. The models that determine whether teachers emerge with a positive, 'serene focus' may have a component of experimentation and involvement with change, leading to renewal and resolution.

The introduction of changes, however, can have disastrous consequences for teachers. The following extract shows two different paths that teachers may follow; either will bring their career to an unhappy end, but Huberman emphasises that a certain cause of this is clumsy innovation.

> 'The royal roads towards negative focusing are more visible. We have, on the one hand, the
> sequence: **Stabilization - Waves of doubt - Negative focusing/Non-resolution**
> On the other hand we have:
> **Experimentation/renewal - Negative focusing**
> In the former case, it is particularly the teachers in the 20 - 29 year group who are victims; in
> the latter, it is the older teachers with 30 -39 years of experience who have endured sweeping
> reforms in a negative way, either because of the shoddy execution of these reforms or because
> of an unsuccessful aftermath'
> (Huberman, 1993 p 108).

This scenario has implications for the teachers facing the present reform of education which if successful in its own terms will incorporate technology into their working lives, and may have profound consequences for teacher-learner relationships. Talking to teachers, interviewing them about their histories, concerns and ambitions as changes take place is a direct attempt to gain insight into their thinking about their professional development in ICT.

In summary changes which are 'clip on' solutions or the ideas of management alone may be hard to implement, and so may be abandoned or adapted by teachers. For practising teachers some of the innovative impulses of non-teachers may be at best impractical and at worst educationally inappropriate.

'Innovation is not of necessity a good thing' (Whiteside, 1978 p 26).

This issue is further discussed in the Theories of Learning section later in this chapter.

What promotes successful change?

Fullan's (1982) criteria with which teachers assess proposed change provide further structure for the framework for the research:

• Does the change potentially address a need?

• Will students be interested? Will they learn?

• How clear is the change in terms of what the teacher will have to do?

• How will it affect the teacher personally in terms of time, energy, new skills, sense of excitement and competence, and interference with existing priorities?

Fullan later (1985) develops this list to include:

• Characteristics at the Local Education Authority level

(including history of innovation attempts, training for head teachers, community support, time line and monitoring, and 'overload').

• Characteristics at the school level

(including the actions of the Head, and the relationships between teachers).

• The role of Government.

Fullan's identification of two factors: (a) teacher's colleagues as a preferred source of knowledge, and (b) the influential support of the larger community, can be usefully coupled to significant theories of learning (Section 2.2).

Fullan's criteria complement Ridgeway and Passey's (1995) evaluation of the 'two sides of the coin' questions:

what change is likely to succeed in education?

what change is likely to fail?

Change, they conclude, is likely to *succeed* when:

• it lets one achieve goals which are hard to achieve in other ways

• it makes life more fun

• it makes life easier

• it is seen to be desirable by the community at large.

Change is likely to *fail* when innovations:

• challenge fundamental values and practices

• are associated with over ambitious claims by advocates

• underestimate the practical constraints of resources such as time and support

• ignore the starting point of individuals involved

• fail to monitor progress and adapt the programme appropriately.

> (adapted from Ridgeway and Passey in Watson and Tinsley,1995, pp 65 - 66)

These criteria are used to help evaluate the NGfL in Chapters 8 and 9.

A third set of criteria for the success of innovation in education is provided by Desforges (1995p 397) who itemises what he calls the 'features of organisations which are essential to the sustenance of learning individuals': these are summarised:

• decentralisation of information so that individuals can gain access

• dense communication networks affording many opportunities for discussion of ideas

• visionary leadership allowing for re-definitions of central objectives

• useful feedback, that is to say, learners must have swift access to feedback on performance which is meaningful

Promisingly, these four points seem to add up to a working description of what it is that, at best, networked computers offer. If the response to the NGfL drives is favourable, sustainable change can occur. However as Hargreaves argues:

> 'Even the most well intentioned change devices which try to respect teachers' discretionary judgements, 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 or suffocated through stifling supervision'
> (Hargreaves 1994p3)

Aspects of the nature of schools as organic and social organisations strongly affect the work of the teacher, and the ability or inclination of the teacher to accept change. The next section deals with literature relevant to this.

School Culture, ICT, and the Work of the Teacher

'In the contemporary world, change is the norm' (Bruner, 1996,p15).
Bruner argues that while it is the function of education to enable people to operate at their full potential, it is also the function of education to maintain and further the culture which supports such education. These aims are contradictory, in that individual realisation may provoke disruption of the social order. The tension inherent in such aims is particularly apparent in times of rapid change; this is especially pertinent to planned change which involves maximising the opportunities of the learner to access knowledge through technology. Technology provokes debate around the re-definition the of role of the teacher and the learner in education, with the premise that the teacher's role will become diminished. Not only that, new technology enables learners to communicate freely with like-minded others, allowing discussion of ways to promote, or undermine, cultural stability.

We can consider this argument in terms of society as a whole. But it is also applicable to the society of the individual school. In this case, the teacher is learner (of technological skills and understanding of network literacy). Educating teachers in the use of ICT is based on the first of the aims Bruner describes - to enable teachers to achieve their potential in its use. However it is uncertain that such knowledge can fulfil the aim of ensuring the continuance of the educational establishment. This then is a very powerful and demanding change, in which teachers are asked to equip themselves

with the understanding of machines that are designed to replace all or part of their work.

Teaching is a vocational occupation; Huberman's (1993) study indicates that a frequent motivation for becoming a teacher is that of taking pleasure and satisfaction from the contact with young people, linked with a desire to impart knowledge, and to be influential in young people's lives. The distancing of the teacher from the learner, or the deconstruction of the teacher-subject-learner triangle by the agency of technology may mean a lessening of teacher satisfaction with their profession. This perception is not likely to motivate teachers to embrace technology wholeheartedly as it is pushed into schools and classrooms.

Huberman (1989) emphasises the effect on teachers of their histories, their aims for themselves, and the way that experience of the work itself alters the way the teacher feels about the job. When considering the issue of school development, he charts the disillusion which can be provoked by poorly implemented reform (p. 59):

> 'The new ideas, new vision, new attitude towards school work: 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 on proven effectiveness'.

Research undertaken by Fullan, 1982; Huberman and Miles 1984; Nias et al, 1989: Smith et al, 1986 has indicated how the culture of the school determines the response to change in practising teachers. The reforms, changes and 'improvements' that are imposed on schools impact primarily on teachers (Sikes,1992 p36), with the inescapable implication that if development of teachers is necessary, it is to remedy some deficiency in their work. Following Sikes, who takes the view that:

> 'teachers are people who make up their own minds; people who are pro- rather than re-active; who choose a particular course of action *because* it seems to them to serve their purpose...'(Sikes, 1992 p39, emphasis added)

this study examines the rationale of teachers when responding to change, in the belief that this is based on reasoned decision making (as evinced by the *because* in the quotation above).

The 'development' of teachers is closely linked with school development. The overall aim of whole school development is generally to increase the effectiveness of the school, to make it a better place for learning. Holly and McLoughlin (1989, p 179) note that although teachers have been described as isolated, in English schools the recent focus for change has been the school rather than the individual classroom: so, for example, funding for basic ICT training is allocated to schools, rather than to individual teachers. This system creates expectations of teachers without negotiation with them, and is one of the potential sources of tension to be investigated through interview.

In summary, the literature dealing with change in education provides a framework for this research in which the focus of study remains the professional lives of teachers, but with a concern to 'look around' the teacher and discover what it is in their work context that enables their professional development – the antecedents to change, the process of change, and its consequences. Within this, the concept of 'teacher resistance' to the integration of ICT into classrooms will be examined, and evidence for and against considering this as a critical factor will be presented. The next section looks in more detail at theories dealing with the process of learning as change.

2.2 Theories of learning: what theories apply to teachers as adult learners? By what process is professional expertise transmitted?

This section reviews work concerned with theories of learning in order to provide a framework for understanding the processes involved in learning experienced by teachers.

Computers are probably the most costly pieces of equipment to find their way into classrooms, particularly in primary schools. The potential they offer for enhancing the learning of pupils is one justification for such expensive purchase. It has become increasingly evident (Papert 1993: Scrimshaw1993: Stevenson1997: Littleton and Light 1999: Leask and Pachler 1999) that in order to realise the potential that pupil-computer interaction offers in schools, teachers must be involved with pupils in the structuring and ordering of computer-based tasks. This is crucial. Discussing the

effective adoption of computers into education, Crook (1994) uses theories of cultural psychology to arrive at this conclusion:

> '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 p 87).

For many teachers, such involvement necessitates learning.

There is a diversity of influential factors which affect learning by teachers. Some of these factors can be listed as: teachers' histories and experiences; their intrinsic motivation or coercion by external agencies; their access to the machines they are asked to use; the myriad factors that affect their relationship to classroom computers; the age and stage of pupils they are involved with; teachers personal aims and current state of work satisfaction or otherwise.

An initial understanding of the essence of what learning entails may help to clarify what emerges as influential in an individual teacher's circumstances.

Teacher education for ICT use involves learning how and when to use particular applications, but the nature of the technology also involves teachers learning *with or from* ICT. Much NGfL advertising has been directed towards stressing the redundancy of teachers in ICT-rich classrooms (Selwyn et al 2000). However, increasing familiarity with the sort of learning that computers offer may serve to allay anxiety on the part of teachers. Powerful though they may be, computers remain no more than one of range of ways of educating people. As an understanding of the capacity of computers develops, the media emphasis on computers as competitors with teachers may diminish. The following sections therefore develop an overview of theories of learning which are relevant to the research questions.

Behaviourist and Constructivist Theories

The behaviourist position involves the use of instruction to generate a clearly defined set of behavioural responses. Learners are expected to memorise and accumulate facts,

and their learning can then be tested by such strategies as multi-choice questions or by one-word answers. Such answers would be categorically correct or incorrect, and success is judged by the quantity of correct responses. In behaviourist settings, the teacher is expert and controls access to knowledge. The learner listens or reads or repeats. This approach to learning can produce quantified success - it is an ideal way to teach and learn the vagaries of English spelling, for example, or to teach typing skills. Behaviourist approaches are based on the relationship of response to stimulus, using such mechanisms as response to feedback, or conditioning, and view change in behaviour as a direct indication that learning has taken place.

By contrast, the constructivist position involves the interaction of the learner with the relationships between facts, and the transformation of ideas into new knowledge. Learning outcomes involve assessment of the quality of understanding of the learner, which can be demonstrated by production of a portfolio of work, or by discussion. In constructivist settings, activities are learner-centred and the teacher's role is that of collaborator, and sometimes learner (Sandholtz et al, 1997, pp12-15).

Consideration of the advantages and disadvantages of these two approaches has relevance for aspects of this research. The learning of skills and learning of understanding of ICT run parallel to one another but remain distinct, and different approaches underpinned by behaviourist or constructivist ideology may seem appropriate to achieve different aims. An example is given here:

The TTA National Curriculum for ICT for trainee teachers provides a basis for the training of serving teachers in ICT. It is divided into two sections:

Part A: Effective teaching and assessment methods.

Part B: Knowledge and understanding of, and competence with, communications technology.

Part A deals with the pedagogical understanding and knowledge required to implement ICT policies,and Part B with ICT skills. It will be interesting to see whether Training Providers adopt a constructivist approach to the former and a behaviourist approach to the latter, as would seem logical. The DfEE consultation document 'Connecting the Learning Society' (1997) labelled the competence required of teachers as 'network literacy' and went on to define this in terms of skills rather than understanding (see Chapter 1). This may or may not indicate the way learning will be encouraged by

Government initiatives. One indicator of behaviourist teaching and learning lies in

assessment procedures. The European Community Driver's Licence computer training

is behaviourist, in that students undertake on-screen tests with a multi-choice format in

which answers are categorically correct or incorrect. The TTA specified that no

funding was available for assessment of teachers who had undertaken New

Opportunities Funding training. But is becoming evident that the designated Training

Providers may offer accreditation for courses, presumably based on assessment,

because they feel that this will make their training package more attractive to

prospective customers. Whether the customer in this case is the school or the

individual teacher is not yet clear. To complement this approach to learning theory,

research into teachers' professional development strongly benefits from a

consideration of socio-cultural theories of learning.

Socio-cultural Theories of Learning

> 'Thought and speech turn out to be the key to the nature of human consciousness'
> (Vygotsky 1994p 51).

As Saljo (1999) argues, we have to define what counts as learning in order to study

how people learn. For example, what is considered to be knowledge and learning can

be approached from the different perspectives outlined above. The socio-cultural view

of adult learning considers that knowledge is neither purely 'mental' as constructivists

think, nor is knowledge a matter of leaned behaviour, as behaviourists think.

> 'A sociocultural view builds on the assumption that learning has to do with how people
> appropriate and master *tools for thinking* and *acting* that exist in a given culture or society'
> (Saljo 1999,p149).

The primary psychological 'tool for thinking' is language. The Russian psychologist

Lev Vygotsky concluded:

> 'Thought development is determined by language, ie. by the linguistic tools of thought and
> by the sociocultural experience of the child.[...] The child's intellectual growth is contingent
> on his mastering the social means of thought, that is, language'
> (Vygotsky, 1994 page 46).

Although most of Vygotsky's own research was with children with learning

disabilities, his work informs theories of human learning and development throughout

life, as emphasised by the editors of Vygotsky's 'Mind and Society'(1978):

'Intellectual growth' might not happen if people have no access to new ideas and new thought, but most people in society do have access to other people and experiences which enable growth to continue throughout life. Perhaps that is why older people are regarded as having accumulated 'wisdom'. On the other hand it is perfectly possible to reject opportunities for new language experiences, new social experiences, and new ideas, in which case 'intellectual growth' might become 'intellectual consolidation': maybe people move from growing to consolidating and back again quite often throughout their lives. Computer Mediated Communication (CMC) seems to provide a real opportunity for people to maintain access to the sort of community they may have been involved with as learners during their school and student days - people with common aims and purposes, willing to share and discuss ideas. CMC can thus help people - teachers - to carry on 'mastering the social means of thought' as new vocabulary and concepts are considered in a supportive virtual social setting.
Uses of CMC in educational settings are further discussed in Section 2.4 of this chapter.

Vygotsky contributed the concept of a Zone of Proximal Development (ZPD) which describes the gap between existing knowledge and potential achievement with help. That is, what people can do with the assistance of others indicates an area for intellectual growth. Specific assistance in the form of 'scaffolded' tasks and discussions can guide learners - adult or child - through this 'area' so that they move towards a more advanced knowledge and understanding (Bruner, 1986).

The following is a comment on this sort of learning, from a fellow research student, a 'virtual' partner on a computer conference.

'I think we have an example in our conference - people assist one another in a way that engenders personal development, contributing to the joint development of ideas. Therefore, it can be said that this conference extends our ZPD (zone of proximal development). I think that this conference functions as a tool (to speak in Vygotskyan terms), in a parallel way that

a book would help me learn, adding to the benefits of being interactively involved in the
discussion, and exchanging views on issues that we jointly decide and not merely absorbing
the author's ideas. (I have used the book because it is an object). Other people's ideas can
be 'signs' which provide stimuli for the discussion. The electronic messages that we sent
each other (mediated activity) may promote understanding' (NL, 1999).

Vygotsky provides evidence that he believed his theories had wider application than child psychology.

> 'Words and other signs are those means that direct our mental operations, control their course, and channel them toward to the solution of the problem confronting us. None of the above mentioned functions undergoes any substantial change in adolescence [...] Learning to direct one's own mental processes with the aid of words or signs is an integral part of the process of concept formation.'(Vygosky 1994p47-8).

That is, once learnt, this ability is available to the individual throughout life. The implications for teachers as learners is that concepts, definitions and procedures can be jointly explored and developed through productive use of the psychological tool of language. Building on the work of Vygotsky, Mercer (1995) describes the joint use of language as a 'social means of thought'; a powerful resource for teaching-and-learning. In order for such dialogue to be structured and effective, the teaching-and-learning conversations people have are most productively situated in the context of a community of practice.

Learning as community-joining

Other theories of learning view the individual learner developing within a cultural context. Learning as community-joining involves considering learners as part of a community which supports and encourages learning, even though this might not be its primary purpose. Lave and Wenger (1991) envisage learning as a process essentially dependent upon participation in a community of practice. The learner, the activity to be learned and taught, and the community are mutually interdependent.

> 'Learning is an integral and inseparable aspect of social practice'
> (Lave and Wenger, 1991,p 31)

Lave and Wenger argue that learning takes place in social settings, and that the learner constructs meaning by becoming involved in the activities and discussions of a group with a mutual purpose. Such activities may involve the use of specific artefacts, that is, 'technological tools' as simple as paper and pencil, or as highly developed as the computer. The discussions use the powerful psychological tool of language. Such discussions require the newcomer to listen and join in with talk organised in the preferred genre of the community, which might include specialised vocabulary and syntax. Integration of theories based on anthropology and psychology have a precedent in Cole's discussion of a Vygotskian approach to learning within 'human activity mutually constituted in interaction' (Cole, 1978p159).

> 'More capable participants structure interactions so that novices can participate in activities that they are not themselves capable of; with repeated practice, (they) gradually increase their relative responsibility'
> (Cole 1978p155).

The novice or learner is a 'newcomer' to the practice, and their status as a 'legitimate participant' allows them opportunities to engage in aspects of practice. The community in this study is that of educational users of ICT. Newcomers, in this case teachers, have a high value for any community. Without newcomers, communities become extinct. The initial aspects of practice with which newcomers engage are limited and structured. That is, tasks and discussions are scaffolded in accordance with informal assessment of the learner's ZPD to allow a flexible, learner-driven entry into full participation in the community.

These aspects are 'peripheral' because they are elements of the practice - allowing the learner to proceed through the steps that lead to 'old-timer' status. Peripherality is a positive term, suggesting an opening, a way of gaining access to sources for understanding through growing involvement.

Legitimate peripheral participation therefore involves *access* to:
• chances to talk about tasks, activities and ideas
• chances to observe and imitate
• chances to question
• opportunities to perform tasks which are shorter, are more straightforward, carry less responsibility, and are designed to minimise the effects of errors.

Dewey (1974) also emphasised the relationship of the learner to 'senior practitioners'.

> 'The customs, methods and working standards of the calling constitute a tradition [...]
> initiation into this tradition is the means by which the powers of learners are released and
> directed'
> (Dewey, 1974 p151).

Computer use has barely had time to acquire tradition. With impetus from current initiatives such as the NGfL, building such tradition is set to involve all teachers. In this situation, where adept practitioners are scarce, the opportunity for dialogue between learners is crucial. Fortunately the technology itself addresses this issue: the new opportunity to use e-mail, video conferencing, bulletin boards and newsgroups has the potential to link teachers productively with one another.

There are implications for how teachers are trained in ICT use. Should the ICT community of practice be real or virtual, or both? In order to maximise the benefits of ICT in schools, teachers need an understanding of the communicative functions which can provide direct and almost instantaneous links with others. In the context of virtual communities, participation might be expected to provide teachers with effective learning opportunities. Williams and McKeown(1996) writing about Australian professional development programmes for teachers advocate support mechanisms that enable teachers to link with one another via the Internet. The net as 'community' may have more impact on the learning of teachers (and others) than a consideration of the net as 'information provider'.

The next section deals with the situation of learning in the community of practising teachers, that is, their professional development, as described in the seminal work of Donald Schon. This is included here because of the strong links between socio-cultural theories of situated learning, and Schon's location of the mastery of the craft of teaching in the classroom actions of teachers. The work of Schon is discussed and then related to this research.

Reflection in Action

The concept of the 'reflective practitioner' was advanced by Donald Schon (Schon, 1983, 1987) and has been influential in describing the situation of the practising and new teachers in relation to professional knowledge. Developing this idea, Eraut (1995) considers that teachers as learners are involved in two continuous processes.

1. 'Reflection-in-action', in which innovation, new knowledge, and contexts are considered in the light of personal professional understanding. Teachers' previous experiences and their own theoretical frameworks influence their evaluation of and insights into the educational practicability of new ideas presented to them. Implicit in this is the element of *surprise* identified by Schon, in which events provoke immediate and effective reflection without interrupting action. Surprise calls out professional artistry in competent practitioners. Its product is the performance of best practice. Later reflective conversations between teachers enable such professional understanding to be shared and assimilated.

2. 'Knowing-in-action' describes the everyday use to which ordinary practical knowledge is put as teachers work, that is, the customary practice of the teacher. This should not be taken to be fixed and inflexible, since it is dependent on constant interactions with pupils and colleagues which require teachers to be permanently adaptable. New knowing-in-action is thus generated through reflection-in-action. The value of such intuitively acquired knowledge should not be underestimated.

Reflective practice as a way of learning practical knowledge accommodates 'learning as community-joining' in that mastery is held to reside within performance. Reflection-in-action is 'a process of knowledge creation' (Eraut, 1995p 12). Schon thus offers a theory of professional creativity in which adept practitioners can proceed with the scaffolded, low-risk steps of newcomers at points where they are exposed to new knowledge, or when decision making involves non-textbook situations (that is, often). Simultaneously they hold within the community the crucial expertise that ensures its educational effectiveness on behalf of others. The significance of the influence of reflection on action is that professional reflection is experience based, so that subsequent action is not simply expedient but a product of informed insight and

focused thought. The creativity of this process and its application to problem solving results in what Schon (1987) describes as 'professional artistry'; briefly, the understanding of how do the job well which can not be entirely discovered in books or words. The acquisition of such artistry partly depends on immersion in the profession, and even then remains a mysterious process. Without wishing to follow this line of enquiry too far, it is interesting to consider how in Far Eastern countries, the mastery of skills is only one aspect of learning. After studying the practice of archery with the Zen Master Kenzo Awa, the German philosopher Eugen Herrigel concluded:

> 'If one really wishes to be master of an art, technical knowledge is not enough. One has to transcend technique so that the art becomes an 'artless art' growing out of the Unconscious' (Herrigel, 1989p vii).

Reflection is a way to begin to 'transcend technique'. Schon's description of the conditions required for the learning of professional artistry - which he describes a 'magical environment' - is interesting in its links with both Zen 'coaching', and situated learning.

> 'Perhaps learning of all forms of professional artistry depends on conditions [such as] freedom to learn by doing in a setting relatively low in risk, with access to coaches who initiate students into the traditions of the calling and help them [...] to see on their own behalf and in their own way what they most need to see' (Schon, 1987,p17).

As Eraut (1994) says, some kinds of practical knowledge cannot be reduced to technical descriptions. Teaching involves an element of 'live' performance - unscripted and context dependent - which is informed by practical knowledge. In this lies its artistry.

The relevance of 'learning as reflection' to this research is twofold.

First, integrating ICT requires almost the entire profession to accept education in ICT use and applications. The necessary skills and understanding are not contained within the profession, and not contained in any sense anywhere, but are under discovery as the innovation proceeds. The TTA-organised 'NOF' training provides an example. The designated Training Providers put together training courses intended to enable teachers to use ICT effectively. These courses, which ran from September 1999, relied on some examples of good practice drawn from schools, combined with suggestions and ideas which had not yet been used in practice. The implementation of the ideas

gained from such training is experimental. Teachers are part of a discovery process involving ICT, and their professional artistry may be one essential factor ensuring sustainable change.

Second, the reflective process is not confined to the individual. Visitors to staff rooms may notice that seemingly small events and happenings around the school are standard discussion topics. Some of this talk is to do with the nature of children - they are, after all, amusing and unpredictable beings who say and do funny things. But much of the talk is to do with retrospective reflection on events in order to contextualise, analyse and make joint meaning from them in a way that shares and broadens experience, and shapes and reinforces the ethos of the school. Reflection on their practice by teachers happens within a framework of the rules that govern the profession, the familiar patterns and procedures that make up day to day working life. Reflection-in-action allows teachers to make sense of new, uncertain or problematic situations, going beyond the learnt rules and guidelines to deal competently with events as they arise. Adept teachers 'follow rules that have not yet been made explicit' (Schon, 1987 p35). As Bengtsson (1995) puts it, reflection is 'a kind of self-research' which feeds into and depends on teacher competence. The effective use of new technology requires prior and continuing reflection. Individual reflection is necessary in order to understand and accommodate the new learning entailed, and joint reflection between teachers is necessary in order to create the new patterns and procedures which will enable the profession truly to integrate ICT into their practice.

Cognitive Approaches to Learning

As with any other learners, individual teachers 'start where they are' on the learning process, and 'where they are' has past and future components, as well as describing a present state. That is, histories and purposes or aims colour the current context. In their specific situation as developing users of ICT, which it is essential to acknowledge explicitly, teachers require the interactive support of both experts and peers to enable them to move forward in their learning. Such learning is complex, having two major components: technical skills required to operate the machines: and, an understanding of how the facilities the machines provide can be used with pupils as tools for their learning, within classroom situations.

Training days with stand-alone content may leave teachers unable to integrate new ideas into practice. As Whiteside (1978) points out, this system may leave the newly-trained enthusiast worse off than before, when on returning to school it is clearly impossible to apply the new knowledge in the prevailing conditions. A cyclical programme of structured input, discussion, reflection in action, and consolidation through experience might be one model addressing the essential requirements for learning indicated by the summary. Underpinning such a framework are cognitive models which deal more directly with the processes by which information becomes knowledge. Neisser (1967) provides this definition:

> 'Cognitive psychology refers to all processes by which the sensory imput is transformed, reduced, elaborated, stored, recovered, and used.'

Elaborating on this, Best (1999) notes that:

> 'Physical energy from the world must be converted into a pattern of neural events - a kind of neural energy - that can be used as the basis for all subsequent cognitive processing' (p. 5).

New information is provided for the brain by the senses, is processed, and crucially is then available for *use*. The subtle workings of the brain are not the subject of this study. Such approaches do not address the more global ideas which inform how teachers learn in this specific context.

The application of such information indicates that teachers as adult learners can be 'trained' and expected to acquire skills and knowledge, but that perhaps the main purpose of educating adults is to provide them with the means to evaluate what they encounter (Entwistle, 1997). Critical thinking, or what Ashby (1973) calls 'creative dissent', can be enhanced by the acquisition of knowledge, and by the inclusion in a community of discourse. Problem-solving skills, communication skills and the ability to work effectively with others are all valued traits of adults, and all rest on the ability to use creatively what has been learnt. The intention of the TTA's teacher training for ICT use is that it will allow teachers to create meaning from information, and to construct ideas from focused face to face and online conversations. To this end, the TTA has provided a set of 'Expected Outcomes' which are introduced:

> 'The principal aim of the ICT training based on these Expected Outcomes is to equip teachers with the necessary knowledge, skills and understanding to make sound decisions about when, when not, and how to use ICT effectively in teaching particular subjects' (TTA, 1999 p1).

Thus the training is intended to raise competence within the realms of professional expertise, that is, to ensure that teachers who are engaged in reflective practice have a sound basis for decision taking.

How learners might approach learning

One sort of learning is that which has the character of acquisition of information, or mastery of a skills based task; such learning, for example, is required to accumulate keyboard skills and a knowledge of how a particular computer or device 'works'. Studying in order to understand ideas or meanings or in order to conceptualise academic input requires an engagement with the material not required by learning of skills.

The ways people approach learning have been distinguished as 'Deep' or 'Surface' (Morton and Saljo, 1976). The terms 'Deep' and 'Surface' describe not just the approach or intention of the learner but their consequent understanding of concepts, and arising from this, the use they can make of their learning. The motivation of individual learners may cause them to adopt either a Deep or Surface approach, depending on the context.

The significant features of Deep and Surface learning are shown in Table 2.2.1: *Deep and Surface Learning.*

(Based on Ramsden et al, 1986: see Atherton URL)

Table 2.2.1: *Deep and Surface Learning.*

Deep	Surface
Focus on 'what is signified'	Focus on the 'signs'
Relates previous knowledge to new knowledge	Focus on unrelated parts of the task
Relates knowledge from different courses	Information is memorised for assessment
Relates theoretical ideas to everyday experience	Facts and concepts are associated unreflectively

Relates and distinguishes evidence and argument	Principles are not distinguished from examples
Organises and structures content into a coherent whole	Task is treated as an external imposition
Emphasis is internal, from within the student.	Emphasis is external, from demands of assessment

Some learners may be pushed into adopting surface learning strategies in order to cope with an over demanding syllabus, assessment demands, or insensitive teaching (Ramsden 1986). The efficacy of Surface learning styles should not be underestimated, and may provide an opening or a basis for a subsequent Deep approach. A third 'Strategic' approach, involving well organised study methods and efficient time management, describes learning with the intention of achieving high grades in assessment. Surface approaches to learning are, Ramsden notes 'relatively easy to induce' (p.214) whereas encouraging a Deep learning approach requires allowing the learner freedom, but within clear frameworks. Surface learning, if encouraged by assessment, may mean that teachers engage in the TTA training in a way that does not specifically encourage the achievement of understanding. It is therefore important to evaluate the nature of the training and the associated accreditation procedures in the light of this theoretical perspective.

Saljo (1979) categorises what is understood by 'learning':

1. Learning as quantitative increase in knowledge. Learning is acquiring information or 'knowing a lot'

2. Learning as memorising. Learning is storing information that can be reproduced

3. Learning as acquiring facts, skills and methods that can be retained and used as necessary

4.. Learning as making sense of abstracting meaning.
Learning involves relating parts of the subject matter to
each other and to the real world

5 Learning as interpreting and understanding reality in a
different way. Learning involves comprehending the world
by re-interpreting knowledge

It seems that conceptions 1, 2, and 3 might be usefully applied to the skills section of
the TTA syllabus (Section B), and view 4 and 5 relate to a Deep learning approach,
which might be adopted by teachers in order to understand and integrate new
technology and its uses into their work (TTA Section A).

A further discussion of 'teacher resistance' to change

The way theorists have described 'teacher resistance' to change was introduced earlier
in this section. A theory of learning, proposed by Atherton (1991), can further the
examination in this thesis of evidence for and against the idea that such a phenomenon
exists. 'Teacher resistance' may be a simplistic umbrella term used to categorise a
diverse set of rational responses to externally proposed change.

Teacher resistance describes the observed adaptation or neutralisation of innovation by
teachers in their classroom practice. This can be regarded as a failure to learn new
skills, or a failure to understand and make meaning from new ideas in a way which
would make them subsequently useful. Atherton notes that when people fail to learn,
this can be attributed to lack of motivation, lack of ability or aptitude, or to poor
teaching: and suggests a fourth factor: the *cost* of learning. He describes as
'Supplantive Learning' the re-ordering of thought which some sorts of new ideas
demand. For teachers, the inclusion of ICT in all aspects of the school curriculum is
exactly this sort of learning: witness the common juxtaposition of the words
'computer' and 'revolution'.

'By 'cost' is implied the loss involved for the competent and experienced adult in 'changing
their ways'. This change may be termed 'supplantive learning', to be contrasted with simple
'additive learning' in that instead of just adding new knowledge or skills to an existing

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repertoire, supplantive learning calls into question previous ways of acting or prior

knowledge'

(Atherton, 1991).

The practising teacher is faced with a situation in which learning about ICT is demanded by the requirements of the pupils, the school development plan, by colleagues, governors and management, and ultimately by Government. There may be some personal motivation, but there may be conflicting priorities which diminish this. Supplantive learning proceeds in three stages:

1. De-stabilisation	The previous way of thinking or acting is upset	Previous ways of working are called into question by the introduction of new technology
2. Disorientation	A 'trough' in which loss of competence and morale combine to make learning difficult, and there is considerable temptation to return to 'the old way'	New ways of working with integral technology prove difficult to implement and may seem to reduce educational effectiveness
3. Re-orientation	The gradual climb towards new competence, following a 'normal' learning curve	Establishment of new patterns of working and discussion with supportive colleagues enables integration to proceed.

(adapted from Atherton, J: see web address)

During the Disorientation phase the teacher is subject to many forces which might cause them to question the 'new way'. Briefly, the technology may be unreliable or inappropriate. The training provided may be inadequate. There may have been little opportunity to evaluate new ideas or discuss them with others, or to construct educationally effective programmes in which they are embedded. The overall outcome is that the teacher may believe that the innovation is having a negative effect on learning: and immediately makes changes to try to remedy the situation. This may involve abandoning the innovation entirely, or adapting it in the light of reflection.

Either will be seen as 'teacher resistance'. However, teachers have the ultimate responsibility for the learning of their pupils, and are constantly aware that time lost during unsuccessful experiments is lost for good. More recently, the insistence on measuring what is measurable in learning and the comparative 'League Tables' of SAT results have made teachers very reluctant to trial overly adventurous plans.

The implications for the current proposed changes are that in order to ensure 're-orientation' - with the innovative drive intact- Atherton suggests that what is necessary is a *facilitating environment* which provides a safe opportunity to change. A facilitating environment in this context might be expected to ensure reliable technology, appropriate training, and opportunities to discuss and work with other professionals to make meaning of new ideas, and to create educationally effective programmes using ICT.

Further reflection on learning as a process of social participation

Wenger (1998) puts forward a social theory of learning in which for individuals, learning is an issue of engaging in and contributing to the practices of communities. For communities, leaning is an issue of refining their practice and ensuring new generations of members. Wenger's theory of learning involves opportunities for any individual to move between various communities, with different degrees of involvement in each. Atherton's concept of a facilitating environment providing 'safe' opportunities for people to change through learning maps on well to this theory once the distinction between the concepts of *boundary* and *periphery* are recognised. Boundaries are discontinuities between communities: peripheries are continuities - areas of overlap and connections. Entering a community involves an engagement with the processes of practice within its periphery : 'The periphery of a practice is a region that is neither fully inside nor fully outside, and surrounds the practice with a degree of permeability'(Op cit p117). Teachers as learners of ICT, for example, might become involved with computers by undertaking achievable tasks with the support of more adept peers. A facilitating environment can thus exist at the periphery of communities; being a context in which opportunities exist for the newcomer to engage with practice. When this occurs 'periphery is a fertile area for change - a source of dynamism' (Op cit p118).

The task for managers and policy makers is to open up the practice of educational ICT use and allow all teachers to become included. Wenger indicates three conditions which are necessary if such an 'opening up' is to occur:

'To open up a practice, peripheral participation must provide:
- access to mutual engagement with other members
- access to their actions and their negotiation of the enterprise
- access to the repertoire in use' (Op citp100)

These conditions are especially difficult to create amongst teachers, since the nature of the work means that discussion time with colleagues is brief, and issues to do with the immediate welfare and learning of children tend to take precedence. Only by ensuring that blocks of time are set aside for joint engagement with ICT can communities be fostered. Thus the establishment of community for teachers is necessarily slow.

Managing the boundaries of a community involves creating situation in which boundaries are 'bridged' with the aim of connecting the community with others. Wenger presents two types of connections:
1) boundary objects - artefacts, documents, terms, concepts
2) brokering - connections provided by people who can introduce elements of one practice into another.
In this research, computers can be considered as boundary objects: they are artefacts which can create divisions between users and non users. But they can also connect people in various ways to communities of practice involving their own use, providing links enabling practice to be shared. Thus as boundary objects computers quite uniquely allow brokering to make new connections. Practice is the source of its own boundary, but in the field of ICT, access to the boundary artefacts which are computers can encourage peripheral participation. In the sense that boundaries keep outsiders out and insiders in, the community of educational computer users may be remarkably open to newcomers and supportive of generation of new practice. It may be lack of access to *participation* which results in teachers' inability to get to grips with ICT.

The work of forming communities of practice is referred to as *engagement* (Op cit p
184) and entails such processes as:

- the definition of a common enterprise in the process or pursuing it in concert with others
- mutual engagement in shared activities
- the accumulation of a history of shared experiences
- the production of a local regime of competence
- the development of interpersonal relationships
- a sense of interacting trajectories that shape identities in relation to one another
- the management of boundaries
- the opening of peripheries that allow for various degrees of engagement

The establishment of a community of practice of ICT use within the teaching profession underlies sustainable innovation.

Summary: Theories of learning and the teaching profession

This section has attempted to organise relevant theories of learning and apply a synthesis of their implications to the study of teachers as learners of ICT. Two 'extreme' predictions of the actions of teachers as learners of educational ICT skills and pedagogy can now be described. Neither is likely, but these scenarios serve to indicate the worst and best outcomes of the current changes.

1) The teacher is required to make changes which are *problematic/ impracticable and* which seem to have a negative impact on learning. The change is wholly or partly rejected. A Surface learning approach defeats understanding and creates confusion and insecurity about further attempts to force change.

2) Within a facilitating environment, and with situated learning supported by the community, the pressure for change is meaningful and change beconmes achievable. Successful adoption of low-risk (peripheral) changes can increase learning opportunities and have a positive effect on motivation. More, and more radical,

changes can then be undertaken. A Deep learning approach ensures understanding and enables critical awareness.

The theories of learning described here will provide insights for understanding the data collected by interviewing teachers as the NGfL initiatives were introduced.

2.3 Information and Communications Technology in Society

Developments in communications technologies have meant that new uses of machines have become possible for educators. At the same time, ICT has become both more compact and more affordable, making it possible for schools to acquire more, and more powerful, equipment. Until recently, little communications technology has been specifically designed for educational purposes. The push to equip schools with ICT proceeds in parallel to the increased permeation of computers into homes and workplaces. This section reviews literature dealing with the impact on society of ICT, and the subsequent effect of this phenomenon on schools, discussing literature dealing with:

- computers as a new medium for communication
- the rise of virtual communities
- the social influence of technology – is this evolution or revolution?
- the Information Age - some problems for education
- media portrayal of teachers and technology

Computers as a new medium for communication

Rheingold describes the rise and influence of on-line communities and Computer-Mediated Communication (CMC) generally. In 1994 he speculates:

> 'CMC might become the next great escape medium [...] which means that the new medium will be in some way a conduit for and reflector of our cultural codes, our social subconscious, our images of who "we" might be, just as previous media have been.[...] Something big is afoot, and the final shape has not been determined'
> (Rheingold, 1994,p11).

Warning that the new medium may have its 'dark side', Rheingold intimates that socially attractive examples of online communication may be balanced by more

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dubious uses which the disinhibiting effect that lack of 'real' identity and lack of context clues can allow. Computer mediated communities can establish cohesive links between people, but can reshape social and cultural boundaries in a less benign manner. (Escobar, 1994, p219).

Societies and schools have to evaluate and adapt to the ways that computers can provide what Turkle calls 'the new location for our fantasies'.

> 'Computers don't just do things for us, they do things to us, including to our way of thinking about ourselves and other people. People explicitly turn to computers for experiences that they hope will change their ways of thinking or will affect their social and emotional lives. They seek out the computer as an intimate machine'
>
> (Turkle ,1996,p26)

Turkle looks at the way people interact in 'cyberspace', portraying the Net as a forum for the development of imaginary, extreme and ephemeral relationships, uncluttered by conventional rules and the physical constraints of being human. Turkle's open minded stance in which freedom of expression is regarded as irreproachable has some merit: but in schools, teachers may feel that it is their responsibility to question some sorts of interactions. The Internet provides people with a fertile medium for developing multiple realities and multiple identities. That such activity is conducted on highly technical machines does not ensure its educational value. Jones (1997) notes that the primary activity of Internet use is reading; this might be expected to have some beneficial effect on literacy levels. More importantly, reading has long been known to be a powerful changer of minds. Unfortunately minds can be darkened as well as enlightened by reading. The powerful tools of new technology and be harnessed for the benefit of society, or for *individual gratification: the role of the teacher is critical in* determining best uses of CMC in educational establishments.

Spender (1995) looks at the history of print and its cultural influences, and describes the way in which CMC with its anarchistic style is both part of the print tradition and an opportunity to escape some of its constrictions. One of Spender's concerns is with the portrayal of women in computer programs, and whether interactive pornographic games are an inevitable extension of the 'normal' practices of cyberspace. Debate on such issues is vital if the new medium is to become or remain a development which can enhance culture as well as run counter to it. In the teaching profession, awareness of

women's issues tends to be low key, although the majority of primary teachers are women: ICT assimilation and CMC may encourage productive discussion of such issues.

Virtual Community

Access to ICT will allow teachers the new experience of access to the complexities of interaction in virtual communities. Jones (1997) evaluates the concept of community in both real and virtual settings, and links the desire to re-create the sort of 'community' seemingly lost to many people in the present with the impetus to create computers which appear to help re-establishment of community links. Jones warns that loss and estrangement can be the result of trying to simplify the complexity of reality into a virtual 'unity'. Speaking of citizenship he notes:

> [The organisation of the Internet is] 'successful at putting people together, but does little to foster association in the sense of intimacy and fellowship. The former is an intellectual process and one of action, the latter is an act of humainty and reflection – and community. This gets to the heart of social relations as process ... what is lacking in citizenship not only on the Internet but generally is an ability to transcend action, not only to provide a response but to have responsibility'
>
> (Jones,1997,p 29).

Teachers in UK schools in the last decade have seen the focus for their continuing professional development transferred from Teachers' Centres to schools, which with the move to Local Management of Schools have meant a loss of 'real' community links. If the new virtual communities are to serve educational purposes, some consideration will have to be given to what is expected of them; what rules operate; what is their purpose and what meanings do they make. Virtual communities are not unrelated to the people who create them. They are unrelated to the machines that enable them, but it may not seem this way.

> 'Virtual communities do not exist in a different world'
>
> (Robins, 1995, p147)

There is a whole strand of literature devoted to the study of cyberspace. A summary of the terms and their provenance can be found in Featherstone and Burrows (1995), a volume which attempts to detail and make meaning from the linking of communication, control and the human body into cybernetics.

Human-machines with blurred boundaries between real and virtual worlds have unlimited potential in fiction and may have become dramatically possible:

> 'The next generation could be the last of "pure" humans'
> (Featherstone & Burrows ,1995,p3).

All this can lead the reader a long way from educational applications of ICT, but the machines that are being put into schools are the same machines that Turkle, Spender and Jones warn about. Brook and Boal (1995) provide an examination of what might result from the ICT revolution: global information mastery by corporations, control over consumers, a bland and unified culture, the 'hell' of information, the Virtual National Gallery 'better than the actual paintings'.....

> Virtual technologies are pernicious when their simulacra of relationships are deployed
> societywide as substitutes for face-to-face interactions, which are inherently richer than
> mediated interactions. Nowadays, the monosyllabic couch potato is joined by the information
> junkie in passive admiration of the little screen: this passivity is only refined and intensified
> by programmed 'interactivity'
> (Brook and Boal, 1995,pvii)

Whilst welcoming these machines into our schools for their educational purposes, teachers aware of their responsibilities to children and parents, may heed William Gibson's epigraph for his 1986 novel Neuromancer: 'Watch out for worlds behind you!' – and may be sensibly wary of some aspects of the drive towards ICT integration. This research will seek to probe the views of practising teachers as they consider introducing ICT into teaching.

Technology and Social Influence - Evolution or Revolution?

The changes brought in by technology are often described as 'revolution'. In this tradition, predictions that the inclusion of ICT in educational setting will precipitate revolution are commonplace. Predicted futures for society are polarised round the extremes which Winston (1998, p2) labels 'apocalypse or techno-glory'. Such phrases as 'The Information Revolution' and 'The Digital Age' imply a fracture between past and future in a manner which makes choices about change in the present seem remarkably portentous. In order to understand what changes ICT is likely to bring, to try to distinguish what is achievable from what is possible, this section looks at literature dealing with a history of prediction and surmise in technology. How does

technology gain acceptance in society? Is society driven by technology, or vice versa? Why are changes labelled 'revolution' when their evolutionary style is evident?

It is difficult to evaluate the influence of technology on society objectively, because notions of progress and loss are necessarily subjective, and because the evaluation itself is undertaken with the assistance of the tools under evaluation. However, Winston argues:

> 'there is nothing in the histories of electric and electronic communication systems to indicate that significant major changes have not been accommodated by pre-existing social formations. The term 'revolution' is therefore quite the wrong word to apply to the current situation. It is possible to see [...] regularities in the pattern of innovation and diffusion as to suggest a model for all such changes'
> (Winston, 1998, p2).

The model he proposes suggests that society conditions and determines technological developments. The ideas which are constructed into devices are present in society for some time before such devices become prototypes. Once 'invention' occurs, ideas take shape as machines, which are more or less effective at addressing a perceived need. The prototype machine is then subjected to *'supervening social necessities'*. That is, the fate of the prototype is determined by society's perception of its use.

Whether the use of ICT in schools constitutes a revolution or not is infinitely arguable. For teachers in this study, what matters is that they are constantly confronted with the threat or promise of 'revolution' in their workplace.

Revolution is political, a struggle for power and control. Teachers faced with media insistence that there is an 'ICT revolution' must have to overcome a certain amount of cognitive dissonance, a mismatch between what they experience in their professional lives and futuristic depictions of virtual worlds, data-driven cyberspace, Gibson's 'consensual hallucination'. But this is what ICT provokes, or allows.

> 'The emergence of the virtual world releases us from the bondage of the computer terminal and its tiny window on the world'
> (Jacobson, p336).

It is tempting to argue that a No. 47 bus has the same function. The point is that talk of revolution and the eerie invocation of unknown worlds may be intended to encourage sustainable change, but may be a way of trying to force change by stressing

its inevitability. In this research, teachers reflecting on the ideals of revolutionaries in the context of professional experience may offer insights into the direction of change which they intend to pursue, and why.

The Information Age: some new problems for education

Electronic information is a stream of digital data, and the main function of the computer is to process the information so that it is transmitted with absolute accuracy. Turing's development of the de-coding computers at Bletchley Park during the Second World War marked a change in computer use from manipulating information - computers as calculators - to storing and retrieving information - computers with memory: intelligent machines (Turing, 1937). The characterisation of the1990's as 'The Information Age' arose from the volume of information that computers could now generate, store, and transmit, and that people could trade. Some found even the thought of so much information overwhelming.

> 'We are told repeatedly that we live in an information society. This is true. There has never been a society which generated so much information. The moment Michael Atherton scores a run, the screen can reveal what his test batting average is and how he is placed in the world rankings [...] Soon everyone will be able to look things up. The information society has indeed arrived, even in Stoke on Trent. Access to the Internet is becoming ubiquitous. Tony Blair has promised that the Labour Government will network every school....'
> (Barber, 1997, p181).

The real task for educators and learners alike is to select relevant information, and to make meaning from it. Schools exist to put into practice theories concerning the ways humans use information to construct knowledge and subsequently to enact what they know. It is important to distinguish information from knowledge, and accessing information from acquiring knowledge. Haywood (1995) provides an evaluation of information as it relates to culture, concluding that 'the quality and quantity of information is still determined by humans in engagement with their peers' (p.178). He distinguishes between information 'designed to support lifestyle and fashion, and that which truly facilitates our search for richer domains of human existence' (p.178). This seems to accord with Winston's assertion that there is nothing revolutionary about new technology - because it deals mainly in information 'designed to support lifestyle and fashion', and anyway the Internet is clogged with 'clutter and absurdity'. The

growing use of the Internet for buying and selling can hardly be considered to contribute to the profundity of human existence.

> 'The most unambiguously valuable facility provided by the net is e-mail [...] Other uses such as the creation of a virtual social community seem to have less, if any, purpose except as a sort of hobby.[...] There is little to support the idea that the net will become a crucial method for selling goods and ordering services, and a way of avoiding business and other travel. People like shopping and travelling'
> (Winston, B 1998 p 334ff).

As the Information Age arrived, uses for the proliferating data seemed remarkably un-revolutionary in their scope. Rather than assisting humanity's search for answers to profound questions, the Internet was to be used to enable mass commerce and entertainment.

> 'The new networks will be able to carry vast amounts of data...those who have it say it will change how we use the Internet, how we watch TV, and how we communicate with each other'
> *'Multimedia services for the masses'* Guardian Online 8.7.99

> 'People are very conservative in general ... it has taken them a long time to take to multi-channel TV, and we're not going to see an interactive revolution in the next year or two. What people want are things like video on demand and broader use of e-mail. Access to the Internet is quite frankly becoming a little unmanageable at the moment'
> *Telewest Digital Rollout Manager* Guardian Online 8.7.99

Technology to access the 'Information Highway' is being introduced into schools partly as a way of ensuring that children are adequately prepared to deal with future technology.

> 'In the last 20 years, new technology has revolutionised the workplace. We must now ensure that our education system provides Britain's children with the tools they need as adults in tomorrow's economy and society' (Howells, EDSI Report, DfEE 1997b).

But as Jones (1995) points out, the 'highway' metaphor with its romantic connotations of freedom also indicates the sort of problems that a society dominated by Internet use might expect:

> 'Highways have monstrous side effects. They have often rolled through cities, splitting communities off into ghettos, displacing people, and crushing the intimacy of old cities. While promising to bring us closer, highways in fact cater to our sense of separateness'
> (Patton 1986, p 20 quoted in Jones, 1995 p 11)

Predicting the general effects of the 'superhighway' (a term becoming less prevalent) is difficult, but a consensus seems to be that those businesses not connected to electronic networks will find it hard to remain competitive (Cockfield, Federal Trust Report 1995). A parallel effect is that badly equipped schools will fail to address the needs of their pupils. But those schools with little equipment as the NGfL was introduced may have found it difficult to escape further disadvantage. The following is an extract from an interview with the Chief Advisor for ICT in Milton Keynes as the NGfL Standards funding became available.

> *'There is an inherited inequality of provision of IT in MK schools. Smaller schools and primary schools may find that the costs involved in NGfL connection amount to a gross disproportion of their budget. Decisions about which schools are allocated funds depends partly on their ICT development plans. Plans submitted by MK schools for NGfL funding are variable - "from 1 cm thick, to 1 cm long" - and the outcome of this is that people who can write successful bids get more. And the ability to write successful bids does not always mean that schools can translate the funds they obtain into curriculum provision for students'*
> *(QI, 1997)*

'The gap continues to widen between schools which give a high priority to information technology and the one in five schools which do not: [..] The most ambitious information technology work in well-resourced schools has again become more sophisticated this year...(OFSTED Annual Report 1997-98)

The idea that information technology may compound existing inequalities is unwelcome but must be considered if such problems are to be recognised and addressed (Selwyn,1999a, 1999b: Robins & Webster, 1989: Postman, 1992), especially since inequalities in school computer provision may reflect differences which children experience in their homes.

Media portrayal of teachers and technology

The marketing of ICT to teachers could play an important role in the eventual success of educational computing in UK schools. First, as Selwyn (1999) argues, teachers need to be convinced of the worth of the National Grid for Learning and the many claims surrounding it. Secondly, and perhaps more crucially, the advertising of educational ICT plays a vital role in defining how teachers see themselves and technology. Thus, alongside other sources of information, such as professional networks and LEAs

(Leask 1998), the advertising of educational computing is a 'pivotal determiner' in the way that teachers approach technology. As Berdayes and Berdayes (1998, p109) argue:

> "Today's media are full of stories about how emerging communication technologies will change our lives and unify the planet. Yet, what tends to go unnoticed is that these stories shape the development of technologies by conveying assumptions about how these instruments will be used and the interests that shape their development. Such narratives tell us where we have been, who we are, and what we might expect. Thus, they have a role in articulating or reproducing social reality"

The reflections teachers see of themselves and their profession in advertisements for the NGfL and new technology may serve to create a positive climate for innovation, or conversely may be disheartening and create a climate of anxiety (Selwyn & Dawes, 2000: also Appendix 7).

The National Grid for Learning initiatives are intended to enable all teachers to become competent and confident users of new technology. This reflects an awareness that the educational effectiveness of computers in classrooms is largely dependent on the teacher's structuring and framing of tasks for the pupils (Watson1993, Littleton 1999). This focus on teachers' professional development represents an improved understanding of the role of the teacher by those wishing to make changes (DfEE 1997b). Historically the attempts of teachers to temper technological dreams with practicalities have meant that initiatives have been adapted, transformed or even ignored; the result has been that teachers have acquired the reputation of 'Luddites and reactionaries resistant to progress' (Cuban 1986, p 61).

Information for teachers involved (or wishing to be involved) with ICT is to be found in media outlets such as the Online section of the Times Educational Supplement, and the Educ@guardian. Such publications contain the usual mix of news, opinion, information, cartoons, and advertisements. Media depictions of the relationships between teachers and computers help shape ways teachers consider new technology (Selwyn, Dawes & Mercer, 2000).

Comic strips and cartoons in news media are used to raise issues, reflect immediate events, and comment on them, in a format which is rapidly understood by the target audience. Their humorous quality allows the presentation of contentious ideas whilst

evading presentation of a rational evaluation of complex issues, in the 'only joking!'
tradition. Comics tell stories (Berger,1997) and the story of the relationships between
teachers and computers is an interesting one, because it contains conflict,
unpredictability, highly technical and expensive machines, and teachers, who are after
all something of an enigma, being both powerful and of low social status.

Reviewing recent research, Pachler (1999,p 4) discusses some ways that ICT can
support teaching and learning in schools. He emphasises that such findings support a
consideration of the role of the teacher as 'pivotal' in ensuring effective use of new
technology. The Government's NGfL initiatives (DfEE 1997a) were designed to
encourage business and industry to work in partnership with educational
establishments in order to improve technological provision in schools. The success of
the NGfL rests partly on the transformation of the teaching profession towards
competence and confidence with ICT. The TTA curriculum for ICT reflects the duality
of teachers' engagement with ICT: teachers must learn the skills necessary to use the
machines, and they must also learn how to deploy technology to enable their pupils to
achieve stated learning objectives.

Cartoon depictions of the relationship between teachers and ICT almost invariably
show teachers as laughably and ridiculously inept (Selwyn and Dawes 2000): this
unremitting message cannot but be detrimental, undermining as it does the confidence
of 'newcomers' to a community of practice (Lave & Wenger, 1991). Doubt is created
in the capability of the profession to tackle the task of integrating ICT into classrooms.
This is reinforced by accompanying advertisements which persistently present IT firms
as expert in education.

Warburton and Saunders (1996) examining cartoon depictions of teachers'
professional culture, consider cartoons as embodiments of public opinion. They stress
that many cartoons produce depictions relevant to the reader rather than the subject: in
the cartoons studied, teachers are both. This means that the image teachers receive of
their profession is doubly powerful. 'The term 'image' is applied to the range of
understandings which count as [a] reasoned conclusion' (Warburton and Sanders,
1996 p323). Images gain currency by repeated use: repetition coupled with the concise

nature of the cartoon provides a powerful means of transmitting ideas. Humour may
act as a 'mask' (Barker 1989, p271) a device to deflect serious commentary on the
cartoon's content, however deserving of this it may be.

Advertisers also draw heavily on cultural images of teachers in their attempts to sell
new technology. But given the uneasy relationship that teachers have had with
technology in the past, it is crucial for the success of the NGfL initiatives that the
positive contribution of the teacher is both acknowledged and valued.

An emphasis on teachers and teaching has not been evident in the historical
development of educational computing. In general teachers have been rendered
invisible or, at best, problematic by those seeking to establish computers in schools.
For example, early software produced for schools was often developed around an
assumption that it was best if children could interact with computers free from the
interference of teachers, with programming designed to be 'teacher-proof'(Papert
1993). Only over the last decade has thinking evolved on this issue towards a
recognition that it is the teacher's structuring and framing of ICT-supported tasks
which allows their pupils to realise both their own potential and that of the technology
(Scrimshaw 1993, Somekh & Davis 1997). For the best part of the century,
technological reformers have tended to be 'teacher-bashers' (Cuban 1986).

The NGfL has involved the IT industry as an integral part of its development (DfEE
1998b). With British schools estimated to be spending £200million per annum on ICT
(TES 1999), teachers' use of computers is emerging as a major focus for many IT
firms. Yet a traditional lack of interest in teachers, coupled with an unfamiliar but
newly lucrative marketplace, means that many IT firms were attempting to 'sell' their
product to teachers for the first time. Although the educational (or 'edutainment')
capacities of computers has long been a mainstay of companies' promotion of ICT,
marketing has previously been directed towards the home/parent consumer (Haddon
1988).

In summary, the media have a role to play in the success or otherwise of NGfL
initiatives. The depiction of teachers as incompetent and unable to develop as
professionals in a world newly invaded by ICT may prove by the end of this study to
be accurate – or utterly misguided.

2.4 The effectiveness of computers in educational settings

As described in Chapter 1, computers have become increasingly evident in educational settings in the UK since the early 1980s. This section reviews work which details and evaluates uses of computers in schools. Findings indicating effectiveness (or otherwise) of ICT use might influence the response of serving teachers to the prospect of increased integration of technology into their practice.

Computers and the role of the teacher

Papert (1993) envisaged a computer-driven revolution in education even greater than that achieved by the printing press. He uses stories of innovative projects and teachers to provide a glimpse of the potential that computers offer as an educational resource. This vision is to do with computers being truly integral to classrooms, part of the everyday equipment used by children and teachers. More recently he has recognised the fundamental role of the teacher in framing and structuring computer work and use. He notes that one challenge facing those who wish to promote innovation is to gain an understanding of:

> '[...]the currents in the world of teachers that favour change and resist it. Finding ways to
> support the evolution of these currents may be among the most important contributions one
> can make to promote educational change'
> (Papert, 1993,p59)

Papert has continued his emphasis on the role of children as promoters of change, asserting that constructing video games (rather than just playing them) will enable children to take control of ICT and use them as tools (Papert, 1997). He implies that teachers are an unnecessary encumbrance in this procedure: but loss of the teacher's role in framing and organising relevant and purposeful activities may diminish the value of ICT (BECTa 1998a).

Cornu (1994), noting that computers were still not used extensively in classrooms, suggested that teacher-trainers should consider the ways student teachers are taught.

> 'So, why are new technologies not as widely used in education as one would hope? There are
> two main reasons: generalisation and integration.

Generalisation: We now need all teachers and all pupils to use computers in teaching and

learning.

Integration: We now need a clear integration of new technologies in school, not an

addition[...]

Future teachers do not teach the way we tell them to; they reproduce the way they are taught.

So in teacher education, the methods and the pedagogical strategies which are used are at

least as important as the content. This is particularly true for new technologies. In teacher

education, the first need is not courses about the use of new technologies, rather the first

need is to actually use new technologies in the training. It is therefore absolutely necessary to

integrate new technologies into teacher education'

(Cornu in Watson and Tinsley, 1995, pp 4-11).

Initial teacher training training is an important issue, but new teachers can not bear sole responsibility for bringing in change. With the TTA NOF -funded training under way (Dawes & Leask, 2000) it is also important to consider the approach of serving teachers to change. One influential factor determining teachers' responses in this research is the essential nature of computer technology and the ethos surrounding the machines. As Kling (1995) puts it, the computing world is 'very future orientated' making the value of experience tend to seem unimportant, and tried practice obsolete. Political involvement in the NGfL initiatives means that computers are not being introduced into classrooms simply as tools for learning, but as catalysts for social change. This study is designed to sample approaches to technology from a range of teachers, including those previously excluded from experience of the 'catalysts'. The rapidity of uptake of technology by educationalists is another factor which the study considers. The pace of change is hard to estimate - Heppell (1994) says we can be relied on to always misjudge it. Heppell considers that educationalists may not take up new technology with undue haste and that this is not only understandable but wise: teachers are centrally placed to evaluate new opportunities with the benefit of their own experience and technology's history in education.

'Teachers are fundamental to all this. They are learning professionals of considerable

calibre. They are skilled at observing their students' capability and progressing it. They are

creative and imaginative but the curriculum must give them the space and opportunity to

explore the new potential for learning that technology offers'

(Heppell in SCET, 1994,p 30)

Teachers in the study schools can be expected to have informally evaluated the uses of computers, and have formed opinions based on professional judgement which can be elicited at interview. The relationships between information, knowledge, and learning

are at the heart of the ways ICT might provide teachers and learners with what Heppell calls a 'new potential for learning'.

However, there are concerns about the inequalities that might be reinforced or initiated by the advent of ICT in classrooms. Selwyn (1998a) examines some of the practical and ethical issues which require clarification or consideration if ICT is to be a general asset. The introduction of the Learning Grid may create or reinforce existing disadvantage; Selwyn emphasises the importance of examining the optimistic claims for the integration of ICT into education, since technology operates not as another and 'better' world but within existing social structures.

> 'Instead of blindly concentrating on the potential vast opportunities available on the information superhighway for schools one must also be very aware of the social choices and contexts of computerising education in this way'
> (Selwyn, 1998ap423).

Worryingly, the TTA National Curriculum for ICT does not include study of computers in social contexts, or study of their history in education. It is based on the assumption that once developed, appropriate uses for ICT will be educationally valuable. Evaluation of the forces encouraging technology use in education may be necessary if the aims driving such forces are to be understood and harnessed to educational purposes.

> 'Access to others is undeniably important to learning. Actually, access is also what worries us about the Internet: unequal access, that is. [...] There are inequalities in terms of gender, ethnicity and class'
> (Garner and Gillingham, 1996, p16)

Whether the opportunity to harness the power of the technology in classrooms can be extended from the pioneers to all schools will depend on factors this research is designed to determine. Looking at Internet communication in American classrooms, Garner and Gillingham note almost as an aside:

> 'Teachers often can think of very meaningful ways in which to use technology when they are sufficiently prepared to do so'
> (Garner and Gillingham1996, p 11).

The phrase 'sufficiently prepared to do so' carries two equal meanings: if teachers so wish, and if teachers are properly equipped and trained.

The intention of the remainder of this chapter is to show the sort of developments that have taken place in computer use in schools; to look at real projects and actual learning outcomes. There is much 'hype' surrounding ICT: research identified in this section offers ways of evaluating what is useful for education, and making decisions about what uses are inappropriate or ineffective. This is not an exhaustive review of successful computer use in schools, but an attempt to highlight examples of *what has been learned* by researchers and practitioners. The literature detailed here typifies the dissemination of research and classroom findings in which examples of best uses of computers are made available to teachers, problems are identified, and conclusions based on experience are shared. It is such work which, shared amongst teachers, which may establish a community of ICT use for educational purposes.

How 'Educational' is Software?

Littleton and Light (1999,p1) provide an overview of the introduction of computers into classrooms, from the earlier 'drill and practice' software to the advent of 'Intelligent Tutoring Systems'. Such software has tended to concentrate on the tutoring of skills rather than addressing learning as personal development (Willis 1993: Dillon 1998). It is particularly problematic to assess learning as 'changing' a person, but change is exactly what collaborative tasks involving computers are predicted to offer.

Recent studies of 'educational' applications of computers in schools in Monteith (1998) question some of the claims made for technology. In doing so they provide some indicators of how ICT might become more useful as users gain a better understanding of how learning progresses in this medium.Exploring the nature of multimedia interaction, such as use of 'educational' CD-ROMs, Williams writes:

> 'Educational systems are touted as flexible, interactive and user-led. [...] I want to assert that current systems still do not fulfil the promise of educational technology, or offer the learner real interaction of educational, rather than merely instructional, benefit' (Williams, 1998 p153)

Defining interactivity as 'inter-action between the learner and information, not merely choice of how to receive it', Williams points out that much so-called interactivity is simply access to opportunities to collect information. Pursuing a set of links has the trappings of control of the programme, but actually information provision is structured

by the designer, and paths through the information are limited, and not created by the learner. Learning may be confined to learning the metaphors of the medium: such as that a screen button can be activated by clicking the mouse or enter key, and that doing so 'turns the page'. Unless material found in this way is contextualised by other classroom activity, the volume and irrelevance of much of it makes it difficult to recall later. Teachers' views on the extent to which learning the skills of the medium of ICT has become a dominant concern will be requested in this research.

Even those who strongly advocate the use of CD-ROMs are aware that the promise of 'learning outcomes' is not simply achieved by introducing the learner to the machine.

> '-the great strength of CD-ROMs is that teachers and pupils are able to access information quickly...CD-ROMs can offer a versatile and stimulating environment...can increase motivation and enhance learning...offer a high speed facility for searching large amounts of information...' (Bruntlett 1999, p 75).

Later in the same chapter, the amount of teacher input necessary to harness these perceived strengths becomes evident.

> 'pupils need to be taught otherwise they may become lost in the vast quantities of information....teachers should become aware of the problem of plagiarism... monitoring pupil use may be achieved by use of log sheets...the use of multimedia needs to be thought through and not just introduced to try to motivate reluctant learners...teachers need to provide guidance material... primers or guides for particular pupils...'(op.cit, p77).

That teachers are still required to do such work says much about the inflated claims for the 'computer revolution'. Surprisingly Bruntlett dismisses the potential but more profound problem of the asocial nature of work at computers by invoking the received wisdom about ICT: that because it is new it is better.

> 'There may be problems inherent in the overuse of new technologies that may lead to lack of socialising by pupils, for example, but there are new ways of learning' (op. cit, p 93).

Evaluating Virtual Reality (VR) projects, Grove and Williams(1998) state:

> 'VR clearly does have great potential as an educational tool. However, that potential is dependent on educators being able to locate the technology in a sound educational framework, a framework which takes into account both the pedagogic and pragmatic aspects of implementing VR in the classroom' (Grove and Williams,1998p 173).

Here again is the same idea: without teacher input, the educative potential of new technology is diminished. Citing evidence to show that a range of learning outcomes can be achieved by use of Virtual Reality scenarios, the authors nevertheless suggest that before VR can be used as a vehicle for learning in curriculum areas, learners have

to find out how to 'read' or interpret the medium. Until this happens, the content of the medium is inaccessible. This is the same problem learners have always had with the tools they use - from learning to control a pencil onwards.

C for Communications: why is this important?

O'Neill (1998, p 143) argues that to make best use of ICT, learners (including teachers) must be provided with the range of tools ICT can offer, placed in the real-world contexts of 'rich problem solving situations'. Problem solving involving groups provokes discussion, therefore can be expected to enhance communication, allowing people to be constructively 'social' in educational settings.

The profoundly educational value of communication lies in people's joint use of language to construct meaning, to 'get things done', to recall and revise common knowledge, and to productively assimilate experiences (Mercer, 2000). Stevenson's addition of 'C' to IT (1997) emphasised the growing use of Computer Mediated Communication (CMC) or 'telematics' (a contraction of 'telecommunications' and 'informatics') in society, and stressed the factors which would make such communication possible in and between schools. The communicative functions of new technology seem to offer more potential for education than simple 'Information Technology'. Links between schools allow teachers and pupils the chance to collaborate. Links to libraries, museums and other institutions allow schools ready access to up-to-date resources. Links between school and home may be of particular value. For teachers in the study useful communication might include professional links.

Communication technology in use in education

Much of the work on the effectiveness of Computer Mediated Communication (CMC) as an educational tool has been undertaken in higher education institutions. Nevertheless the issues highlighed are relevant to uses of CMC by teachers and pupils. Some of these issues are identified here.

Asynchronous learning networks (ALNs) involve the exchange of information exclusively online, with no face-to-face interaction or conventional classroom

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arrangements. They therefore represent a shift in the way education is organised.
Advocates have argued that such new ways of delivering education are more efficient
in terms of institutional 'productivity', and better reflect current social and economic
conditions (Hiltz, 1994: Harasim, 1993). However Jaffe identifies ALNS as posing the
greatest perceived threat to educators, because of the way that 'they are virtual
classrooms that dematerialise the physical classroom setting' (Jaffe 1998, p25).
Teachers whose students and classrooms disappear may feel that the essential nature
of teaching and learning has been undermined to the point that the costs outweigh the
predictied benefits. Teachers in the study can provide insights into this challenge of
threatened obsolence.. A 'third way' mixed economy of classroom courses and online
web conferences might offer an enhanced learning environment without discarding the
benefits of traditional methods.

Watson et al. (1998 p18) describe a fundamental problem that can occur when CMC is
used to deliver information: information remains embedded in the documentation and
is not transferred to the tacit knowledge of the learners. The social construction of
knowledge is missing unless CMC involves interactivity between the traditional
triangle of teacher, subject and pupil. Veen et al. (1998), stressing the value of
communication with others, indicates that students may find collaborating with their
peers requires them to undertake a perhaps unusually active role in their own learning.
When initiating CMC there are also the problems of unwarranted assumptions that
access to good facilities is universal, and that technical expertise is developed to such a
point that computer use is unproblematic. Unless ideal conditions are met, in telematic
learning environments 'it may be concluded that learning activities [...] mainly refer to
reading activities[...]: reading is a learning activity whch has a low rating on the list of
learning effects' (p32). The conclusion that the limits of current technology mean that
'email and today's video conferencing [are] poor substitutes for on-site presence'(p34)
may or may not accord with the views of teachers in the study.
Innovative uses of software, Internet resources, increased interactivity, partnership
projects, and so on can all assist learning processes in formal and informal ways, in
schools or universities. Currently most innovative uses of CMC are small scale,
contained within traditional learning environments. Commenting on this, the Editors of
the Journal of Computer Assisted Learning (JCAL) state:

'Certainly there are problems posed by the scaleability of technology-dependent innovations but this may not be the most significant barrier to larger-scale adoption. The major barrier is that of human change - one aspect of the broader change in social culture. The problem lies at the heart of many current attempts to increase the regular use of information and communication technology. A project director recently said, "It seems that we have been too ambitious and that we need to design a first activity that would prepare students to use the activity and to collaborate with it..."

(Journal of Computer Assisted Learning, 1998 Vol 14 No. 3 p 2).

The problem for technology enthusiasts remains the same: people. Those who have developed technology can see its potential and may wish others to adopt its use without question or time for reflection. Those who are required to use technology in this way, 'because its there', seem inevitably to exercise their option to not rush into things. Teachers in this way differ little from others: except that their caution must be more extreme, given their responsibility towards their pupils.

The research literature dealing with CMC, ALNs, telematics, online education, etc., is comprehensive and growing (see Cox 1999: Harasim 1993: Collis 1996: Selinger 1998a). The debate about what uses of CMC are effective and in what contexts is fuelled by such points, which are often contradictory, but seem to add up to a picture of developing knowledge within the community of CMC users. Indeed, many papers include in their conclusions a list of guidelines for others undertaking CMC, thus sharing the benefit of practical experience in this new area, and creating a community of educational users of ICT.

The Social Dimensions of Asynchronous Learning Networks

Wegerif (1997) stresses the social dimensions of CMC. From the stance that 'it is already apparent that education of every kind and at every level is being changed by the use of CMC' Wegerif looks not at the details of the technology but at how the use of technology changes people's lives and their relationships. This is directly relevant to the focus of this research on teachers' 'stories' of their relationships with technology.

'I believe that there is a new vision of education emerging based on the potential of information technology to support communication and community. This is, of course, a personal view. Some teachers, unhappy at the many changes they have had to respond to in recent years, have become disillusioned with promised 'new dawns'. There are plenty of pessimists out there who would not agree with me about the potential of IT. Some would

describe this vision of education as 'technicist' implying it reduces complex human problems to technical problems with technical solutions. There are no simple technical solutions but the technology can make possible human solutions. This is where the response of teachers is crucial. Teachers will, to some extent, be the gatekeepers, allowing the future vision to become a reality or denying it entry into our schools and our lives.

[...]Applying (Lave's 1991) extended metaphor of education as becoming part of a community of practice can offer us two important insights.

The first of these insights is what education is really about. It should be a bridge between outsider or newcomer status to full participation in society. Too often the needs of the education system itself seem to dominate and, instead of being drawn into effective participation in society, children are drawn deeper into practices specific to that system with no relevance outside it. Much of the curriculum looks pretty bizarre seen with these fresh eyes.

The second big insight is that the abstract knowledge education appears to aim at is actually rooted in communication and community. In every area knowledge and skills are embedded in living communities.

There is, in my view, a natural convergence between technological developments and this situated model of education as becoming part of a community. Increasingly the actual communities of practice, in every area of social life, are moving out of the shadows and onto the internet' (Wegerif, 1997, see web address)

This approach seems to offer much more to education than a technology-led determination to put machines into classrooms and then work out uses for them. It stresses the centrality of the teacher, who in this scenario works with learners and computers to create knowledge in the former with the support of the latter. This role of active interference in learning seems more likely to interest teachers, who as Huberman (1993) argues have a strongly vocational conception of their role, than does that of 'facilitator'. The drive towards technological innovation seems to leave its most ardent proponents with the worry of what to do with teachers made redundant by computer-learner interactions; assigning them the passive role of 'facilitators' is their most common response to the problem. But as Cox points out, best uses of technology may well require teacher intervention.

'Often, the best opportunities for motivating pupils using ICT are lost because many teachers have been led to believe that when they use ICT they must always change their role to that of facilitator [...] pupils, alongside teachers, share the role of exploring uncharted ground together, but this does not mean that pupils have the bility to organise and manage learning or to know what is useful to learn and what is a diversion. If we leave pupils to discover on their own, then sometimes the result can be demotivating or at best confusing [...]the need for teacher intervention is stressed to avoid leaving the technology to control the lessons' (Cox, 1999, pp 19 & 34).

Using The Internet and Email in Schools

Increasing use of the Internet and email by teachers may or may not be a result of the NGfL initiatives, and the research is designed to study whether teachers see such applications as providing genuinely educational opportunities for themselves and their pupils. The educational potential of email lies in the way users can exchange ideas, information, questions and opinions. Email can alter the communicative structures within and between organisations such as schools (Lea, 1992: Bowers and Benford, 1991). The Hanau Model School 'technology infusion' project linked four schools on an American army base in Germany: the use of email is reported to have had a 'sudden, stunning and profound effect' across the cluster of schools (Wasser et al, 1998). Teachers reported that administrative tasks had become 'infinitely easier', and that sharing resources and information was simplified and thus more likely to happen.

'Teachers and administrators feel less isolated from their teaching colleagues than they did before. Gradually, we are seeing changes in collegiality that have been facilitated [...] by the breakdown of isolation. E-mail, we think, was a critical agent in this turn about of affairs' (Op. Cit, p 11).

The disadvantages of email are the volume of correspondence which it can generate, and the problem of 'junk mail'. For teachers, however, email may be the 'killer application' which encourages further ICT use (Younie, 1999): once all teachers have reliable easy access, it may well become an effective way to communicate. The research will explore this issue.

The teachers of the Hanau Schools Project (Wasser et al, 1998) found that the provision of digital images was one of the most useful aspects of the Internet. Otherwise, it was considered 'an up to date encyclopaedia' and appropriate use required careful planning on the part of the teacher. Developing web pages and

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undertaking problem solving debate about Internet access were also cited as having
educational value, though of a rather introspective kind. Describing Internet access as
having a 'moderate' impact on educational practice, the authors say:

> 'The jury is out on the Internet. [...]The various changes and effects emerging from use of the
> Internet are difficult to interpret yet
> (Op. cit, p 15).

The project had then been running for three years.

Considering collaborative interactions around and through computers, such as Internet
projects, Crook writes:

> 'The localised and interactive properties of this technology do suggest that it has a special
> potential for resourcing the social construction of shared knowledge'
> (Crook, 1994,p189).

Discussions using computers have been shown to enable problem solving collaboration
(Teasley and Rochelle, 1993: Underwood and Underwood 1990: Barbieri and Light
1992). Again, researchers stress the importance of 'high levels of teacher preparation'
in order to successfully integrate the Internet into the curriculum (Corbett,1997:
Falcon, 1997). Underlining the point that as a resource, the Internet can provide
information that is difficult or impossible to obtain from traditional sources, Sloan
(1997) points out that 'there are many instances where learning is better accomplished
through the use of more traditional resources' and that as a sole means of reference,
the web has limitations.

The most popular use of web pages for schools is as an online brochure (Selwyn,
1998b). Abbot (1998) describes construction of web pages as 'an amalgam of
publication and communication', describing the enthusiasm with which young people
are prepared to offer personal details to the general Internet audience. Abbot suggests
that schools begin to archive material produced by pupils so that there is a 'rich
collection' to draw on, and that school web pages will in future be supplemented with
'video clips, sound files from the Chair of Governors, and e-mail links to various
departments'(Abbot, 1998, p105). Evidently there is room for reflection here, in order
to match the possibilities of the technology with genuine educational purposes. The
idea that 'students of the early 21st Century will be active media producers as well as
enlighted consumers of the digital world' (Op. cit, p 105) sounds rather hollow.
Creating web pages has educational potential, but their nature and purpose must be

considered if they are to be more than an ephemeral attempt to link with an uninterested world.

The importance of 'Technological Imagination'

A nation-wide Australian project indicates how some researchers consider technology might reshape literacy teaching (Bigum et al., 1997). The project report lacks an understanding of the priorities and concerns of practitioners, and thus highlights some issues for my research. The authors begin with a redefinition of existing terminology which transfers meanings from one word to another, confusing rather than clarifying. So, technology in this study is 'a socio-cultural practice, not just a tool or a body of technical knowledge': schooling is a technology (' is schooling in its present form appropriate as a technology for new forms of work and play?') and literacy is 'a group of literacies, and each kind of literacy develops peculiar forms and uses within particular social practises and cultural communities'. Classrooms come alive and have problems like the rest of us: 'classrooms have to organise themselves round the interactions between their various human and non human components' (Morgan 1998 p 6). It is evident that these hyperlinked definitions are meant to indicate a blurring of boundaries. New ways of thinking may be created by new uses of technology, but indistinct use of words does not necessarily indicate creative thought. The researchers were dismayed to find teachers working with whole classes of students in computer rooms, pre-selecting web sites, insisting that non-Internet materials were studied, 'marking' spelling and grammar errors, and worrying about timetabling. The research vision was of 'technologised literary practice' as a different way of being:

> '...a more multi-dimensional world where it's not just a case of walking down streets or turning corners, it's a case of being able to drop down into the sewers and have a look at what's underneath and also being able to go up into the sky and look at things from above, or go through the sort of wormhole that takes you somewhere completely and utterly unexpected'
> (Morgan 1998 p 6).

Neither the students nor the teachers seemed to wish to go through the wormhole, remaining instead in the realms of examination results and end of module assessment reports to parents. There may well be a place for visionary dreams in schools, but the futuristic science fiction visions of researchers may not translate readily into practice constrained by a mandated curriculum and where teachers are accountable to parents

in terms of the performance outcomes of their children. Such constraints operate very strongly in the UK, and can be expected to affect teachers' expectations for their use of ICT with classes.

There are three small but very clear indications in Morgan's paper of where one significant pressure for change in education is located: not at government or grassroots level, but in the community of ICT enthusiasts and researchers. This has important implications for my research.

First, 'The role that's envisaged for technologised students entails a complementary role for teachers.' The question here is, *who* envisages? To what purpose? Have what Rogers and Shoemaker (1971) call the 'adoption units' (the teachers or students) been consulted? Evidently not: 'X (a researcher) invited the students to present their assignments in hypertext form. But his invitation was a complete and utter failure, because of the conservatism of the kids'. The children refused to be guinea pigs. This report of 'kid resistance' is a welcome change from the more famous teacher resistance. There are serious implications. What were the children's reasons for avoiding hypertext? How could the problems they identified be addressed to make the schemes of the visionaries more practicable? Understanding how such issues are mirrored in the situations of teachers in the study is critical.

Second: 'Teachers shouldn't be underestimated: some young teachers are quite at home in a computerised "games and apps" culture'. This suggests that some young teachers are not - and most old teachers are not? The admonishment *'teachers shouldn't be underestimated'* is forgotten immediately after the colon. The writer is exasperated by the intransigence of the entire profession, who *will not change quickly enough.*

But as Marris states:

> 'When those who have the power to manipulate changes act as if they have only to explain, and when their explanations are not at once accepted, shrug off opposition as ignorace or prejudice, they express a profound contempt for the meaning of lives other than their own. For the reformers have already assimilated the changes to their purposes, and worked out a reformulation which makes sense to them, perhaps through months or years of analysis and debate. If they deny others the chance to do the same, they treat them as puppets dangling by the threads of their own conceptions'

(Marris 1975 p 166, quoted in Fullan, 1993).

Third: 'There's plenty of work to be done still, to develop in teachers a technological imagination'. Teachers are here represented as presenting an immovable obstacle on which work must be done by the external change agency of IT firms and innovators. It is important to look at how such change agents approach UK teachers as the NGfL is introduced. If new ideas are of worth they require the opportunity for those assimilating them to understand both their aims and how they might be practically applied. However the development of technological imagination in teachers may not take too long, because the researchers provide a list of projects using computers which they undertook with groups of four students, and which therefore might be expected to show 'technological imagination'. In fact they are remarkably straightforward. The projects include 'design a web page for a client': 'construct a data base for a community located in a school': 'organise a computer Olympics, where the groups works to get all participants up to a minimum skill level on a popular computer game within a certain time'. If this is all that is required, the 'multi-dimensional world' is easily within reach and may have been discovered and colonised by teachers already. For example Senior (1989) a primary teacher using pre-mouse technology, undertakes and evaluates a wealth of technologically imaginative projects with discernable learning outcomes. Practising teachers are perhaps good at recognising and organising what is possible when faced with what is possible or imaginable.

Collaboration around Computers

Crook (1994, p 48) argues that human cognition is socially grounded, and that the influence of social interaction on learning must include recognition of the influence of societal artefacts such as technology. The socio-cultural approach to understanding learning allows a framework within which the achievement of learning with technology can be contextualised. This approach accommodates the idea that individualised learners can make differential progress, but also offers some insight into the potentially isolating effect of computer use. Using technology to coach isolated sets of skills has the advantages of individualising learning and encouraging learners who enjoy the sort of feedback computers give. Such learning can be transferable, and the pupil can trace their own progression through the programme. 'There are strongly expressed concerns that there may be negative psychosocial effects for students working individually at the computer' (Underwood and Underwood 1998, p 11) who go on to quote Wragg:

'The majority of parents do not want their children to learn by sitting at a screen all day long. Most normal adult behaviour is interactive - and you get some strange people if they've been up in the attic staring at a computer screen from the age of 5 to 16'.

Further discussion of the merits and otherwise of ILS can be found in Underwood and Brown (Eds)1996.

An advantage of basing group work around computers is that the inclusion of technology may sustain the motivation of the group. However the quality of the discussion that is generated, and the learning gains for the participants, may be disappointing unless pupils are trained in the power of productive talk (Dawes 1998). Studies reveal the real potential which computers offer education- to support learning through collaboration (Littleton and Light,1999). Once again the crucial factor in realising the potential is reported to be the work of the teacher.

> 'Central to these accounts is the role of the teacher [...] Teachers have an important role to play in creating acommunity in which collaborative activity occurs and is valued' (Littleton, 1999 p 191)

Classroom learning situations are moving from interactions around the computer towards interactions through the computer. New ways of collaborating are are becoming available for teachers to exploit on their pupils' behalf. In situations such as Internet, email and Virtual Reality projects, in which communication depends on the technology, the quality of interaction with others may be a determining factor in learning. As Littleton stresses here, technology enables the communication of learning.

> 'Computer technology will never replace communication between learners, rather it holds the potential to resource their collaborative endeavour in new and exciting ways' (Littleton, 1999, p193).

Teachers as Users of ICT

Cuban (1986) carried out a study of teachers and machines since 1920, aiming to review teacher use (or otherwise) of technology in the classroom. His book tracks the introduction of radio and television and more recently computers. Two of the main findings of Cuban's study are:

a) technologies go through a cycle which can be described as 'exhilaration...scientific credibility...disappointment...blame' - with the teacher receiving the blame for blocking progress through technology.

b) teacher use of technology rarely exceeds a fraction of the school week even when users are very committed. The structures within which the teacher operates are maintained by the establishment - and by the teacher. The professional cost of 'supplantive learning' (see Chapter 2 Section 3 of this thesis), the process of acquiring new knowledge in the field of ICT, may be prohibitively high for teachers.

More recently Cuban (1993) develops these ideas by considering the introduction of 'Information Technologies as tools to create self directed learners'. Accounting for 'the snail-like pace of technological progress' in education, Cuban notes that the reasons assumed for this include lack of money, teacher resistance, little administrative support, and inadequate training: all of which are 'plausible but superficial' (Cuban 1993 p 209).

Cuban identifies three possible responses to ICT innovation:
1. The technophile
2. The preservationist (who believes that maintaining and improving school computing is important but peripheral)
3. The cautious optimist (who advocates slow growth of integrated ICT rich environments in schools).

Cuban concludes: 'Computers meet classrooms - and classrooms win: for now'. This approach, though unusually teacher-friendly, still does not identify what it is possible to change in the situation of the teacher in order to enable sustainable ICT use. Bliss, Chandra and Cox published findings based on an in-depth case study of the implementation of computers in a UK secondary school (Bliss, Chandra and Cox 1986: Chandra 1986). Their research investigated the interaction of teacher's attitudes with the organisational restraints of the school. They found that uptake was influenced by teacher confidence, competence, and changes in the teaching situation, with teachers expressing 'anxiety and feelings of inadequacy' when faced with the task of mastering technology (Chandra 1986 p 305).

Draper (1999) addressing this issue of teacher anxiety argues:
> 'For computers to be used regularly, then in preparing a lesson computers have to be an option as convenient to use as the alternatives. Where are lessons prepared? I understand

that some are prepared at school, and many are prepared at home. So obviously there needs to be a computer always available to each teacher in school, and another in every teacher's home. Actually, as someone recently and wisely remarked on IT Forum, there needs to be two in the teacher's home: one so that they don't have to negotiate to use it, and another for other family members firstly to avoid that negotiation/competition and secondly to have a competent user community there to provide help and support. So every plan for school computer use should clearly give each teacher 3 personal machines besides those for the children' (Draper, 1999 p3).

The simple point Draper makes here - that people can be expected to be anxious when they do not have the resources they are told they should be using - means that basing teacher categories on 'attitudes' is unsafe. Further, the work of Potter and Wetherill (1987) indicates that attitudes are not firmly held and are not reliable predictors of behaviour. Bliss, Chandra and Cox (1986) describe seven different types of teachers as users or ICT:

(1) favourable

(2) critical

(3) worried

(4) unfavourable

(5) antagonistic

(6) indifferent

(7) uninitiated

These value-laden categories do not enable change by identifying the factors which could support the professional development of teachers in this area.

This discussion is continued in Chapter 5 of this thesis.

2.5 Summary: Chapter 2

Innovation and change in education

Purposeful change depends on people, and rather than being passive 'adoption units' teachers can be seen as the change agents most able to ensure that their own professional development takes place. Successful change in schools, in this case the realisation of the NGfL aims, might strongly depend on whether teachers feel that these aims are valid, achievable, and involving. Imposed change is less likely to

succeed. However the coherence of the NGfL initiatives (that is the provision of hardware, software, training, and relevant educational content on the web) indicates that 'imposition' is not a good descriptor of the government's strategy: perhaps 'supported development' might be better term. In addition, the nature of the medium of ICT is that once acquired, and basic skills are learned, communication and negotiation between teachers and innovators becomes much more possible.

Theories of learning relevant to teachers as learners

The process of embedding new learning in the profession is complex and dependent on many factors. In this research one such factor which has been identified is that of ensuring that members of the profession are increasingly involved with using and discussing ICT for educational purposes with pupils, and for their own professional purposes. Theories of learning as community – joining provide a model for understanding the importance for individuals of inclusion in this forum. The professional profile of teaching now includes ICT, and therefore membership of the community of educational ICT use is not optional. However differing degrees of involvement are initially unavoidable, and practitioners who are newcomers can expect to be valued and supported. Adult learners require special consideration since they come to new knowledge with individual histories of professional involvement, with expectations of personal success or failure, and with their own (often definite) aims, all of which influence their motivation and acceptance of opportunities.

Information and Communications Technology in society

Technology is developed by society, while society assimilates technology and comes to view what was new as normal. Supervening social necessity might well dictate the design and shaping of new technology, but once available, technologies offer themselves for adaptation to a variety of purposes which had no influence on their design. The Internet was not conceived or developed as a tool for education, but ways of making it so are developing to provide teachers with new and potentially useful ways of interacting with pupils, other professionals, and each other. The assimilation of computers into educational settings can be considered to proceed as a result of what has been found to be of practical value. Media publications can provide up-to-date ICT information for teachers, but their value may be tempered by such features as inappropriate advertising and cartoons. By insisting that teachers have a fearful

approach to computing, or are inept and incapable of learning, such publications can create a negative social climate in which the teaching profession sees its own reflection as undervalued.

The effectiveness of computers in educational settings

Research studies provide indications of how, when and why ICT can be effective in educational settings. Innovation in this area depends on collaborative enterprise involving researchers, teachers and pupils, and technical experts. There is a strong indication that motivation for learners is improved by the use of ICT, and that computers can provide a social setting for groups to profit by discussing their work together. Projects with an ICT component require careful organisation to ensure that technical problems and the necessity understand the interfaces of the medium do not interfere with curriculum learning.

Educationally effective uses of ICT are generated as new applications are used and evaluated. Change is evident in education, both physical change as new equipment is purchased, and less visible but equally crucial change as teachers interact with ICT. The requirement to share best practice is embedded in the concept of community, and the NGfL initiatives allow the teaching profession to be considered as a learning community in this field.

The literature reviewed here provides an overview of areas relevant to the research. The research will build on this foundation by examination of some of the issues and ideas encountered in the literature. A particular focus for the research will be an examination of teachers as adopters of change, to discover what is really meant by 'teacher resistance' to ICT. The research will also strongly focus on professional development as learning involving joining a community of educational users of ICT.

The next chapter in this thesis provides details of the methodology used to collect and order data in this research.

Chapter 3: Methodology

Introduction

This chapter sets out the methods employed to collect and analyse data throughout the study, in order to investigate the research questions and the issues raised in the literature review. The research was conducted through largely qualitative study of the experiences of practising teachers, with the use of questionnaires, interviews, observation and examination of documents as the primary data collection methods.

In Chapter 3, Section A details the research paradigm, setting the work in the context of educational research traditions. The detailed research design is then exemplified in section B. The study proceeded in two phases. The phases are described in detail, with a timeline for the research, and introductory details of the schools and teachers involved in the study. Section C reviews relevant issues in qualitative research and relates them to the design and conduct of the study. Each of the methods of data collection employed in the study is discussed theoretically in Section D. Further details of specific research design are provided.

The summary in Section E provides a condensed version of the research methodology in a way that might act as an accessible reference when reading further chapters of this document.

NB. All the names of schools and teachers have been altered to ensure confidentiality.

Table 3.1 *Summary of research questions and data collection* is intended to act as an accessible reference when reading this and further chapters of this document.

Table 3.1 *Summary of research questions and data collection*

Topic	Page no.	Summary information
1. Research questions	**Ch1**	What factors support the professional development of teachers in ICT? What factors hinder progress? What are the outcomes of the opportunities available under the NGfL?
2. A description of the research	**Ch1**	The research investigates the ICT situation of teachers in primary and secondary classrooms. By considering teachers as learners in a community of practice of ICT use, it clarifies what conditions are essential in order to make the aims of teachers, and the NGfL initiatives, achievable.
3. Research paradigm	**Ch 4**	This illuminative democratic research, undertaken with largely qualitative research methods, aims to provide teachers with images of their work which will allow them to reflect on and thereby develop their own practice.
4. Research methods	**Ch 4**	Research methods employed were questionnaires and interviews, an examination of a range of relevant documents, and (mainly participant) observation.
5. Phases of the study	**Ch 4**	*September 1997 - July 1999* Phase 1: Individual teachers and ICT: **Data collection and progressive focussing on emerging themes** *August 1998 - January 2000* Phase 2: Teachers working together with ICT: **Detailed probing – a model for teachers' professional development as users of ICT**
6. Schools in the study	**Ch 4**	14 schools took part 2 secondary schools 12 primary schools
7. Teachers in the study	**Ch 4**	140 teachers took part 46 were interviewed
8. Scope of the study	**Ch 3**	The study is focused on the professional development outcomes for teachers in a time of rapid change.

A] Research paradigm

This section sets the work in the context of educational research traditions.

Qualitative research is 'a dynamic process which links together problems, theories and methods' (Bryman & Burgess,1994). Atkinson, Delamont and Hammersley (in Hammersley, 1993) provide an overview of the diverse origins and development of British qualitative research on education, and identify approaches associated with particular groups of researchers. These are not definitive categories since they build on one another's traditions and show overlap, but they provide a pedigree or history for current research. This research study fits into what is described as the 'illuminative democratic' approach, which is characterised by 'an aim to provide teachers with images of their work and its context that will allow them to generate reflections on, and thereby develop, their own practice' (Hammersley,1993, page 23). This is achieved through the development of a model which identifies categories of teachers as users of ICT (described in Chapter 5).

This interpretive research was designed to enable an understanding of the reality of the relationship between teachers and their use of ICT. A quantified approach which attempted to measure the issues involved could not reflect the social and individual nature of events and situations. Some factors are expressed quantitatively: for example, how many teachers in the study schools have home computers? But statistical answers to such questions may be of limited value: for example, ownership of home computers, and family patterns of use, are likely to be fluid. This study is largely qualitative because if the findings are to have veracity they must be derived from the teacher's experience. It is designed to look for characteristics of teachers as computer users, and to discern patterns of use through analysis of data collected from teachers. Discussion and explanation of issues can then be held to represent the realities of practising teachers. 'Although words may be more unwieldy than numbers, they render more meaning than numbers alone'(Miles & Huberman, 1994, p 56).

Figure 3.1 *Framework for the study of the outcomes of professional development opportunities for teachers in ICT* is a conceptual framework for the study, adapted from the qualitative methodology of Miles & Huberman (1994) and Stake (1967).

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Figure 3.1 is designed as a graphic representation of the focus of study. The National Grid for Learning initiatives, aiming to improve radically the use of ICT in schools, are important to the Labour Government: on evaluation, a judgement of success or failure will be indirectly a judgement of government effectiveness. Stake's (1967) democratic illuminative approach provides a framework for evaluation of this educational innovations by distinguishing two components of evaluation: *description* and *judgement*. These components are products of research based on a study of the *outcomes* of innovation. Stake suggests that it is valuable to collect specific kinds of data in order to describe situations fully, prior to judgement. Therefore data collection in this research is designed to provide information clarifying Stake's *three aspects of the educational process* (see Figure 3.1):

1. Antecedents: any existing condition which may relate to outcomes of change
2. Transactions: interactions between people, and between people and contexts
3. Outcomes: interpreted in its widest sense.

Antecedents include what I have called *Human influences* and *ICT Context*. Transactions are the interactions between people and the influence of conditions on people and vice versa. In Figure 3.1, such transactions are shown to include formal training and informal training. Outcomes of transactions may be planned or unplanned: unplanned outcomes ('side effects') may be as significant as planned outcomes. The evaluation of outcomes may lead to further change.

Figure 3.1 emphasises how the human influences which teachers experience in their professional lives interact with their contextual conditions, so that outcomes of plans for change will be affected by the relationships of teachers with these factors. Both positive and negative outcomes of plans may feed back into the school context and provide information for those who will go on to influence further change. This diagram acknowledges the change agentry of teachers (see Chapter 2). Teachers act as change agents in the context of antecedents and transactions, and by doing so significantly affect outcomes. This framework thus provides a structure for interview questions: the nature of the antecedents can be expected to differ at an individual level, and transactions are also highly individualised within the wider, more general school situation. The point at which plans for professional development are generated and realised, and the actual outcomes of implemented plans, are the 'unknowns' which the

research is designed to investigate. The NGfL aims to provide teachers with opportunities (DfEE 1997 a). What will be the outcomes of these opportunities once affected by antecedents (school contexts) and transactions (the practising teacher's interaction with others)? In this study, the process of collecting data is expected to cover an extended period of time, during which some, but not all, outcomes may become apparent.

Figure 3.1 *Framework for the study of the outcomes of professional development*
opportunities for teachers in ICT

Teachers as change agents

Antecedents

Any existing condition which may relate to outcomes of the change

Human influences

Government
L.E.A
Head Teacher
Governors
Parents
ICT Co-ordinator
Other teachers
Pupils
Other ICT users

ICT Context

Access in school
Access at home
Training
Communicative links

Transactions

Interactions between people, and between people and contexts

Training
Formal
- ECDL
- LEA
- NOF

Informal
- ICT Partner
- 'just in time' learning

School ethos for ICT use: A supportive community of practice

Technical support

Outcomes

Planned Outcomes

An increase in ICT competence and confidence for all teachers

Increased use of ICT to deliver the curriculum

Learning gains for pupils

Actual Outcomes

- Description
- Judgement

The next section provides a description of the sample of schools which took part in the study, with information about the teachers interviewed. It also provides a summary time line to show how data collection proceeded in two distinct but overlapping phases.

B] Detailed research design

The study proceeded in two phases. Background information about schools is provided as context for describing the phases. The two phases are described, with a timeline for the research.

The Sample of Study Schools and Teachers

Background information: how schools are organised in Milton Keynes

Table 3.1 *Ages, Key Stages and Pupil Transfer* provides an overview of the organisation of schools in Milton Keynes, showing the allocation of children to schools depending on their age. This system was set up before the National Curriculum(NC) was implemented, and the table shows how pupil transfer at 7+ and 12+ cuts across the National Curriculum Key Stages, which end at age 6+ and 10+.

Table 3.1 *Ages, Key Stages and Pupil Transfer*

Age	5	6	7	8	9	10	11	12	13	14	15	16
NC Year	1	2	3	4	5	6	7	8	9	10	11	12
Key Stage	One		Two				Three			Four		
MK Schools	First school		Middle School				Secondary School					

Schools and Teachers in the Study

Table 3.2 *Schools and Teachers in the Study* provides an introduction to the schools and teachers in the study, showing the mixture of types of schools involved, and specifying how many teachers took part in the study. Note that school names have

been changed for confidentiality. The sample comprised fourteen schools, two of which were secondary schools, and the remaining twelve were primary schools. One hundred and forty teachers took part in the study. Of these, forty six teachers were interviewed. Several of these teachers were interviewed more than once to provide data reflecting change over time. The remaining ninety four participant teachers completed questionnaires, and took part in Phase 2 fieldwork.

Table 3.2 is followed by a timeline for the study.

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Choosing the sample of schools

In order to address the research questions, it was important initially to have access to teachers across the Key Stages. Inviting linked schools to participate in the study provided opportunities to note ICT development initiatives within the group, and to analyse the outcomes of such collaboration.

Schools in the new Milton Keynes Unitary Authority were approached to determine whether they had any interest in participating in the ICT research. At this time (September 1997) the National Grid for Learning proposals had just been outlined by the new Labour Government. An underlying aim of the NGfL initiative was to ensure that all teachers were provided with access to up-to-date technology, and training to use it. It was therefore unnecessary to select schools of a particular type, since equality of opportunity was built in to the plans for change.

The different initial conditions which could be found in different schools should not affect their access to NGfL resources – although these antecedents for change might affect outcomes, which is why the case study school Drigg was included in the sample. As detailed later, in contrast to other schools, Drigg school was especially well equipped with ICT hardware in 1997.

Letters outlining the purpose and duration of the study were sent to the Head Teacher and IT Co-ordinator of five secondary schools, twelve middle schools and twelve first schools. For various reasons (including impending or concluding OFSTED inspections, implementation of the Literacy and Numeracy hours, absence of key staff or appointment of new staff to management positions, other priorities such as concentration on Action Plans generated by OFSTED) several schools felt that they could not commit the time of their teachers to the study.

However one 'set' of three linked schools expressed strong interest, and became the study schools for Phase 1.

NB. A description of the phases of the study follows the Timeline.

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Table 3.2: *Schools and Teachers in the Study*

School code	Name	First Middle Secondary	Number of teachers completing questionnaire	Number of teachers interviewed
A1	Askill	S	30	14
B2	Banna	M	12	5
C3	Causey	F	8	3
D4	Drigg	F+M	9	9
E5	Eskdale	F + M	9	3
F6	Fleetwith	F+ M	13	1
G7	Gable	M	9	2
H8	Honister	M	13	2
I9	Isel	F	8	1
J10	Jopple	F	7	1
K11	Knotts	M	9	1
L12	Laurel	M	10	1
M13	Mosser	S	1	1
N14	Netherton	F+M	1	1
O14	Orgill	F	1	1
TOTALS	14 schools	2 secondary 12 primary	140	46

The following Table, 3.3: *Timeline* provides a brief summary of the research events, particularly the longitudinal data collection which took place over two and a half years from 1997 until 2000. This timeline introduces the two phases of the study, the first from September 1997 until July 1998, and the second phase from August 1998 onwards. A detailed description of the two phases follows. Table 3.3 indicates data collection and interrogation of data proceeding simultaneously, with progressive focusing on emerging themes, and later data collection providing opportunities for triangulation and checks for validity.

Table 3.3: *TIMELINE*

Date	Event
Phase 1 : Individual teachers and ICT	
Pilot study data collection and progressive focussing on emerging themes	
September 1997	Data collection in three linked schools Questionnaire 1 First interviews *(NB.Documents collected throughout study)*
December 1997	Interviews continuing
March 1998	Analysis of Phase 1 data
June 1998	Data collection in Case Study school Questionnaires and interviews Participant observation: ICT use in practice
July 1998	Analysis of findings of Phase 1 allows description of an emerging model for teachers as users of ICT. Phase 1 ends as this model is evaluated, refined and then shaped to use with teachers in Phase 2 of data collection
Phase 2 :Teachers working together with ICT	
Detailed probing – using a model for teachers as users of ICT	
September 1998	Interviews continuing Questionnaire 2 Observation: 'Driver's Licence' training Testing the model in the Case Study school
December 1998	Interviews continuing Data collection in eight primary schools Using the model in these schools
March 1999	Interviews continuing Observation: ICT use in practice
June 1999	Interviews continuing
September 1999	Analysis of data Observation: NOF training
December 1999	Questionnaire 3: all schools Final interviews: linked schools and Case Study School
March 2000	Final analysis of all data

Phases of the study

The study was carried out in two phases. These had some overlapping characteristics, but as explained below the distinctive difference between them lies in the focus of fieldwork carried out in schools.

Phase 1: Individual teachers and ICT

Pilot study. Data collection and progressive focussing on emerging themes
September 1997 - July 1998

Phase 2 :Teachers working together with ICT

Detailed probing – a model for teachers' professional development
as users of ICT
August 1998 - January 2000

Phase 1: Individual teachers and ICT: Data collection and progressive focussing on emerging themes involved collecting data in a community of three schools: a first, middle and secondary school which are linked by their catchment area. During this phase a further Combined school in the Milton Keynes area was enlisted as a case study. Data analysis during Phase 1 proceeded in two ways: simultaneously with data collection, and as a distinct event during which data from questionnaires, interviews, observation and documents were brought together. This process resulted in the description of a model for teachers as users of ICT (see Chapter 5). The model draws from theories of learning as community joining (see Chapter 2) and the key issues arising from Phase 1 data to provide an understanding of how teachers integrate ICT into their professional lives. It identifies pivotal contextual factors in the work situation of the teachers which strongly affected ICT use and professional development *(see Chapter 5 for a complete description of the model)*. Once this model had been described, the fieldwork was focused on testing the model. Doing so allowed opportunities to discern the antecedents, transactions and outcomes of the variety of opportunities for change experienced by teachers in their school contexts. Thus describing the model signified the end of the first phase of data collection.

Phase 2: Teachers working together with ICT: detailed probing - a model for teachers as users of ICT involved continuing regular contact with the Phase 1 schools in order to collect longitudinal data illuminating issues of change over time. During Phase 2 the sample of schools was broadened to provide more comprehensive data. Supplementary information was collected from one further Secondary School to provide data for triangulation.

The data collected is therefore longitudinal, allowing analysis of outcomes of opportunities for change, and also the inclusion of additional schools in Phase 2 allows a more detailed analysis of some issues arising from Phase 1. The fieldwork design for the Phase 2 data collection was strongly influenced by the more exploratory work of Phase 1, as well as more theoretical considerations which developed as a result of initial data analysis.

The Phase 2 data collection was designed to apply the model to a new group of schools, enabling data collection which could provide a basis for analysis of change and outcomes of change: and at the same time to continue collection of further data from teachers in the three 'linked' schools.

The second phase of data collection and analysis recognises that although teachers exhibit individual differences they are nevertheless shaped, as a group of professionals, by the context of their workplace. The immediate social environment usually comprises teachers and other adults working in the school, the children, their parents, and the school governors. This is the larger school community. Phase 2 data collection involved primary schools, because some of the factors which foster (real) communities are easily identified here - the schools are physically smaller; teachers teach the entire range of curriculum subjects and can alter the age group they teach, so team links are fluid. A whole school concentration on such issues as literacy, special needs, behaviour problems - and ICT use - is possible. So, this strong background of 'community' was harnessed by collecting the Phase 2 data in primary schools.

The data collection in Phase 2 had three strands:

a) continuing interviews with teachers, focusing on opportunities for change as the
NGfL initiatives were implemented nationally

b) interviews with professionals in other schools and other related areas of education,
such as the General Advisor for ICT, focusing on change at LEA and national level

c) testing the model with primary schools in Milton Keynes, focusing on aspects of the
professional development opportunities perceived by teachers, and the barriers and
supportive actions they might experience.

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140 teachers took part in this study, and of these 46 were personally interviewed.
94 were involved in other data collection: they

- completed questionnaires

- discussed their ICT use with myself and their colleagues

- were observed working with ICT or undertaking relevant training.

The next section, *Some issues in qualitative research,* focuses on the theoretical issues
underpinning the methodology, and relates these to selection of data collection
methods and analysis.

C] Some issues in qualitative research

1. Achieving validity in qualitative research
2. Reliability of data
3. Further aspects of validity of data
4. Drawing and verifying conclusions
5. Generalisability
6. Ethics

1. Achieving validity in qualitative research

This section looks at how inaccuracies might be introduced and provides information
about how the research design has dealt with and tried to minimise sources of
inaccuracy. As with other phenomenological research, achieving objectivity and thus
validity requires the researcher to engage with different perspectives and strategies so
that data can be verified. This research attempts to gain an understanding of the reality

of a defined situation by discovering and connecting the multiple realities of the people involved. In this undertaking, the researcher is necessarily part of what is being researched; qualitative interviews are essentially personal interactions, and the positioning and stance of the interviewer can influence the data elicited. Conversations, questions and observations are ways of taking a measurement of what constitutes an individual's reality at a given point in time. Especially in interviews, the researcher has to attempt to minimise the impact of their own perspective on the respondent.

Validity may be compromised because individuals reveal different 'sides' of themselves in different contexts. If a teacher in the study wished to present a strong case to the interviewer, for example to clarify their opinion about the siting of computers within the school, what Potter and Wetherell (1994) call their 'rhetorical organisation' may be evident. That is, the opinion they provide is highly contextual and coloured by the wish to present a particular, polarised stance. When describing less contentious issues it may be less so. Participants may provide an overview or a range of views if their own interest in a subject is merely academic. The different ways of describing reality produce different accounts or alternatives. It was therefore important to collect a range of 'versions' describing school contexts, work practices, and visions of the future, so that factual data could be correlated and opinions classified as such.

> 'The rhetorical orientation draws our attention away from questions about how a version relates to some putative reality[...] and focuses it on how a version relates to competing alternatives' (Potter & Wetherell,1994, p. 59).

It is as if the different 'sides' to people are not really apparent until a question is asked or a conversation initiated, whereupon the interaction induces the attitudes and rhetorical position which can be observed.

Triangulation of data sources can help to minimise bias and systematic enquiry may make the progressive emergence of theory more accountable. The discovery of what definitely constitutes reality, or the truth of how things are, is not a realistic aim for research: Bertrand Russell, writing in 1931, says:

> 'I do not see that we can judge what would be the result of the discovery of truth, since none has hitherto been discovered' (Russell, 1995, page 445).

The history of science shows that what people think is true can change. However, as Eisner points out, the acceptance that we cannot entirely or objectively know the truth should not prevent enquiry.

'We ought not to limit enquiry only to those forms for which a literal conception of truth is a relevant criterion. A novel as well as a statistical mean can enlarge human understanding. [...] The facts never speak for themselves. What they say depends upon the questions we ask. [...] I urge that we accept the idea that all experience is transactive; hence all we can know is the result of a transaction between our sentient and intelligent selves and a world we cannot know in its pristine state' (Eisner 1993, p. 55).

Within this framework of accepting that the whole truth can never be conveyed, the research methods were selected to ensure collection of reliable and valid data for analysis. The methods chosen allowed the collection of data which could describe with some accuracy the experiences and work contexts that teachers using (or attempting to use) ICT experienced during the research period.

2. Reliability of Data

Reliability is concerned with consistency in the production of results. Reliability can be of two kinds (McCormick & James 1983 p.187)
1. Inter-judge reliability, which refers to the degree of agreement between two researchers in recording their observations of the same or similar phenomena
2. Intra-judge reliability, which refers to the consistency of a researcher's observations on different occasions.

Research literature provided checks for 'Inter-judge reliability'. Studies of teachers using ICT (Watson 1993, Scrimshaw 1993, Sellinger1999, Brosnan1997, Somekh & Davis 1997, Wegerif and Scrimshaw 1997, Leask & Younie 1999, Leask and Pachler 1999) provided indication that the teachers in Milton Keynes schools were reporting similar experiences and tensions in their experience of NGfL initiatives to other teachers.

The following details are provided as a direct example of Inter-judge reliability. In March 1999 I gave a paper about Phase 1 of my research (Dawes, 2000) at the Computer Assisted Learning (CAL) Conference at the Institute of Education. In the audience was Dr Steve Draper, Senior Lecturer in Psychology at the University of Glasgow. I quote the following extract from the online 'Instructional Technology

Forum' (see URL) Dr Draper is here commenting on a paper which argues that teacher **attitudes** are the determining factor in ICT uptake and use.

> 'This year at CAL I had a bit of a conversion experience [...] Here is a guess about important kinds of factors determining computer use by way of illustrating what might be discovered by research that hasn't fallen into the trap of presupposing that teachers are the problem (actually, not just a guess, but inspired by Lyn Dawes' data). [...] She has absorbed some of the situativity literature, and applied it to teacher uptake of ICT. In her perspective it isn't a question of whether teachers will take it up but of where they are in the apprenticeship/community model: out beyond the firelight, in the outer circle, the inner circle, etc. What I like about this so much is that it is quite possible to ask about attitudes and about 'situation' variables such as availability and a supportive community of other knowledgeable users, along with asking about use. Then we can test what is only assumed in the kind of attitude survey done in the past.'

> (Draper, 1999)

The paper was accepted for publication by Dr Jean Underwood on behalf of the journal *Computers in Education* because its content was felt to be 'important'. I gratefully accept both of these events as some evidence of Inter-judge reliability.

Intra-judge reliability (which 'refers to the consistency of a researcher's observations on different occasions') is difficult to see as useful. When trying to record data objectively, concentrating on things that seem consistent with previous observations might perhaps introduce bias. But this concept provides an underpinning for coherent data analysis, since it foregrounds a continuous examination of the raw data throughout the study.

The research design attempted to avoid random fluctuations in recorded observations by drawing on a large number of participants, over a considerable period of time. Audio recording of interviews provided data which was reviewed reflexively on several occasions to minimise errors arising from early judgements or assumptions.

3. Validity of data

Different types of validity are suggested by McCormick & James (1983 p.187-8): these are considered here to explore the validity of the selected research methods.

i) 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 just for what it is without any need for further justification or research (Brooks, 1998). Some documentary evidence used (e.g. government publications: school information documents for example) have face validity whereas others (e.g. media supplements for teachers) may not, because of their editorial stance. A range of documentary evidence was therefore collected.

ii) Content Validity: *the data cover all relevant subject matter.*

The focus of the research is the interaction of the teacher and opportunities for professional development in the field of educational computing. The choice of a variety of research methods (interviews, questionnaires, documents, a case study, and observation) helped to ensure content validity within the sphere of the study, which is a specific focus on teachers as individuals.

iii) Internal Validity: *Soundness of explanation: whether what is interpreted as 'cause' produces the 'effect': the appropriateness of the research design and measuring instruments for producing this explanation.*

Some effects are easy to attribute (wrongly) to perceived causes. For example one school in the study had impressive displays of examples of 'data handling' on their notice boards. All teachers in the school had studied this topic with their classes. The initial cause seemed to be a strongly ICT-oriented staff. But the twin causes of this effect (revealed during interview) were firstly a new and charismatic ICT Co-ordinator, and secondly a focus on ICT for the school's OFSTED inspection. It was important to investigate causes thoroughly before attributing effects. The choice of semi-structured interviews allowed discussion with teachers to clarify any points which may have been due to mis-attribution of cause.

iv) External Validity: *generalisation from one set of conditions to another.*

Discussing case studies as a research method, Elliott (1990) notes that the 'validating audience' for research is different for different levels of description. Those operating at a matter-of-fact level and attempting to achieve objectivity can produce data derived from directly observable phenomena, which can be straightforwardly validated by

others. Those describing communicated subjective experience, as in this study, find that their focus and therefore their data is not easily replicated. However this chapter is intended to ensure that the research methodology can be replicated to a certain extent. Accounts can only be validated by applying to the participants, and asking them if the account represents their experience of events. Research design included points at which such feedback from participating teachers is requested (See Appendix 3) . Elliott also points out that the individual researcher's conception of validity is derived from what they consider to be *relevant*, which in turn depends on their theory of knowledge. Researchers, for example, may search for 'typicality': or they may search for 'issues'. The aim of this research design is perhaps a combination of these searches: it draws on theories of learning as community joining to look for what is generalisable from individual teaching experience, but also searches for identifiable issues concerning equality of opportunity, and the identification of barriers.

The research is based on Elliott's argument, in which he considers that experiential case studies (and by extension other qualitative studies) can be externally valid.

> 'Validity rests on the usefulness as projective models for others in exploring their own unique situations.[...] The test is that the theory embodied in the study can be fruitfully elaborated and corrected by participants in other situations, i.e. in ways which throw new light 'on the situation' and help them to generate a new theory about it. [Case Studies] are a source of projective models which teachers in schools can employ to generate their own theories of the unique and complex situations in which practical educational judgements have to be made' (Elliott 1990 p.59).

Other forms of validation.

Further, two forms of validation, *triangulation* and *respondent validation*, are particularly appropriate to qualitative data (Elmer, 1997). Triangulation depends on the convergence of data gathered by different methods, such as observation, questionnaire and interview. Triangulation can also occur with data collected by the same method over time, which the longitudinal nature of this study allows, and with data collection from different sources, which the number and variety of schools in the sample allowed. In this study there are a number of markers at which the data collection methods were open to interrogation.

These markers were:

1. Questionnaire 1 information and early interview information could be compared with one another.

2. Questionnaire, interview and observation information from the Case Study School,

c The primary school Banna was also an early adopter with strong parental support, while Causey school at the start of the study had other priorities for staff development. Interrogation of data from each school allowed triangulation by comparison and contrast with the three linked schools.

3. Interview information and observation in Phase 2 Primary Schools. The breadth of the study was widened by the addition of eight schools for Phase 2, in order to ensure validity.

4. Discussion of the theoretical model relating to teachers' uses of ICT with teachers in schools provided triangulation in the form of respondent validity. This process helped ensure the accuracy of the model in the light of feedback from teachers.

5. Discussion of the theoretical model with academic colleagues.

6. Information about teachers and ICT from documentary sources. The media documented the astonishing rapidity of change in the field of educational ICT over the study period.

7. Questionnaire 1 and Questionnaire 2 responses. Comparing the data from early in Phase 1 with that obtained in Phase 2 provided indication of change over time.

8. Comparison of earlier and later interviews with the same teacher allowed differences to emerge and apparent contradictions to be clarified.

On analysis the data collected seemed to have its own coherence which indicated its veracity. Teachers' revelations in the interviews provided patterns which might be thought of as like diffraction patterns - some areas reinforcing whilst others cancelled one another. Earlier interviews were used to inform later ones, as progressive focussing on key themes in the data occurred *(see Chapter 4 for detailed interview findings).*

The Questionnaire data provided a range of responses, again with emerging patterns. The only information which seemed at odds with the rest of the data came from documentary sources: from some of the research literature, and media publications

dealing with educational ICT. This related specifically to the concept of 'teacher resistance' to ICT. See Chapters 2 and 9 for a discussion of this.

Respondent validation occurs when the analysis of data is verified by the participants of the study. The study had built in respondent validation (Bloor, 1978: Stake 1985, p282) in that during Phase 2, the reactions of the participants to Phase 1 findings (the building of a model showing factors supporting and inhibiting the outcomes of NGfL opportunities) are recorded. Validation is also found in the invitations from individual teachers to return and talk to them ('do another interview') - which has been a feature of the study. Also, the ICT Co-ordinators in three unrelated schools invited me to staff meetings to discuss ICT uses with themselves and their colleagues.

5. Drawing and verifying conclusions from the data

The conclusions drawn from the data were verified by considering guidelines established by Miles and Huberman (1984, p 28). They suggest a number of 'tactics' by which conclusions can be verified:

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) replicating a finding

g) checking out rival explanations

h) looking for negative evidence

i)s getting feedback from informants

The following section details how these tactics were employed.

Check for representativeness: In reporting the research findings, checks for representativeness were carried out by establishing data categories or **themes** *(For detail of themes, see Chapter 4)* which were evident in more than one data source. As Table 4.1 indicates, the percentage of interview respondents providing data about each theme was over 60% for half of the themes. Some themes with low percentages are included (such as 'Parents and ICT': 14%) because this data provides an interesting or important angle contributing to the understanding of more dominant themes.

Check for researcher effects: this was carefully considered in the research design. A variety of data collection methods were established in order to minimise the effect of the researcher. Interviews especially were considered sensitive in this way. The danger of bias was recognised, and the interview structure *(see Appendix 4)* was used as a protocol in order to minimise bias effects. However, lack of response to some questions or a keen interest in others were accepted as the right of the respondent to 'bias' the talk agenda within the framework.

Triangulation of data: the study's internal validity arises from integration of the interview responses, questionnaire data, and data from observation and documents.

Weighing the evidence: The analysis proceeded by presenting different forms of data side by side, and exploring the relationships between them. That is, evidence is 'weighed up' in the light of data from other sources. Integration of data is achieved by employing strategies established by Bryman and Burgess (1994, p.105):

i) following up similar themes in the different data sets

(for example, looking for evidence of the relationship of teachers to computer literate pupils in observation, documents and interview data)

ii) generating 'propositions' which can be checked against the data, enabling exploration of the data from a variety of angles

(for example, using a question not asked at interview, but relevant to the data: such as, when teachers say they choose not *to use computers, what reasons do they give?*

iii) using the data sets to address a particular topic from different viewpoints

(for example, considering the views of teachers as learners of ICT, and teachers as peer tutors of colleagues)

Contrasts and comparisons between the data were used to establish an overall picture of teachers as learners of ICT, from many angles.

Replication of findings became possible as data collection proceeded, with teachers providing related and comparative interview responses. An accumulation of the data underpinning the themes occurred, that is, saturation of categories of data.

Rival explanations for findings were encountered in the research literature, and only became apparent as 'rival' when the data failed to support them. The two most notable 'rival explanations' of other researchers are first the notion of 'teacher resistance' to technology, and secondly, documentary representation of the relationship of teachers to computer literate pupils. These contrast sharply with the research findings.

Looking for negative evidence: It is important to avoid asking what Bryman and Burgess call the 'wrong questions' about the data, for example, the qualitative findings of this study do not support statistical inferences. Neither does the field data support a thorough discussion of the direct impact of use of ICT on children's learning. The data was designed to collect information about teachers, their personal and professional uses of ICT, and their professional development in this area. So, for example, it cannot provide an evaluation of the educational effectiveness of the teachers' use or non-use of technology. A search for 'negative evidence' in the data involved looking at the blanks that interviews revealed. For example, why were teachers unconcerned with ICT development plans?

Feedback was obtained by providing teachers with summary information. Teachers commented favourably on the practicality of the emerging model. Feedback in Phase 1 was also obtained informally: an example is that two teachers invited me to return for a second interview, because they felt they wished to 'keep me up to date' with changes. These interviews form part of the Phase 2 data.

5. Generalisability

The issue of generalisability of qualitative research is thoroughly dealt with by Schofield (1993). The work is especially apposite since it concerns 'what may be' - focusing on the impact of computer usage on students and classrooms.

Schofield (1993, p.104) suggests:

a) Many qualitative researchers reject generalisability as a goal, arguing that every topic researched must be seen as carrying its own logic, sense of order, structure and meaning. Producing laws that apply universally is not a useful standard or goal. This is not a rejection of the idea that studies in one situation can be used to help form judgements in other situations. An aim of the research design is to provide teachers with images of their own work which allow productive reflection and dissemination of best practice.

b) Other studies give the issue of generalisability low priority, especially those describing cultural groups in fine detail. Whilst generalisability was not the main focus of this research, teachers in state schools have enough in common for valid research to be widely applicable, especially if it has implications for management or practice.

c) It is impractical to make precise replication a criterion of generalisability: qualitative researchers must instead thoroughly question the *internal* validity of their work.

e) Multi-site studies increase potential generalisability. This research was conducted in state schools which have similarity to others, but it is impossible to say whether any specific school is typical. The sample of fourteen schools increases generalisability.

f) Studying future technology in the context of a present day institution peopled with individuals shaped by their past requires research study design which will make the work applicable not particularly to other similar institutions, but to future institutions. Research design requires structure that 'explicitly probes the impact of things that are likely to change over time' - as did this research.

The issue of generalisability is not to be ignored; it may be a requirement if theory arising from the study is to be seen as useful. However it is impossible to select a 'typical' school in which to collect data, or to find 'typical' teachers. Schools and the people who work in them are so diverse, and the pace of change in ICT provision in schools has been both rapid and unpredictable in its scope. Since the intention was that the National Grid for Learning was truly ubiquitous in its range, any school in the country should have an equal opportunity of development in the area of ICT.

Note: March 2000: Evidence of generalisability.

Evidence was provided by invitations from two further primary schools, who wished me to provide my 'ICT Staff Meeting'. These invitations arose because head teachers of schools in the study have found the input for staff (which is directly derived from the research data) of practical value, and have therefore mentioned this to their colleagues. Also the General Advisor for ICT in Milton Keynes invited me to talk to ICT Co-ordinators at training session, which I take as endorsement of the practical value of the work, since time at such sessions is at a premium. Also Richard Millwood of UltraLab,(see URLs) used the 'Model for teachers as users of ICT' as a structure for TeacherNet profiling software, which allows teachers to conduct a self audit of their school ICT situation. In doing so they can identify and begin to address barriers to development.
Such invitations endorse the validity and generalisability of the research.

7. Ethics

The ethical code of the study was made clear to participants before questionnaires were filled in and before interviews took place, in accordance with the British Educational Research Association code of practice (1992). The following points, which have been strictly adhered to, were set out for participants:

❖ The purpose of this research is to collect information from teachers and others concerned with schools about their working practices, ideas and opinions.

❖ Data will be collected by questionnaire, interview and in documentary form.

❖ The privacy of those taking part will be respected at all times.

❖ All information 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 myself and my helper with the transcribing.

❖ Information intended for publication will be made available to participants in the study at all times.

❖ Research archives will be destroyed two years after successful completion of the study.

Further ethical guidance was obtained by studying the Code of Conduct, Ethical Principles and Guidelines of the British Psychological Society (1996). As well as the points mentioned above, these guidelines are concerned with the interests of participants. Such issues as obtaining consent, confidentiality and personal conduct are addressed. The following points are relevant.

> ❖ Because of the concern for valid evidence [...] ensure that research is carried out in keeping with the highest standards of scientific integrity. *(Page 1)*
>
> ❖ Carry out investigations only with the valid consent of participants, having taken all reasonable steps to ensure that they have adequately understood the nature of the investigation *(Page 2)*
>
> ❖ Take all reasonable steps to preserve the confidentiality of information, and to protect the privacy of individuals or organisations about whom information is collected or held *(Page 3)*.

D] Data collection methods

In this section methods of data collection are discussed theoretically, and details of research design are provided, specifying how the data collection proceeded.

Data Collection Methods

The professional development of teachers in aspects of ICT use is central to this study, and the data collection involved obtaining relevant information directly from teachers. The study was focused almost exclusively on teachers, rather than on external 'change agents' in the shape of representatives of IT firms, and not on the pupils who might be expected to benefit from, or at least notice, the effects of change. The most immediate source of information about how change affects teachers is the teachers themselves.

The work focuses on the *relationship* of teachers and ICT. That is, it investigates the uses individual teachers make of ICT, for their professional purposes, as well as in their teaching. This is necessarily individualistic and dynamic. The data collection from teachers took place over the time span September 1997 to January 2000. During this time, national, local and personal change and development proceeded to a greater or lesser extent, and data collection was focused on teachers' reports of their situations

and experiences. For example teachers provided descriptions of their home context for ICT use and the management of ICT resources in their work situations.

In Figure 3.2 *Overview of Data Sources*, the four main data collection methods of questionnaire, interview, documents, and observation are shown to draw data from both teachers and other educators. 'Other educators' refers to a range of professionals: head teachers, ICT specialists, school governors, technical support staff, LEA representatives, teacher trainers, and representatives of organisations or companies. Teachers are depicted as both central to the concerns of educators and contained within their aspirations and intents. The data collection methods are augmented by field notes in the research journal.

Data Collection

The data collection methods, together with methods of analysis and research design specific to this study are described in the following sections:

- Questionnaires

- Interviews

- Documents

- Observation

- Research Journal

Figure 3.2 *Overview of Data Sources*

class teachers

questionnaires

interviews

documents

observation
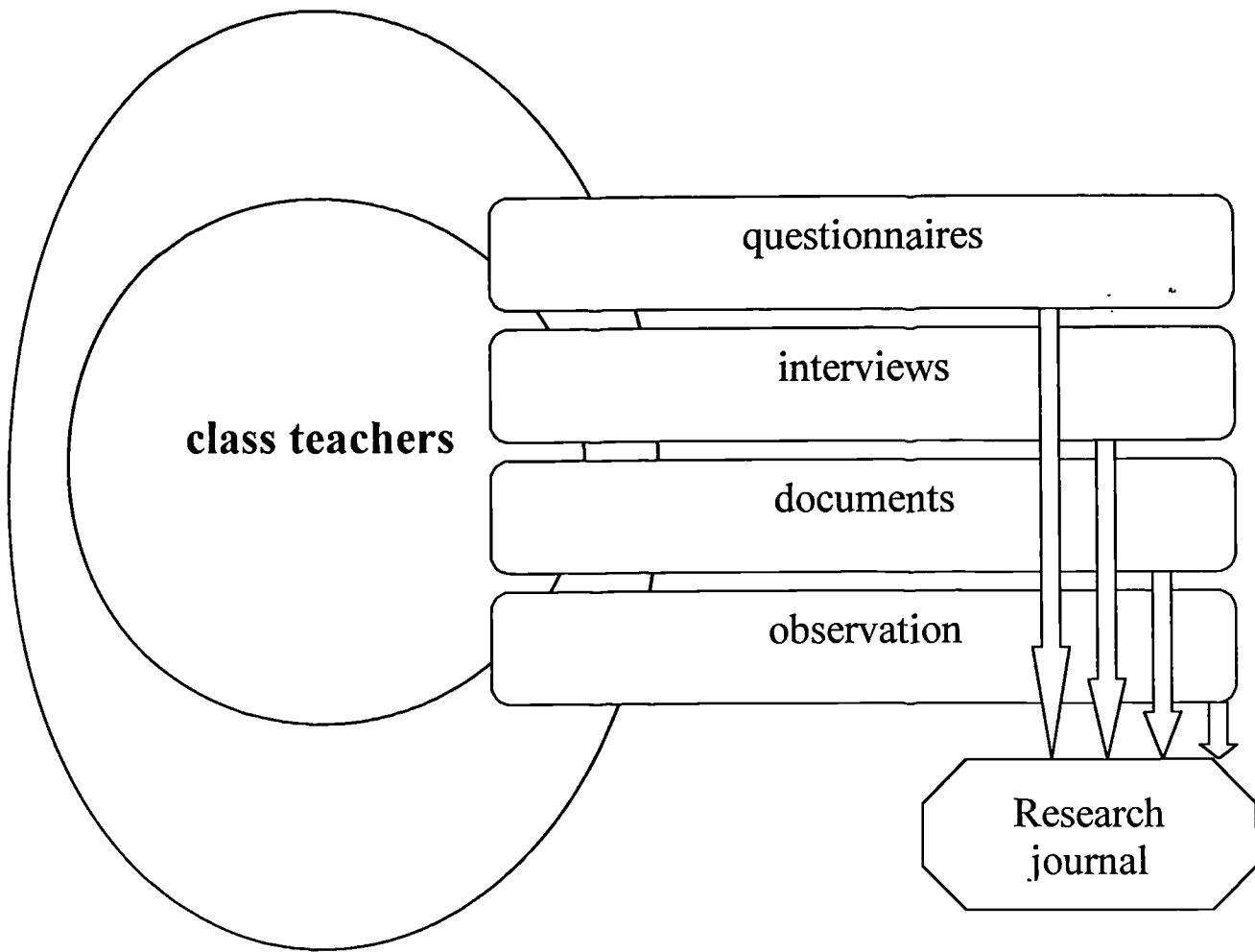
Research
journal

Questionnaires as a research method

Questionnaires are instruments which allow the recording of factual information and personal ideas in a format amenable to analysis, and were used in this study to collect factual information and opinon (Cohen & Manion 1981: Hammersley et al 1994).

> 'Questioning people is more like trying to catch a particularly elusive fish, by casting different kinds of bait at different depths, without knowing what is going on beneath the surface. The function of a question in a questionnaire is to elicit a particular communication. We hope that our respondents have certain information, ideas or attitudes on the subject of our inquiry, and we want to get these from them with the minimum of distortion' (Oppenheim, 1992 p.121).

Problems associated with questionnaire use

Questionnaires were designed to ask only questions that were necessary (Wilder 1996 p.10). The questionnaires used unambiguous language and had clear instructions. Questions about similar issues were grouped together to make the document more coherent for the respondent.

The questionnaire was clearly marked as confidential and was treated as such. In schools, there is a potential problem of 'institutional coercion' of respondents. Teachers may well feel that they are obliged to complete a questionnaire if asked to do so by the Head Teacher. Whilst this is a problem in that it may provoke unwillingness or resistance, it is also paradoxically a solution to the problem of ensuring that questionnaires are both completed and returned.

The problem of 'absentees', that is people not available when the questionnaire was administered, causes gaps in the data. It is difficult to avoid some loss of data in this way. It is also difficult to encourage people to return questionnaires. This particular problem is best solved if it never arises. The simplest way of ensuring returned questionnaires was to administer them in person and collect completed forms immediately.

The questions were a mix of open and closed. Open questions allowed respondents to answer spontaneously, with the acceptance that respondents may not reflect and consider issues. Closed questions were used for factual queries. The draft questionnaire was completed by a group of eight teachers not involved in the study to check for problems such as ease of use, and leading questions. The draft questionnaire was amended after trialling and then was approved by teachers.

Administering the Questionnaire

Questionnaire 1 Teachers and the Internet' (Appendix 1) collected a mix of qualitative and quantitative data which would provide the base line information about teachers in schools in January 1998.

The questionnaire collected information about teachers' use of computers in general, and communications technology in particular.

Questionnaire 1 collects background information and then focuses on two particular uses of computers - the use of the Internet and email. Fluency in the use of these applications can be a measure of *network literacy* (DfEE 1997a p10). The questionnaire was designed to establish the histories, ideas and predictions of teachers as the study began. Presented as a mixture of open and closed questions (Foddy, 1993) its purpose was to find out whether and how often the teachers in the sample used computers at work or at home, and if they do so, for what tasks.

Table 3.6 *Questionnaire returns* shows the numbers of teachers at each school who completed the questionnaire, which can be seen to be over a third of teachers at the secondary school, and almost all the teachers at the primary schools. This was because at Askill The Head Teacher felt that staff should not complete questionnaires within 'directed time', but should take them home. The result was fewer returns.

Table 3.6 *Questionnaire returns*

School	Type of school	Number of teachers in school	Number completing questionnaire
1. Askill	Secondary	84	30
2. Banna	Middle	15	12
3. Causey	First	8	8

The final question was as follows:

Question15. Would you agree to a short (10 minute) interview about how the use of computers affects your work? Twenty teachers agreed to interview: fourteen at Askill, and three at each of Banna and Causey. All of these teachers were interviewed.

Interviews as a research method

Interviews were conducted in order to collect unique data from individual subjects. This research used semi-structured or focused interviews in which the interviewer 'directs the conversational agenda' (Rubin and Rubin, 1995, p 5): wishing to find out what the subject knows and thinks, the interviewer structures the conversation in order to encourage the subject to speak.

The subjects were practising teachers, talking about the introduction of ICT into their classrooms. The 'conversational agenda' was to discover the individual teacher's orientation to technology, find out what they knew and understood about initiatives such as the NGfL, and to collect information about their thoughts, feelings and ideas. Some teachers were interviewed more than once over an extended period of time. These were ICT Co-ordinators teachers in the linked schools, and a further group who agreed to close involvement in the study. Each teacher at Drigg was interviewed once, and four teachers more than once. After interview some teachers changed jobs, or were unavailable for a variety of reasons. One particular cause of loss of interviewees was the introduction of the Literacy Hour, which took up the time and energy of primary teachers throughout 1997/98.

Interviews are, or can be, a sort of dialogue or interaction, in which the interviewer
and respondent use talk to jointly construct a view of the respondent's reality. Dexter
(1970: quoted in Erlandson et al p 85) describes interviews as 'a conversation with a
purpose'. The interview is conducted in the medium of spoken language. A distinction
can be made between language and the discourse that it allows in such circumstances
as interviews:

> 'Language is an abstract system from which, using the input of the lexicon and grammatical
> rules, sentences can be produced as output. Discourse is the concrete manifestation of this
> abstract system. Discourses are produced in a specific context of time, place, persons present,
> and their relationships to each other. Speakers combine these circumstances with the
> linguistic elements of language to produce[...] utterances.'
>
> (Barnes & Todd,1995, p140).

In the abstraction that is language, words and sentences can have single, defined
meanings. In interviews as a type of discourse, utterances can be interpreted in a
number of ways. This has implications for interview analysis which will be discussed
later in this section.

Interview Design

A difference between an interview and an ordinary conversation is that interviews can
be recorded and in this way the talk is 'captured'. The recording of talk is necessary
since the alternative is lost data; the nature of spoken language is that it is ephemeral.

Recording is an interference which may have side-effects. Some subjects may feel wary
when presented with a microphone and tape recorder; others may feel that written
notes will not be an accurate record. Capturing the talk on audio tape or in written
notes was the first step towards analysing what was said, but simultaneously the first
step towards altering it. The distinction between the original talk and a written
transcript of it lies in the way that 'fixing' talk transforms it into something definite and
unalterable. It was important to minimise the interference effect of recording, and to
transcribe accurately all that was said, including the researcher's contribution which
provides the true context for the subject's words.

Interviews in the study had outline structure and key questions, but allowed for the differences between subjects, and were capable of evolving to fit the needs of the study as it proceeds. Rubin and Rubin (1995, p. 43) describe qualitative interviewing as flexible, iterative and continuous. The design must be flexible in the way it adapts to what the interviewer is learning, and as it is refined each iteration can focus more closely on the key points subjects are trying to convey. This re-definition of the interview continued throughout the project.

The interview is a unique event, almost like a performance, dependent on its time and place and the coincidence of the interviewer's trajectory and that of the subject, unpredictable and unrepeatable. The generic purpose of an interview is to try to understand how people think and feel about the topic with which the researcher is concerned (Oppenheim,1992, p.67) or as Kvale (1996) says,

> 'If you want to know how people understand their work and their life, why not talk to them?'

However there is a great potential for bias of one sort or another, especially during a less structured interview. Making interviews more rigid may reduce bias but at the cost of loss of insight. Awareness of the problem may go some way to alleviating it.

Productive Interviewing

In order to talk to teachers productively, it was important to have an awareness of the effect of the relationship between interviewer and subject. A productive personal interview requires the people involved to establish some sort of relationship. The subject may be strongly encouraged to trust the interviewer. Conducting interviews commits the researcher to a serious consideration of the following ethical issues: interview subjects may:

- disclose highly personal information
- be led to talk about issues which they had not intended to mention
- not 'weigh their words' but speak impetuously
- feel some obligation to agree to an interview
- feel that they have established a friendship or personal

relationship

- feel disturbed or upset by some questions
- feel unappreciated or that their time has not been well spent.

Considering these factors, teachers were approached openly with information about the nature and purpose of the study. Walker (in Hammersley, 1986 p. 214) describes the ethical implications of conducting interviews:

> 'In the hands of a skilled interviewer most people are inexperienced and will reveal things they do not intend. Only by allowing retrospective control of editing and release of data to informants can the case study worker protect his subjects from the penetrative power of the research as well as checking his own misinterpretations or misunderstandings. Ethically this involves taking the view that people own the facts of their lives and should be able to control the use that is made of them in research'.

Rubin and Rubin (1995 , p.125) detail what distinguishes interviews from 'normal' conversation:

> 'Although generally following the rules of normal conversations, interviews also have distinctive features. A normal conversation can drift along with little goal, but in interviews, the researcher gently guides the discussion, leading it through stages, asking specific questions, and encouraging the interviewee to answer in depth and at length. The interviewer might ask about the meaning of specific words, a rare circumstance in a normal conversation.'

It was not difficult to 'be convincingly enthusiastic and encourage listeners' (Walker 1986 p.214). It was also interesting to adopt Walker's suggested critical skills for successful interviewing - 'psychological mobility' (the ability to suspend one's own values and points of view in order to allow the subject's values to be made clear): and 'emotional intelligence' (the ability to empathise).

Could interviews elicit 'attitudes'?

Iinterviews might be used to canvas *attitudes* of teachers to ICT. However the research literature suggested that this might be a futile undertaking since people's attitudes may be variable or may be something that they do not wish to reveal.

The interview conversation allows the subject to think aloud in a way that may encourage them to 'discover' their own attitudes during the course of the interview. The company of an interested listener may be an opportunity to put in to words ideas previously unsaid: questions phrased and asked by a different interviewer may have provoked a different response. The interaction of context, subject and interviewer generates data. The idea that people hold 'attitudes' (as an abstract concept) which can be brought out, measured and compared by using scales has been much used in social psychology: for example a classical technique for eliciting attitudes is to ask subjects for their responses to attitude statements. An attitude statement is a single sentence that expresses a point of view, a belief, a preference, a judgement, an emotional feeling, a position for or against something.

'Most researchers seem to agree that an attitude is a state of readiness, a tendency to respond in a certain manner when confronted with certain stimuli [...] Most of an individual's attitudes are usually dormant and are expressed in speech or behaviour only when the object of the attitude is perceived.'(Oppenheim, 1992, p. 174).

What the subject says can be interpreted as an account constructed in the context of the interview. Put another way, within a certain discourse, certain attitudes may be generated:

'The crucial assumption of attitude researcher is that there is something enduring within people which the scale is measuring - the attitude.'

(Potter and Wetherell, 1987, p.45)

Potter and Wetherell discuss the difficulty of considering attitudes since their effects vary depending on the demands of the situation.

'It is commonly found in attitude research that people will say one thing, or express one kind of attitude, but then will behave in a way which is inconsistent with this attitude'

(Potter and Wetherell, 1987, p. 53).

The strength of interviews is that they can provide very personal data because of their essentially tete-a-tete style. The interviewer and subject collaborate to produce the data: interviews are 'us', not 'me getting information from an unrelated other'.

'The interview is literally an inter-view, an inter-change of views between two persons conversing about a theme of mutual interest' (Kvale,1995, p14.)

In 'Researching and Understanding Schools' (Nias, Southworth and Yeomans 1989 p.6) the authors describe how evidence was collected using interviews.

'Almost all the interviews took place in school, many during school time. They were loosely structured round key questions specific to the circumstances of each school, but interviewees were encouraged to talk freely and for as long as they wished. They also had the right to turn off the tape-recorder. Interviews varied in lengths of time from 40 minutes to two hours'

It is hard to understand why teachers would spend two hours talking unless they felt that the conversation had some purpose for themselves as well as the interviewer. One of the authors confirmed that teachers (and more especially Head Teachers who have no in-school peer group) are willing to talk about their work and themselves to an interested listener because they seem to value such an opportunity to describe and reflect on their practice. (Robin Yeomans 7.6.98 pers.comm.) My interviews were scheduled to last 15 minutes, but rarely lasted less than half an hour. The longest was an hour and ten minutes, and was finally stopped by the school bell.

Problems associated with interviews as a research method

Interviews can lack objectivity. The face to face interview is a negotiation, and what is said depends on the interaction between the people talking. A certain amount of mutual trust is required to encourage honest or comprehensive answers; but an over friendly approach may cause bias.

Another sort of bias can arise because of the interaction between interviewer and respondent. A teacher asked to say what they feel about ICT use in classrooms, or its introduction into school, is offered the rhetorical task of presenting themselves in relation to ICT. In this situation they will seek to pursue their interests in this area, or to 'tell their story' about ICT, and that story may be subtly different for different questioners. A respondent, in this situation a teacher, 'positions' the questioner by considering what they know of them, and responds accordingly.

The question, 'How useful are computers in the classroom?' can be expected to elicit slightly different responses if the questioner was the head teacher, a philanthropic

lottery winner, an OFSTED inspector, a colleague, a governor, a pupil, the cleaner, a representative of Research Machines - or a research student. Similarly responses may be shaped by recent experience, such as having attended a useful training course, having failed to operate classroom software, having found that a particular programme can directly benefit a particular learner, or having had problems with managing groups 'collaborating' on a piece of work at the computer. In this research the interview schedule was used to provide a framework for the talk. This 'semi-structured' format has the disadvantages of not entirely addressing the potential problems described above, but this was outweighed by its advantage of encouraging unrestricted talk.

Another problem was that of asking teachers to talk about the possibly insecure subject of ICT. However, this problem is somewhat overcome by the nature of school technology – it is common knowledge that school computers are cranky and recalcitrant machines, and are particularly prone to crashing and refusing to co-operate. Admitting to having been a teacher myself provided a basis for common understanding in the interviews.

Interviews as a Research Method (2)

As a research method, the personal interview is unrivalled in allowing access to complex and intense data specific to the individual subject. The interviewer and subject jointly construct the discourse of the interview. Such a collaborative venture requires mutual interest in the content of the talk. As well as factual information, interviews can elicit attitudes. However, an expressed attitude may be dependent on the context provided for its expression, and may be variable and no indicator of subsequent behaviour. The next section describes the practical application of interviews as a research method.

Conducting The Teacher Interviews

All the interviews took place at the teachers' schools. First and Middle school teachers saw me after school hours, while Secondary teachers usually arranged meetings in their non-contact time. A semi-structured format was used, with time for teachers to ask questions or raise issues they felt were important (O'Sullivan, 1994). The confidentiality of the data was stressed. No teacher objected to recording, though

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initial wariness was quite common. However this seemed to be to do with people disliking their own voices on tape, fortunately irrelevant. Interviews were recorded on audio tape in order to ensure accuracy. The interviews were transcribed and typed. Copies were provided for those teachers who requested them (2). Two teachers wanted to talk to me together, and I subsequently discovered that this is a valuable interview arrangement (Arksey, 1998).

Documentary evidence as a research method

A range of documents from as wide as possible a variety of sources provided contextual and informative data. Documents were either official documents such as school policies or government guidance: or personal records (Cohen & Manion 1981). Some school documents were freely available, whilst others were confidential or only available to staff or parents. During Phase 1, the developing National Grid for Learning was introduced and explained by a range of Government publications, and chronicled by observers and analysts. Electronic and printed documents were collected from a variety of sources. Of particular importance to teachers' understanding of the NGfL were media publications. The print media responded to the Learning Grid initiative by producing supplements aimed at the new audience of teachers as users of ICT. Two of these supplements - the TES Online and Educ@guardian - have been collected throughout 1997, 1998 and 1999 and provide an invaluable historical resource. Developments in educational computing have been very rapid: some themes in the data analysis can be traced from their inception in the documents available. Others can be seen to have seemed important, but their impact has diminished over time. Documentation has a rhetorical stance and therefore needs to be contextualised.

Access to the following types of documents has enabled the compilation of a comprehensive picture of the context for ICT introduction.

a) School policy documents dealing with ICT

b) Handbooks which are provided by schools for parents

c) Details of LEA involvement with staff training for ICT

d) Electronic Information

- details of online projects undertaken by schools (nationally and internationally)

- educational web sites

- information from government, for example, feedback on the consultation document 'Connecting the Learning Society': Education Department Superhighways Initiative (EDSI) Report: DfEE web site

- specific professional development material designed for teachers, such as the site of TeacherNet UK, the BECTa site, and the Virtual Teachers Centre

- information from online conferences and journals.

e) Government information

f) Media - supplements for teachers dealing with ICT in education

       - media information about education generally

g) Advertising by IT firms directed at teachers

h) Information produced by Training Providers

i) Conference papers dealing with ICT in education.

Observation as a research method

The method of observation of teachers depends on its purpose. The observation of teachers took place to provided background and supplementary information for the interview study. Wragg (1994 p. 14) argues that there are advantages and disadvantages involved in collecting data by observation. Although participant observers may find it difficult to detach themselves from their own prior knowledge, beliefs, commitments and prejudices, they can expect to understand the significance of events in a way that strangers might not. Non-participant observers may be more detached about what they see, but may misinterpret events through unfamiliarity with the situation. As an observer it is necessary to try to avoid making subjective judgements. A consideration of the following points contributed to ensuring the legitimacy of qualitative observation.

- The purpose of the observation must be clear. The observer must make clear to the teacher whether they are there to offer feedback and advice, or to make judgements about quality. In this research the purpose of observation was simply to record what was happening for later analysis.

- The need to reflect on observed events is inherent. There are often several ways that what is seen or recorded can be interpreted.

- Discussion can inform observation. Allowing the teacher opportunities to explain events or interpret the actions of others can enrich the data. Teachers in the study were asked for clarification and feedback.

- The nature of the event observed should be recorded. The role of the teacher changes in different situations, for example the same teacher may be observed in a classroom, talking to parents, or in a staff meeting. What is observed should be set in context.

(Adapted from Wragg 1994 p 61).

Observation in this research

Informal and participant observation were used and entry to situations in which teachers were working were fully negotiated. Observation followed the precepts put forward by Sanger (1996 p.31).

1. The observation activity should be practitioner led, not observer led.
2. The observation should be arranged in an optimistic climate of professional trust, in the belief that it will improve knowledge about the work of professional staff.

Informal observation was useful during the school's normal work, to watch, listen and take notes. Audio recordings would have been unclear, because there were usually too many people talking, and special permission to record might have altered what happened. I was introduced on some occasions as a teacher, and others as a researcher - I always introduced myself as both, so how teachers presented me was an indication of how I was perceived by the speaker. At Drigg school, probably because I taught a course of lessons there, I was always treated as a colleague. Informal observation provided background data about contexts, plans and new ideas in the following circumstances:

- Teachers using ICT during non-contact time
- Staff meetings dealing with issues to do with ICT
- Schools Open Evening presentations of ICT work
- Observation of general patterns of ICT use in schools

Participant observation is potentially a much richer source of data than informal observation. Its disadvantage is that by interacting the researcher may affect what happens. Participant observation was possible by participating as a teacher, but observing as a researcher. For example in contexts where teachers were learning ICT skills I could offer suggestions (e.g. about how to compile tables, or put things into columns) - but simultaneously I could ask the learners questions about themselves. Questions might be to do with motivation for undertaking training, perceptions of the usefulness of training, if training matched expectations, plans for the future. Participant observation was used in the following circumstances:

- Teachers undertaking training for ICT use
- European Community Drivers Licence training: New Opportunities Funded TTA training
- Training Provider meetings to discuss the design and delivery of teacher training for ICT use
- The normal school day: teachers and learners using ICT in classrooms

Field notes were used to cross-check aspects of the data gathered by interview and questionnaire.

Research Journal

The research journal contributed answers to specific questions of detail (what happened? when? who was present? what was the immediate effect?) and provided some indication whether factors as seemingly insignificant as times of day, particular venues, histories of relationships, and so on, did in fact present themselves as significant if recorded systematically. This accords with the idea of interpreting data by conceptualising it and relating the concepts to form a theoretical rendition of reality (Strauss & Corbin,1990: Cohen & Manion 1981). The research journal was compiled throughout the data collection phase and included conference notes, reviews of books and journal articles, and reflections on data and contexts as they occurred.

Analysis of data

Open ended questions in both the questionnaires and interviews provided data for qualitative analysis. The Strauss and Corbin (1990) definition of grounded theory is included here since this concept informed the process of conducting questionnaires and interviews and provided a framework for the analysis of data.

'What is a grounded theory?

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 a 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 1990 p 23).

Analysis of data was concurrent with data collection as suggested by Richards and Richards:

'In survey research, teams of data collectors and coders dominate the early action, moving off-stage when data collection is completed, to clear the way for the dramatic finale of analysis. To talk of data 'collection' as a prior stage is inimical to the theoretical assumptions behind qualitative data. The goals of producing theory from data, rather than merely testing prior theory, require that 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 derived. So data control methods must be processes of analysis'

(Richards & Richards, 1994, p. 149).

Bryman and Burgess (1994) suggest that although analysis may not be a distinct phase but a continuous process, and although this process may be initiated immediately or later in the research, there is still a requirement that some sort of coding of the data takes place.

'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',

however:

'there is the potential for considerable confusion regarding what coding actually is, so that it is doubtful whether writers who employ the term are referring to the same procedure'

(Bryman & Burgess,1994, p. 219).

A working definition of coding for this study is that 'coding' refers to the process by which segments of texts were allocated to categories, codes themselves arising from the content of the data, and categories arising from ideas which link or concentrate the information in the data. 'Coding is analysis'(Miles & Huberman, 1994 p. 56). Coding of data was an ongoing process of scrutinising the interview transcripts and questionnaire responses for similarities, differences, links, or contradictions, and allocating a code to information which was significant in its content. Collecting together data with matching codes allowed investigation of data sets, and enabled the content of the data to generate issues or themes.

Methods of managing the data which encouraged continuous exploration of both the data and the ideas that arose from it as it accumulated were adopted.

Managing data: summary of methods

• Entire documents stored so that the context of segments of data was always available

• Numerical and colour coding of documents and text segments carried out routinely

• Structured index of major categories with hierarchical subdivision of material compiled: comments and ideas were added so that they were integral with the original data.

Data management and analysis continued throughout the study. The data collected in Phase 2 was analysed separately, and then considered as a whole with Phase 1 data. This allowed the opportunity to ensure that preconceptions did not colour the themes and issues arising from the later analysis. This also allowed a comparative analysis of data from Phase 2 with that from Phase 1, to check for differences over time.

Analysis: what themes emerged?

Data was initially reviewed by returning to a consideration of its purpose. It was linked with previous data and theoretical constructs. Themes and concepts which arose were considered against the background of research literature, and in relation to the research questions. Interview data analysis was based around reading transcripts minutely and marking subjects (here synonymous with issues, ideas or themes) with a code. Items given the same code are then put together in categories. The categories are generated by the interaction of the researcher with the material, that is, they are 'grounded' in the data as Strauss and Corbin (1990) suggest. Once material is categorised it can be examined in order to refine concepts, compare examples, or create a narrative. The material is 'interpreted'. Rubin and Rubin (1995) describe the final stages of this process as follows;

> 'The coding process fragments the interviews into separate categories of themes, concepts, events, or stages. Coding forces you to look at each detail, each quote, to see what it adds to your understanding. Once you find the individual concepts and themes, you have to put them together to build an integrated explanation. You follow a two-stage process of thinking about the data. In the first, you examine and compare the material within categories. In the second, you compare material across categories' (p 251).

Coding the interview data

Copies of the interviews were identified by colour as teachers at first, middle and secondary schools. The interviews were examined, and statements which contained similar themes or related ideas were then coded and collated to enable comparison. Coding involved the identification of key words and phrases containing key words (such as 'the future' or 'training'). Further examination of the data involved adding ideas and opinions to the themes emerging from the key word coding (such as: the future: 'I think we can all see that it's got to come, and it's going to be amazingly useful'. 'Training': 'I don't want to know why it does something, I just want to know how to do it'. Some of the themes which emerged from this process arose directly from the common questions asked at interview. Some themes elicited more data than others; more discussion was generated, and the points raised were more complex. It was then possible to sub-divide themes into issues and identify linked responses across

the range of interviews. Some interview data was concerned with contained opinions
and ideas, whereas other data was factual. Both types of data contributed to the
overall picture of the experiences of practising teachers.

Further themes which arose from the data were raised or initiated by the teachers
during interview, and so did not relate directly to the questions. Again there were
patterns to be discerned. Further study of the data allowed some data reduction, and a
clarifying of themes and issues within themes. Finally I used the data to draw out
categories of teachers as users of ICT. Initially I resisted this procedure because it
seemed that categorisation is a risky process, 'fixing' people into a defined position,
and imposing a rigidity on the data. However categorisation also allows meaning to be
made from otherwise loosely associated ideas.

Why construct categories?

People seem to like putting things in groups or categories: the biological argument for
this observation is that categories reduce the complexity of the lived environment and
therefore allow individuals to act more effectively within it (Tajfel, 1981). People often
describe one another in terms of the category they wish to invoke. Social psychologists
focus their research on the cognitive processes underlying categorisation and its
consequences (Potter and Wetherell 1987 p.116). People may have a 'prototype' of a
category in mind which is used as a comparative standard in order to assign things that
seem to 'fit'. In coding and categorising interview data (admittedly only obliquely
similar to categorising people!) it was worth keeping in mind that matching things and
grouping things and seeing patterns constructs one version of reality. It is necessary to
validate such an account.

Coding procedures provided such validation (adapted from Lincoln and Guba 1985):
1. Filling In
Adding codes as new insights emerge. The Phase 1 coding of interview data did not,
for example, allow interpretation of teachers' perceptions of such issues as home use
of computers, problems associated with Internet use, and establishing educational uses
of ICT. These were 'filled in' during Phase 2.

2. Extension

Returning to materials coded earlier and interrogating them in a new way.

For example The Phase 1 data was examined at the end of the study not to find new ideas but to use comparatively as a 'benchmark' so that change could be noted.

3. Bridging

Seeing new relationships within units of a category. The inter-relationship of the categories relies on a 'community' model of learning. This allows changes in the school context of the teacher to change how the teacher allocates themselves to a category. Bridging occurs when considering the separate categories provides insights into what might support change.

Content Analysis

Content analysis provides techniques for making inferences by systematically and objectively identifying specified characteristics of data (Holsti, 1968).Specified characteristics in the analysis of interviews were such indicators as references to change, or to any of the key words which emerged as themes. Once identified, all instances of key words were examined to ensure that the messages contained in the data were corellated. This approach allowed an understanding of the effects of proposed innovation as perceived by teachers, the recipients of change. Inferences drawn about the stance of teachers under the circumstances of their local and national context were therefore based on a comparitive analysis of their responses.

Conclusion of Chapter 3

Chapter 3 sets out the methods used to collect, order, and analyse data in relation to the research questions. Chapter 4 *Themes from the Phase 1 data* provides details of the research findings, using the data generated by the collection methods and analysis. Themes emerging from the data are linked with issues raised in research literature and with documentary and observational evidence, so that the context in which teachers use ICT is clarified and evaluated. This process allows teachers' perceptions of reality, their hopes, expectations and their identification of problems, to inform discussion of the research questions.

Chapter 4: Themes arising from the Phase 1 data

This chapter reports the Phase 1 findings, with preliminary discussion of issues arising from the data. The chapter has three sections:

- Introduction
- Phase 1 findings
- Summary of Chapter 4

Introduction

The methodology detailed in Chapter 3 was used to collect data to clarify the factors which affected teachers' professional development in ICT use. Such clarification was important in order to develop an understanding of the barriers preventing further use of ICT by the teacher. The introduction of ICT into classrooms is complex, proceeding under the impetus of political pressure, with added pressure from the IT firms who stood to gain financially. It appeared that the NGfL, while designed to counter inequalities, created or compounded inequality during its initial introductory phase, partly because those schools which had been early adopters of technology were able to make more successful bids for further funding. Another complication arose because at the same time as the NGfL was introduced, the literacy and numeracy strategies were put in place in primary schools. Teachers indicated that pressure from OFSTED inspections and SATs league tables continued to focus their attention on ensuring that their schools were categorised as successful in these measurable terms. So, while the NGfL was a flagship initiative for the Labour government, to many teachers it was an added burden. This negative effect was coupled with the history of technological innovation in schools as documented in Chapter 2, in which inadequate hardware, poor quality software, and no technical support had left many teachers with the belief that computers were unreliable, of little educational value, and vastly time consuming.

Research to do with social aspects of ICT and its inclusion into the educational process indicated that computers had not had enormous impact, with Cuban (1986) claiming that many classrooms remained machine-free zones. The rapid development of computers which were not only powerful but affordable seemed set to alter this

situation. But would the advent of the new machines prove to be another bandwagon initiative, or could their predicted educational potential be realised? What factors must be in place in order to achieve this? And since there are never gains without drawbacks, what new problems might arise?

Interviews provided insights into teachers' professional knowledge and understanding of these issues. Analysis of the data distinguished twelve themes.

THEMES ARISING FROM THE DATA

1. Computers at home (1997-1998)
2. Computers at school (1997 – 1998)
3. Teacher training for ICT use
4. Purposes for ICT
5. The role of the teacher with ICT
6. Problems
7. Predictions
8. Parents and ICT
9. Pupils and ICT
10. Gender issues
11. Teachers' desire for knowledge

Structure of this chapter

The rapid pace of change in ambient ICT conditions within schools, at home, and in society generally, over the period of this research meant that for teachers, professional contexts shifted and new situations were generated throughout the time when the interviews were conducted. First, the teachers in the study were working in an evolving national context, in which the heightened profile of ICT in education was just beginning to become evident. They were moving from an awareness of impending change, towards a consideration of a more integral use of ICT in practice. Secondly, the context for the ICT involvement by all the schools in the area was changing, largely as a result of the activities of the LEA and its advisory team. And third,

individual schools were responding, in terms of policy and practice, to these broader influences and also to the increased physical availability of hardware and software.

The findings from the analysis of teacher interviews need to be set in this contextual framework.

Therefore, rather than presenting the documentary evidence relating to these changes in a separate section, the relevant evidence is presented here, closely linked to the findings from the questionnaires and interviews. Each theme is prefaced by a brief indication of relevant situational conditions gathered from documentary evidence. Also, after the findings are presented for each theme, a short discussion is included so that points arising from the findings are noted within the relevant context.

The structure of this chapter is therefore to present the findings for each theme in the following format:

i. *Context*

Data from analysis of documents and research journal: an indication of the national and local context within which teachers were working

ii. *Findings*

Data from face to face interviews: the outcomes of initiatives on teachers professional development. The distinctive Drigg data is presented at the end of each section.

iii. *Discussion*

Interpretation of data.

Drigg School Case Study

Schools which had an established ICT capability and those with no ICT resources at all were favoured in the initial funding round in Milton Keynes. The rationale behind this was to create schools which could generate good practice and then disseminate expertise to other schools: and to help late starters to begin to catch up. In this research, change in terms of teachers' professional development could be expected mainly in those institutions which received funding. In 1997/8 it was not clear if the study schools would do so. At this time, Drigg school had through its PTA funding

recently purchased enough computers to establish a small suite. Drigg could therefore offer a changing ICT capability, with some possibility of discernible impact on staff development. Drigg was therefore included in the study to provide data for comparison and perhaps contrast with the three linked schools. Following their resoundingly successful OFSTED report in 1998, teachers at Drigg continued to move towards integral use of ICT. As detailed in Chapter 2, data from Drigg school was collected by questionnaire and interview, but also by participant observation and by becoming a member of staff for a time, and is therefore slightly more comprehensive than data from the linked schools. The distinctive Drigg data is provided separately at the end of each section in this chapter in order to highlight contrasts and comparisons.

Table 4.1 *Summary list of themes and numbers of interviewees commenting on each theme (n=35)*

	Secondary Teachers (n=14)	Linked Primary Teachers (n=6)	Other Primary Teachers (n=12)	Others (n=3)	Overall %
Themes arising directly from interview questions					
1. Computers at home	14	6	9		83%
2. Computers at school	14	6	11	1	97%
3. Training	14	6	9	3	91%
4. Purposes for ICT	4	5	4	1	40%
5. The role of the teacher	5	4	5	1	43%
6. Problems	8	4	7	3	63%
7. Predictions	8	5	8	3	69%
Themes raised by teachers					
8. Parents and ICT			5		14%
9. Pupils and ICT	8	4	5		49%
10. Gender issues	5	1	4		29%
11. Teachers' desire for knowledge	8	3	8	1	57%

Phase One Findings

1. Computers at home

i. Context

Reviewing the purchase of home computers, the IT firm Xemplar noted that home ownership was increasing as the price of a PC dropped to around £1 000.

> 'Soon, for the first time in history, we will have a situation where the majority of the homes feeding a school will have a richer and more productive learning environment than the school itself'

> (Xemplar 1998 p 24).

However it is people rather than computers who reliably generate a learning environment. And is it unproven that the sort of learning that technology supports is richer and more productive than ordinary lived experience in either school or home. The statement is also misguided because with NGfL support, schools at this time had begun to lease or purchase new computers, and teachers were planning to undertake training was planned. Xemplar's questioning of the role and effectiveness of the teacher was not unusual in the advertising literature available in 1997/98. Meanwhile the role of the computer was predicted to be entirely beneficial. Other examples of this phenomenon will be provided throughout this chapter, and some effects of this on teachers summarised in section 5 of this chapter.

In 1997 a survey reported that one-third of UK homes had a computer, with the figure rising to 45% in families with school age children (Olivetti, 1997). The Bristol On-line Education Network (BEON, 1997) noted that children were spending less time watching television, and using computers instead.

ii. Findings

Table 4.2: *Home Computer Owners* indicates that of the teachers in the questionnaire sample (n=48) the teachers of secondary age pupils were much more likely to have a computer to use at home, therefore were already likely to be more familiar with its potential uses. Almost all of the Secondary teachers owned a home computer, or shared home ownership with a partner or with their children (some of these computers

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had been bought primarily for children's use). Less than half of the primary teachers had home computers.

Table 4.2: *Home Computer Owners*

First School (4 - 7 years)		Middle School (8 - 12 years)		Secondary School (13 - 18 years)	
Sample Size	Home Computer	Sample Size	Home Computer	Sample Size	Home Computer
9	2	11	6	28	26

Teachers who had home computers relied on them for compiling worksheets, record keeping, or writing Individual Education Programmes(IEPs). Those who had no computer cited financial reasons, or reported a lack of information about what to choose.

'I bought myself a new one. For school work. I do word processing, spread sheets, desk top publishing[...] I couldn't live without it now . I hardly use the computers in school because it's so difficult to get access to them'[I N]

'Only for word processing. I'm starting to rely on it a bit more' [QH]

'I'd love to get one. I don't know. It's that or a holiday' [LH]

'Eventually I would like to . I'd like to get one that connects up to the Internet. But again I don't know enough about it'[ET]

Primary teachers gave similar responses.

'Only stuff for school. I don't use it for anything else really'[HJ]

'Just personally the email's useful isn't it? It's also useful professionally because I've got friends who are teachers. I've been emailing them to say, "Help, do you know anything about this?" or "I've done a lesson on this". You get ideas.'[UX]

'No, I haven't got one. I'm hoping to in the very near future but I don't know an awful lot about them. So. Yes I'd like to have one. It just saves time doesn't it.[EU]

Teachers reported receiving help from partners, offspring and friends in acquiring initial training. This informal tutoring is an induction into the community of computer users, with skills to be learned from daughters, sons and partners. Such tutors may provide the structured, one-step-at-a-time tasks 'newcomers' require. However some teachers reported encountering impatience:

'My boyfriend... if I get stuck I just ask; but I have to say 'Let me - I want to do it myself -'

The following is an extract from an interview with a teacher who had received a laptop computer under the DfEE Multimedia Portables for Teachers pilot scheme. Because of this single factor, this teacher's beliefs and practices altered radically.

'In the past I was very aware that I was being asked to teach children to use the computer when I really had very little idea myself. I had attended courses to try and improve my skills but their real problem was that any skill I learned was soon forgotten as I did not have a computer of my own. They only way you learn to do anything is to practice it yourself on a very regular basis. I knew I could master computing skills but because of the gaps between 'hands on' I never reinforced the skills. Because I now have a machine which is 'mine' and I have daily hands on I can now, with some measure of confidence, endeavour to teach the children some basic IT skills.

I would say that it is the ONLY way that you will make teachers computer literate. Give them a computer of their own so that they can use their skills. Joking apart I don't consider myself the thickest person on the planet and yet I had a real struggle to get to grips with computing. Now I am confident and await Robert's *(her son's)* Christmas visit so that I can master some new bits and pieces.

I used to have to rely on children who were more computer literate than myself to help me. Now I find I am usually ahead of the game. I hated not being able to manage something that even the least able child had come to terms with. I now recognise that it was simply not having one of my own. Once you own one you improve immeasurably. In every school I know, the teachers who are computer literate are the ones who have their own systems.

If the government wants us to teach IT then they must be prepared to commit themselves to giving teachers the correct tools to do the job. All the training in the world can't replace having one of your own. How much more expensive would it be to have given teachers one at the beginning instead of all the wasted training sessions that have been paid for? Other staff in the school are all envious in the nicest possible way. They all quite rightly say, why should it be restricted to senior management, we all need this' [KP].

Drigg School

Seven of the ten teachers at Drigg School had a computer at home. These computers were used for professional purposes, and teachers were self-taught in skills. Teachers were required to produce word-processed end of term reports. One teacher gave a reason for her lack of home computer.

'Oh I'd love to have one if I had the money'[I].

The following dialogue about home computers between myself and teacher A highlights some interesting aspects of the NGfL innovation.

A: Well I bought it, as part of my teaching, I thought I'll buy a new computer. But I get my son to do it if I need anything typed out. He's 13 and he can do it just like that. Awful isn't it.

LD: No not really. A 13 year old is a good resource and you have to use these things when you're a teacher

A: He keeps saying to me, I'll teach you mum. I say I'll go on a course to learn how to use the computer properly. "I'll teach you mum. You don't need to go on a course, just sit down with me". Well he can type and he can do spread sheets, everything. We have fax but we're not going to have Internet at the moment although James desperately wants it

LD: What does he want to do with it

A: I hate to think

A found her home computer useful. While admiring her son's skills, she believed that the tuition he might provide would not teach her to use the computer 'properly' – that there is a 'right' way to use the machine (which belief may be unfounded), or that her son's knowledge is inappropriate.

iii Discussion

At the time of sampling, the importance of personal ownership of a computer was not widely recognised, with innovative drives designed largely to increase the numbers of computers in schools. One important study of teacher use of home computers was The Multimedia Portables for Teachers pilot project, part of the DfEE's (pre-NGfL) Superhighways Initiative. Senior Teachers were provided with portable computers for personal use, and the evaluative report concluded that very high proportions of them felt that their self-confidence and knowledge of ICT had increased substantially, and considered that the projects had allowed them to develop uses of ICT in their teaching (BECTa 1998a). This study was an influential confirmation of the finding that home ownership made a crucial positive difference to teachers' ICT competence and confidence. Teachers who owned computers had the opportunity to try out new ideas and to practice after training, and could be considered part of a wider community of computer use. Those without were excluded from this. None of the teachers

mentioned the fact that home computers increase the amount of work done at home. Possibly teachers are used to working at home, and at least the machine streamlines or makes interesting some otherwise mundane tasks.

The Internet was new to most teachers and was felt to be somewhat dangerous. Such wariness was justified, since the Internet can put children in touch with people and sites whose purpose is far from wholesome. It may be that parents and teachers, aware of what Jones calls the Internet's 'monstrous side effects' (Jones 1995 p 11), will not wholeheartedly embrace Internet use on behalf of children until they have control of it.

However The Bristol On-line Education Network (BEON) reported that participating schools had found that ICT provided opportunities to develop and foster local community links. Home-school links involved parents in the education of their children, and joint access to global information networks were transferred into productive curriculum projects(BEON , 1997 p.33). Certainly at Drigg parents, the Vicar, and local businesses all contributed to education in school delivered through ICT.

2. Computers at school

i. Context

In early 1997, the report *'The Future of Information Technology in UK Schools'* (McKinsey & Company, 1997) put the UK ahead of most other countries in terms of availability of hardware. However, the report also noted that primary schools lacked equipment, and much of the technology was obsolete.

A year later, the British Educational Suppliers Association (BESA) survey found that the number of schools with Internet connections had increased: 87% of secondaries and 34% of primaries had access. However many of these schools had only one computer linked to the Internet (TES 20.11.98). In November 1998 the Prime Minister announced the £1 billion package which would continue the NGfL development. This high profile boost for school computing was given much publicity as Mr Blair watched pupils searching web sites in his constituency. 'Computer

revolution will connect schools to a National Grid for Learning, preventing emergence of an 'information poor' generation' (Guardian headline 7.11.98). Mr Blair is quoted as saying 'This is the kind of learning revolution that will now become possible for every child in every school in the country.' The high expectations for computer supported learning are clear, if unclearly defined. One effect of such reports was to raise teachers' awareness of the NGfL, without necessarily clarifying how it would affect them as individuals. Ensuring children's access to computers at school was one of the main aims of the NGfL initiatives: ensuring teachers' access came later.

One IT firm said: 'ICT is going to be at the core of what a school does and decisions have to be made about what will be omitted in order to include it' (Xemplar 1998 p 18). The document goes on to suggest 'imaginative rebalancing of budgets, hard analysis of what we are trying to achieve, and judicious use of staff' implying that fewer staff might be employed in order to ensure more machines could be purchased.

ii. Findings

No primary teacher had a personal computer at work. Table 4.3 *Use of computers in non-contact time* provides a summary of questionnaire responses to the question, 'Do you use computers during non-contact time in school?' and shows that primary teachers made little use of computers for professional purposes whilst at school. The computers used with pupils were not appropriate for personal purposes, being of low technical specification, having minimal software, and being sited in busy corridors and classrooms. There was no Internet connection in either primary school, and the primary teacher who did use email and the Internet went home to do so.

Secondary teachers had computers in their staff area and half of the sample used these for word processing. They also had an email system as part of the electronic Bromcom registration system, but few used it. This data was collected in early 1998, and indicates that teachers faced very real barriers if they wished to use computers: they lacked access to reliable machines and electronic connections, and email was not an effective way to communicate. Primary teachers with little or no non-contact time reported that using computers for professional purposes was not an activity that occupied any part of their working day in school.

Table 4.3 *Use of computers in non-contact time*

1ry = Primary teachers (n=20)   2ndry = Secondary teachers (n=28)

	frequently 1ry	2ndry	often 1ry	2ndry	infrequently 1ry	2ndry	never 1ry	2ndry
word processing	2	14	1	2		4	12	8
email	1	2				5	19	22
Internet	1	2				2	19ʻ	26

Secondary teachers had little uninterrupted time to use PCs within a normal working day, and found the complex system of passwords time-consuming. Those who owned home computers used for administrative tasks cited lack of access to school computers as a barrier to use with classes. This was an unfortunate effect of the school's new Technology College status. Upgraded ICT rooms were fully booked by IT staff to deliver the IT curriculum, leaving little opportunity for IT use by teachers in other curriculum areas.

'At the moment the IT rooms are fully booked, so, no, no-one takes their students up to the IT suite at all'[NH]

There's a sheet up in the library I think. You can actually book IT room time, but there isn't a lot available. There isn't enough' [DX]

'We've got a hell of a lot more computers. But there's still an access problem. You can't use your free lessons because the kids are on there, and at dinner time and before school as well[TC]

'I think the rooms are booked up every lesson. It's very difficult to find a space to take a class in. I found that last year it was easier to get hold of a room' [QH]

'There's no chance of getting in there. Perhaps we've gone a bit OTT on how many courses we're running for IT'[LH]

Primary teachers also faced problems of access. Two models of computer distribution were evident - computers spread around the school in classrooms, or all together in a computer suite. There were management problems either way.

'I mean now we've got one computer in each class, which is a luxury compared to what we used to have, but even that, you know , if you introduce something, by the time every child has got round to actually having even one turn on it, it's a lengthy period of time' [DJ]

'Obviously we're exceedingly lucky in this school. We've got a whole bank of computers.' The children love it, and teachers are beginning to love it. It was awful to begin with. Just stressful. And it would be quite nice to have one in class. I find it difficult timetabling still. In class it would be easier' [UX]

Drigg School

Teachers at Drigg were awaiting the arrival of their new computers, purchased by parental fund raising and NGfL Standards Funding, which would be networked in a small room between the Year 6 and Year 7 classrooms. The IT Co-Ordinator was confident.

'I don't see any problem with the new ones. There will just be a question of schemes of work, and progression' [FD].

The new computers arrived the week before the school's OFSTED inspection, and were installed three weeks after the inspection was over. Teachers had very little time for extra work before and during the inspection, and afterwards there was a sense of relief, and starting anything new would have been extremely difficult.

Teachers used a variety of software with their classroom computers. They valued the ways computers improved presentation and added an interesting dimension to many topics. But sorting out such problems as work was lost or a paper jam was time consuming and meant that attention was drawn away from the children.

The Internet link provided free access from 8am to 6 pm daily. It had was found to be slow and ineffective. The head teacher at Drigg can be seen as exhibiting characteristics of an 'early adopter' of change (Rogers & Shoemaker, 1971) Having previously worked in a school with a strong emphasis on technology, she intended her present school to gain from integrating ICT into its practice, even though this meant much input.

'We tried to get connected. The connection is horrendous and it keeps cutting us off. I sat here till about 8 o'clock one night trying to see if that would help. I now realise that America's online -'[M]

Two of the teachers used email at home for social purposes.

iii Discussion

Different models for computer distribution and teacher and pupil access to computers are provided by literature distributed by The Technology Colleges Trust (TCT 1998), and by the EDSi report (DfEE 1997b). Briefly, the computer suites of Askill school were complemented by a small number of stand alone computers in curriculum areas, and three computers for teacher use in the staff area. An alternative model is that all computers are distributed evenly throughout the school, and that pupil use is negotiated with curriculum teachers as and when required. In another scenario, teachers are allocated laptop computers, and parents are encouraged to purchase laptops for their children. Management staff at Askill were aware that their teachers were experiencing problems, and by Phase 2 some changes had been made. It is hard to see how teachers can fully integrate ICT into their practice, and move towards encouraging children to become independent learners, until the provision of hardware is adequate to support new ways of working. In all of the schools, teachers aimed to use computers, but such use was never spur-of-the-moment. Rigid timetabling was essential to ensure fair access to all where there were computer suites, and a high degree of organisation was necessary in order to ensure the educational effectiveness of stand alone classroom computers. The Research Machines advertising motto, 'It's just a tool' seemed highly inappropriate to the work practices of teachers. There was nothing casual about including an IT component into delivery of the curriculum.

3. Training

i. Context

In1997 British Telecom seconded a head teacher to undertake a review of best practice in school computing. After visiting 300 schools he advocated that primary schools should use their Lottery Funded training to train two teachers per school, who 'could then show everyone else what they had learned'(TES 9.10.98 p 29). 'There is going to be some cultural resistance to the innovations of technology, but we want the enthusiasm of the minority to carry the rest,' he said. There is a connection between the provision of minimal 'cascaded' training and lack of enthusiasm, and this recommendation seems to have been sensibly ignored by schools.

As the BECTa document 'Connecting Schools, Networking People'(1998b, p.29) pointed out: 'Teachers who are not involved from the start with learning new systems inevitably feel less confident and enthusiastic about them'. The Stevenson Report

(1997, p.22) says 'The objective should be for all teachers to have competence in ICT and to be confident in its use'.

Identifying lack of teacher competence as a 'hurdle to be overcome before this vision (*the NGfL*) can be realised' Tony Blair in his foreword to Connecting the Learning Society (DfEE 1997a) described the Lottery funded provision which would remove this obstacle. Mention of teacher training in this document is brief. 'A vital part of the progamme for implementation of the Grid will be the development of teachers' and librarians' skills' (page 5). This statement acknowledges only that ICT skilled teachers would be essential to the success of the Grid: while the Stevenson Report had stressed the 'crucial importance of teachers in ICT' (page 22), that is, that teachers educated in ICT would be essential to the success of pupils.

The central importance of initial and continuing training for teachers was highlighted by the DfEE report 'Preparing for Information Age'.
'Teachers need to know not only how to operate a system in the technical sense, but also what educational possibilities it has: these two aspects need to be developed together' (DfEE 1997b p. 35).

At this time computer advertising in the press was becoming more commonplace, with the price of a home computer dropping to around £1 000: web addresses were finding their way into advertising, television credits, and the media: and the National Grid for Learning was a new phrase, and a nebulous concept. Tension was created by publications insisting that the accumulation of ICT was essential if schools were not to be left behind by the Information Society (Haywood,1995). An example of this urgency of style is The British Educational Communications and Technology Agency (BECTa 1998b) publication 'Connecting Schools Networking People' which in its introduction generates tension by stressing urgency:

> 'The Challenge for Education.
>
> With commerce and industry seizing the advantages which ICT has to offer, it is vital to ensure that the education sector is not left behind. In its consultation paper, Connecting the Learning Society, the Government stresses the urgent need to accelerate schools' use of ICT as a national priority, and sets out targets for the education service to attain'

But the challenge for education may have meant, to teachers, a challenge to acquire an education in the uses of ICT without allowing the media and political 'hype' of computers to overwhelm them.

ii. Findings

The issue of training for new technology was of great importance to teachers and administrators.

Table 4.4 *Have you had training....?* provides a summary of questionnaire responses to the question, 'Have you had training for any of these?' and shows that in early 1998 few teachers had undertaken training to use email or the Internet. Those who had done so were IT Co-ordinators, or those with home computers. Such training was skills based and was not directed towards enabling the use of communications technology in education.

Table 4.4 *Have you had training....?*

1ry = Primary teachers (n=20)   2ndry = Secondary teachers (n=28)

	yes		no	
	1ry	2ndry	1ry	2ndry
Using email	1	8	19	20
The Internet	1	4	19	24

The concern of administrators was the management of programmes and finances to ensure that all teachers should be provided with training at their level. The Director of Education provided the following background information about schools in the city: 'As a new authority in our first year of operation, we have had no advisor for IT. We have now appointed an ICT advisor, and training will be down to him' [BG].

This newly appointed advisor reported:

'There is no Teacher Centre here now, and the city bought into a 'hotline' service giving IT and curriculum advice. It is severely under-used, perhaps because it is unpublicised. The training for ICT will be provided by a collaboration between the LEA, private providers and

higher education institutions, and its focus will be on ICT capability in the classroom rather than personal technical expertise'[QI]

In summer1998, the TTA announced lottery funded ICT training for teachers, with training based on some sort of analysis of the present capabilities of serving teachers. Further than that, details of the training were as the advisor put it 'spectacularly unclear', with such issues as assessment, accreditation and who would be the training providers all under discussion. At this time the Needs Identification Materials (which each teacher would use to decide the level at which they would start training) were commissioned and were due for publication in December. (They eventually became available the following April.)

Teachers reported the sort of interest in knowing about new technology that is driving 'the computer revolution', and were extremely frustrated to find that their own learning needs were not being met in spite of their personal motivation.

> 'The main reason I want to do it is some of my students are talking about, oh yes we did this, and video conferencing, and when we get a video conference I think I need to know - I just need to be aware what's happening' [IN]

Untrained teachers expressed dismay and even anger, feeling that the expectation that they should teach without prior training could only be to the disadvantage of their pupils. A primary teacher who did not have a computer at home because of financial reasons said:

> 'We're trying to train the children for the future, to use the Internet and everything else. And we don't know anything about it ourselves. It's ridiculous that we should teach them but not know anything about it.'[EU]

A secondary teacher who had recently completed her teacher training and used her home computer frequently emphasised the importance of time to practice use of relevant applications:

> 'Well at the minute no, I don't use computers with my classes, because I haven't got the confidence, it could all go horribly pear-shaped: I am trying to get to grips with it - I keep sort of tentatively trying to take the pupils up there but it's a waste of their time'[TC]

This anxiety about wasting pupil time can be seen as a practical example of Schon's (1983) 'reflection in action'. The teacher had evaluated her practice in this context and

decided that, on balance, ICT use was not educationally effective. Change in circumstances would be necessary in order to convince her otherwise. Also, there was an awareness that lack of expertise and lack of confidence were inhibiting, and were effects of lack of training.

'I think it's an issue of partly confidence at the moment and I probably SHOULD know how to do things. I've never actually tried sending an email message.'[UN].

Lack of practice after training meant that it may be wasted, since newly acquired skills and understanding could not be consolidated. Lack of access to computers in schools (either with classes, or for personal use) meant that teachers could not practise skills or plan educationally effective use of ICT. Indeed it is hard to believe that a 'deep' understanding (Saljo 1979) of technology and its uses could be acquired by anyone with no access to the machines. Teachers emphasised that training was hard to recall if there was no opportunity to use their new knowledge

'You're going to forget it if you don't use it'[NH]

'And that's why it would be useful it you had a system at home. I mean I can't stay forever and a day working on a computer here but I could if I was at home'[ET]

Acquiring ICT skills is unproblematic for some teachers, but more difficult for others. A teacher involved in training his colleagues to use the Bromcom system reported that some teachers rapidly acquired the necessary skills, while others took much longer to become confident.

'We've had staff training and some who are very keen and pick it up quickly, and there are others who - train them twenty times and they won't be able to log on next time. Just for some reason absolutely daunted by the fact that it's technological'[TH].

Asked to consider their priorities for professional development, many teachers reported competing demands. Other aspects of their work such as creating Staff Development Plans, and other Government initiatives such as the Literacy Hour, SATs, and OFSTED Inspections were all cited as of higher priority than ICT training. A middle school teacher who wished to undertake training said:

'Training for IT here is not on the Development Plan and we at the moment have a rule you can only go on courses to do with that. For me that means, Maths!'[NH]

'There's so many priorities for our time that it becomes a lesser priority. Until it suddenly becomes urgent, and then it's a bit late'[QH]

'I'm not sure it's my priority at the moment' [CE]

Many teachers mentioned time, or lack of it, as a constraint preventing training and practice. Their anxiety about this accords with the effect noted by Hargreaves (1994, p.101) who points out that in the context of innovation teachers feel pressure because of excessive time demands, along with guilt and frustration because implementation seems less rapid and efficient than projected. Stress generated by this may mean teachers feel that unwinding is essential, even if in the abstract they would like to keep going.

> 'We're offered training but it's all twilight sessions when you're absolutely knackered at the end of school days and you've either got other meetings to go to, or you've got a home to got to because you've been to all the meetings for that week. I've been to one or two *(training sessions for specific computer software)* but I couldn't keep it up.'[ET]

> 'When do I have the time? the time to actually do it'[LH]

> 'A couple of years ago there were courses on Word and Excel but they weren't very well attended. People have other things to do' [IN]

> 'If I had a system at home I could become more familiar with it in my own time. But I'd like more training, more training on IT, definitely' {ET]

Other factors such as irrelevant training, problems with software, issues of classroom management, and lack of opportunities to practice with new technology were all offered as reasons why teaching with ICT was found to be stressful, difficult or educationally ineffective, even after training.

> 'He - the bloke that was teaching us was focussing more on the things we didn't need. He wasn't from school. They got a bloke in'[TC]

> 'I think there is a lot of insecurity about it. I wouldn't say our staff was resistant to it. I mean you may be insecure about some other areas of the curriculum but at least you've probably had some training in them. Yet we're being thrown in to these (IT use) and even I felt insecure at times although I knew pretty much what I was doing. The computers acted sometimes in a different way from what you might expect' [DU]

> 'Or something goes wrong. One of them will lock up or something. You've got 30 children in the library, 15 on computers, and there will be 10 hands up at once saying "Miss I don't know what's wrong with this"[NH]

> 'I wanted to be practised myself before I did it with kids'[I N]

One teacher mentioned the value of peer tutoring.

'I did databases last year and it was a case of use teaching each other. We'd sort of guess - see how this works and I'd quickly gen up on it with someone' [LH]

Few teachers had experienced training for Internet use. A secondary teacher undertaking an MA degree said of training for Internet use:

'It's so slow and the idea of spending hours on it...no, I just can't see it.' [QH]

There was also a perception of the 'chicken and egg' effect of training and purpose.

At the moment I think people can't see a purpose for it, you can't see the need. But if you've had chance to have a go, you can suddenly see ways that you might need it. I think it's an unknown quantity isn't it?[DJ]

This interview data confirms that it is not to be expected that people will perceive a purpose for technological applications of which they have had no experience. Teachers expressed some concerns about new technology: in these examples, secondary teachers express reservations about some aspects of Internet use.

'I mean people say to me, you can access information from all over the place but I already suffer from an overload of information! I don't need any more information.'[ET]

'Frankly I don't think at the moment that would be high on our priority list. The danger I see is that we just get swamped with low quality information' [CE]

Do I need to 'tune in' to the Internet when I can get the test match on the radio?[TH]

This tension resulted in such effects as, for one teacher, reservations about their own speed of learning, although it seemed evident that his enthusiastic and inquiring style had secured the position of great responsibility he held within the school. His concern can be interpreted as an example of a teacher conscientiously carrying out a demanding job, but always aware that there is more to do, and new learning to tackle - fast.

'Well you see I've always been sort of a few years or months behind things that are happening. Things that happen here, happen somewhere else. There's people who just enjoy it - it's a hobby. I'm quite a slow learner when it comes to stuff like this.[ET]

As the study began, the acronym 'ICT' was not yet commonly used by teachers. In the questionnaire, questions were phrased specifying the Internet as an example of ICT use. Table 4.5 *What use will the Internet be?* is a summary of replies (n=48) to the open question,

'What use do you think the Internet will be in your teaching in the next year?'

Replies were categorised as 'no use' 'unsure' or 'some use'. 6 respondents left this question unanswered. Table 4.5 indicates that most of the respondents fall into the first two categories, and shows that few Primary teachers had experienced Internet use. Representative quotations are included in the table.

Table 4.5: *What use will the Internet be ?*

	No use	Unsure	Some use
First School Teacher (n=9)	3 'probably none'	6 'I honestly haven't a clue'	0
Middle School Teachers (n=11)	7 'None'	2 'Don't know anything about this'	2 'A useful tool, I've got it at home'
Secondary School Teacher (n=28)	9 'Nothing. Perhaps in several years'	10 'I cannot foresee. Beyond me at present'	9 'A service for seeking information'

Similar answers were given to questions about the fledgling National Grid for Learning and Virtual Teacher Centre. The few teachers with some experience of ICT thought of Internet access primarily as a source of information, particularly for their students rather than themselves. Communication, which has subsequently been emphasised as potentially the most educationally useful aspect of ICT, was mentioned only by the IT Co-ordinators at the Middle and Secondary Schools.

The views of teachers in the study are very positive towards training.

'I'd like more training'[PR]

'I've always wanted to know more and enjoyed doing it'[TH]

'I'm quite attracted to the idea'[LN]

'I'm always interested in staff training' [DX]

'I'm trying to get myself on an Internet course'[IB]

Relevant training for ICT use could assist teachers to integrate ICT into their practice with some rapidity.

'The weekend INSET session was the first time that some of the teachers had seen a multimedia authoring package. By the end of the weekend each pair of teachers had made their own multimedia presentation and were feeling much more confident about working with their pupils'(BBC, 1998 p16).

After her three hour induction session, one teacher in the Multimedia Portables for Teachers Project said:

> 'When I took delivery of the government machine the IT chappie came along for three hours. We spent half the time plugging it in and then later on discovering that we couldn't use the school's existing phone line. So consequently when he left I felt rather as I did the day I came home with Katherine *(her first child)* from the hospital. However I had the advantage of having a computer literate son who hastened down from the frozen north and spent a weekend getting me to start on the basics. Basically now I can try and sort it out and if not I don't feel foolish asking for help' [KT].

The Head Teacher was determined to use the NGfL initiatives to best advantage.

> 'We are having OFSTED coming in on 29th June: but computers are quite a priority in this school at the moment. It will start after Easter ('98) because for the year we're in this project, I want us to take every single opportunity that's available to us. So after OFSTED basically it will be ICT all out. I want to be developing from September onwards but we will have to be doing something after Easter because if we leave it till September we might miss opportunities. We had one morning whole staff training on Databases, so that is fine'[M].

During1997 and 1998, the phrase 'Lifelong Learning' was gaining common currency. The government had established the National Advisory Group for Continuing Education and Lifelong Learning, and announced four major initiatives which would affect lifelong learning - the New Deal, the University for Industry, the creation of Individual Learning Accounts: and the National Grid for Learning. The government's white paper Excellence in Schools linked these initiatives to its aims for school reform. All this was directed towards initiating a 'cultural revolution' in the UK, to create a

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'learning society' (Fryer, 1997) in which people could be expected to cope better with change through a flexible and ongoing approach to learning.

Drigg School

Teachers at Drigg expressed their motivation for ICT training and described the goals they set themselves. They had been consulted about the number and type of computers the school would acquire, and where these would be sited. For them, the new computers and the new opportunities offered by access to the Internet made undertaking training imperative. Change in the school situation was seen here to have a positive effect on professional development. The school acted as a learning society, within which individuals progress through dialogue with one another and by organising their own learning.

> 'I am aware that I need to be trained because I don't know how to use the Internet and eventually we are going to have to. I think we are getting four computers linked, so I'm going to have to make sure the children use them sufficiently[L].

G saw formal training as important for her professional development. She was also motivated by the skill level she observed among her pupils. The school community at Drigg contains a high level of technical expertise, which both supports the impetus to learn and drives it forward. G expresses no indication that she is threatened by the computer literacy of pupils. She wishes to teach them at their level, and to do so she must move with and ahead of them.

> 'I really do need to do something and its no good trying to do it after school because I just haven't got time. So it's got to be an organised course. Yes, it will have to be. There's programmes here that I don't use properly myself or with the children. And the children are coming up with so much better skills now on the computer. I think there are only three children in this class that haven't got one at home: so their skills are much better than mine and I have to keep up with them'[G].

The head teacher M was seen as supportive. She accomplished changes by engaging with the requirements of individual teachers, creating a community of reflective teachers who relied on her support. Teacher E indicates that learning with ICT is a personal venture, an interaction with the machine. She takes new computers home.

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'I hope to have some training. I know vaguely about it. I'm sure we will have training for it. I think it's all part of the package of going on the NGfL isn't it, that we have to have training. And M is doing quite a bit and I'm sure she will give us training.'[E]

And I also, actually, personally, like to get on the machines and that's how I train myself. You know, as soon as we get a new machine in, I've taken it home and just worked on it to get to know it myself. I find that's the easiest way of doing it. And then when courses come up I tend to go one the ones which are the next stage on. I can teach myself all the basic stuff. You're best sitting there and teaching yourself'[E].

'We had an Acorn at home so I am sort of used to computers, and I've been IT co-ordinator, so whenever they've bought new machines into school, I've had the training and I've explored them myself'[B].

Teachers at Drigg indicated that for them, training to use new technology was a real priority. The Deputy Head was also the IT Co-ordinator, and a decision was taken to change this and appoint a new IT Co-ordinator from amongst the staff. L accepted this position, and she and H enrolled for a training course provided by the LEA. The training at the start of September term1998 is described in Phase 2 of this research.

iii Discussion

There was amongst teachers a belief that training was perhaps the single most crucial factor which would make a difference to their involvement with ICT.

None of the teachers interviewed said they did not want training for ICT use. Many had other priorities for their professional development, but all of the teachers who discussed training -91% of the sample - expressed interest. This evidence belies the media image of teachers as Luddites, reluctant to become involved with technology, and fearful of its effects on their world, in which computers are for pupils but not for them. The following text is taken from a contemporary advertisement, illustrative of this strange determination on the part of the media to render teachers obsolete in favour of computers. Here the advertisers note that *even teachers* may use their network:

> 'The Highdown Information Hub network provides structured information and
> communication to some 1,100 participants. Network users include not only all pupils, but
> also many teachers......'
>
> (TES 13.3.98 Microsoft In Education advertisement).

At the start of The Multimedia Portables for Teachers Project, teachers were given a laptop computer and 3 hours' training in its use. The report (BECTA 1998a, p.18) notes: '.teachers were reasonably happy with the support and training they received, though most would have appreciated more. [...] Teachers attitudes towards the project and its outcomes were overwhelmingly positive: 95% of teachers agreed that the project had allowed them to develop their teaching...Teachers were clear that they were not the only beneficiaries of the project, 90% agreeing that 'the school as a whole' had benefited, and 86% agreeing that 'pupils had gained a lot' from the project'.

Teachers thus demonstrate their capacity to learn in a context where there is a purpose to do so and where learning support is offered - a capacity they share with other human adults, but which the media and some sections of society find it hard to accept, preferring to reinforce and transmit a stereotyped image of dusty, fossilised teachers forever insulated from lived experience, jealously guarding their ivory tower knowledge, and determinedly rejecting the advances of technology. Here is another example of 'teacher bashing' in which the real factors influencing teachers' use of ICT are ignored in favour of the belief that teachers do not want competence.

> 'The traditional concept of a child's world view being presented through one teacher in
> carefully controlled, curriculum prescribed chunks becomes ridiculous. [...]the world's
> available stock of knowledge and information is expanding so rapidly that it can no longer be
> contained neatly in a syllabus. [...] It is understandable that teachers should feel vulnerable
> when confronted with this image of the future. But if their new role is to help us all cope
> better with change, they will have to embrace change themselves first. [...] They should want
> competence in using ICT for themselves. Pleading ignorance because they haven't been sent
> on the training course yet is not good enough'
>
> (Xemplar 1998 p 17: David Gordon, Vice Chair, Campaign for State Education).

For teachers, training in ICT use seemed a crucial element enabling them to evalate critically its educational effectiveness, not a clip-on luxury which they might manage without. Teachers who had experienced one-day IT skills courses noted that once back at work their new knowledge was quickly lost due to lack of hardware, time, and no productive purpose for regular IT use. It was clear that appropriate training was a priority for all teachers, since everyone would be expected to engage with new technology. At this time the Teacher Training Agency took over the provision of training. The National Curriculum for Information and Communications Technology for students undertaking initial teacher training was issued. This curriculum stressed that skills training should be coupled with training dealing with ensuring the educational effectiveness of technology in classrooms. That is, teachers were to be offered an education in the application of the new medium. During Phase 1 of this study, this provision was in the future and teachers were not aware that it would take place.

Staff at Drigg did not attempt to use the new computers to access the Internet with classes, or for email projects, until they had undertaken some training. This delay could be interpreted as wasting the potential of the machines, and denying opportunity to pupils. However another interpretation is that it was crucial to establish a whole school policy for ICT, to obtain permission from parents for children to use the Internet, and most importantly to ensure that teacher competence. Some children used the machines after school. Such independent learning should not be underestimated. It is evident that children using the Internet for their own purposes are establishing a relationship with the technology, and acquiring information. They are learning to become part of a culture with integral technology. Further than that it is difficult to judge whether 'playing' on computers by looking at web pages helps children acquire knowledge or develop mentally. The nature of web pages allows the user to access a huge amount of information fairly rapidly. What meaning is made of the information cannot easily be discerned by conversation with the children. Attending the after school Internet group, I noted a high level of interest, and a slight reluctance to discuss what had been found. The children's choices of web pages were Homer Simpson, Spice Girls, and ManUs. The line between entertainment and education can be crossed, but in Drigg's computer club in summer 1998, it was accepted that

entertainment was the aim of Internet use. It would be unfair to the children to claim otherwise.

4. Purposes for ICT

i Context

Indications of uncertainty about the nature and meaning of new technology amongst teachers, and acknowledgements of lack of expertise, were coupled with strong interest in finding out more about the educational potential of new technology. At this time special supplements to broad sheet newspapers became available, and touched on this issue.

> 'A rumour starts in the staff room that the school is on the Internet but you're not sure what that means. When the head gives out her email address at the open evening, and a previously Luddite partner suggests going halves on a computer and getting on the Net from home, you think its finally time to take notice.

> You first must work out what the Internet has to offer you as a front-line teacher. The good news is that the Internet is only about two things, finding information and communicating. Both are invaluable for the perennially isolated class teacher' (Educ@guardian 13.10.99 - the second edition of this publication).

The Internet was seen as interesting but there was little experience of its use in classrooms. This is an indication of the relative novelty of Internet access and email communication in 1997/8. Home use of the Internet was confined to those teachers who taught IT. Pupils whose parents had a home computer were beginning to bring material downloaded from the Internet in to school. Little of this was of great value, because the reading level and therefore the content was hard for pupils to understand. But at this time the growing ambient social use of the Internet and email resulted in increased awareness of the communicative functions of computers. In addition, the NGfL initiatives were beginning to filter through, again increasing awareness of what might become possible. Still, in Phase1 of this study, the educational value of the Internet was conjectural.

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ii Findings

None of the schools had Internet access at the start of the study.

The following teacher sums up the problem.

> 'We're not connected yet, but I'm interested in finding out and using it. But until it's there,
> it's difficult to know what you're doing' or what you can do'[NH].

Eighty-five per cent of teachers, including all First School teachers (n=9) in the questionnaire sample had never used the Internet or seen it used. Of the sample, 8% (one Middle and three Secondary teachers) said that they used the Internet frequently; thus only these teachers felt that the Internet could have an impact on their teaching. Use of email was similarly untried or infrequent. The link between a home computer and developing professional practice in ICT was clear, as was the amount of interest in finding out what was happening in the world of ICT.

> 'I've no idea how it works, so I would be interested, but at the
>
> moment I've no idea how I would use it particularly.'[DJ]

Of all the sample, only one teacher felt that Internet access would be an irrelevance to pupils, being unconvinced of its educational purpose. The teacher was not expressing unwillingness or reluctance to learn, but with the benefit of experience of educational innovation is reserving judgement until there is reason to react positively. The teacher is prepared to reserve her right to change agentry: the 'someone' she mentions (who could be seen as a generalised ICT innovator) will have to accept that consultation with the teacher is essential in order to proceed.

> 'For me it is an irrelevance. Obviously someone has come to the decision it's a worthwhile
> and good thing but nobody has persuaded me yet that it is so. Their first job will be to
> persuade me and the likes of me that there is a point to it.'[QD]

Teachers who had asked pupils at Askill secondary school to research topics on the Internet at home found that they were likely to be presented with random text and pictures. It became evident that a priority for teachers must be to help pupils develop

the research skills necessary to assess the suitability, accuracy or relevance of such information.

The Director of Education acknowledged that implementing ICT initiatives was a minor fraction of a teacher's work load.

> [BG] 'All schools have had a copy of Connecting the Learning Society. How far it will have gone round the staff remains to be seen. Not very far I shouldn't think And if it did, it's in a pile, waiting for that magic moment -'
>
> [LD] Until there is a purpose for it?
>
> [BG] Yes, a purpose, that's right. Purpose rather than time.
>
> [LD] One generates the other doesn't it really?
>
> [BG] Allegedly -

Given the strong purpose of the national curriculum with its IT component, and computers to use with children, ways to ensure that the technology supports learning begin to evolve as teachers and pupils collaborate in schools. A teacher from Banna school gives an example of this process happening as an everyday occurrence.

> 'Oh well yes it's like anything, IT. It takes a while to get used to it and to understand what you can do with it. And to think, well, how can I use it in different ways? So much time is spent just surviving - someone will say "How do I do that Miss?" - " Well I don't know! Shall we push this and see what happens?"'[NH]

Drigg School

The head teacher, convinced that her staff would find the Internet a useful resource, chose an RM package which included filtering software.

> 'The Internet, I think it's going to be so easy, they'll be so interested in it, I'm sure. I think if they can download, the teachers themselves won't be worrying about what's on line and what the children are doing. There will be lots there'[M].

Several teachers at Drigg believed that one of the best uses of ICT was for communication, while teachers in the linked schools still saw ICT as information provision. This may reflect a different range of experience of technology than teachers

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in the linked schools, or may indicate of how thinking was developing in education at that time, partly due to the NGfL initiatives.

'When I was on the OU course we used to share worksheets. That's quite nice. If you are in a situation, like we are, in a small school where you're the only one who is teaching a certain year group, it's nice to actually share your ideas with other people. You can with email'[I].

'I think it would be much more interesting to use it for talking to people'[B].

L felt that research was a real purpose for Internet use, although she wished to ensure that children didn't spend too much of the short school day surfing. This approach is very teacher centred, necessarily so since the teacher had envisaged her own use of the Internet as a first step to finding information relevant to the programme of study she was delivering.

'It will be good when we get our own ISDN line, if we can get on to it and download information for research purposes. Although I wouldn't like them to go in and just put a few key words on the Internet at school. It takes such a long time to focus down what you want. They would spend a long time just not getting anywhere. So I think I would probably download the information first and then limit how much they could actually look at it'[L].

'The computer room has to be timetabled and organised'[G].

'There will be the question of schemes of work and progression'[E].

'I think I need to know how to use the computers first'[A]

'We'll have to wait and see. Nobody knows how it will work out until it (the computer room) is there'[H].

iii Discussion

It is the non-linear, hyperlinked nature of the Internet that requires of users new skills and strategies in their search for information (Pachler, 1999, p52). Teachers intended to intervene in this search, bookmarking resources to avoid either time wasting or disappointment on behalf of pupil. It is an example of what Mercer calls 'the teacher's dilemma':

'the problem of reconciling an experiential, non-didactic 'progressive' approach to learning with the requirement that learners follow a given curriculum and do not waste their time chasing intellectual red herrings or wandering up alleys that the teachers knows full well are blind'

(Mercer 1993, p36)

Drigg teachers had decided that their responsibility was to deliver the curriculum, not to allow free reign to the glitzy distractions of the Internet. Teacher development depends on this interaction of the practising teacher with innovative ideas - their own, or those of others (Hargreaves and Fullan,1992 page 157).

Reflection as learning for teachers was evident in the Drigg school data.

This school provides an example of teachers having up-to-date equipment, access to the Internet, a supportive community of colleagues and parents, interested children - and still, in 1998, finding themselves unable to give the subject of ICT priority. Their OFSTED inspection (which was a resounding success) not only soaked up all available time, energy and commitment, but had a full stop effect on the school's innovative drive. The computers arrived a week before the inspectors, and were kept in their boxes because the Head felt that her staff would be judged on their use even though there was no chance to practice, discuss and implement educationally effective strategies. This professional wisdom allowed the teachers to concentrate on the all-important OFSTED visit without feeling the pressure to rush into change. Their change agentry as individuals and as a group is evident. As Fullan points out 'every person is a change agent: change is too important to leave to the experts' (Fullan, 1993, p39) and this pacing of change must account for some of the success of the school

5. The role of the teacher

i Context

Using the Internet as a resource doesn't make teachers redundant but it does allow them to focus more time on students who are having problems. It's a tool for independent learning.

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The interesting point about this quote is that it is in a publication with a target audience of practising teachers: none of the teachers in this study ever indicated imagining that the Internet *would* make them redundant. The idea that computers can (or should) replace human teachers has its roots in science fiction, as in this example where a boy, Fizzy, has been educated entirely by machines:

> 'He had a type number; he had been designed; he had specifications and probability. He had done everything that had been required of him. But he had not lived. His mind was a vivid island of intelligence in an innocent body' (Theroux 1986 p.228).

Fizzy's problems in the novel stem from his isolation from other humans. The concept that computers do better as teachers than humans draws also on the 'Mindstorms' idea of Papert (1980) in which the 'poweful idea' of the title is partly that learners might profitably think in machine code, or a programming language, in a way that would train them for problem solving in other areas of their life. A central tenet of the computer revolution is that the role of the teacher will, indeed must, change. In revolutionary terms, teachers are dispensers of information, who must relinquish their position of information ownership now that computers can provide much more, much newer information, ever more rapidly. This is of course nonsense. It is computers which are dispensers of information. Teachers are people who attempt to enable others to develop meaning and knowledge from information, whatever its source. Those who hold the stereotype of the teacher as information provider most dear tend to advocate computer 'solutions' most strongly - not surprisingly, given that huge profits are to be made from educational computing, IT firms are foremost amongst this group. But others are also keen to champion the computer revolution.

For example the ICT expert Bridget Somekh, speaking at a conference, said:

> 'The British education system is designed for the nineteenth century: we are stuck with children in boxes, and we have to get away from what is not a useful learning environment; it is not in human nature to sit with 30 others and learn.[...] Something needs to give otherwise we will never make full use of these tools' (Oracle 1999)

The education system is not perfect, but neither is it to blame for all the ills of society. It is not especially natural to sit alone with a machine in order to acquire information. And, whilst agreeing that something needs to give, a teacher would be more likely to say that otherwise we will never *realise the full potential of our children*. The role of the teacher must therefore be understood in its entirety, and the role of the teacher as much more than that of a provider of information.

The words 'computer' and 'revolution' are often found linked to one another. In education, computers were (are) predicted to revolutionise schools, radically altering the role of the teacher (See Appendix 7). Articles in media publications for teachers at this time attempted to inform, ridicule or cajole teachers into accepting the depiction of themselves as Luddites:

> Serious about revolutionising classrooms: Technological problems appear to have been solved, leaving education with the most important question: what do we want to do with it?
>
> (TES Computer Update, 10.10.97 p 3)

> Holding Teacher's Hand: The truth is that despite the millions spent on ICT in schools, many teachers still cannot programme even a video recorder. Teachers are sorely tempted to stick their heads in the sand. (TES Online, 15.5.98 p 9)

> Keep Up With the Whiz Kids: Change is the hardest thing anyone has to do, and that includes changing your working methods. Teachers who are wary of, or even phobic about, information and communications technology (ICT) might find the contents of this magazine rather glib, with its underlying assumption that it could help them both personally and professionally. (Editorial, TES Online 10.7.98, p 3)

The first edition of Educ@guardian was produced on June 2nd 1998. Its front cover reads:

> 'Join the Party! Are you taking your first steps in using computers in the classroom? Help is at hand'.

In 1998 educational computing had been a feature of classrooms for about 17 years, that is since Kenneth Baker launched the 'Micros in Schools' scheme by announcing that the 'kids of today' should be equipped with 'skills for the information age' (Scaife

and Wellington, 1993 p.16). Still the persistent image of the teacher as novice was reinforced.

Inside, the short editorial reads:

'IT, ICT, CD-ROM... a language full of baffling acronyms merely adds to the sense of dread many teachers feel when confronting computers as teaching tools for the first time.'

The two headlines on page 1 read:

'A Student Revolution' : 'Negotiating the Obstacle Course'. The byline for the second article reads, 'How can teachers be helped to overcome any psychological hurdles they may have about computers?'

Some teachers may have found this reassuring, or helpful. But others may have been adversely influenced by the patronising tone, and non-teachers may have been encouraged to accept the myth of teacher incompetence or rejection of technology. I return to this in later chapters. But a teacher like those at the study schools, with a working knowledge of computers in classroom contexts, might have turned to this publication for up-to-date advice or information in 1998. A 'Questions and Answers' column appears on Page 4. These are the first two questions, after which they do not improve.

Q: I teach 28 children for 20 lessons per week and we have one computer in the class. How can I integrate ICT into my lessons?

A: Buy some multimedia software such as Hyperstudio and a scanner. Then children can work on individual pieces of work with pencil and paper.

Q: What operating system should I choose for a home computer?

A: All manufacturers provide computers with easy to use point and click environments, provided you can use a mouse (a hand-held control panel).

There is obvious doubt that such skill would be within the capability of a teacher, who may not have heard of CD-ROMs or a mouse. It is impossible to estimate the effect of such patronisingly silly replies, but they are included here as indicators of the sort of ICT information teachers might find in the press. Many more examples could be given. The most common theme is that of 'revolution'.In 1997, reviewing its relationship to ICT and the role of the teacher, the profession found itself in a 'Catch 22' situation:

(a) How can you use new technology effectively if you have no experience of what it can do?

(b) How can you gain experience of what new technology can do if you do not know how to use it?

Teachers therefore required the chance to look at new developments and examples of technology used in educational practice so that they became aware of the opportunities it offered. They also needed an awareness of educational purpose for ICT use. And there remained the possibility that once provided with experience, purpose, or both, teachers would find the machines themselves fascinating, involving, or just plain useful.

An IT firm advocated the deployment of resource managers to work alongside teachers. The financial implications of this are prohibitive for primary schools.

> 'Teachers alone will not solve the problems of implementing ICT in the classroom[...] -
> resource managers working with teachers: the teacher manages the learning; the resource
> manager manages the leaning environment'
>
> (Xemplar 1998 p 28).

The following excerpt from the Guardian Education supplement summarises the prevailing thinking of those advocating revolution and injects a note of caution.

> 'The Germans are experimenting with courses via the Internet. Numbers permitting the
> computer tutor can even add personal feedback to the student - especially if the tutor itself is
> a computer! Learning on networks will create new styles for lessons and, at least according
> to its supporters, be more enjoyable. The Internet also changes the idea of the teacher/pupil
> relationship. Computerphiles have long dreamed of teachers becoming less of a source of
> knowledge and more of a facilitator and manager of learning resources. [...] As initiatives by
> IT quangos such as NCET and Schools Online have shown, it's not what you've got but what
> you do with it that matters. Too often the emphasis is on the superficial, physical aspects of
> computer technology and not enough on the intangible, complex and ultimately more
> important implications for teaching and learning in future' (Guardian Education 6.5.97 p.3).

Yet the research data did not indicate that teachers anticipated a revolution, but that ICT was fascinating and created a climate of optimism. A wider indication that teachers might be interested in ICT developments can be found in a Guardian Education report.1998 had been designated 'UK NetYear' in order to boost uptake

and awareness of NGfL initiatives: by the second week in January, 4 000 schools had registered an interest in UK NetYear. As the report points out, 90% did so by snail mail - lack of technology not being a barrier to interest.(Guardian Education 13.1.98 p 5).

ii Findings

ICT can support the role of the teacher but may not necessarily supplant it. A teacher of Year 2 children said:

> 'How could anything be as good as a teacher? I think the communication's limited - children need the sort of human communication, actually speaking with other children, with the teacher. People sitting in other places watching a screen instead of interacting - I don't know I think that's progress really.'[DJ]

The outcome of revolution replacing teachers with computers is a dream of an ideal society in which young people are a homogenous group desiring appropriate kinds of knowledge, and set on a quest to attain it. Fortunately, teachers have already begun to develop the sort of special relationship with ICT necessary to ensure it can be usefully deployed by learners.

> 'I think all the students who are regularly upstairs in the IT rooms, mornings, before school, break time, lunchtimes, after school., its quite a big minority. They are the ones who outside of school who are on the Internet, communicating, down loading information. I think it's great because they are improving their research skills but we've got to teach them how to use it once it comes down and that's the same with any research. They go to a library and find something out of a book. How they use it is where we come in.'[QH]

An Askill teacher gave their opinion of the likelihood of the Internet making teachers redundant.

> 'I don't think teachers here will see the future as the teacher being replaced by the Internet, because there's so much collaborative work. There's so much other stuff that goes on here rather than the taking in of knowledge'[UX]

Teaching is a vocational occupation (Hargreaves, 1994) and teachers did not see themselves conforming to the stereotypical image of didactic instructor, delivering information to a passive audience of children. Therefore the constructivist idea that

computers may offer a learner centred approach did not strike them as a radical change. They already offered their pupils a range of approaches, appropriate to the task in hand. The addition of computers to this range was welcome - as long as it was clear that there would be real gains for the learner, rather than simply novelty. This Askill teacher expressed a sense of frustration with the post-Piagetian style of training for computer use:

> 'We tend to forget that we are called teachers for a reason. The reason is we are supposed to teach. I have never understood how children are supposed to learn simply by a process of osmosis. If they haven't got the basic knowledge, or been taught the skills, how will they move forward themselves? And it is the same with adults' [JO].

It seems, then, that a misunderstanding of the role of the teacher in the 1990s is at the heart of the media push for revolution. The teacher quoted above, with her interest in developing the child, is unrecognisable as simply a 'sole source of information' as this IT firm would have her:

> 'An insight into a key cultural shift is evident here: participating teachers are evolving from sole sources of information to enablers - teaching children how to learn...'(TES 13.3.98: Microsoft In Education advertisement).

Teachers have always tried to help children learn how to learn. They will now also help children how to learn with computers, which there is no reason not to do, if learning can be usefully accessed this way. Still the received wisdom remained, though the IT firms were trying to make it sound less threatening: the role of the teacher would change from didactic instructor to technical support assistant, and facilitator, and mopper up of problems ('weaker areas') that computer could not reach.

> 'A Microsoft Spokesman said: 'The classroom of the future will be dominated by computers that talk, listen and can even see. We don't believe that computers will replace teachers, but the role of the teacher will change. There will be less talk and chalk'
>
> Guardian 17.1.98 (BETT week).

> 'Professor Hinchliffe, former managing director of ICL, Museum of Science and Industry at Manchester: 'Teachers will have an overseeing role and will be freed to concentrate on children's weaker areas'

(TES 26.6.98).

'The Royal Society of Arts urged schools to move away from the rigid 9am to 3.30pm three term year attendance model and stay open all year round. Teachers would work more shifts. Valerie Bayliss, former head of youth and education policy at the DfEE said 'Britain's 19th-century education system with school attendance patterns devised for an agricultural society and the teacher seen as the fount of all knowledge simply will not meet the needs of the 21st century[...] Teachers must be ready to say they don't know the answer to a question, but will find out'

(TES 3.6.98).

Section 3 of this chapter provides evidence of teachers' willingness identify their own needs and to find out, and this evidence was collected before any of them could have read the above exhortation. The Director of Education held the view that many sorts of educational change were happening, and that the role of ICT might be to rescue the learner from the negative effects of the most prescriptive of them.

'The changing nature of education for all sorts of contextual reasons, one of which would be technology, ought to be quite an important topic for teacher training [...] a curriculum that's getting progressively narrower, and all to do with assessment, has an even greater chance of turning pupils off. What's necessary for the future is that pupils are involved in self directed learning'[BG].

Drigg School

The following is part of an interview with two teachers, considering the question: 'As computers become more common, the role of the teacher may change - what do you think?' These teachers are convinced of the value of the role they hold.

L: It's rubbish. They come to me - some of the ones in my class are starting to learn more than I retain in my head. They do a lot of research but they need to know what to do with it when they've got it. They need to know how to use it. Some of them are streets ahead with some of the things they know because they are specifically interested in whatever

H: But they still need guidance as to how to use it and when to use it

L: And to direct them. They sometimes get too specific and you can show them ways round it

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H: So they have a structure for the information collection. The computer would have to be set up with loads of options for 'I don't understand this bit' whereas with a teacher there, they could say, Oh yes, and explain it a different way.

Teacher I gave a summary of her understanding of the teacher's role, which is to do with teaching learners how to learn. Where this is the case, revolution has already happened.

'I don't think computers will really make much difference. The only thing a PC will replace would be like a book for example. Teachers are supposed to teach the skills to learn, not just spout information all the time. So I don't think teachers will become redundant. No. Maybe they'll be forced to improve their IT skills though'[I].

The following teacher had envisaged the classroom of the future, but felt that such a scenario dealt only with older children. This accords with the comments from primary teachers in the linked schools, who felt that young children required human contact. There is an element here also of the primary teacher's idea of what it is that secondary teachers do, assuming that older children are independent learners (which they aware is a fallacy, but it allows this sort of joke).

'The way society is going - I'm assuming that within a few years computers are going to be old hat and everybody is going to have one and everybody is going to work on it. The GCSE syllabus might be on the computer; we might get to the stage where older children never go to school. They might just be plugged in at home to a programme. It already does happen doesn't it, because it happens in languages in secondary schools. They sit on their own computer and work away. Teachers go around and say, are you alright? Any problems?'[G]

iii Discussion

An IT firm provided this list of how teachers might benefit from ICT use. But it is actually a list of how new technology might influence anyone. It is included here as an example of the high expectations for ICT in education which IT firms were generating, perhaps philanthropically, perhaps in order to sell their wares.

'Teachers using ICT

• can re-evaluate their role

• can rediscover how to learn

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• can define and evolve different learning strategies

• can find relevant resources

• can accelerate their own personal development

• can find more opportunities for individual teaching and group work

• gain a better understanding of the way ICT is altering their own curriculum area

• gain access to current thinking

• improve their understanding of their pupils' learning'

(Xemplar 1998 p11)

The rise of the information society, initiated by defence ministries networking their computers, and furthered by academic establishments, had by 1997 barely touched the study schools. This is partly an indication of their insecure financial status, and partly an indication of the nature of the work that adults in schools undertake. Dealing with large numbers of students, coupled with the requirements of society that the students will attain set goals and behave in set patterns, leaves little energy or time to review global trends or become involved in cutting-edge work practices (though of course this does happen, because some teachers are highly self-motivated and effective people). Without specific top level 'interference' on their behalf, it is a titanic struggle for teachers to organise real development in their work context. Considering 'The role of the teacher', IT firms and other advocates of ICT envisaged improvement of this. However teachers know the value of the multiplicity of their current role. Their role changes constantly, as they interact with dynamic circumstances, a variety of other professionals, and each individual child. The addition of a further role, which might rather clumsily be called 'User of ICT for educational purposes' does not diminish the value of all the other teacher roles. And yet teachers in 1997/98 were confronted with a barrage of expensively persuasive advertising material designed to convince them (and the world) that their profession was of little worth, and would be swept away by a new order of machines which would efficiently deliver information. Fortunately teachers have developed a resilience to society's attitude to them: and they have little time to look at adverts.

Writing for teachers about designing interactive tuition using the web, Brooks claims:

'The World Wide Web is changing both what we teach and how we teach it' (Brooks 1997 p2). However he does not envisage the replacement of teachers by machines: ' Once you have your courses totally Webified, will they still need you? I suspect the answer is yes. There are two reasons for this. Essentially no humans are good enough at self regulation that we can learn new, difficult areas outside our expertise without some teacher. Also, as time goes on, learners will need to know more – not less'

(Op. cit p.32)

It is possible to challenge these rather weak reasons for retaining teachers; the interesting point is that the potential for machines to replace teachers is accepted, and the Brook only 'suspects' students will still need teachers. Watson in the ImpacT report which evaluated the impact of IT on children's learning, provides a more robust depiction of the teacher's role once ICT is integral:

'Effective use of ICT was supported by individual teachers' understanding of, and willingness to experiment with, the underlying philosophy of the software being considered for use by the pupils'

(Watson,1993 7.3.2.1)

This debate is really academic until schools acquire enough equipment for patterns of pupil use to change. Dicussion of the role of the teacher continues in later chapters. However it is worth including here the views of the feminist writer Dale Spender, to indicate the prevalence of the idea of the changing role of the teacher. The data indicates that teachers in schools remain unconvinced that they are rapidly becoming obsolete, since their experience of the reality of their school situation provides no indication of revolution. Spender, writing about a society in which IT is universal and the environment is 'data-saturated', believes that the growing volume of information is what will defeat teachers. Her argument is flawed by the use of 'information' and 'knowledge' as synonyms.

'The theory about knowledge and its transmission is also becoming increasingly difficult to sustain. In the electronic world, we don't have knowers; we have users. The transition has been going on for the past few decades: the role of the teacher as authority figure and knower has been in decline as the amount of available information expands. [...] The 'ecology of knowledge": while knowledge was scarce, it required centralisation and conservation. But now that we live in a data-saturated environment, our distinctive information problem is one of selection, as much as conservation'

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(Spender, 1995 p 102).

Knowers and users are not mutually exclusive. Users do not necessarily gain knowledge. Some sorts of knowledge have been retained by some sections of society for their own ends (for example, until the beginning of this century the knowledge required for medical practice was retained by men). But knowledge amongst humans has never been scarce, although some sorts of knowledge may be undervalued (for example, how to cook dumplings). That does not mean they are not knowledge. 'The role of the teacher as authority figure' can be taken to mean two things: (a) That teacher's knowledge of a subject discipline confers on them the distinction of being an authority on that subject. Teachers are not the only subject experts: an eminent historian is an authority: an eight year old may be an authority on playground clapping games. ICT can not replace such authority. It may enable it. (b) That the teacher acts in an authoritarian manner, in which pupils are expected to conform to expectations for their behaviour. I believe that teachers would gladly relinquish this role, it being an unfortunate consequence of many factors, few of which are under their control, such class sizes and underfunding as well as complicated social expectations.

6. Problems

i Context

The word 'solution' is common in IT advertising meaning, not the answer to a puzzle, but a marketing opportunity (Appendix 7). ICT is often depicted in advertising material as a panacea for the problems society perceives in its education system. The reality is a little more complex. The following headline appeared in the TES in 1998, with a picture of Tony Blair watching pupils use computers. The busy world of the larger school obviously horrified him.

> (Headline)National Grid is a virtual reality.

> *caption:* Tony Blair in the IT room at Holland Park School which he described as 'an oasis of calm'(TES 10.10.98).

Anything new is never all good, and although the benefits from ICT use were the subject of media interest, teachers and others involved in education have enough

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experience of technological innovation to be cautious rather than overly optimistic. Some evidence was available indicating that technology could not be a 'quick fix' answer to intractable problems(Jones, 1995: Winston 1998). The restructuring of schools to integrate technology reflected what was happening not just nationally but globally, with what Castells (1998) calls 'informationalism' emerging as the material foundation for a newly global society. Information Technology was the indispensable tool supporting change. In schools, the opportunity to join in with the changes had come late, and so there had been time for some aspects of change which might create problems to emerge. This short section looks at teachers' perceptions of emerging problems precipitated by ICT use.

ii Findings

Teachers in the study had identified some areas of ICT use which they felt might be problematic. Several Askill teachers mentioned that it was important to have clear learning objectives for pupil use of ICT, and strategies for the monitoring and assessment of learning using ICT. It was seen to be easy to misuse technology. A science teacher explained his attempt to steer a middle course:

> 'At the one extreme you've got the danger of the sort of Luddites -"We don't hold with this new-fangled technology" - on the other there's this "technophile" thing: "Oh it's amazing we'll use it for every conceivable thing - even when it's not appropriate we're going to use a high-tech solution."[TH]

Teachers, commonly represented as having a fear of technology, indicated that the reality may be that anyone would be fearful of placing reliance on the sort of computers universally found in schools.

> ' You know, the printer doesn't work and there you are - Somehow we're used to dealing with that in the classroom, or we try to manage the situation so that they don't all need help at once. But on the computers, that tends to happen and we are running around like headless chickens.'[DU]

> 'I'm afraid I'm a bit of a phobic on the computers. After the first training day I was convinced the computer was against me. It really did have a life of its own.

A different order of problem was that a personal conflict of interests arose when teacher training for ICT during normal school time meant that classes had to be taken

by supply teachers. This difficulty is a perennial problem for teachers. Disrupting classes can be educationally damaging for individual pupils and can cause problems for the entire school. A secondary teacher, talking about leaving one of her classes with supply cover during ICT training, said:

> 'I've got some very difficult groups. The supply teacher jumps on me and tells me all the problems so I have to follow them up: so the lesson is wasted and my time is further wasted before I can move on to the next lesson.'[QD]

Some teachers identified the expense of training as a major problems for schools. Also, ICT resources are scarce and badly maintained because of lack of proper funding, making use of the machines a risky enterprise. Lack of any technical support compounded the problem in primary schools.

Teachers also stressed that they realised the need to teach study skills. There was little evidence that pupils found it easy to learn simply because they had better access to information.

> 'The danger I see is that we get swamped with low-quality information. It depends on having the knowledge to pose the right question in the first *place [....]* They stick the CD in the slot and download pages and pages of stuff and they think that's a wonderful piece of homework and it's rubbish'[TH].

Drigg School

Teachers were anxious about inappropriate material on the Internet, lack of technical support, and shortness of time - common themes in all the schools.

> 'Some of the material on the Internet. I have heard that they can still get through screens even though the ones that come to school have been 'vetted'. They can still get to material that might not be suitable. We need to be careful'[L].

> 'I find that the main problem with IT in a school of this size is really there's no technical support. So if you've got a dodgy printer how are you supposed to deal with that, or anything else, when you've got the rest of the class wanting help with other work?'[I]

'Also in secondary schools you have free periods and things and somehow in a small school, because there isn't so many people to share all the jobs, everyone's a co-ordinator of one, two or three subjects, I find it quite frustrating and time consuming'[B].

'And of course the other problem is when you have, say, three in a family and they all want to do their homework on the computer and you only have one computer. And there's another problem. N (a teaching colleague) was talking about it. She couldn't do some of her reports. She could only do four of them because her son had a deadline date for his project. So they were both wanting to use the computer. You don't have that problem if you're writing by hand do you'[A].

iii Discussion

Classroom management becomes very difficult when machines break down. An unreliable machine is worse than useless to a teacher, because of the disruption breakdowns cause, especially in rooms full of highly volatile young people. Teachers were thus understandably wary of computers. Since little technical support was available, the unreliability of computers and peripherals proved a real barrier to sustained use. Perhaps printer problems might be held 90% responsible for what is called 'teacher resistance'!

Difficulties such as negotiating useful ways of using material from the web, unproductive searches, and social use of email in work time are all examples of ICT related problems that the teaching profession will have to address. At this stage such problems were emerging as issues.The NGfL initiatives were designed to address problems of lack of hardware and connections, but their effects were not evident in schools at this stage.

7. Predictions

i Context

The future was seen by one IT firm as hurtling towards educationalists because of the arbitrary phenomenon of the approaching millennium.

'As the millennium approaches, the search for education models worthy of the next century is gaining urgency'(TES 13.3.98: Microsoft In Education advertisement).

However there was some recognition that the input of the teacher would be required in order to make computers deliver education.

> 'The Tech Truck made their first stop.... Questions were posed and children were told the answers could be found on the Internet. A variety of web site addresses were suggested but no glues we given as to which one related to which question *(sic)*. Teachers were invited into a separate room to pupils [...] 'We thought it was important to point out the short comings as well as the benefits of the Internet. It is a unique resource which can really assist in the teaching and learning process but like any resource it has to be used correctly.' (BT Advantage Education advertisement: Spring/ Summer 1998)

The success of the NGfL partly depended on the establishment of productive partnerships between businesses and schools. The huge amounts of money newly available had attracted much (not entirely altruistic) interest in school children's education.

> An IT Revolution is taking place in schools. Companies see pupils as tomorrow's customers.
>
> In the school of the future there will be virtual libraries used by pupils working on laptop computers and teachers could be trained in teacher training centres which exist only in cyberspace.
>
> Technology in schools has become one of the fastest growing areas of the British economy as a host of high profile computer companies scramble for a share of a lucrative market. The companies are spurred on by the fact that today's children are tomorrow's customers.'(Guardian 17.1.98)(BETT week).

Teachers' expectations of the computer revolution were mainly positive. The idea of using ICT generally and the Internet specifically was not mentioned as threatening: one of the most threatening aspects of the technology - its ability to support communication between groups bent on different sorts of destructive behaviour - had not become apparent. Teachers had not had the opportunity to study writers such as Jones (1997) and Turkle (1995:1996) who present some questionable aspects of 'computer-rich' societies.

ii Findings

One teacher expressed reservations when considering a vision of the future.

'I think that's a bit sad, that people are sitting in other places watching a screen instead of any kind of interactive communication with the teacher - I don't know that I'd think that was progress really' [DJ].

But the majority of teachers had very positive views on what might be possible. Those who had never used the Internet wanted to try it, and could think of uses for it.

'You could ask someone from, say, America - contact them - and I thought, wow that's amazing. It's an unknown quantity isn't it' [DJ].

'I've never had a go. I've never seen the Internet used and I would definitely like to know more about it and how it works' [EX]

'I think we can all see that it's got to come and it's going to be amazingly useful'[DU]

'I've heard some publicity about lesson plans: if they were available *(on the Internet)* I'd certainly use it for them. I could evaluate them. They might not be as good as ours'[DU]

'We do faxing backwards and forwards. I know she is on the email system so that would be a good way of communicating with her when we need to send results and so on'[DU]

'It never quite worked when you wanted it to. You couldn't get through and I can see there being a rather frustrating element. The children find that difficult, wanting to use it now, and being told I'm sorry we have to wait'[FJ]

'If it did work it would be wonderful'[JO]

'Definitely, I think it will be useful. I think we have to work very hard with children to teach them to be able to use it effectively. To get the right information from it'[IN].

I still think that the Internet to some extent isn't a good use of my time. I'm not getting enough out of it for the time I've put in to it'[IN]

'Predicting a use for the Internet, oh God yes. The homeworks I'm giving out now - the kids use the PCs , or I'm trying to get them to have a go on the Internet' [TD].

'Video conferencing. Just phenomenal. I can't imagine it'[IN]

The following teacher had access to the Internet at home, and really enjoyed finding new uses for it - while noting its capacity to act as a black hole where time is concerned.

'It's just fascinating that you can just order books by typing in your credit card number. It's just mind boggling. It's good to feel part of it. But that was my evening gone and I'd looked at maybe six titles' [DE]

Drigg School

Similarly, the same sense of anticipation of a new and exciting application of technology, which might or might not be incorporated into school life.

> 'I've seen on TV you can actually have picture of people who are talking to you. That would be fun. And accessing information. But because I've never surfed the Internet I don't know how long it would take to glean information from it. I don't know if a pupil would have to sit a long time to access the information. I don't know'[A].

iii Discussion

Technology, as Katz (1996) says, is 'very future oriented'. Visions of a technology-rich future have been the subject of science fiction stories for decades. The ability of new computers to support not only information provision but communication is fascinating in its creation of opportunities. The future will now be different from how it might have been because of the way people developed computers. That sounds obvious, but it is important to remember that this new sort of cyber-future was only becoming evident during the late nineteen-nineties, and people had to encounter the idea, accept it, and decide what to do about it. School teachers were no different. If the idea of a computer-pervaded world was difficult to accept, that was unsurprising: a world full of school computers of the early nineties type would be almost entirely dysfunctional. The constant reiteration by advertisers of the theme that computers could improve education by replacing teachers remained of little concern, and teachers at this time envisaged the potential to expand horizons and make useful links.

8. Parents and ICT

i Context

This research did not specifically investigate parental attitudes to ICT. However parents of course exert a significant influence on their children's educational experiences in and out of school. Even if they do nothing, that is an influence. All three schools had a strong parent group involved in fund raising and other support for the school. Growing home ownership of computers at this time meant that some homes had more up-to-date equipment than the schools. Those parents working with

computers themselves seemed especially keen on ensuring that their children were taught IT skills in school.

The Xemplar document ICT in Schools: A new reality (1998, p 24) describes massive parental expenditure on 'learning tools' and claims that ICT will force schools to open their doors to parents. No evidence is given to support the view that school doors are closed to parents, and again this quotation is given as an example of the sort of patronising, ill informed literature which was produced for teachers as the NGfL got under way.

> 'Education in the recent past has been suspicious of the business world. Education has traditionally been suspicious of anything that is not directly labelled education. Many schools have been ivory towers, no-go areas for both parents and employers'(Xemplar 1998).

ii Findings

A primary teacher summed up what she knew of parents' attitudes to ICT.

> 'The parents love it' [UX]

The secondary school Askill was hugely popular with parents and over-subscribed, for several reasons, one of which was the emphasis on learning through technology. The school prospectus provides an indication of the confidence placed in teaching with technology, in this use of the word *guarantee* in its prospectus for parents:

> 'As a Technology College, we can guarantee that all students gain a full range of Science, Technology and Mathematics qualifications at both GCSE and A level, and the enhanced Information Technology provision enable students in all subjects to benefit from the use of up-to-date hardware and software applications' (Prospectus 1998/9).

The secondary school's implementation of the Integrated Learning System 'Vector' shows how a school in this position of strength can approach its parents. The Year 8 pupils at the school were required to undertake half an hour per week using the Literacy programme, and half an hour per week using the Maths tutor. To fit all this in, pupils were asked to attend before school at 8 am, and during their lunch times.

'The Head had a meeting and told them about it, and that was it. If they don't agree to get their kid to co-operate, then they are asked to take the kid somewhere else. That's how it is. So all Year 8s are on the ILS now' [DX]

Drigg School

Parental occupations varied from unemployed to part of the farming community, and some were affluent business people. The school is a Church of England school. Its community links are strong. Teachers indicated that the parents of some children had been very active in getting the school its computers and connection.

'In terms of networking, it's the parents who have done it in their own time and donated the equipment'[I].

We've got a parent who is very good with Apple Macs and he's networked two in one class and two in another, connected with a printer '[M].

Many children had state of the art technical equipment at home, and had been taught to use it by their parents. A nine year old explained how to use a spreadsheet to me; his father had taught him how to use Excel.

'A lot of them have things. Some of the children in my class have a scanner at home. We don't have a scanner in school. I don't know anything about that. They bring things in and tell me how it works. And a lot of the children have parents who have that kind of job. They have the most up to date software. A lot of the children have the kind of equipment that I would just dream about, and to them its commonplace. It's always up to date and its very expensive because their parents get it for virtually nothing. They get it through their work'[G].

Parental concern generates high expectations which the teachers work hard to fulfil.

'They are usually very keen. If they feel that their children aren't using them they come up and ask why not'[G].

I've had some parents come after a few weeks of the September terms and say 'My daughter hasn't used the computer yet - is she on the list?' It's all quite high profile'[L].

iii Discussion

Parental choice gives parents much power, but as Askill it can be seen to also give the school power. The school is extremely popular with parents, as is Banna school. The ethos of both establishments supports the use of ICT by teachers, pupils and parents,

in a way that could be considered creating a learning community. It was clear that Causey school, lacking technology minded governors, has not yet achieved integration of ICT into its ways of working.

Children have always learned at home, and computers in the home can support learning, especially if parents contribute time, ideas and encouragement.

> 'Children encountered opportunities to learn in many settings outside school. Much of this is bound to be at home, where diffusion rates of computers continue to rise swiftly. Half a million personal computers, most with modems, were sold into British homes last Christmas' (Paley and Ardern, 1998).

The Bristol On-line Education Network (BEON) reported that ICT was found to provide a focus for raising parent's awareness of their children's achievements: and that increasing home computer ownership may provide new avenues for communication between parents and schools. (BEON, 1997 p.31).

Drigg School teachers had strong links with the parents of their pupils, who had been responsible for much fund raising to enable the school to become well equipped, not only with ICT equipment. Such a relationship is supportive of the work of the teacher.

9. Pupils and ICT

i Context

As the Learning Grid was introduced in 1997 and 1998, schools and classrooms were the usual focus for IT initiatives. Teacher use of ICT for professional purposes was rarely mentioned. Pupil use of ICT was predicted to free their education from teacher intervention. The following email message from an ICT in Education lecturer, whose work is widely published, indicates the dominance of the idea that computers users in schools were invariably children, not teachers.

6.11.1988 5:04:08 pm From: Dr -

Subject: Research on teachers and computers

To: Lyn Dawes

Dear Lyn

Thanks for the Email - it would be a very good idea to replicate my [...] research with teachers - not only with the portables for teachers argument dragging on but also with the perennial debate about giving teachers tax relief for buying a PC. I have yet to see any comparative research done on what advantages (if indeed any) owning a PC has for teachers.

It would certainly be a timely piece of research to do but I tend to concentrate my research on students - partly for theoretical grounds **(at the end of the day it is the student who is using the computer)** but also because research- wise it is far easier. My little experience of trying to get teachers to fill in questionnaires would suggest that carrying out a similar study with a reasonable number of teachers would be a nightmare.
(Emphasis added)

There is evidence from schools which have already acquired new technology that staff confidence is vital to ensure successful innovation. A head teacher of a Technology College describes the phases of the implementation of IT policy:

> *'Lots of equipment arrived: the pupils sat at computers churning out pages...staff were confused about the use of IT. The second phase focused on staff expertise. This paid dividends [...] IT was seen as an important component of the learning environment.[...] Teachers develop, change their roles, become more self confident and able to experiment to improve student learning' (Gerry, 1998 p.11).*

ii Findings

One factor that can make a difference to ICT use by individual teachers is their awareness of the computer literacy of their pupils. The findings show that teachers may readily acknowledge that pupils with home computers or with an aptitude for technology have more confidence than themselves when using the school's computers.

> 'It was obvious that the school was getting more and more equipment and students were getting more and more competent'[ET].

> 'This is unfair - we are really being asked to do something that with the best will in the world we don't have the expertise to teach. I think training before you have to do it is really important. And practice'[UX]

> 'I mean I dare say there are some children in a class who are far more au fait with a computer than I am. They are very skilled at using it. I can keep ahead with our programmes we have on our systems at school, but they are very good at using it. Some of them have got systems at home so they get that practice'[DD]

The idea that teachers feel threatened by pupil knowledge is prevalent in the documents collected as data (e.g.Computers Don't Bite Teachers, 1998) and highlighted in the headlines ('Teachers Fail Computer Test': The Independent 4.4.98)

But far from feeling threatened by computer literate pupils, teachers in the study indicated that they had done what teachers usually do when they can see an educational opportunity for their pupils: find a way to use the new resource.

'I take students in some lessons with IT and I rely on there being one or two students in there who can do it, and in every group there is at least one or two'[[NH]

'We had a few training sessions in school then someone will come up with a table and say how do you do this? And someone will help you - kids mostly - then something goes wrong and you go, oh I don't know what to do now - who knows how to get me out of this situation?'[LH]

'I find it very useful. I have no problem about it when the students say to me, 'Oh this has happened' and 'that has happened'. I tend to say, 'Oh Matthew can you help us' and talk to which ever student is good at that particular sort of thing. I know what students can do. I don't have any problem with that. I don't have a problem with saying 'I don't understand - I haven't got a clue how to help you with this' QD]

'They are really busy on these things at home so if somebody gets into problems either you can do it or say, 'Go and ask Jacob'[QH]

Teachers expressed anxiety about using pupils as peer tutors. Those acting as tutors have learning needs of their own which such activities cannot address. Also, some pupils in this position dismiss or ridicule others because they equate lack of skill with lack of intelligence. These are young people after all, and not trained to teach. They may not have had chance to consider more positive ways to approach their fellow pupils.

'Boys can be very arrogant in their dealing with girls: 'Oh you're stupid you just press this'[LH]

The teacher remains aware that their own lack of expertise is slowing down or even stopping learning for many pupils.

'We are used to dealing with that in the classroom; or we try to manage the situation so that you wouldn't get fifteen hands up at once. But on the computers, at least to begin with, that

tends to happen, and we were really running round like headless chickens. Because you would have to say, well, put your hand up and you'll just have to wait patiently till I can be with you. Because you'd have to sort this person out, and it wasn't as if it perhaps was something you could do immediately. You actually had to work through the book, well, let's try this button -'[DU]

'I don't know. I took GNVQ groups up there for maths and we have gone wrong - or we haven't gone wrong, but we haven't been able to do a certain thing: and it is embarassing - I mean I wouldn't do it again. I keep sort of tentatively trying to take them up, and we get further each time but it's a waste of their time'[TC]

They also know that there is more to teaching than demonstrating the most immediate aspects of a task.

'They can sit in front of a computer as much as they like but who assesses whether they understand what they are learning, what they are reading? Who gives them that input, and explains things in the first place? They might read it off the screen and not understand it. That's where a teacher's job is'[CU]

Teachers felt that ICT still had novelty value in classrooms, and could be motivating and exciting for everyone.

I think we are all keen to use the computers here because the students are so well motivated themselves, and we can't assume they have computers at home'[TH]

'The main reason I want to do it is some of my students are talking about it, they say, oh yes we did this, and I think I need to know -'[NH]

But ICT use can cause friction - something teachers work to minimise in the interest of learning. Pupils are frustrated when computers don't work as fast as they would like. An increasing number of pupils have 'state-of-the-art' computers at home.

'We're obviously gradually losing the excitement as - there's a lot more frustration now when the computers don't work as fast as they'd like. They take a lot for granted now' [IN]

'We've got fantastic systems but if they happen to get on a computer that's not running as fast as the others then it's crap, the whole thing's crap'[TN]

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Pupils may see computers as games machines, and teachers have to ensure that time wasting is avoided.

Drigg School

Because so many children at Drigg owned home computers, their skill level was high. Teachers turned this to the advantage of others, but as in the other study schools indicated that they felt that this did not particularly benefit the computer literate child.

'Two of mine are quite good, so they are computer monitors. They are in charge of turning them on and off but they also can deal with some of the problems that we have in our class. The printer tends to get jammed. The people who know what they are doing with the computer are quite good at taking the paper out and setting it up properly. It would benefit them if we had something like the Internet. It would actually challenge them a bit further, instead of just helping others. At the same time there are still some that haven't used a computer at home and they are still light years behind the others with their skills'[L].

C: What I think is best, is different with every year. The children who were in my class last year were certainly more IT enthusiastic and skilled than the children I've had this year

LD: Did that make you feel more like using it if they were keen

C: Yes it did. And also in terms of problems - If we had problems it was, let's put our heads together, not just throw up a hand and say come and help me here. And they were the kind of children - they had computers at home and they would go home and carry on with things that you'd started. Just keen really.

'Well it's great if they can use computers, they are useful actually because they can help if the computer goes wrong and a member of staff can't manage it. They do have their uses. I know you have to watch them because from time to time they will quite often stop doing what they are doing to go to help people who are having problems on the computer. So that's something you have to be aware of'[E].

iii Discussion

The stereotypical teacher, holder of all knowledge, may not exist in schools. Teachers talk to the children they spend their days with. It would be impossible to maintain the position of universal sage for long when surrounded by such a variety of experience and diversity of interest. The real teacher's task is to order thought, and help children

make meaning of their experiences by developing frames of reference and wider contexts in which to think and reflect. This may involve controlling the child's educative experiences in the classroom. Parents, colleagues, governors, and pupils expect nothing less - and teachers expect this role of themselves. There are no doubt other approaches which enable learning and development in schools. But teachers accept this important, if not universally admired, role in children's lives. The following extract from Professor Stephen Heppell's introduction to the BBC magazine 'Computers Don't Bite Teachers' reminds teachers (and others) that this is so.

'Every teacher, parent, grandparent, guardian and governor will confirm that children have an unshakeable faith in the ability of their 'millennium generation' to do remarkable things with technology. Of course every teacher will also tell you that an unshakeable faith does not necessarily translate into their doing as well as might be possible. Children need teachers to guide, to inspire, to brief and debrief them, to mediate their experiences and to help them leap from learning about the computer to learning with it. The good news is that teachers' common-sense still works around a computer and teachers' wisdom remains a valuable complement to children's enthusiasm' (Heppell, 1998).

Looking at the literature, including material designed for teachers, the strong implication is that teachers feel threatened by technology. Looking at the interview evidence, this seems to be a misperception. What teachers do feel threatened by is their own lack of knowledge, a different thing altogether. This is an important distinction. The persistent 'teacher bashing' (Cuban, 1986) of the media is dealt with more thoroughly in Appendix 7. Luckily, the representation of teachers as 'always in the wrong' has itself been neutralised since it has achieved the status of a sterotype. Stereotypes are necessarily highly inaccurate when applied to individuals (Warburton and Sanders, 1996). Teachers must wryly accept that one of their roles is to be a scapegoat for all social ills. This is evident in this quotation in which an MP reviews a book by Peter Hitchens (MP) in which he allocates blame for the decline of British society:

'All the usual suspects [are] put up against the wall to face the Hitchens firing squad. Teachers, schools, the curriculum, The Church of England, comedians, satirists, novelists, television, unmarried mother, women, the pill, gays, Americans'(The Guardian 5.10.99)

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Teacher reliance on the resource of pupil knowledge is evident. Pupils willing to share their expertise are much appreciated. This is not a real solution to the problems caused by lack of teacher confidence, and there are further reasons causing teachers to feel genuine anxiety. The teacher is aware that computer literate pupils also have learning needs which are not being addressed while they are tutoring their peers.The issue, then, is not teacher resentment of computer literate pupils, but of teacher dismay at finding themselves in a situation in which they have no option but to fail to teach some of their pupils. In this situation, ICT is not an educationally effective option. A reluctance to use ICT may therefore be a sensible and practical reaction, an avoidance of a situation unacceptable to any responsible teacher. Teachers are aware that it is not good practice to rely completely on the expertise and goodwill of one or two pupils in the group.

The BECTa document 'Connecting Schools, Networking People' confirms that however helpful able pupils are, they may not make the best teachers:

'It is a popular lore of our age that children are better at using technology than adults. Indeed, in some cases this is true [...] When teachers disengage from the use of the technology and leave pupils to use it and teach each other how to use it, the potential for enhancing learning drops away steeply. ICT can only achieve the promise it holds for enhanced learning when its use is integrated with the curriculum by effective teachers' (BECTa 1998b page 56).

A further conflict in teachers' minds arises from the awareness that their pupils have a right to be taught by people with knowledge. To acquire knowledge and skills in ICT, teachers have to leave their classes and undertake training and practice. This causes its own problems when pupils find the change of teacher difficult.

So, when considering the opportunity to use ICT to enhance learning, teachers are prepared to accept and value the help of adept pupils. However they may be aware that this is a short term solution which does not address their own need to learn about how and when to use ICT in an educationally effective way. The desire to do so may be tempered by concerns about other priorities and about the effects on the stability of pupil's learning when their usual teachers are withdrawn for training. An obvious solution for teachers is to acquire ICT skills in the same way as their able pupils, by using a computer at home. Uncertainty about which particular computer would be best

may make teachers wary of financial commitment. As the many issues which influence teacher confidence are addressed, their reliance on computer literate pupils may develop into a productive learning partnership. The simplified view that teachers find such pupils 'threatening' is unhelpful; the threat that teachers perceive is that overall pupil learning suffers in situations where teachers cannot feel confident.

Some pupils may dominate the computers, while others lack confidence when faced with a computer and particularly in the presence of other more confident peers. Again this is a classroom management issue which teachers tackle to ensure the effectiveness of ICT as a learning tool: but which tends to go unnoticed by the 'technophilic' writers of documents advocating ICT use in classrooms. The following quotation collected at the BETT show in 1997, in a catalogue providing details of suppliers of IT to schools, is given here to show that although unusual, there were instances of teachers being seen as the focus for NGfL initiatives.

'The consultation regarding the proposed NGfL will focus attention on how communications technology can be harnessed to benefit, in the first instance, teachers and then all students'

(BESA 1997 p.3 : UK NetYear sponsor).

10. Gender issues

i. Context

Gender issues were not a primary focus of this study, because structure of the NGfL initiatives indicated that opportunities were for all. The provision of hardware, software and training has proceeded with no bias towards any group.

But the history of communications technology indicates that its designers and developers were mainly male, and that while women might be expected to use computers in the workplace, the technology tends to be 'owned' by men (Spender, 1995). In schools, this effect is seen in out-of-hours use of the IT rooms in secondary schools, which are dominated by boys. Boys approach machines with more confidence (bravado, perhaps) and are more likely to take control of what is happening on screen (Swann, 1992: Watson, 1997). Boys use computers more frequently at home and are more likely to be integrated into a culture of computer users (Selwyn, 1998b). The

issues raised cannot be fully dealt with here, but this section is included so that teacher's perceptions of the interactions of boys, girls and computers can be noted.

ii Findings

All teachers stated similar determination to acquire training and resources. Teachers in the study felt that computers could provide equal learning opportunities when and if existing inequalities are recognised and addressed.

'I think the Internet is something that a lot of people haven't got into to, and I suspect more women than men have. I think many women don't have access to the technology, and men are perhaps more interested in upgrading their machines and doing more with them. But here, women are fairly confident and fairly skilled'[NI].

The primary IT Co-ordinator, talking about the after school IT Club, revealed that what she had expected was not what she found:

'A real mixture of abilities. Actually they are mostly girls. We never have this problem with girls being pushed off by the boys. It's often the other way round. We've got to make sure the boys get a chance'[UX].

It may be that as computers become more common, their image as 'boys toys' diminishes, and to these under 12's technology 'belongs' to no-one. However the older pupils in the secondary school showed different patterns of computer use.

'Girls follow the tasks rigidly and if they press a button that does something they don't expect they will be in panic mode : "Oh I don't know what I've done -" whereas a boy will just carry on, pressing things. The two newly qualified men IT teachers were saying that they've noticed that boys will go and explore how to do things wheras girls won't. There was almost a suggestion that that was a good thing but I'm not sure it is a good thing. It could be, or it could mean they can't do the task properly'[JO]

'It's a real concern. When I've worked with students in the IT room for instance, when I've done IT tasks with students many of the boys, not all of them, won't follow the task. I'll give you an example. They might have to write in the names of countries in the first column. The

task says type them all in then change the column width. Well some of the boys just won't do that. They just go fiddling around playing with it and they work out they can move it manually at the top. So they haven't gone through the format menu. I know its quicker to do it like that but I think they need to know how to do something properly. They've got the required effect but the next one might be longer so they have to do it all again.

'Boys can be very arrogant sometimes in their dealing with girls: "Oh you're stupid, you just press this-" Some of them are not. Some of them are very good and they'll go and help people because they are more skilled. But even in the 6th form: I have 2 bright girls students starting in the 6th form. They have no confidence with computers at all. They have computers at home and hardly use them. They obviously avoid them. I am trying to improve their confidence by teaching them some of the basics, spreadsheets and so on.

I think the world is going to be more and more and more about computers and ICT, whatever job you're going in to'[IN].

The Askill IT Co-ordinator felt that boys' use of English was improved by email use. His use of the words 'just' and 'need' in the last line of this quotation is interesting, perhaps implying that boys make best use of computers:

'Especially with boys, because it's usually boys on the (email) system: it's improved their standards of use of English beyond belief because they can't just say 'hey you there' sort of thing to people.

LD: why is it usually boys?

The boys will spend more time on it. The boys will go home and spend hours playing games. The girls won't. The girls just use the computers for school work and stuff. They don't see the need to play' [DX].

Some teachers felt that both adults and pupils who avoid computers may ultimately find themselves disadvantaged. A secondary teacher who had specifically encouraged girls in her classes to spend study time in the (boy-dominated) computer rooms said:

'I just think girls especially are going to be so disadvantaged if they don't have the skills and confidence (with ICT)'[IN].

Drigg School

'I think that a lot of our children are privileged in as much as they have computers at home, so a lot of them are quite used to computers. But they all love using the computers, and love the opportunity to get on them. One or two fight shy a bit but I wouldn't say it was a boy-girl

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issue, just a character issue'[E].

'The ones who don't take to computer are basically the ones who lack confidence anyway'[B].

'I don't think there is a difference. But I think perhaps if one boy is the hottest on the computers you tend to go to him naturally'[L].

Similarly, teachers felt that boys gained their competence and confidence by spending more time using computers. The NGfL initiatives are based on a philosophy of inclusion and it is possible that one effect may be to remove the perception of computers as 'pre-eminently male machines' (Hoyle, 1998 p. 1) which they still seem to retain in spite of becoming ubiquitous in the workplace. The revised Curriculum 2000 with its enhanced ICT component might augment the effect of freeing ICT from restrictions for pupils: 'There is hope that the development of IT applications across the curriculum, and the gradual impact of the National Curriculum requirements for IT capability will affect the next generation's approach to the potential of IT' (Loveless, 1995 p.103).

'It is the boys who tend to be better. I think they are just more keen about it whereas the girls spend more time at home doing other things. They could be just as good as the boys. There are two boys in particular in my class who know a lot more than anyone else. But the girls are just as keen'[L].

'The girls are just as keen but the boys will spend more time on it which then means they are better at it because they know more. I think it's the boys that aren't into sport so much in my class because the girls tend to do things like clubs and ballet after school, and music lessons. The only thing the boys are into apart from computers is sport. So they spend most of their time on the computer'[H].

Another teacher had noted the same phenomenon pointed out by Askill's Games teacher: that computer use and sport for boys tended to be mutually exclusive activities. There must be a time component in this, but it is only to be expected that some people like using computers more than others.

"'I'm fed up with sport, let's get on to the computer..."I mean the one who knows the most is definitely one of those. He hates sport and much prefers reading or playing on the computer. They are the only things he likes to do really. It's a hobby. And chess'[B].

One teacher pointed out that confidence may be a misplaced attitude.

'I think the boys are more confident. I think the boys think they know what they are doing and are willing to have a go and just go for it: whereas the girls want to know that they are doing it all right: so I think they are a bit less forward at saying I'll help . If you want someone to help someone else it's always the boys who want to help. If anyone's stuck on the computer it's always the boys that help - the girls just hang back. Though some of them are perfectly capable. It is actually quite dangerous because they come into school and they think they know everything about the computer, and they are into things and fiddling with it , and before you know they've lost part of your programme. They've actually done that once or twice in Year 7 - deleted applications and things'[G].

The following extract – a personal favourite - is part of an interview with the Year1 teacher, whose class had recently used a graphics programme to illustrate some poems they had written. These very young children had enjoyed the computer work, but showed no signs of rejecting more traditional pursuits.

LD: Do you find any difference between the boys and the girls?

A: That's difficult because..you mean wanting to go on the computer?

LD: Yes, feeling drawn towards the technology.

A: I haven't noticed particularly. It's more the sand at the moment. Sand has priority over everything.

LD: (astonished) Is it new?

A: No it's just that they seem to like sand. That's the thing they want to do all the time. I don't think the computer features so largely.

I found this immensely amusing in the light of the amounts of money being spent on the NGfL. It is a reminder of the child's perspective: ICT is just a part of things, and maybe not such a major part. For these five year olds computers were not a novelty, and tactile interaction with sand had the edge over pressing keys. It would be fascinating to find out whether as these children grow up this preference translates into choosing a day surfing on the beach rather than a day surfing the web.

Some teachers at Drigg indicated that the gender differentiation noted at Askill secondary school did not seem evident in their pupils. This reinforces the finding at Banna school, and Somekh's finding that girls in the early years of primary schools are willing to engage with IT, but as they reach the end of their junior years they become more hesitant (Somekh, 1998). Research indicates that ultimately increasing familiarity with the technology diminishes initial differences in approach (see Littleton and Light, 1998 p.164) A discussion of the differing roles boys and girls may adopt in group work at the computer can be found in Watson, 1997. Briefly, girls were observed to make more supportive contributions to the discussion, asked more questions, and were less likely to have their contribution accepted. Swann's (1992) analysis of the talk of girls and boys indicates that different interactional styles of talk may affect how the children work together.

Gender issues in this study are not of enormous consequence, because of the even handed provision of NGfL resources established by government. However it was interesting to note that before transfer to secondary school, there was no evidence of boy domination of computers in the study schools. This may be because younger children provide an indication of how things may be in the future, when everyone uses computers just as we now do cars: or it may be that the social pressure causing girls to choose other pursuits than computer use do not begin to tell until a later age.

11. The desire for knowledge (professional development)

i Context

The literature reviewed in Chapter 2 Sections 1 & 2 provides the context for the findings relating to professional development.

ii Findings

Teachers expressed willingness to undertake ICT training. This was coupled with a desire for knowledge about the potential uses of new technology, and an awareness that schools were lagging behind developments in business and society generally.

'I've never seen it used and I would definitely like to know more about it and how it works.'[EU]

'I love trying it out for myself. That's the learning part isn't it' [ET]

'We haven't been offered training as such, which is sad really because lots of people are all linked up and talking about it'[EU]

I've no idea how it works, so I would be interested, but at the moment I've no idea how I would use it particularly.[DJ]

I'm trying to get myself on an Internet course. *(An evening course in the city 60 miles away).* I want to keep up with the new technology. I need to know what's going on.[NH]

'It's one of the things I'm interested in, the publicity recently about lesson plans the Government were talking about putting on the Internet for teachers to pull down. I could evaluate them. They might not be as good as ours'[DU]

'If it (email) did work it would be wonderful'[CE]

'I've never had a go. I'vee never seen it used and I would definitely like to know more about it and how it works'[EU]

'It's just fascinating. You can just order books - type in your credit card number: that's mind boggling. It's good to feel part of it.. But! That was my evening gone and I'd got maybe six titles' [IN]

'Just phenomenal. I can't imagine it.[]

LD Can you predict any use of the Internet in the future

TH Oh god yes - [TH]

'I think we can all see that it's got to come, and it's going to be amazingly useful, it's just whether we are ready to teach it'[DU]

Teachers were positive, interested, even fascinated by what they had heard and seen of new technology. Many of the teachers in the study expressed great interest in acquiring access to technology for themselves so that their pupils would benefit. The quotations from interviews in this section cannot be balanced by providing quotations in which teachers express a reluctance to learn or disinterest: there are none in the data.

'I just want to keep up with the new technology and see how I can use it here [...] I need to know what's going on so I can see opportunities for the students themselves'[NH]

"I Just got interested in it. I've always been a bit technophile so I've always wanted to know more'[TN]

Drigg School

Teachers liked the idea of knowing more about ICT, because such knowledge would increase how effectively they could use technology. This teacher was worried about the time spent practising.

'I find it a huge time waster. I cannot get down there and waste my time doing it. That's my problem. I have other priorities. But that's what I need to do. Sit down and spend half an hour a day just playing'[A].

'I would love it most of all, the idea of children actually talking to other children. Children who are just in schools round here, other people who are in the same year. If they are doing Victorians and you are doing Victorians - send them some questions and find out what they are doing'[I].

'I'm taking over Assessment in September so that's my first priority. But with all the new computers coming in IT comes a close second really. It has to because otherwise we don't make full use of it'[H].

'IT skills are essential for the teacher just because it's going to be essential for the children for when they grow up. So therefore if they are going to need to know how to use it so you are going to need to know. If I actually had email I could email instead of writing letters'[L].

'I'm looking forward to having the new computers really, taking them to the room, and they we'll have a small group all looking at the same screen at the same time, and it will be like: 'Now we can do this, now do that, this is what we do here'[E].

iii Discussion

Professional development for individual teachers and the development of the teaching profession form a reciprocal relationship. The findings indicate a clear awareness amongst teachers in this study of the requirement to continue learning throughout their career. This theme will be discussed more thoroughly in Chapters 8 and 9.

Conclusion: Chapter 4

The findings reported in this chapter indicate the complexity of the integration of ICT into the practice of teachers. The findings show that teachers were aware of their own value and believed that, provided with training and the support of colleagues and parents, they would be instrumental in ensuring the implementation of change.

Considering now the research questions:

- What factors support the professional development of teachers in ICT?
- What factors hinder progress?

'Progress' is a difficult word in post-modern times, weighted with implication that there is no such thing without its antithesis. However progress in the context of this research can be defined to mean change toward realisation of the government targets for ICT as set out in 'Connecting the Learning Society' (DfEE 1997a p.24). One target is:

- by 2002 serving teachers should generally feel confident, and be competent to teach, using ICT within the curriculum

By the end of Phase 1 of the study, not all of the study schools had been allocated funding to purchase equipment and connections. Decisions about what to do with such funding were difficult, and the General Advisor for ICT arranged meetings with representatives of IT firms. The Head teacher at Causey school later reported her impressions of information provided by Xemplar:

> 'Most of it went over my head. I've spoken to other people who were there. They seemed to understand a lot more than me, but I did get some of the information. If it was pitched at non-specialist people, there are a lot of non-specialists who know a lot more about computers than I do. I am around people quite often who talk computer-speak, but even so for a lot of it I was thinking 'what are they saying?' I am waiting for a phone call from QI (General Advisor for ICT) and hopefully he'll come and look at what we've got and help us make some decisions. But he is busy – it must be terrifying – a big job – and, the cost! The year on year cost. It is going to be horrendous'[BI]

Until equipment was in place, training could not be organised, and the move towards personal competence and confidence for teachers could not begin. Askill School had decided to become a training centre for the European Community Driver's Licence training, but courses for staff did not begin until September 1998. However the time

scale of competence and confidence for all by 2002 was achievable, and conditions were being put into place to help meet this target.

The standards funding allocated to the Unitary Authority in the first year of the NGfL was used to help the least well equipped of the Authority's primary schools to acquire basic hardware and connections. Better-equipped schools were also allocated funding to enable them to become 'beacon' schools, centres of excellence which could then act as models and advisors for other schools. Forty-three primary schools were in the first cohort, of which twenty six chose an RM package of hardware and connections, and fourteen chose Xemplar, with the remainder choosing other suppliers. The Authority planned that secondary school ICT provision would be reviewed and upgraded once the primary spending round was complete in 2001.

This chapter contains information about the school context in which the 'transactions' to implement change, between people and events, would take effect. The NGfL was under construction. Its targets were to provide the infrastructure, training and content on the web which would make ICT use measurably educational. By summer 1998 little change had taken place in these teacher's working lives, but there was a raised awareness of ICT issues. Teachers who were finding it difficult to implement ICT innovations were often categorised 'reluctants' by impatient 'pioneers'. However an examination of the environmental conditions in classrooms at the time of the inception of the NGfL indicates that teachers based decisions to use or not use ICT on identifiable reasons. Eliciting these reasons could provide a basis for plans for change. Teachers were waiting for change to approach them, or moving towards it themselves. As one teacher put it,

'Just give us the equipment, and we'll get on with it.'[HI]

There were so few teachers using the Internet and email that there was no possibility of teachers establishing the sort of online community links which might feed into their practice. There was little evidence that the educational effectiveness of computer use was established in the minds of teachers. Advantages and disadvantages of the technology were conjectural. The Phase 2 interviews would collect further information

on these issues. Teachers provided not just factual information but their opinions, wishes, anxieties, and perceptions of ICT as it affected their work. If resistance to new technology was present, no expression of it was evident in the data. Teachers exhibited a range of views informed by the evidence of experience. The indications were that teachers wished to be involved with ICT.

Teachers who were not using ICT at all in their classrooms did not report an aversion to technology. Instead they identified what seemed insuperable problems. They did not find excuses for their own lack of expertise and skills, which would indicate resistance, but pointed out the disadvantages that such lack created in their classrooms. They considered their own lack of skills detrimental not especially to themselves but to their pupils.

The reasons which teachers provided for their non-use of ICT can be interpreted as a strongly positive force for sustainable change. The professional wisdom of teachers enables them to evaluate new ideas. If they can forsee difficulties which innovators and external change agents can not, their contribution may be to point out such issues. What they offer is the craft knowledge that will make the change practicable if heeded. Suggestion of different ways of implementing new ideas is creative resistance; the type of resistance that an established habitat might offer to an evolving variety. It is this force that shapes the change so that it becomes part of the environment, and is fit to survive. The most radical ICT enthusiasts are for revolution, and breaking down the walls of classrooms, but teachers are for evolution, and maintaining the composure of the system whilst quietly and effectively integrating ICT in places where it fits well.

Some of the reasons for non-use of ICT were obvious and could be relatively easily addressed, like lack of equipment. Others were more subtle, and were to do with professional development. The NGfL initiatives were in place and beginning to tackle problems of access to equipment, training, and connections.

In Chapter 5 I describe a model for categorising teachers as users of ICT which draws on the reasons elicited by interview, and identifies the barriers and the supports which teachers encounter as they approach ICT use in classrooms.

Chapter 5

An emerging model for categorising teachers as users of ICT

Introduction

This chapter links the findings described in Chapter 4 with theories of learning as community-joining described in Chapter 2. Theoretical frameworks are used as a basis for constructing a model of practising teachers as users of ICT. This model, described in detail below, provides a structure for observing the course of professional development in ICT proficiency within the teaching staff of a school, and allows individual development to be traced as integration into a community of computer users begins and continues. In this model the opportunities presented to teachers by external change agencies can have impact on professional development only if the contextual factors enabling progress are recognised as an integral part of proposed change. The change agency of teachers is integral to the model, since it provides clarification of the situational factors which teachers indicate make a difference to them. Discussion with other professionals about what must be changed provides strong support for individuals trying to increase their own effective use of ICT with pupils.

The Use of Categories

Once defined, categories may constrain thinking, compounding the tendency to generalise and imposing a rigid order on the data. However, constructing categories can usefully allow the emergence of patterns which enable understanding, and focus the continuing process of data collection. The classic study of Hightown Grammar by C. Lacey (1973) provides insights into how evaluation of methodology, analysis and data collection can contribute to ensuring that the direction of the research remains clear, while its form is continually reviewed and refined. The study is especially relevant in that it describes changes in school. Reviewing the study, Lacey describes moving backwards and forwards between observation, analysis and understanding in order to 'escalate insights'.

'I feel very strongly that the world under investigation seen through one method of data collection becomes enormously distorted by the limitations of that data and the available methods of analysis'

(Lacey 1993p.123).

A diversity of research methods contributed to understanding in this research. Building on understanding gained from analysis of the questionnaire data, interview data provided further material for reflection.This is turn provided a context for considering evidence from documentary sources and from opportunities for observation. These sources thus allowed conceptualisation of the model described in this chapter.

The categories described in this chapter were established in order to provide a structure within which patterns in the data could be identified. The issues arising from the analysis, detailed in Chapter 4, were examined and reduced in order to clarify common elements in teachers' experiences of ICT use or uptake. The categories described in this chapter are what Mason (1994 p 94) describes as 'the starting point for various forms of analysis'.

The categories described below are both analytical and participant. They attempt to describe the reality of practising teachers from the research perspective, based on analysis of the data as detailed in the preceding chapters. Therefore they are 'analysts categories, imposed' on the teachers (Edwards, 1997 p 60). Making claims about the nature of the world is undertaken from a personal perspective; what Edwards describes as 'the backdrop of reality' can only be clarified if 'the workings of the mind' are made overt. One way round this problem is to refer the analytical categories back to participants, to ensure that the categories 'are not merely higher-order abstractions that the analyst constructs, but also categories that participants themselves may also treat as meaningful' (Edwards, 1997 p. 60). This was achieved by assigning teachers to categories and subsequently requesting that teachers allocate themselves to a category. In the (uncommon) instances where their decision was different from mine, one of two things happened:

• the teacher and I discussed the decision and came to an agreement.
• if it was not possible to contact the teacher and talk to them, their categorisation was used in the results.

The development of these descriptive categories is grounded in the data and uses as a theoretical model the work of Nias et al (1989) whose work involves interview conversations with teachers, from which themes are drawn out and discussed.

Answering the research questions

At the end of Phase 1 of the research it was possible to provide a partial response to Question 1:

1. What are the key factors which enable teachers to integrate ICT into their classroom practice?

The simplicity of this questions belies the complexity of the answer, but analysis of the data indicated that of the many factors affecting teacher's use of ICT, changes in the following conditions could create change in practice.

• possession of a personal computer, either portable or at home.

• perception of a purpose for the use of ICT as an educationally effective tool in the classroom.

• reliable, up-to-date technology at school, with technical support.

• training in ICT skills and the opportunity to observe and discuss best practice using ICT as a classroom tool.

• the opportunity to practice new skills before transferring them to the classroom.

• an ICT partner or 'peer tutor' to allow productive discussion of problems, and to provide opportunities for minimal risk learning conversations as new knowledge was negotiated.

• a community of ICT practice at school, to include both colleagues and pupils.

• an online community of practice of teachers in a similar curriculum area or Key Stage.

• allocated time to use and develop ICT resources within the working week.

These key factors arising from the data were used to build a model of teachers as users of ICT. That is, the everyday working situation of the teacher is acknowledged, and the reasons for use or non-use of ICT become part of a description of what must change to enable professional development. Such factors (as those in the bulleted list

above) are themselves dependent on other factors, such as finances, school Development Plans for ICT, family circumstances of pupils and teachers, the ethos created by the head teacher, involvement of the LEA, parents and governors, and not least the developing user-friendliness of new technology. The National Grid for Learning framework attempts to address some of these factors - those that can be addressed by government. The NGfL provides hardware and training to a minimum standard, and relevant web content: for some teachers this may tip the balance and enable ICT integration. For others, more may be required.

Teachers as Users of ICT

Cuban (1993) notes that the reasons assumed for the slow uptake of technology by teachers include lack of money, teacher resistance, little administrative support, and inadequate training: all of which are 'plausible but superficial' (Cuban 1993 p 209). Note that only the last of these appears in the list of key factors, above. Lack of money and administrative support were not mentioned by teachers (possibly since the former is universal and the latter unchangeable).

Considering the following seven different types of teachers as users or ICT:

(Bliss, Chandra & Cox,1986):

(1) favourable

(2) critical

(3) worried

(4) unfavourable

(5) antagonistic

(6) indifferent

(7) uninitiated

These value-laden categories could not be used to describe the reality of the teachers in the study schools, since they are simply descriptors of attitudes which could be expected to change if circumstances changed.

Slightly more recently the Pupil Autonomy in Learning with Microcomputers (PALM) project (Somekh, 1989) identified barriers at the personal and institutional level in an attempt to collect evidence about the educational value of computer use.

Table 5.1: *Barriers Identified by PALM* summarises some of the PALM findings and relates these to the findings of this research. Barriers were identified at a 'Personal Level' and at an 'Institutional Level'. My findings are in generally in agreement with those mentioned at an institutional level (for example, the finding that insufficient access to computers impedes professional progress). However less agreement is found in the 'Personal Level' section of the table.

Table 5.1: *Barriers Identified by PALM*

PALM findings: BARRIERS	Current research finding
1. PERSONAL LEVEL	
• teacher's self-image may conflict with the innovation (e.g.. being a 'non-technology person')	•ICT is now integral to Curriculum 2000. Such a self-image would be inappropriate since ICT use is part of the profile of the profession. Teachers seemed aware that this was the case.
• teachers' concept of teaching may put little value on change as opposed to expertise	•teachers in the study consistently expressed a desire for training and a personal interest in acquiring new knowledge
•an anxiety felt by the teacher that they may feel inadequate because the students are more confident with technology	•teachers identified computer literate pupils as a resource and welcomed their expertise, whilst expressing disquiet about not fully addressing the needs of such able pupils.
•teachers feel that technological failures can jeopardise a class session	• classroom management has evolved to cope with this: teachers using ICT had non-ICT based back up plans. However technical support is still deemed essential by teachers.

2. INSTITUTIONAL LEVEL	
•insufficient access to computers impedes personal progress	•agreed
•insufficient teacher time to reflect on professional uses of ICT and engage in dialogue	•agreed
•logistical barriers such as rules for computer use, provision of discs, etc	•not enough evidence to comment: this was not mentioned as a barrier.

Teachers' professional development as change

Returning to the importance of understanding change in education, as discussed in Chapter 2, Jean Rudduck worked on innovation in education in England from the 1960's to the 1990's. She takes the view that real change in schools is only possible if teachers are consulted, and if they feel that prospective change has good purpose, and that they have control over what happens to themselves and their classrooms and schools. The nature of the work of teaching is that it is both isolating and demanding, and changes which are 'clip on' solutions or the ideas of management alone may be hard to implement, and so are abandoned, because the ordinary struggle is difficult enough. Rudduck(1990) argues that more profound change *in the teacher* must take place before new developments can be implemented in the classroom.

Considering teachers as a learning community, and by looking at the interview findings which provided insights into the rational responses of teachers to opportunities for change, I could discern five categories of teachers as users of ICT. These categories represent steps towards and into the skills of network literacy, and allow the outcome of a sustainable community of educational ICT users. In the spirit of Lave and Wenger's 'legitimate peripheral participation', any particular category should not seem either the wrong thing to be or a state of grace. Movement between categories is always possible. In this model, 'teachers', 'learners of ICT' and 'users of ICT' are synonymous. The structure of the categories acknowledges apprenticeship and

scaffolded learning, but reflects the tensions inherent in the changes towards integral
ICT use. That is, elements not under the control of the teacher are included.

This emerging model can be used as a tool for understanding of teachers in their
contexts, to describe the ICT status of an entire school, or to chart change over time
so that it may be possible to recognise Rudduck's 'change in the teacher'. A whole
school profile of teachers as members of categories can highlight the relevant issues
and enable planning for ICT integration. The following section describes the
categories. The NGfL initiatives are aimed at ensuring that teachers reach at least
Category 4, Adept User of ICT, by the year 2002.

Teachers as Users of ICT: Categories

1. Potential User

Teachers have no personal computer at school or home. They may use ICT occasionally but not systematically. They have not had recent training opportunities or sufficient time to practice skills or develop understanding of appropriate ICT use. The technology available to them may be unreliable. Teachers become 'potential' users by virtue of their profession.

2. Participant User

Teachers have a personal computer (not usually a communal one) at home or work, and use it to do work-related tasks. They may use ICT with pupils occasionally but unsystematically. They may feel that they lack the confidence or preparation time to use technology with their classes, or more commonly that its purposes are dubious.

3. Involved User

(a) Teachers have a personal computer at home or at school, and plan and prepare work using ICT. They may have ICT skills but can not use ICT systematically because of **lack of equipment, or lack of access to equipment.**

(b) Teachers have a personal computer at home or at school, and plan and prepare work using ICT. They may have access to ICT but can not use it systematically because of **lack of training and time to practise.**

(c) Teachers have a personal computer at home or at school, and plan and prepare work using ICT. They can not use ICT systematically because of **lack of training *and* lack of equipment.**

4. Adept User

Teachers in this category have network literacy skills, and an understanding of when and how to use ICT. They have reliable ICT access and technical support, and use ICT for themselves and with their pupils in a planned and systematic way. They may be members of a professional online community.

5. Integral User

Teachers in this category integrate ICT use seamlessly into their work practices whenever it is appropriate to do so. They have access to constantly updated resources, and opportunities to undertake further training. Time is allocated for use and preparation of ICT resources in their timetable. They may be members of a professional online community.

Applying the model to the Study Schools

Once the model was described, I could use it as a tool for two tasks. Firstly, the model could be used with the staff of a school (its teaching community) to build up a whole-school profile of teacher use of ICT. Secondly, the model provided a tool for tracking the professional development of individual teachers over time. In both cases, the model provided a structure for direct identification of barriers, and provided a basis for discussion enabling change. I used questionnaire and interview data to allocate teachers in the three study schools Askill, Banna and Causey to the categories described above.

Table 5.2: *Teacher Categories in the Study Schools* shows the proportions of teachers in each category in the three study schools in January 1998. Teachers in the sample at the time of the survey fell largely into the first three categories, so that it can been seen that their moves to integrate ICT into classroom practice were thwarted by identifiable barriers. The double barrier of lack of equipment and lack of training was the most commonly identified. Only the IT teachers at Askill secondary school could be classified as Adept Users.

Table 5.2: *Teacher Categories in the Study Schools* January 1998

Teacher Categories in The Study Schools
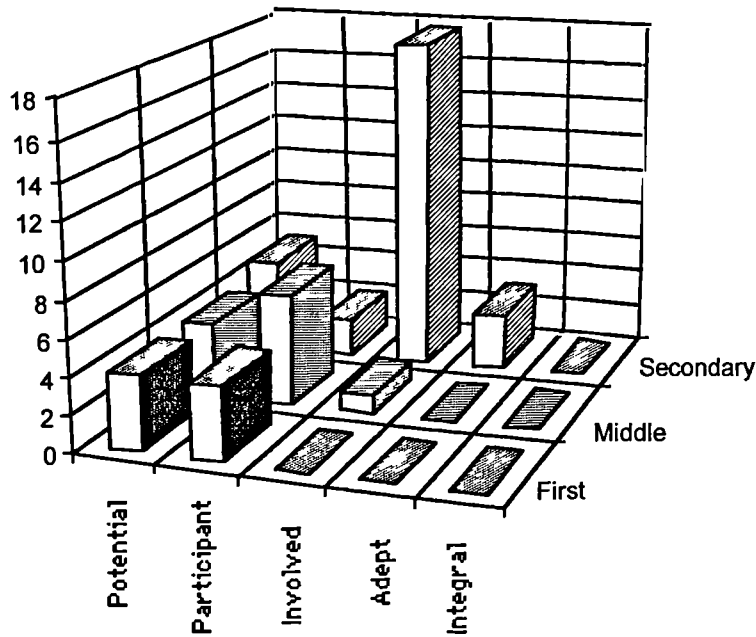
A Whole School Profile

To test the practicability of this model, teachers in an additional school, Eskdale Middle, were asked to join the study (see Chapter 3) and were allocated to the above categories. They were also asked to allocate themselves to a category: the agreement between their evaluation and mine gave some indication of the model's validity. Table 5.3: *Teachers at Eskdale Middle School* shows numbers of teachers in each category. The majority of the teachers were in category 3c, Involved User, meaning that they made some use of computers, but that they were unlikely to achieve network literacy and Adept User status without at least relevant training and reliable hardware. Therefore integrating ICT into practice was not possible: not because of 'teacher resistance', but for valid reasons.

Table 5.3:*Teachers at Eskdale Middle School*

Category	Number of teachers
1. Potential	1
2. Participant	0
3. Involved a	2
b	0
c	6
4. Adept	0
5. Integral	0

Eskdale school's ICT Development Plan was amended to reflect the requirements which the analysis had clarified. Issues of acquisition of hardware, opportunities for key staff to visit other schools and observe best practice, and training for all teachers in uses of new applications and new machines were formalised as requirements. Time scales were decided, and targets set with achievable outcomes, for example:

Eskdale School ICT Development Plan (Extract)

Aim: Baseline assessment of ICT provision for staff and pupils

Action: Contact LEA Advisory staff to arrange evaluation and audit of current ICT provision in school

Responsibility: Teacher A.K.

Outcome: Written ICT audit and suggested improvements.

Potential budget and timescale for achieving improvements.

This was presented to the school governors as a discussion document. Various ways of addressing the teachers' needs were then proposed, for example leasing computers, or accepting computers on loan from another school who had just updated their hardware. Decisions about change were deferred for complex reasons involving finance, staff changes, and the school's impending OFSTED inspection. However the Development Plan existed as a basis for future change, and the teachers in the school were aware of and understand their position in the move towards change.

Individual Teacher Profiles

Individual outcomes of change have been charted by asking teachers to allocate themselves to categories over time.

Table 5.4: *Individual teacher profiles of change* provides three teacher profiles as examples. In the period of the research study, the NGfL initiatives were beginning to create new awareness of ICT in education. For many teachers, change was still on the horizon rather than actually happening. For some, change was discernable. The three teachers given as examples (here called Chris, Jamie and Sam) were chosen because they show change within the study period. For Jamie, provision of a laptop computer enabled the move to participant status, and interaction with the machine provided impetus for further development. For Chris, the school's changing status meant that previously available computer rooms were fully timetabled. Although not personally de-skilled by this, Chris could not integrate ICT into classroom practice and lack of interaction with school machines meant that it became more difficult to envisage educationally effective uses. Aware of this, the school continued its upgrading and re-

organising to ensure that its curriculum teachers had the equipment they required. Sam began as a class teacher with little IT involvement, but personal choice and changes of staff at Drigg meant that Sam accepted the chance to become ICT CO-ordinator. This post brought opportunities for training and studying new uses of computers. All of these teachers experienced overall positive outcomes of change.

Table 5.4: *Individual teacher profiles of change*

Teacher's name	Jamie	Chris	Sam
School	Eskdale	Askill	Drigg
Position	Special Needs Co-ordinator	Head of Humanities Department	Class Teacher
Category Sept 1997	1. Potential	4. Adept	2. Participant
Change	Allocated a laptop under the Multimedia Portables for Teachers scheme	School granted Technology College status (IT rooms became fully booked: no access)	Accepted post as school's ICT Co-ordinator. Undertook training.
Category	2. Participant	3a Involved	3c Involved
Change	• Undertook training and practice • Evaluated software relevant to pupil needs • Joined SENCO forum	• School acquired new Integrated Learning Centre with 60 new computers	• School allocated NGfL funding to establish computer suite • Joined on-line community
Category Sept 1999	4. Adept	4. Adept	4. Adept

In the model, movement for teachers in terms of increasing professional development is towards Category 5. Table 5.5 *Category Change* summarises what (at least) is required to make a difference, that is, to enable a teacher to move towards becoming an Integral ICT user.

Table 5.5: *Category Change*

Category Change	Minimum requirement to enable change
Potential to Participant 1 to 2	• personal computer ownership • supportive initial tuition • an 'ICT buddy' - a partner at a similar stage
Participant to Involved 2 to 3	• a clear educational purpose for ICT use with pupils • knowledge of new possibilities

Involved to Adept 3 to 4	• up to date equipment • technical support • focused training • access to learning communities • (real and virtual)
Adept to Integral 4 to 5	• continually updated resources • further training opportunities • access to learning communities (real and virtual) • dedicated time for ICT use

Summary: Chapter 5.

This chapter describes how research findings were linked with theories of learning as community-joining to construct a model of practising teachers as users of ICT. This model describes five categories of teacher involvement with ICT, in which the contextual factors of teachers' work places are considered. Teachers allocated to a category are enabled to use their current position to assess factors which they might change, or might require others to change, in order to continue with their professional development. The model can provide a whole school profile, allowing managers and teachers to agree on development strategies, or can provide individual teacher profiles.

Having constructed and tested the emerging model at the end of Phase 1, data was collected from a further eight primary schools, and analysed using the model as structure. The purpose of this data collection was to gather information about a wider group of teachers, specifically to capture a 'snapshot' of the relationship of primary teachers to ICT across the city at this time. The methods for data collection are described in Chapter 3. The next chapter, Chapter 6, details the findings from the eight schools, looking at the professional development of teachers and relating this to their work situation.

Chapter 6 Phase 2 findings: August 1998 - January 2000

The Professional Development of Teachers as Users of ICT

Introduction

Chapter 5 provides details of the emerging model describing the professional development of teachers as users of ICT. The model arose from analysis of data from the three Phase 1 schools, that is the secondary Technology College Askill, and its two feeder primaries Banna and Causey. Chapter 6 presents findings collected as this model was applied in Phase 2 of the research, working with teachers in a further eight primary schools. In each of these schools, the entire staff contributed data in the form of questionnaire responses and self-categorisation within the research model. Head teachers and ICT co-ordinators were interviewed. (Please refer to Chapter 3 for details.) A Phase 2 aim was to collect specific data about situational factors affecting the professional development of teachers. The contribution of Phase 2 Schools was necessary in order:

a) To compare the school profiles produced by the model, and thereby provide a summative profile of the ICT status of teachers at this time.

b) To discern early outcomes of NGfL initiatives. Teachers in Category 4 (Adept) and 5 (Integral) had achieved the necessary competence and confidence with ICT. The new data would indicate whether teachers in these categories were more likely to be found in schools who had been early recipients of NGfL funding, that is, whether definite outcomes of NGfL initiatives could be discerned.

The ICT status of seventy eight teachers in the eight schools is described by this analysis, which contributes answers to aspects of the research questions.

The schools and numbers of teachers (in brackets) involved have been given the coded names:

Eskdale (9) Fleetwith (13) Gable (9) Honister (13) Isel (8) Jopple (7) Knotts (9) Laurel (10). Schools are identified in some tables by their initial eg E=Eskdale.

Table 6.1 *Teachers as user of ICT* shows the number of teachers in each of the 'Teachers as Users of ICT' categories (as described in Chapter 5), and Table 6.2 shows the *Totals for each category.*

It can be seen that seven of the 78 teachers were in the Adept category, and none in the Integral category – that is, only 9% of teachers could be described as network literate. An aim of the NGfL initiatives is that **all** teachers reach one of these two categories by 2002.

The lack of any 'Integral' teachers in this group of schools is at extremely surprising and worrying. Perhaps the principle reason for this situation is that all of these schools are primary schools. Primary teachers have subject specialisms but are expected to teach across the curriculum, and so although ICT co-ordinators devote time and energy to supporting ICT throughout the school they are unlikely to have more than the occasional session of time to do so. The majority of their time when not teaching is likely to be spent in team meetings with colleagues in the same year group, in meetings to do with whole school development (e.g. to implement literacy and numeracy strategies) and in meetings in which they undertake professional development across the curriculum and in professional subject areas. The definition of 'Integral' teachers specifies that they must be allocated time within their professional life in order to prepare and use ICT resources. This may happen occasionally for primary teachers but in this study no school had in place the management structure which would support such opportunity. As ICT becomes more pervasive, perhaps the role of the ICT co-ordinator may have to be adapted to reflect what is an increasingly urgent requirement.

The table shows that 9 teachers did not have a computer at home, and that 8 teachers indicated that the purpose of ICT use in education was unclear to them. The majority of teachers (almost 75%) had neither the appropriate equipment in school or the relevant training to enable fluent ICT use.

Table 6.1 Teachers as user of ICT (n=78)

	School Code							
	E	F	G	H	I	J	K	L
1. Potential	1	0	0	1	2	1	2	2
2. Participant	0	1	0	3	1	2	0	1
3a. Involved (lack equipment)	2	4	1	1	0	0	1	5
3b. Involved (lack training)	0	1	2	1	1	1	0	0
3c. Involved (lack both)	6	6	4	4	3	3	6	2
4. Adept	0	1	2	3	1	0	0	0
5. Integral	0	0	0	0	0	0	0	0

Table 6.2 Totals for each category (n = 78)

Category	Number of teachers
1. Potential	9
2. Participant	8
3a. Involved (lack equipment)	14
3b. Involved (lack training)	6
3c. Involved (lack both)	34
4. Adept	7
5. Integral	0

All teachers in categories 1, 2 and 3 therefore identified situational factors which seriously affected their capacity to engage with ICT in practice. Such teachers may be classified as 'resistant' to technology; however their work practices could not alter unless action altered their circumstances.

The remainder of this chapter comprises contextual data for the Phase 2 schools, with an accompanying graphical representation of teacher categories, using the model described in Chapter 5 as a structure. The contextual data provides a 'snapshot' of the ICT provision for teachers and pupils in the school at that time, that is, information about the school's ICT status, with any plans for development of ICT provision, teacher training, and other relevant factors. The following graphs can then be directly interpreted in the light of the classroom situation of the teachers. The data allows

investigation of reasons for change, or reasons for lack of change during the introduction of the NGfL. Teachers were asked to assign themselves to a category within the model, and the questionnaires were used to validate their assessment. Each section concludes with a percentage indicating what proportion of the teachers in the school are in categories Adept or Integral, that is, how many teachers can be said to be network literate.

Chapters 7 and 8 also contain Phase 2 findings.

Chapter 6: Questionnaire findings and an analysis of the professional development of teachers in ICT during the introduction of the NGfL, using the model described.

Chapter 7: Interview findings, following the format used for Phase 1 findings.

Chapter 8: Comparitive analysis of changes in the study schools over time.

Eskdale School [E] September 1998: 9 teachers.

ICT context

The new head teacher decided to centralise all the computers so that ICT lessons could be formally timetabled and variation in provision between classes could be minimised. The computers were moved to a room which had a narrow bench on two sides. The following computers were put in the room:

Nimbus 6   Apple Mac 4   Acorn 3   PC 3

Of these the Apple and PC computers had been donated by the local university and were over 4 years old. Some of the computers were not fully functional (for example one of the Apple Macs would not type numbers or symbols properly). Most of them were slow and some were obsolete.

The computers were not networked. This, coupled with the variety and age of the equipment, prevented effective whole class teaching in the computer room. It was possible to have children working individually or in pairs, to carry out word processing or to use specific items of software. Under these circumstances it was extremely difficult for the class teacher to address the learning needs of individual children, to monitor or assess progress, or to ensure that each child completed specific tasks satisfactorily.

A particular problem was the arrangement of the computers on the work surfaces. Some computers were on benches which were not wide enough, so that the keyboard and mouse were at an angle to or beside the screen. This meant that children working at computers had to sit 'sideways' to the screen. Best practice from a health and safety point of view is to have the screen and keyboard directly in front of the user, to minimise stress injuries.

Other computers were on trolleys with no room for the keyboard. Children used the keyboard on their knees but this again is not good practice. Also the screens on the trolleys are too high for children, or too far away from the keyboard. Computers were used erratically. Year 7 pupils allowed to play on them at break. The Apple Macs were particularly muddled by this , and had many empty folders on the desktops, and none of their printers worked. The PCs had other problems, eg the menubar moved to fill half the screen, and overtype left switched on which made error correction incomprehensible to most children and staff.

The head teacher planned to lease 5 RM machines, which could be networked with the 3 reasonable PCs. The Acorns and Apple Macs will then be put on trolleys to be used in classrooms. Governors have agreed this plan but were not sure of time scale: 'not soon'. Staff training will happen when these new machines arrive.

Eskdale School Teacher Profile n=9
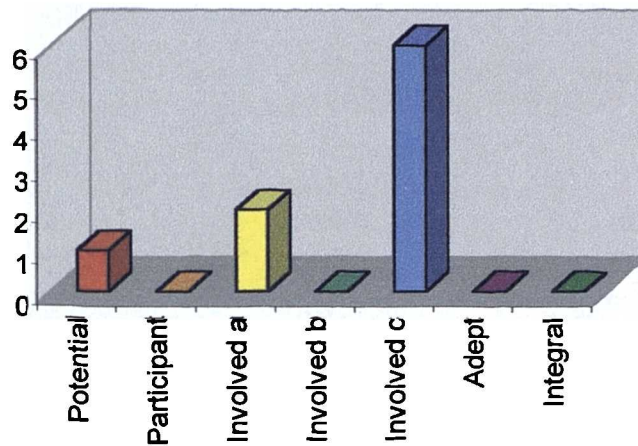
Teacher Profile Graph

This indicates that most teachers have computers at home. Two teachers were computer literate but felt hampered by the school's inadequate equipment. The majority of teachers required both coherent equipment and relevant training in order to progress.

Percentage of Adept/Integral teachers: 0%

Fleetwith School [F] : May 1999 13 teachers.

ICT Context

Fleetwith is a large primary school, having 16 classes, 474 children, and 20 teachers of whom 13 took part in the analysis.

Each classroom had computers: a total of 1 per class BBC Acorn, 2x Window Box with CD ROM and 8 PCs spread around school. Under the NGfL standards funding the school had ordered 7 new Xemplar Toolbox machines.

The school was told in March 1998 that they would receive NGfL funding, that is, they qualified to be in the city's 'first cohort' of funded schools. However 'nothing happened' then until October 1998 when the ICT Co-ordinator attended RM and Xemplar presentation organised by the General Advisor for ICT. The ICT Co-ordinator had to decide which package to take. She decided on the Xemplar package because it offered seven machines instead of the five Rm offered for the same price. The computers arrived just before Easter 1999. Staff unpacked them and started children using them, but

the printer and scanner were not set up, and there were no passwords provided for staff to use important functions.

Training to use these new machines was organised with the computer firm: the standard one hour's training. This was arranged for a Friday after school. Teachers waited but the company representative did not turn up. The school is trying to arrange another day soon. The Internet connection is paid for and the cabling firm 'came to look' today but gave no date for the work. The ICT Co-ordinator had not heard of the TTA needs identification materials.

The school gave ICT given high priority and teachers were looking forward to getting started with new machines: they had much enthusiasm but needed expertise. The ICT Co-ordinator was leaving at the end of the summer term. She felt that the hardware installation had been badly organised. 'The Government, it was a good idea to have schools connected up, but they haven't considered what that means in terms of the reliability of the IT firms' [MR].

Teacher Profile Graph (Fleetwith)

All teachers had home computers, and only one teacher felt that ICT use lacked educational purpose. Eleven of the thirteen teachers found lack of equipment and training a barrier to ICT use. The new computers had not become integrated into practice because of technical problems. The ICT Co-ordinator was an Adept user, and saw her role as trainer and facilitator, although she was dismayed by the problems associated with new equipment, and felt that teachers would be put off by the long drawn out installation and lack of training.

Percentage of Adept/Integral teachers: 8%

Fleetwith School Teacher Profile n=13
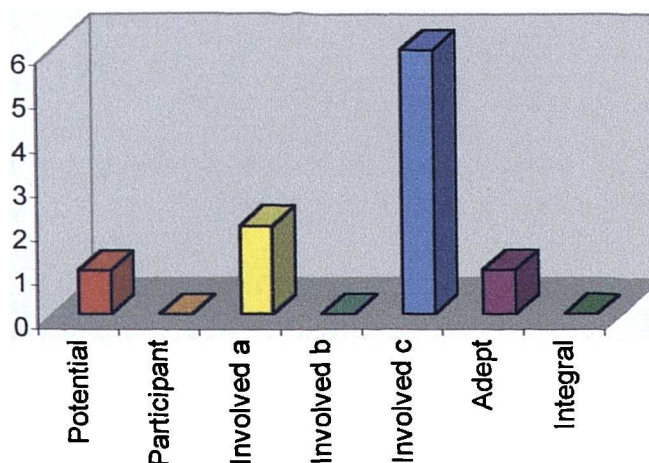
ICT Context

The school's computers had been stolen five months previously. Gable was in the first cohort for NGfL standards funding. Their new computers had arrived (10 RM Window Box machines) and had been put together in a room converted from a stock room. This meant there was nowhere in school to store the science equipment which was 'highly stealable'. A substantial sum from the school's budget (£500) had been spent on having window bars and other security devices installed. The Head Teacher had bought and fitted what he called 'kitchen tops' with the help of the caretaker. He felt that they were not really wide enough: however, the room was not suitable for greater width of surfaces. The computers were cramped together and the printers balanced on top of the hard drive towers. New seating had also been purchased. The computers had been networked by Cable and Wireless - the engineer was 'unhelpful' and had not returned to install the link to the Internet. This link was free for the first year but after that would cost the school £800 per year.

The ICT Co-ordinator had heard of the TTA needs identification materials but not seen either the CD ROM or hard copy. The staff of the school were giving the literacy hour priority, and since this was June, report writing: and in September 1999 they would have to give the numeracy hour priority. The Head Teacher like the idea of peer tutoring for ICT amongst the staff but felt that outside expertise was also required. Staff were determined to use ICT and said they were 'very keen' to use the computer room, but felt that they didn't quite know where to start. Their computer use was mainly for word processing. They were also teaching the children keyboard skills off computer, but felt that the transfer of skills when using real keyboards was low. The teachers indicated that they were worried about being 'left behind' by developing technology, and they were anxious because their new machines were under-used. The pressure for ICT use was generated by teachers rather than parents, governors or pupils.

Teacher Profile Graph (Gable)
All teachers had home computers and expressed enthusiasm and a sense of purpose for ICT use. Two of the staff were Adept users whose training helped them to use what equipment was available to good effect. Seven teachers found lack of equipment and training were barriers to ICT use.
Percentage of Adept/Integral teachers: 22%

Gable School Teacher Profile n=9
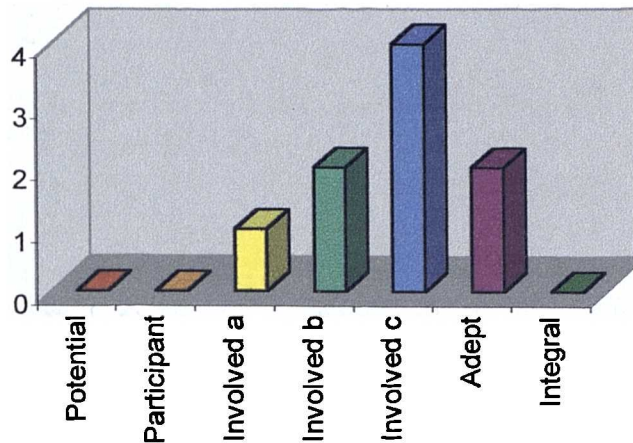
Honister School [H] June 1999: 13 teachers

ICT Context

Before Christmas 1998 there was 'virtually no IT in the school'. There were four machines which were all non-functional. A new ICT Co-ordinator was appointed and started work in January 1999. This teacher was technically adept enough to get all four computers working, and new machines had been purchased from the school development fund. The school now had Acorn computers for year 4 and 5 classes, and PCs for years 6 and 7. Word processing had been standardised, pupils either using Word or Pendown. The school had not received NGfL funding, but had plans for when this happened. Rather than accepting the RM/Xemplar packages the more independent (because more knowledgeable) ICT Co-ordinator was looking at a Time Computers package 'which is less expensive'.

The school had no technical support. Teachers made much use of their home computers for professional purposes, but did not use computers so much at school. The ICT Co-ordinator had provided intensive training for data handling which teachers had both enjoyed and used to great effect immediately afterwards. Their pupils used data handling programmes and produced impressive displays of their work. ICT was 'very important' to the school and mentioned as a priority in the school's OFSTED report. The ICT Co-ordinator went on to train staff to use control and modelling software, which again was met with enthusiasm, though teachers felt that their time to practise such applications before use was limited, and this diminished their confidence. They found it useful in this session to work together and share skills.

The ICT Co-ordinator took a Montage web project leaflet from me and within days had joined a project and was encouraging other teachers to do likewise.

Teacher Profile Graph (Honister)

One teacher did not have a home computer. She was a PE specialist and felt it was unnecessary, and three teachers felt that increased use of ICT would not help them deliver the curriculum. Six teachers identified lack of training and equipment as barriers, and three teachers were 'Adept users', integrating ICT into their classroom practice. Their barriers to further development were lack of time, and competing priorities.

Percentage of Adept/Integral teachers: 23%

Honister School Teacher Profile n=13
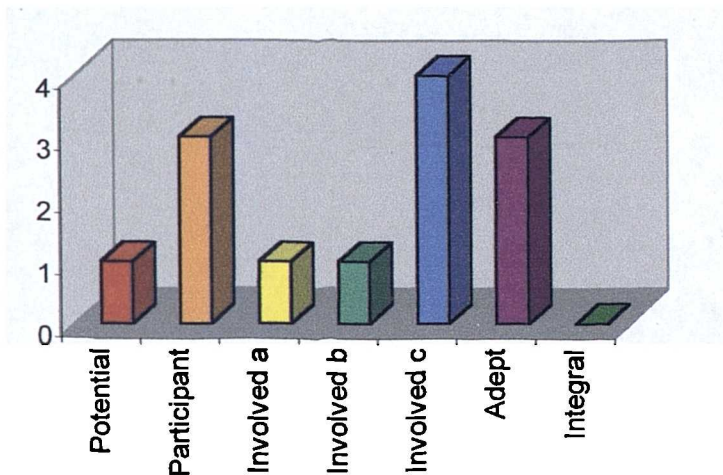
Isel School [I] 8 teachers : July 1999

The ICT Context

The Head Teacher said she had 'managed to get hold of the General Advisor for ICT by chaining myself to the railings -' The school was not in the first cohort for NGfL funding and teachers were anxious because they felt that their ICT capability lagged behind that of other schools. They had BBC computers which were mainly used for skills such as spelling and working with numbers. The school had been offered many more BBC computers from other schools who were updating their machines, but they had decided to refuse such offers: 'the kids deserve better than second hand leftovers'. They had not seen the TTA needs identification materials (which originally should have been sent to

schools in December 1998). The teachers did not want to be left behind and were determined to keep up with ICT current affairs even though their equipment did not support ICT use with pupils.

The local computer centre had become run down, with computers less sophisticated than those in many schools, so teachers did not find this to be much help. The local secondary school was also unhelpful, being 'not interested'. The city would allocate NGfL funding for secondary schools only in the year 2000, and their current equipment was obsolete, used only by Computer Studies teachers. Isel as a small school was planning to 'get together' with other First Schools for training and ICT discussion 'so that we have someone to work with'.

No loss of enthusiasm was evident in spite of the poverty of the ICT context, but teachers were worried that they were being 'left out' of initiatives and that their pupils were disadvantaged.

Teacher Profile Graph (Isel)
Two teachers did not have home computers, and one felt that ICT was 'over-rated'. Four teachers gave the lack of equipment and training as reasons for finding ICT use difficult, and the ICT Co-ordinator felt that her use of the equipment that was available put her in the Adept category. The ICT Co-ordinator felt that NGfL standards funding would make a significant difference to this school.
Percentage of Adept/Integral teachers: 13%

Isel School Teacher Profile n=8
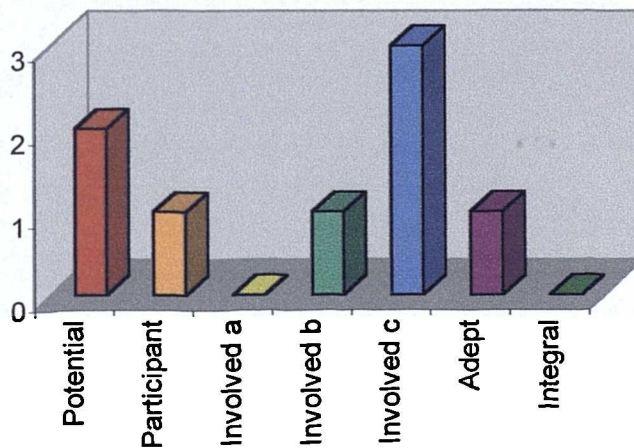
Jopple School [J] 7 Teachers : May 1999

The ICT Context

The school had BBC Computers 'throughout the school' and had just installed two new Xemplar machines which had been purchased with NGfL standards funding. The ICT Co-ordinator felt isolated because the local Computer Centre, which used to hold link meetings for Co-ordinators, had come under the control of the new Unitary Authority and funding for such meetings had been cut. She said, 'Now is the time we need it'.

The school was in the first cohort for NGfL funding and had about £4 000 to spend on RM or Xemplar machines. She had chosen the Xemplar package because the machines were compatible with those of the local secondary school, which she felt would be good for the pupils - only to find that the secondary school had subsequently decided to change to RM machines.

Appendix 5 is one of eight pages of the Xemplar 'connectivity' order form is as an example of how understanding such things can be made even more difficult for teachers by poor quality copying and form layout.

The new computers arrived on a Friday afternoon, unannounced. They were unpacked and set up in the 'Library' (a cubby hole off the entrance hall) and at 2pm the ICT Co-ordinator was sent for to be provided with her hour's training. ('It wasn't worth getting a chair for.') She had to leave her class of six year old children, and felt distracted by the knowledge that the end of their week was therefore muddled: the cover teacher did not know what was necessary to finish things off properly with them, and did not know what to tell them about the coming school week which involved a school journey. These seemingly small details are of course the essence of good teaching. She 'took in nothing' from the session which seems to have been to do with things like bandwidth and gigabytes. She asked her teenage daughter to help her, and they spent Saturday at school looking at software. A rental bill for the as yet uninstalled phone line connection had arrived, which she had sent on to the General Advisor for ICT. Her enthusiasm for the new computers was infectious and teachers had immediately timetabled their use. Since they were not in a classroom, a parent or classroom support assistant would have to work with the children, rather than a teacher.

Teacher Profile Graph (Jopple)
Most teachers had their own computers and used them to make worksheets and keep records. Two teachers did not see a strong purpose for ICT use, citing especially the very young age of these children. The new computers had just arrived in school, and four teachers (half the school's staff) still indicated that for them lack of equipment and training were the barriers to greater use.
Percentage of Adept/Integral teachers: 0%

Jopple School Teacher Profile n≅7

Chart showing teacher profile bars: Potential (~1), Participant (~2), Involved a (~0), Involved b (~1), Involved c (~3), Adept (~0), Integral (~0)
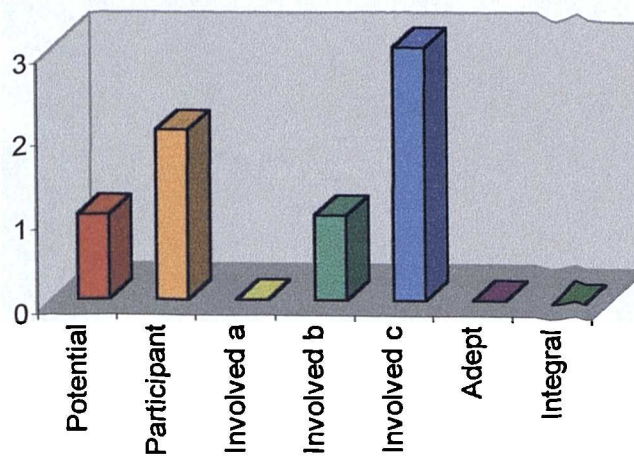
Knotts School [K] 9 Teachers: July 1999

The ICT Context

Knotts school had few computers, none of which were new, which were infrequently used for word processing, spelling skills, and some maths problem solving games. The new head teacher had given teacher's professional development for delivery of the literacy hour and numeracy hour top priority in terms of budget and time: and had not allocated any extra funding to ICT. She was aware that the school provision was inadequate, but said that she had pointed that out herself to the OFSTED inspectors. Her plan was to allow staff to develop their literacy and numeracy strategy until early in the year 2000, and then use the NGfL standards funding and TTA training to implement a whole school policy of increased ICT use to deliver the curriculum ('We will have a big push on it').

The teachers displayed little enthusiasm for ICT although this was evidently not their usual style: the school being busy and purposeful, with colourful and interesting displays, good community links, and a generally pleasant atmosphere. The National Grid for Learning had not impacted at all on this school. However the head teacher was confident that the school would make rapid strides into ICT competence once equipment arrived and training was undertaken. Meanwhile, the literacy and numeracy strategies 'could be implemented perfectly well' without ICT.

Teacher Profile Graph (Knotts)

Two teachers did not have home computers. All others did, and used them to make worksheets and write reports. One computer literate teacher felt hampered by lack of equipment, but all others required both equipment and training in order to use ICT in practice. They felt that this analysis was

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irrelevant, and coming as it did two weeks after their OFSTED inspection, very much a waste of what little energy they had left at the end of summer term. It was impossible not to sympathise with this point of view.

Percentage of Adept/Integral teachers: 0%

Knotts School Teacher Profile n=9
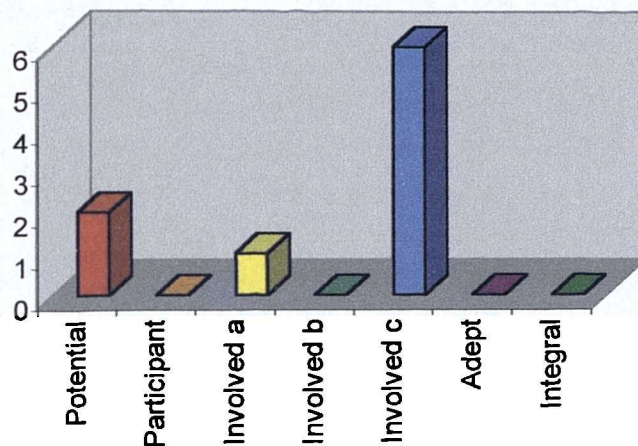
Laurel School [L] 10 teachers: July 1999

The ICT Context

The school had two computers per class, mainly Acorn and PCs. These were used intermittently and mainly for word processing, except in Year 7 where the computers are used more systematically for research using CD ROMs, and for French, maths and problem solving. The school has one iMac which again is used by Year 7. The school has a policy of ensuring Year 7 has privileges which interest the younger children, because the local secondary school to which children might go is hugely unpopular, so many pupils leave Laurel at the end of Year 6 to go to a school over the border in the next county. The school therefore loses a valuable source of revenue (Year 7 is the first year of Key Stage 3 and individual pupils attract higher government funding than Key Stage 2 pupils). The iMac and other computers therefore offer an inducement to pupils to stay another year. Year 7 pupils have the chance to complete a Pitmans' keyboard skills scheme, and many received certificates in 1999 - as did two teachers.

The school is not in the first cohort of NGfL funding, and is preparing for its funding allocation by taking the time to build an extension to house the new computers in a networked suite. The ICT Co-ordinator had not seen the TTA needs identification materials. Many teachers felt that training in new uses of new technology was a priority for them. The teachers were interested and enthusiastic about

technology but indicated that until their new computers were installed little improvement in provision for pupils was possible.

Teacher Profile Graph (Laurel)

Two teachers did not have home computers. One teacher saw little purpose in increased ICT use. The majority of teachers felt that the major barrier to ICT use was the lack of up to date equipment in the school, with two teachers also including lack of training as a problem for them.

Percentage of Adept/Integral teachers: 0%

Laurel School Teacher Profile n=10
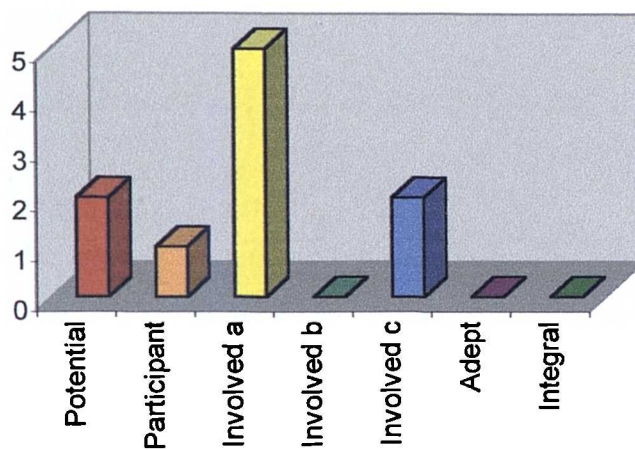
Eight Primary Schools: Teacher Profile Summary Graph

The graph *'Eight Primary Schools Teacher Profile'* includes data from all the above schools (n=78 teachers). It shows that while lack of home ownership and lack of a clear purpose for ICT use are barriers for just less than a quarter of teachers, lack of school equipment and relevant training are barriers for the majority (about 70%) of teachers. This is so even though three of the eight schools had received NGfL standards funding and had purchased equipment. None of the schools had begun the TTA NOF-funded training, which officially started in April 1999. For most teachers training would not have been possible before September 1999, because schools had to demonstrate a high level of ICT capability in terms of equipment before their teachers could undertake training.

The seven Adept teachers were the ICT Co-ordinators who made use of whatever equipment was available as a resource for their classes. That is, their expertise was such that technical difficulties could be overcome relatively rapidly, or they knew who to ask for help. They had received training to enable them to integrate an ICT component into curriculum work. Also, they had opportunities to meet with one another and with ICT specialists in their attached secondary schools to discuss ways of working. The rather resigned ICT Co-ordinator at Knotts school was aware that the subject was 'on hold' until at least Easter 2000. All other Co-ordinators displayed complete commitment to ensuring that opportunities available under the NGfL benefited their school. This reflected the government and the LEA's commitment to ICT: as the Director of Education said in March 1998:

> 'I was determined we'd have an ICT Advisor...we couldn't afford to get left behind over the next three to four years, and with that sort of money available we couldn't afford to let our schools miss out and we wouldn't want them to miss out. Clearly an awful lot is going to be committed by government to teaching and learning development based on ICT. We need to be able to capitalise on that. The government is putting £100 million this year into ICT. We have to make sure that our schools can benefit. Schools have seen ICT as a priority but have had no money'[BG].

Eight Primary Schools Teacher Profile n=78
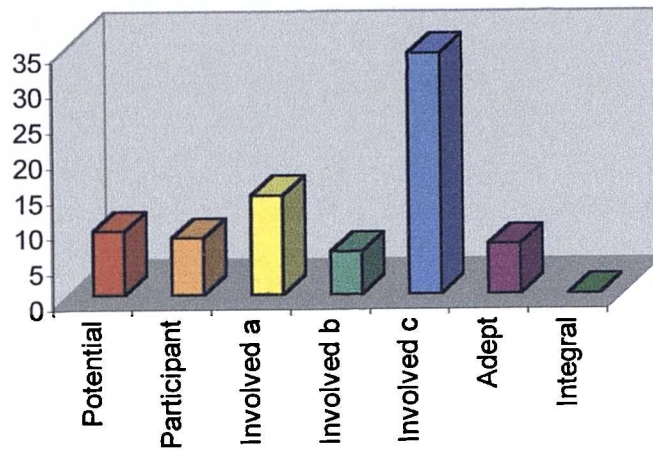
Comparison of school profile graphs

The graphs of teachers' relationship to ICT allow comparison of working contexts between schools. An example of such a comparison is given here, using the graphs for Laurel and Honister schools. These schools are chosen since they are of a similar size and have a similar catchment area.

Laurel School Teacher Profile n=10
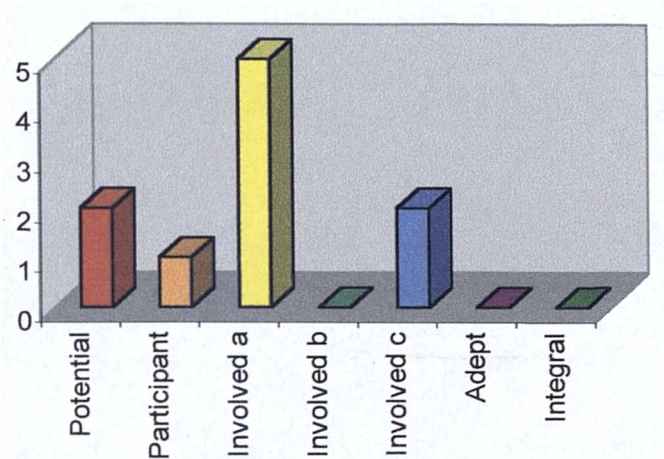
Honister School Teacher Profile n=13
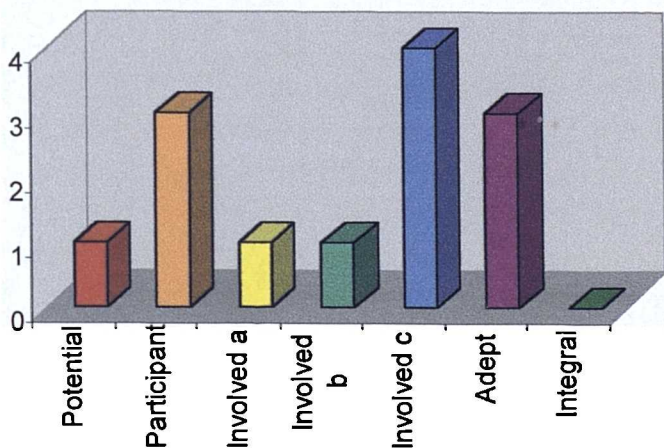
At Laurel school, three quarters of the teachers owned computers. At Honister, almost all teachers owned computers, but three of these indicated that they could see little purpose in increased use of ICT with pupils. At Laurel, 70% of teachers were in the Involved category, that is, lacking equipment at school, training, or both: at Honister,

this dropped to just under 50%. This school presents a wider variety of ICT involvement. This may be because teachers are appointed here as subject specialists, with the effect that for example the specialist Physical Education teacher could expect the ICT Co-ordinator to provide IT lessons for her class. It may be that the range of teacher involvement with ICT is a product of change: the school seems to be using NGfL provision to move towards becoming a beacon school, but some legacies of its very recent non-technical status remain. At Laurel, all but the teachers of Year 7 pupils were in a situation where they were waiting for upgrading of computer provision before any further development became possible.

The model is a rather blunt instrument for making such comparisons, but does provide an overview and an indication of what progress schools are making towards achieving NGfL aims.

The ICT status of the eight schools at the end of the study

Questionnaire 4 (Appendix 4) was given to ICT Co-ordinators of the eight primary schools in December 1999, and completed by seven of them. The previous data collection in the schools took place between September and December 1998. The questionnaire was designed to elicit information about changes during the intervening time. The schools were also sent the profile graphs as in this chapter, with explanation. The ICT Co-ordinator at Jopple first school, a returning the questionnaire, included this message which indicates the sort of difficulties encountered when innovation becomes reality:

Dear Lyn

Thank you for your correspondence. Would you believe it but they came to install our Internet on the children's Christmas party day, and needed to show me what to do as all the children were eating!! They certainly pick their moments to get maximum interest! But we are now on the Internet and have to find time to explore it. The analysis will be very useful.

Table 6.3 *ICT status of Phase 2 schools in Dec 99* details the questionnaire responses of ICT Co-ordinators. Also included in this table are the responses to the question,

'Do you feel that it is possible to deliver Curriculum 2000 with the ICT equipment in your school?' The answers – all but one pessimistic – indicate that ambient anxiety about such factors as lack of equipment continued through what was the second year of NGfL initiatives. The table indicates that staff of these eight schools generally found the opportunity to discuss ICT issues helpful, and that the research had pinpointed some areas in which change was required.

Table 6.3 ICT status of Phase 2 schools in Dec 1999

School	*'Do you feel that it is possible to deliver Curriculum 2000 with the ICT equipment in your school?'*	*Did you find the ICT profile of teachers useful in any way? (Please be strictly accurate here in the interests of research validity!)*
Eskdale	Not really	Yes, it confirmed what we already thought. We need a lot of things to make ICT work in this school.
Fleetwith	No	Yes – it helped focus further on what teachers needed / used for regular teaching
Gable	Hardware, yes Software, no	Yes, but we have had four staff changes (out of 8) since research undertaken. However temp staff still required to deliver nat. curriculum. NQT has very poor skills.
Honister	Yes	It was part of staff training The teachers forgot their numbers so could you send the names please
Isel	*(no response)*	
Jopple	I should think so, but we haven't seen a copy of Curriculum 2000 yet [nb. this was Dec 99]	It was useful – mainly in that it helped to focus teachers on where they were at with ICT. Since your visit we have set up a network and teachers are timetabled to use it. All teachers are becoming more confident.
Knotts	Not very successfully	I haven't found it useful yet
Laurel	Probably	We have discussed the documents you sent.

Summary of Chapter 6

The model provides a structure for analysis which can enable mapping of changes over time. The results of the analysis were sent to schools with a written explanation of the findings. These documents were used by Head Teachers as discussion documents with governors, parents, and the LEA ICT Advisor. One outcome of this procedure was to help teachers to assess the contextual factors in their work situation which made the

integral use of ICT more or less possible. The Head Teacher at Isel school later described this process as having been 'inspirational' for her staff. However it was evident that at Knotts school the staff (who had no up-to-date equipment and had deferred plans to acquire any) felt that the procedure was irrelevant and a waste of their time.

This section of the study can be shown to have achieved the stated aims:

a) *To collect specific data about situational factors affecting the professional development of teachers.* Detailed information about the situational factors affecting the professional development of teachers in the area was collected. The model provided a structure for both collection and analysis. The data collected indicated that in these schools, three quarters of teachers still lacked relevant equipment and training at the end of 1999. It also showed how once equipment appeared and was properly installed, other changes towards ICT integration took place. Finally the data indicated that the competing priorities of implementing the ICT, literacy and numeracy strategies left some schools and teachers with no choice but to 'put off' training and development until finance, time and energy were available.

b) *To compare the school profiles produced by the model, and to provide a summative school profile for the study* The school profiles produced by the model tallied with the accounts given of the schools by ICT Co-ordinators. ICT Co-ordinators had a very clear idea of what was happening in their schools. They were called upon to act as technician throughout the school week, and to provide training for their colleagues. The school profiles provided information which could enable teachers to evaluate their ICT context and make changes. The graphs allow a visual comparison to be made of the status of teachers. The graphs indicate similarities and differences between the school environmental conditions which affect teachers.

c) *To discern outcomes of NGfL initiatives.* It was possible to discern positive outcomes of NGfL initiatives: new equipment was beginning to filter through into

schools, and enthusiasm was evident as its capacity to link schools with others became a reality. Teachers had a heightened awareness of ICT in their school and in other schools, and were keen to undertake training. The ICT profile had some practical implications: it indicated what conditions must be met, and what changes might be made, if the outcomes of teacher confidence and competence with ICT were to be achieved.

The graph *'Summary: Study Schools Teacher Profile'* includes data from teachers in the three linked schools, the case study school, and the eight primary schools (n=136). This graph summarises the situation in these schools in December 1999. The graph shows that 20% of teachers sampled still did not own a computer. However 86% of teachers indicated that they could envisage educational uses of ICT with pupils. About 66% of teachers wishing to use ICT regularly could not do so because of lack of equipment or training. 7% of teachers integrated ICT into their classroom practice, with the other 93% working towards this. It is very possible that by the time this thesis is completed, many more teachers will have achieved Adept or Integral status, as NGfL initiatives acquire momentum and have discernable effects.

Respondent validation of this research was provided by a request from the General Advisor for ICT in Milton Keynes to have access to the findings. The Advisor discussed the findings with the Director of Education. I was then invited to present the work and discuss its implications at a training session for ICT Co-ordinators, since the Advisor believed that a consideration of the issues raised could be expected to help them to implement ICT development policies in their schools. The discussion at this meeting was supportive of the approach taken by the research, with its strong focus on teacher's professional development, and its questioning of assumptions about teacher attitudes in the press and in other documents.

Summary: Study Schools Teacher Profile n=136
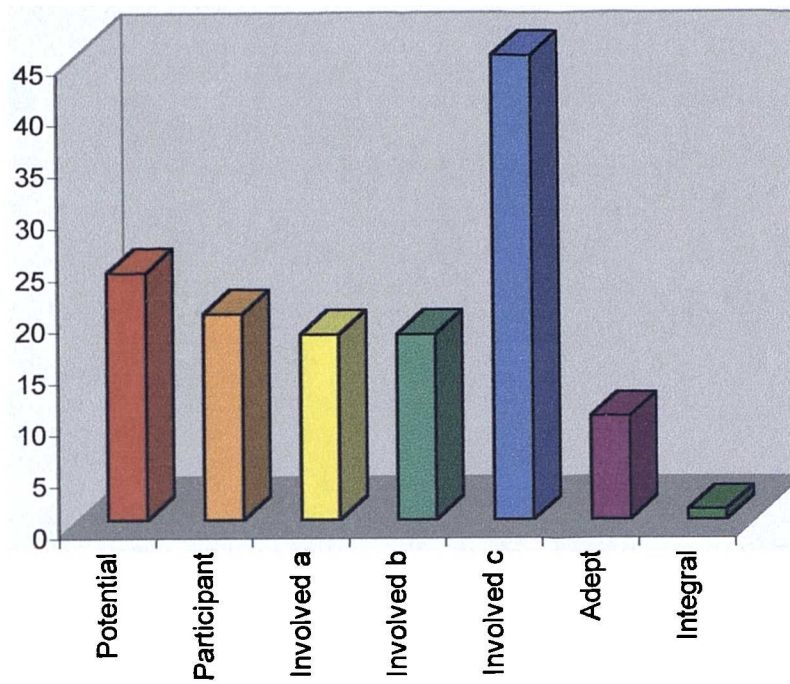
The next chapter uses findings from analysis of the Phase 2 interviews, linked with the data above and data from Phase 1 and the research literature, to discuss the issues contributing towards answering the research questions.

Chapter 7 Phase 2 Findings : Indicators of Change

Introduction

The model for categorising teachers as users of ICT described in Chapter 5 emerged from analysis of Phase 1 data. Using this framework, the ICT status of teachers in eight primary schools was categorised and related to their work situation, as described in Chapter 6. Interviews were conducted in these schools and the original three study schools throughout Autumn 1998, all of 1999, and early 2000. Chapter 7 provides findings from analysis of this Phase 2 interview data. Using the Phase 2 data it is possible to begin to answer the research questions more fully, and to look at the process of change in schools.

The research questions are:

1. What factors support the professional development of teachers in ICT?
2. What factors hinder progress?
3. What are the outcomes of the opportunities available under the NGfL?

The findings clarify some of the factors that enable teachers to acquire ICT skills and expertise, and show some effects that the NGfL innovations had on practising teachers at this time.

Purpose of interviews in Phase 2

i) to collect further information from teachers about the issues identified in Phase1:

ii) to identify factors which made the use of ICT more or less likely once hardware, connections and training were established:

iii) to enable teachers to describe ICT use in their situation.

Notes on Phase 2 Analysis of findings

Analysis was conducted as in Phase 1 (See Chapter 3). The interviews were taped and transcribed, and the transcriptions studied to discover common themes. The structure

for the Phase 1 analysis - that is, the twelve themes detailed in Table 4.1 was not used, because this might lead to misinterpretation of data, or loss of new opportunities for understanding. Instead, themes arose from analysis of the new data as the transcripts were read, coded and common areas identified. During this process it was evident that some themes continued from Phase 1 as discussion items - partly due to the questions raised at interview, and sometimes raised by teachers. However, teachers' experiences with new equipment, and opportunities to consider ways of working with ICT gave rise to new and important issues. These issues are to do with the establishment of best practice in ICT use, and highlighted new sets of concerns, and new opportunities for teachers and their pupils. Themes could therefore be grouped into two sets: firstly, those themes which continued to build on data collected in Phase 1: and secondly new themes arising from Phase 2 data. These themes are listed below, and will be used in the rest of this chapter to order the findings.

Themes continuing from Phase 1:

1. Infrastructure - access to equipment and connections

2. Training

3. Limited time and competing priorities

4. Teacher resistance / teacher anxiety

Phase 2 Themes:

5. Home use of computers by teachers

6. The Internet: problems in use

7. Establishing educational uses of ICT

8. School management and ICT

As in Chapter 4 each of the themes is reported in three parts:	
i.	*Context* (Data from analysis of documents and research journal: an indication of the national and local context within which teachers were working)
ii.	*Findings* (Data from face to face interviews: the outcomes of initiatives on teachers professional development)
iii.	*Discussion* (interpretation of data)

Findings of Phase 2 Interviews

1. Infrastructure - access to equipment and connections

i.   *Context*

Between 1997 and the end of 1999, all primary schools in the city had received at least some standards funding under NGfL provisions to upgrade their ICT. The General Advisor for ICT selected a first wave of schools to receive funding from 1997 to purchase computers, whereas second wave schools were initially provided with small items of hardware, and further funding became available for them during 1999. This selection took place depending on the school's ICT self-audit: 'beacon' schools (such as Banna) and those with minimal equipment (such as Causey) were selected as first wave schools.

ii   *Findings*

Table 7.1: *NGfL funded equipment in the study schools* indicates the changes that took place in hardware provision in the twelve study schools over the study period. The Advisor had recommended that primaries purchase 'packages' from either Research Machines or Xemplar. Honister school, with its expert ICT Co-ordinator, had purchased an individual package from Time machines. In 1997 none of the twelve schools had a connection to the Internet; by the end of 1999, seven had an Internet connection which allowed Internet access to networked computers. In this table 'Classroom computers' indicates what the Advisor called a 'mixed economy' of stand-alone BBC, Nimbus, Archimedes and other machines.

Three of the schools (Eskdale, Isel and Knotts) can be seen to have made no gains in hardware provision. At Eskdale and Knotts this was due to choices made by management about the school's development priorities at this time. Both schools had experienced disruptive staff changes and both schools were at or near the bottom of the 'league tables' compiled by using SAT results. Implementing the literacy and numeracy strategies was a higher priority – and this would be undertaken without an ICT component, because the learning curve needed for integral ICT was considered to

be too steep. Isel had applied to be in the first wave of funding but had not achieved this, and teachers indicated some frustration as they saw other schools upgrading their equipment.

Perhaps the most spectacular change occurred at Honister. The new head teacher took office in September 1997, with the school under Special Measures after an OFSTED inspection. He appointed a technically skilled ICT Co-ordinator. Within two years the school's hardware provision had changed from four machines which were described as 'non-functional' to networked, matching mulitimedia computers in a specially furnished room.

Of the three original study schools, Askill continued to upgrade and extend its technological capacity, organising an effective Internet link and acting as a hub for some of its feeder primary schools. Banna consolidated its already strong ICT position by extending its network to include classroom computers, and linking to the Internet. Causey acquired one new computer, but had problems involving staff changes, and decisions about the siting of the computer meant that cabling for an Internet link was not in place.

Provision of up-to-date hardware and connections had made a difference to the teachers in the schools. Teachers expressed opinions about organisation of computer rooms.

> It's pointless if you've got lots of different machines and if you go in there and try and teach IT it's hopeless [BI]

> It will be lovely when it's all done because there will be enough computers to take the whole class in, two to a computer. They won't all be the same, and they won't have the same programmes on, but at least you'll be able to do something with them all at once. I do find it quite difficult with not being next to the computer room [CG].

Table 7.1: *NGfL funded equipment in the study schools*

School	First or Second wave of funding	Hardware 1997	Additional Hardware 1999	Internet 1997	Internet 1999
Askill	2nd	4 computer rooms: 3 PC, 1 Apple Mac.	Integrated Learning Centre with 60 networked computers	No	Yes Microwave link
Banna	1st	Suite of 15 matching networked computers	Network extended to classroom computers	No	Yes via Askill link
Causey	1st	6 classroom computers	1 multimedia computer: 1/3 share of laptop for head teacher	No	No
Drigg	1st	Suite of 5 networked computers + 8 classroom computers	New computer room (15 networked computers) under construction	No	Yes
Eskdale	2nd	Random assortment of 18 stand alone computers – all but one over 3 years old	No change: Digital Camera purchased.	No	No
Fleetwith	1st	Classroom computers & 2 RM Windowbox PCs	Networked suite of 7 multimedia PCs	No	Yes
Gable	1st	Classroom computers	Networked suite of 15 RM Windowbox machines	No	Yes
Honister	1st	4 non-functional machines	Networked suite of 10 Time machines	No	Yes
Isel	2nd	4 classroom computers	No change	No	No
Jopple	1st	Classroom computers	2 Xemplar machines	No	Yes
Knotts	2nd	Classroom computers	No change	No	No
Laurel	2nd	Classroom computers	RM package under consideration: new computer room under construction	No	No

A teacher at Drigg school had organised use of the new computer room, but felt dissatisfied because she could not be directly involved with children's learning.

I don't like taking all the class in because it disrupts the other teachers, swapping over into another classroom, and also because the children don't get on, - Somehow they don't settle to anything when it's not their turn. And you're trying to run between the two rooms. So I

rely on parents coming in, taking a few over at a time, but then the problem with that is the children are doing stuff with the parent and you don't actually know how well they are getting on with it. You don't teach it. Obviously you get some feedback from parents but it would be nice if you could actually sit there and do it with the kids. It does get frustrating. Lots gets delegated to parents and assistants [CH].

Later in the year, this dissatisfaction amongst the staff had resolved into plans to build a new enlarged computer room, an example of the change agency of involved teachers. The disruption this would cause was accepted because the outcome would be worthwhile.

I don't know what I'll be doing next term! We are all swapping round so it's going to be difficult. And we are having some building work done, so we don't know where the computers are going to be. Might be stored in a shed somewhere. Not even accessible. We're having the courtyard covered and its going to be a library and IT suite. Should be started in the holidays - goodness knows what state it will be in when we come back.[HI]

Computer provision at Askill school was better than at any other school in the city, but teachers still found problems.

There are computers in the library. They don't print but you can look up information. Although again the students are finding it very difficult to get to the computers because they are so busy. Computer time is at a premium. Very rarely do you notice them not being used.[LH]

But here at Askill Internet access is not perfect. When there are breakdowns, people are running around - there is no one person we can ring up. We are at the mercy of the technology [UX]

ii.   Comment

Acquisition of hardware does not easily translate into educational good practice. However without adequate equipment, there was no hope of teachers delivering the ICT curriculum, or fulfilling the government aims for the NGfL. Improved provision of hardware was a gradual process in the city at this time, and might for a specific primary school mean the acquisition of one or two new computers. Once these computers arrived, and were installed (in itself a fraught procedure), ways of using

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them to support delivery of the curriculum had to be considered and organised. This system would certainly not satisfy the demands for change expressed by the Logo guru Seymour Papert.

> 'The cyberostriches who make school policy are determined to use computers but can only imagine using them in the framework of the school system as they know it'
>
> (Papert, 1996 p 25).

If anything, the forces that ensure teachers deliver a mandated curriculum in schools are stronger than ever under the leadership of Chief Inspector of Schools Chris Woodhead. ICT had been drafted into UK classrooms to ensure more efficient delivery of specified content, not to free learners to study what they wish, pursuing hyperlinks at will. As long as this is so, writers such as Papert may continue to insist that schools use computers badly (Papert 1996 p.158), and both pupils and parents may continue to believe that this is entirely the choice of the teacher. But it is possible that this product of the drive to raise standards may not be such a disadvantage to children in school. There is as yet not enough evidence that individual use of computers produces educated people. Therefore it is reasonable for those charged with the education of children to continue their efforts to maximise the effectiveness of school computers (rather than their efficiency). British studies have shown that teacher involvement with pupils and ICT makes a significant difference to learning outcomes (Still & Sharp 1997: TTA 1999: also Section 10 of this chapter).

2. Training: From Driver's Licence to The People's Lottery

i. Context

On January 28th 1998 the Teacher Training Agency released a consultation draft of its National Curriculum for training student teachers in ICT. This document was to become the basis for training both students and serving teachers. The funding for the training was drawn from the New Opportunities Fund, that is, from the National Lottery, and was one of the first three projects to be targeted by government for such spending - the other two being out of school activities, and 'healthy living centres'. The Culture Secretary Chris Smith explained that lottery funding would be spent on

things that 'matter to people', signalling that an ICT-adept teaching force seemed a general priority. Whether this was so or not, £125 million of NOF funding was allocated to ensure that all teachers received training to a basic standard of ICT competence and confidence, as McKinsey and subsequently Stevenson had suggested (see Chapter 1).

An outline of the TTA National Curriculum can be found in Appendix 9. From September 1998, trainee teachers would be required to follow this Curriculum. Training for serving teachers began in April 1999. In summary, the curriculum has two sections. Section A deals with teaching and assessment methods for the use of ICT in subject teaching - a pedagogy for ICT in use. Section B deals with personal knowledge and understanding of ICT - the skills required to deal with the machines. The aim of the curriculum is 'to 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 in teaching particular subjects' (TTA 1998b, p.1: Dawes and Leask, 1999 pp 149 - 164).

Serving teachers were provided with a self-analysis pack which was designed to help them to identify their training needs. These Needs Identification Materials were originally planned for December 1998 and eventually reached teachers in summer 1999. The first time a teacher in this study reported encountering the materials was the ICT Co-ordinator at Fleetwith in October 1999. The school concerned had received a CD-ROM version but had no computer on which to use this. The ICT Co-ordinator attempted to download the materials from the Internet but gave up when she realised that it comprised a 60-page book.

The TTA commissioned training materials from a group of thirty-two training providers, who had fulfilled stringent requirements to achieve registration. Schools could choose any suitable provider, and teachers could begin training from April 1999, if the school equipment was judged suitable to support use of new knowledge in practice. Some schools chose to defer their teacher training until equipment was purchased and operational, while others began immediately. Askill, part of the Technology Colleges Trust, was itself a training provider and began courses for its own staff and teachers in its link schools in September1999. Some Banna teachers

undertook this training. Teachers at Causey did not, having inadequate school equipment. Teachers at Drigg decided to defer training until April 2000 because they wished to concentrate on the numeracy strategy, and because their new computer room would then be open.

Prior to this, training for ICT use had been offered by LEAs and other bodies. Askill School was a centre for European Community Driving Licence (ECDL) training, which used a skills based approach with frequent tests and certificates. The findings in this section cover a period when ECDL training ended in summer 1999, to be replaced by NOF funded training in September 1999.

ii . Findings

The Askill ICT Co-ordinator described the ECDL (European Community Driving Licence) training as 'pretty sound', and it turned out to have a profound effect on the practice of some teachers. However it is interesting to note that the Co-ordinator had modified the course, inextricably linking training with practice, in the belief that skills training alone was inappropriate for teachers.

> We are a Pilot School for the ICT initiative through the TC Trust. So we have 30-odd staff every other Thursday here doing the ECDL - that's going quite well. We've got teachers from other schools in MK, not just our teachers. It's a modular thing. There are 2 phases. The first is getting staff actually confident with using applications. The second is using them in the classroom. Well, that was the way they wanted us to go about it. We said no. We're not just going to teach applications, so all the time we're teaching, we're actually saying, here's how you can use it in the classroom. Only simple ways. Then there's extension modules which they can do with their own subject specialism.[DX].

The following interview extract is from a teacher at Banna who had undertaken the Askill ECDL training, encouraged by the ICT Co-ordinator. Remarkably this teacher's practice developed within a single school term from anxiety about computers to teaching her class how to put PowerPoint presentations on the school's Intranet for parent's evening.

The Driver's Licence training has been excellent. I think it's worked so well because we are very closely linked with Askill and so an awful lot of the things we do in this school will feed in to the Askill system. So, they use PowerPoint, they use Publisher - and we use it too. They have helped us get the Internet link. They use RM machines like us. We've got very close links, so because the training was at Askill it was geared very much to what we wanted. Although it was quite secondary based. A lot of people doing it were from secondary schools. We were the only two primary people on it. [FN]

The value of such training was endorsed by an Askill teacher, who points out here the importance of timing; the training became available at the same time as his partner's school enabled them to buy a home computer.

The Driver's Licence training has been inspirational in its own way. I didn't do the basic word processing course, but the Internet stuff, which is -I want to know how the systems work, and how to make the best use of it. I found it very useful. The presentation package - that was great fun. I volunteered to do it. I want to do a Diploma, and depending how things go I might take it on to a Masters. I wanted to get on it because I wanted someone to show me how to do the more technical stuff. - or what I call more technical - and I thought, now is a good time for me. If it had been a year ago I probably would have said no [QL].

At Causey school, the Head Teacher had assessed some training materials offered to teachers and found them wanting.

I took home a BBC 'Computers Don't Bite' CD and borrowed a computer to play it on. And it was: - well, it won't be any good for the teachers here, because it's all talking about spreadsheets on Word, and we do them through Number Magic. I went through it and it's very basic. There was a bit at the end, ' a mouse is.....' - it's a shame really.[BI]

At Drigg, the staff were aware of their own expertise, and emphasised that their job conditions still hampered increased integration of ICT.

I think in terms of training, we are all just about there. It's just having the time. The equipment, and also your own personal time to get to grips with things[HI]

In the following extracts, a Deputy Head from the secondary school Mosser describes how her school approaches training, and then a teacher from Askill reinforces the indication that 'buddying' and informal training are effective strategies, especially for beginners.

The next stage is, Heads of Department have training. Everybody is going to be trained to use at least one piece of software in their teaching. We thought that for the majority of teachers the way to make them feel it was accessible was to get one thing that they could see was exciting and good to teach a particular part of their course. We had an all-singing all-dancing RM presentation: that helped. Staff came up to me after that and said, I'm going to have to change, aren't I. I'm going to have to learn it. So we have tried: different staff have gone through different stages. And you've got to let them know you're *not* an expert. Any one can do it. So. The policy is to help people become more confident. You've got to sound enthusiastic about what you've found out, and share it. We have said to someone who is confident, pick someone - 'buddy' them. So, Phil who is very confident has actually encouraged Lucy to do a programme and he's going to show her how to use it. That combination of the formal and informal in training, is very good. We had quite a long debate on which works best to change people. The classic example is, we had this formal training a few years ago and it did nothing. We all went in faculties to train for computers and it did nothing, because we were all at different stages. You've got to cater for all people, so very keen people can get on, and others can get very keen.[MC]

The one other thing I've done is - I don't know it now, but I've got the password - we had Helen *(Humanities colleague)*, she's a whiz on computers. She's got a marvellous machine at home. She said, I'll run a session after school to show you how to get into the Internet, for the Humanities teachers. She said, it's ever so easy, let's go and do it. So we all went upstairs and got logged in, or whatever it was. She gave us our passwords and we got into it. Yahoo? Yes? Well we got into it. We only had ten or fifteen minutes. With one thing and another, not long, but it seemed easy to me, to get into it. And then we tried the searching thing. We started to look at that a little bit and then I ended up looking at Single Parent Families. Then I thought I'd try rain forests. So I clicked on that and it said there were X number of thousands of entries. But it wouldn't call anything up and Helen didn't know why, so we left it. So that was it. That was my only introduction to the Internet [ET].

Some teachers still felt that it was all happening elsewhere, and that circumstances presented barriers to their progress.

There aren't enough people I want to send an email to. It can't be too difficult. It's like the fax machine, complicated till you get used to it. Getting on the Internet, I expect that's not too difficult either but I wouldn't have the first idea how to do it. And then, I did putting tables in, importing things, like that. I did it but I couldn't tell you how to do it now. The school does a really good course but it's every Thursday night, and I have *(sports)* fixtures. It would be nice to do it. I can't change fixtures. I think the school's trying to address the issue but I always feel as though I've slipped through the net[LH]

Askill ICT Co-ordinators were pleased with the training they had organised, and stressed that it was successful partly because of the sense of purpose that teachers have:

The object of the exercise is all based around this TTA stuff where they've said by 2001 I think it is, all teachers will have the skills - I think they're going to have a hard job to meet it, but I think we will here. The nice thing is we can push it back into the curriculum all the time [DX]

Askill teachers might be using the computers a bit more, now they've done the training course. Every other week they can go in and practice, and I was there last Thursday, and there were a lot of teachers in practising and using it. They were actually using it for a purpose - doing a class list, or groups, or a worksheet. It's good [UY].

The following teachers emphasised that ICT was no longer optional for teachers.

The Needs Identification Material isn't compulsory - we can't make them. But obviously the message is getting over now, certainly, that teachers are going to have to be up to speed on this or they are going to find themselves marginalised with the curriculum, or just asked to find another job. I mean, that's the bottom line, you know, if the government are saying we've got to do this, management of the school is certainly saying we want all our teachers computer literate, and if people fight on that, they are on to a loser. So. You know. Everyone will eventually do it. [DX]

The teachers will definitely need training when we get the Internet connection. Whether they want it or not - well, they have to teach it, you see. Very few teachers get out of it. Everyone teaches their own class. They have a set IT time and they have to be there. [UX]

Once the TTA training at began at Askill, there were problems. The Technology Colleges Trust (TCT) course was less immediately effective than the ECDL training,

being more rigid and skills-based. It comprised computer-delivered 'Integrated Learning System' type modules and therefore it was less adaptable by the ICT Co-ordinator. At the NOF- funded training sessions I attended, teachers expressed their dismay: the training was not suited to their requirements. It was not pitched at the right level for several teachers, and in fact the course was undifferentiated so that everyone was doing the same thing. It involved working through multi-choice questions on screen and then ticking off achievement statements such as, 'I know how to organise ICT resources in my classroom'.

The following are responses to my question, 'How are you getting on?' during training sessions, from teachers-as-learners working at computers. Note that even at this high-technology school, there were equipment problems.

'This system keeps refusing to accept the password. It's crap -'

'It's - I'm disappointed. I already knew this'

'I can't use this with my classes. There are only two computer labs for 70-odd teachers. I've done well to get six lessons in one term. My own improvement here doesn't help my pupils'

'Poor delivery of training. It's a waste of money'

'We haven't done any assessment of our IT skills. This is no good. I hope it will improve: it's not helping me'

'If they'd given me the five hundred quid towards a laptop it would have been a better idea'

'This training is skills only, and I don't think I'm learning anything'

'You can just go through the end of unit assessment just ticking yes in the boxes. Not really useful'

'It was sort of political that we chose Askill as our Training Provider. We aren't happy. The training is inappropriate; it's too easy'

'It's a bit hopeless compared to the Driver's Licence'..

This training was under trial at this stage, and the teachers were aware that they were 'guinea pigs'. It is to be hoped that their feedback would improve the course for subsequent teachers. As the interview data shows, teachers have high expectations of training. The one-off Lottery funding of about £450 per teacher was well received and

regarded as a genuine opportunity to achieve personal aims for professional development.After the first half of one TCT session, the ICT Co-ordinator became so disenchanted that he summarily stopped the session, and provided an impromptu lesson on how to hyperlink worksheets.

'I'm not wasting your time and mine. Here's something useful'

The teachers-as-learners were immediately fascinated by this procedure and rapidly regained their enthusiasm. At this time, the newly established Integrated Learning Centre (ILC) was about to open at Askill. The library had been converted to house 60 computers, and a technician/librarian appointed. It was intended that teachers compile electronic material suitable for their pupils, which could be used for classes when they were absent, instead of the class having a supply teacher. I asked the teachers practising hyperlinks, 'Will this be useful? Will you have time to make interactive worksheets?'

'Well, we've got to make time. We have to put an interactive worksheet on the ILC system for when we're away, so, yes. We will.'

A Constructive Conversation

The following provides a direct example of learning as community joining(Chapter 2). After the hyperlinks demonstration, the Humanities teacher [E] was working alone to try out what he had been shown, but was finding it difficult. He was invited to join another group, and the following conversation took place. The group were using the 'Ask Jeeves' web search site. Teacher A is an English teacher and K a Business Studies teacher.

A: Oh come and join us a minute, E

E: Can we do one together? I want to talk about it and see, first

A: OK. Shakespeare.(typing into the search engine)

Web, then, type in a word - "Who is Romeo?"

('Romeo Body Builders' site appears on screen)

A: What?! Oh well, whatever -

K: Should we write the worksheet first perhaps, then find the resources that support the content. You can do the search first, like we're doing. But I think we need to do it the other way round really.

E: Perhaps when we're used to it

A: OK. Save him (Collects a picture of a muscle-y male and continues with procedure)

E: I need to see this three more times at least

A: It's a lot of work and I'm not often ill so the kids may not even use what I make.

E did not operate the computer during this session but continued to watch and talk to the others in the group. At subsequent sessions E was working alone to create Humanities worksheets with hyperlinks, having practised at home. This seemed a clear example of a peripheral participant in a community of ICT users, offered peer tutoring and expert mentorship, moving towards personal expertise and independence. Work at home allowed the privacy and time to practice and gain confidence.

K's contribution to the dialogue provides an example of what I can only describe as 'teacher's thinking'. By that I mean that teachers have a particular approach to new ideas, resources, opportunities, challenges and even people. This approach is characterised by teachers bringing their professional expertise and reflective capacity to bear on things, which has the effect that they tend to always evaluate things with this question in mind: "How can I use this with the kids?" Not just "*Can* I use....?" but "*How* can I...?". Once you have noted this tendency in teachers it is often apparent. Teachers constantly collect resources, mental and physical, which will help them to encourage the development of pupils. From the reception teacher picking up shells on beaches whilst on holiday to university lecturers who scribble down ideas on the back of beer mats in the pub, it is a common phenomenon. It is this application of experience to new material which enables teachers to help others make meaning out of relative chaos. Here, K is suggesting a (probably better) way of working, which may benefit practice, resulting in more focused worksheets and a more coherent experience for the students. For E, skills practice had to come first in order that the use of technology become second nature. This however is a learning conversation, and although the teachers were not very happy with the early part of this training session, they left satisfied because of the interactive worksheet training. The ICT Co-ordinator and the peer interaction had provided learning experiences, with the computers supporting learning only once teacher intervention had taken place to make them do so.

iii.   Comment

The requirement for relevant training was highlighted by teachers throughout the study as of central importance to their professional development as users of ICT. Training was organised by central government as part of their coherent NGfL policy, and its delivery was tied in to school ICT development. The Phase 2 data clearly shows how this combination of relevant training linked with school provision of appropriate hardware, can alter practice almost immediately. Significant development was brought about by the combined change agentry of government advisors, ministers, education managers, and teachers. There were also reminders that the opposite case is true, so that for many teachers previous training was a waste of time because their schools did not have the facilities for them to use with classes. When Drigg school acquired its Internet connection, none of the teachers used it until after a training session two months later, and six months later it was still used infrequently because teachers had not had time to become fluent in use, or to ensure that its use could achieve educational aims.

The TTA training was the result of a one-off lottery funding opportunity, and so was organised to address issues to do with the pedagogy of ICT in classroom use. The ECDL training addressed skills needs. Askill school offered ECDL and subsequently TCT (NOF Funded) training. Interestingly the overtly skills-based ECDL training was more popular and seemingly more effective than the TCT training based on the teacher-friendly TTA guidelines. The reasons for the difference in effectiveness are complex, and seem to depend on such factors as the particular mix of teachers at training sessions and when the sessions were held. However the essential nature of the training offered is probably what really affected its outcomes.

Table 7.2 *Characteristics of Training Schemes* compares some aspects of training offered at Askill, and indicates that the TCT training was less well received because it was poorly designed to address individual needs, did not help teachers to transfer their new skills into classroom practice, and was not considered to be good value for money.

Table 7.2 Characteristics of Training Schemes

ECDL Training	TCT training
Teachers had volunteered to take training, and had been chosen as 'the lucky few'	All teachers were required to undertake NOF training at some stage
Training was funded from the school's professional development budget and was thus perceived as 'free'; teachers from other local authority schools were invited along to benefit.	Each teacher was allocated approximately £450 by government, a discrete sum which some teachers felt might be better spent on other sorts of training, or on equipment
Training was based on previous skill level	Training was the same for everyone
The materials had been developed and trialled over time	Materials were generated relatively rapidly with little time for refinement
The training provider had adapted the materials to include an element of how skills might be used in practice	The training provider could not adapt the ILS – type material, and could only make the training more appropriate by abandoning the programme altogether
The software was robust and caused few technical problems	The software was problematic creating a frustrating level of difficulty
Assessment was formative as well as summative and successful candidates received certificates	Assessment was summative, by multi-choice question, and marked completion of the course rather than achievement of learning aims.

It would be of great interest to compare training schemes in depth over time, for individuals and for schools, but unfortunately the study period ended as the TTA training was beginning.

Interestingly none of the teachers who had undertaken the ECDL training at Askill mentioned lack of time to practice as a barrier to using their new knowledge. Partly this may be because the course was structured on a two week cycle, with instruction the first week followed simply by open access to the computer rooms for the second week. It may also be that the finding of Leask & Younie (2000) is noticeable here: that those who have a clear purpose are motivated to use computers without considering lack of time a great barrier.

The findings confirmed that training along with a combination of other factors including equipment, a professional purpose, and inclusion in a learning community, strongly affected the use of ICT in classrooms by teachers.

The schools organised different approaches to teacher training. Despite the predictions that computers in education should support individual learning, much of the training offered to teachers had a traditional style. There was a prescriptive curriculum, and training involved undertaking set units of work with tests at the end. The multi-choice questions in the tests were not designed to encourage problem solving or collaborative learning. Table 7.2: *The range of teaching and learning styles in the study schools* indicates the range of styles in those schools which undertook ICT training during the study period. The table also shows which of the schools had carried out a previous needs identification procedure as recommended by the TTA. All teachers apart from those at Causey benefited from a supportive learning community.

Learning communities were established by Askill, Banna and Mosser management, with a sensitivity to the needs of teachers as learners. Askill and Banna used their established links to further the professional development of their teachers, with the motivation of benefit to their pupils. Mosser has over 100 teachers, and so the school constitutes a community; 'buddying' was organised by senior management as a strategy to ensure that ICT beginners received the support they required.

Causey school, isolated by lack of equipment, staff turmoil and the high priority given to literacy and numeracy strategies, did not develop its ICT capacity. The machine provided by Standards funding arrived but was not connected to the Internet, and no-one at the school knew how to use its facilities. Management could not find time to allocate training for this purpose. The school gained little from the NGfL initiatives during 1997 – 2000. Drigg school went from strength to strength during the same period, and although NOF training was deferred, this was part of a strategy to ensure that new equipment was in place first, and that other priorities were cleared.

Table 7.2:The range of teaching and learning styles in the study schools.

School	Teaching/Learning Style for teachers undertaking ICT training	Needs Identification	Notes
Askill 2ndry	• Direct instruction • Peer tutoring • Participation in community • Personal research/home learning	Yes: ECDL No: NOF	Twenty eight teachers trained in pilot schemes
Banna 1ry	• Peer tutoring • Participation in community • Personal research/home learning	Yes: ECDL No: NOF	Two teachers trained (at Askill)
Causey 1ry	• Personal research/home learning	No	Headteacher only trained
Drigg 1ry	• Direct instruction • Peer tutoring • Participation in community • Personal research/home learning	Yes: NOF	All staff received at least some training
Mosser 2ndry	• Participation in community • Peer tutoring ('buddying') • Personal research/home learning • Technical Demonstration of equipment	Yes, by School management	All staff received at least some training

3. Limited time and competing priorities

i.   *Context*

It takes time to learn enough about software to use it effectively for a task, and even more time to consider how this knowledge might translate into helping others use it effectively. Teachers in the study were allocated time to learn how to operate particular machines or software only as part of the ECDL training.

> 'The time needed for teachers to learn new software has increased with the complexity and sophistication of the software. It is no longer possible to learn to use new software quickly'
>
> (Moseley et al. 1999 p 106).

In the extract below, substituting 'teachers' for 'pupils' provides an indication that there are two stages to learning with ICT: learning the skills, and then learning how to use the tool once skills are acquired.

> 'Learning how to use new software and applications takes time, and when a new application is introduced, the content the pupils are putting in takes second place as pupils familiarise themselves with the tools available'
>
> (Selinger 1997 p 41).

Some tasks can be shared amongst teachers and pupils to ensure best use of teacher time.

> 'Most schools which are successful with telecommunications rely on children themselves to carry out many of the tasks, leaving the teacher to concentrate on teaching, rather than being the technical expert'
>
> (Meadows & Leask 2000 p 15).

ii.   *Findings*

Teachers felt a degree of urgency generated by ICT innovation and competing priorities. Little (if any) time was allocated by management for teacher learning.

There are changes all the time, we ought to be doing ICT, we ought to be getting to grips
with the numeracy, we ought to be getting to terms with literacy: all you can do is take a step
at a time and panic when you get the OFSTED letter. [BG]

Time is what I need! And someone to say, sit yourself down, this is actually your time to sort
yourself out with IT, go for it. You don't actually need someone there, just someone to say
'this is what you are going to do, right now.' [UC]

A teacher at Drigg had found use of the Internet time consuming, and wished to look
further, but felt that within the ordinary teaching week this was not possible. The ICT
Co-ordinator at Drigg confirmed that no other staff had used the Internet link, and
suggested that this was because of the pressure of other work:

I've had a little go at finding the Virtual Teacher Centre myself, but it's the time. We have
the link till 6pm but I haven't used it really. What I'd actually like to do, before another term
goes by, what I'd probably aim to do is to come in during the holiday, but I don't know if we
have the link out of term time. But if we are linked, it would be great to come in and spend a
whole day exploring it all. [FD]

We have the link but no-one at the moment is going in and using it for themselves. They are
going home to use it or they are doing other things. There are so many urgent things to do
that people aren't willing to think, that's what I'll do, sit and play with the Internet. We've
got to encourage people to start if it's going to take off at all, really. [NI]

A primary teacher at Banna confirmed this finding.

I haven't used the email with the class yet. The reason for that, well, its again getting round
to it is the problem, again, it's just time. It's all there ready to go really. [ME]

At Askill, the Humanities Co-ordinator rarely used the PC in his office, and found the
lack of time caused by having too much to do rather demoralising.

I don't have time. I need to get into the habit of switching it on and using it. There's not
enough time when I'm here in this office to use it. I've always got a child in here, or another
member of staff in here, or I'm somewhere else. There's not a lot of sitting and thinking
goes on in here. The sitting and thinking goes on at home, and I use my computer there .

I use it a lot at home, but I'm slow at getting.....I don't think I'm typical. You see these
computer whizzes around school who can do everything. I do feel as if I'm always two or

three years behind what's happening. I bought my 486 - this Pentium one I've got now - and it sat there six months because all my stuff was on the old machine and I hadn't got time to transfer it [ET]

i.   *Discussion*

Time management for ICT use had not been considered by any of the study schools. The NGfL innovations were introduced into schools at a time of competing changes, and at a time when the pressure on teachers created by burgeoning administrative work was causing dismay. Those who had home computers and support in learning could begin to make use of the tools the technology offered for their administrative tasks, but even this did not always translate into increased use with pupils in classrooms. The nature of the work – the way that practising teachers have continuous face to face contact with children, and invariably must ensure that the next day's learning activities are ready to build on the present day's work – creates a permanent pressure. Teachers cannot usually 'free' themselves a day (or in primary schools, even an hour) or set aside time to learn or experiment with new machines or new applications. Such learning must happen in times when pupils are not present, when no meetings with colleagues or parents or other professionals are arranged, when all preparation for lessons is complete and when evaluation of pupil progress is in place, when administrative paperwork, classroom display, organisation of school journeys or outings or prospective visitors, and so on, is done. In some of the study schools such changes as new 'breakfast clubs' for children, loss of classroom assistants, an influx of Newly Qualified Teachers requiring support, training of student teachers, holiday clubs to prepare children for SATs, and OFSTED visits, further erode the time available to teachers for learning about how, when and why to use ICT.

4. Teacher resistance / teacher anxiety

i.   *Context*

'New technologies appear from time to time, offering solutions to all educational problems. Teachers and lecturers are, however, used to such technologies creating as many problems as they solve, and sceptical of the inevitable benefits the latest innovation is supposed to bring'

(Williams, 1998 p.152)

Preliminary discussion of the concept of 'teacher resistance' is found in Chapters 2 and 4 of this thesis, and this theme will be further developed in Chapter 9. Teachers'contributions to the discussion from the Phase 2 interviews are included below.

ii.   *Findings*

One teacher pointed out that technology had become more approachable.

> If teachers started now they'd be much less likely to be computer phobic. The stuff is much more user friendly. You can do things with it much more quickly [QL].

The Head teacher at Causey had refused immediate training for her staff. This could be construed as resistance to change: but a clear rationale underpins this decision, as indicated below. The school had experienced real problems with choosing and installing new equipment, and reported a negative view of the NGfL.

> Ah. We have put off training for the moment. When we filled in the forms it seemed silly when we haven't got anything. Any new computers. If we'd got something then we'd maybe have had a chance to play about with it before we go. Then you don't feel quite so helpless. I think you're better off if you've had a chance to have a play with it before you go on some training like that. Because when you are in that situation you might be wary of trying anything, but if you'd experimented a bit here, you might be more confident.

> *The NGfL has caused us a lot of headaches so far rather than had any positive impact. It hasn't done anything for us yet apart from cause problems.* It may have raised awareness but only as a sort of guilt trip - are we doing enough, and are we doing what we should be doing, and are we making sure that these children become computer literate; I mean, we try, but with what we've got - [BI]

Despite the impression that new technology is user friendly, teachers reported the sort of everyday frustrations common to computer users. In teaching situations, such frustrations might cause teachers to question the validity of their employment of ICT with pupils: again this might be construed as teacher resistance. However if one

considers the learning gains of pupils as of primary importance (as teachers do, generally) refusal to use difficult equipment is logical.

> And another thing. When you pull out the picture of clipart, it's not on there. You need another disc. It's frustrating. The picture is on the screen but when you try to collect it, it says you need another disc. It's the sort of thing that drives you mad in the end [HN]

> It's frustrating to never have the time to go and find out. You've got an idea how to do something and yet you don't have the time to sort out whether it's going to work or not.[TB]

> We've been given so much rubbish in schools, and all the machines are different. To be able to use so many different computers you have to be first, interested, and second, able to devote time to it which you may need for something else. You get people saying, do this, do the other with the computer. Then if something goes wrong with the computer you've got the choice: you either say to the children, leave it alone, which is what I do, or you go and fiddle with it while the rest of them need you. At first I would race across and try to fix it. And then I thought, no, if it goes wrong, you just have to switch it off. The kids see it as a punishment of course. But it is just being sensible. I think in a way they pushed them on to us too soon and we all sat there wondering what was their purpose – we had to say, how am I going to work this into the curriculum? And fit them in.[CG]

At the end of 1999, with TTA funded training at an early stage, many teachers still reported lack of training as one reason for their lack of ICT use. Professional development in this area was important to many teachers. The Deputy Head teacher at Mosser school emphasised that the increasing availability of equipment provided even more motivation.

> I'd come from a background where I'd never used a PC. I looked at the network here and I thought ooops! I became quite phobic actually. I didn't want anything to do with it. They suggested that if I had some training it wouldn't seem so frightening. And it worked like that. Yes. Now I teach all Year 7 for IT [FN]

> I thought I might do some staff training of my own and monitor it, and try to raise standards by training. I think because teachers lack experience and confidence the teaching with IT suffers. When it was mentioned that Askill would be running the ICT course next year I had about eight teachers asking for details about it - eight teachers who are interested.[UX]

> When you've got it here and you've got to use it, you learn how to. You're not going to learn how to unless you've got a use for it. That's the first stage.[MC]

The Deputy Head at Mosser had an informal categorisation of teachers, which included a group who could be thought of as 'hiding from' ICT. A barrier is identified - not teacher resistance, but lack of confidence. The solution for the 'hiding' group was to organise peer support for them. Having done so for many teachers, management at this school noted that further training initiatives were then generated by the staff.

> The most keen group will go, and they will take off. Another group will go and get started, and then there's probably a group that's hiding from it. They will go on if someone will help them. So for them informal training is a good way in. Well, we think the barrier is confidence. And also we think we slightly need to 'buddy' people. What happens with that for me is, I have a partner who uses it every day, so at home if I get stuck I have someone to rescue me. We think there's that element of it. And what's interesting is, we've got this formal training plan, but what is happening is you've got loads of things going on that aren't part of the plan. And you don't even know they are happening sometimes. Like the other day a librarian said to me, I've been asked to train a group of teachers to use the Internet. A group had just decided to develop it that way [MC].

A teacher at Drigg gives the sorts of reasons that deter use of the Internet. Once articulated, such problems can be addressed. If not articulated, non-use by the teacher may be perceived as 'teacher resistance' – a categorisation which does little to move professional development forward or encourage change.

> I do know that a lot of things I've looked at or I've tried to get have stopped me for varying reasons. If the thing works in the first place. And where it's too busy at that time, or there isn't the information there when you get there, I find it really frustrating: but I know there are some good things. It's just chance. And I think it's trying too hard to be up and ready when it's not really set up at all. No one here has used the Virtual Teacher Centre yet. Well, there's nothing there, is there really. I've tried it a couple of times. Well it needs teachers to sit down and put stuff into it, and when are teachers going to?[ME]

One teacher revealed a visionary view of ICT use with students.

> I think it is liberating from the teacher's point of view. Some teachers might feel threatened, or think they are going to lose their jobs, but I've always approached......I went in to teaching as a facilitator. I'm fascinated by ICT and I want to get in to it. Because, I don't see my self

as sending information down the tube to students. I've never wanted to be that sort of teacher. I've always wanted to be facilitator of research and analysis[NH].

The ICT Co-ordinator at Askill felt that computer use was increasing in popularity amongst staff and pupils, but that even so some teachers would not initiate their own professional development. However these teachers could be expected to take opportunities once they arose.

> Teachers, what they will say is, 'you can never get into the computer rooms' - to some extent this is justified, but whatever computers we have, there will never be enough. That is one thing. But I think there are a lot of people out there who actually think to themselves, if I just hang on and keep going, it will come to me instead of me going to it. Then they will jump on board. [DX]

iii Discussion

Further discussion of 'teacher resistance' can be found in Chapter 9. The data included in this section indicates that the opportunity for practicable change is welcomed by teachers. I have no data which indicates otherwise.

5. Home use of computers by teachers

i)   Context

In 1999, 15% of primary teachers and 32% of secondary teachers had email addresses at school. 12% of all schools provided Internet access in the staff room. 30% of all teachers in connected schools also had access at home (BESA, 1999).

ii)   Findings

Teachers in the study emphasised the importance of owning a computer at home. The idea appealed to some of those who did not have home computers.

> I think I'd be more inclined to use it if I had it at home. Because while you're here there's so many things on your mind, you're running around doing jobs. Once you get home you sit back and think, right, what can I do now? and I'd be more inclined to find out about this[UC]

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I had six weeks at home with my leg in plaster. Obviously being at home I did a lot of it. I am getting on fine. I learnt to type with Mavis Beacon. I wouldn't advise every teacher to do it that way. And then we get the born-agains. We get someone who is NOT going to have one, absolutely not going to. And then they get one at home, and they are like a convert - you know, they are using it more than other people.[MC]

Others had reservations about encroachment on the relative privacy and serenity of their home life.

It's got to come out of your home time. And finding time to train, that's got to come out of your home time.[HI]

I don't want one at home. I'd rather stay here a bit longer than have my house turned into an office everywhere [QG]

Teachers in primary schools were used to taking computers home to practice and learn, but this became impossible as the equipment grew more expensive. This effect made it even more important that teachers have their own computer.

We used to take computers home, but you can't take these new ones. If I had the Internet at home...but I'm not sure how the pages are set up. Are they different for schools from one you would have at home?[FD]

I have had a computer at home now, for about a month. But I borrowed a school 386 for a couple of years just to do basic word processing and spread sheet stuff. School are prepared to lend computers to staff, yes, that's how I originally started work on it, using the school system. Then they were able to lend me a computer. Not the more sophisticated ones, just the ones that were coming out of date, but it was very handy, because it did what I wanted to do [QG]

In early 1999, management at Mosser had organised a scheme to enable staff to purchase home computers, which was extremely popular.

We did a survey. A lot of people wanted to have home computers. What seemed to be the
barrier was the cost, so what we decided to do was offer financial help so that they could
have an interest free loan. We also bought a lot of computers from RM, and now staff can get
a package of reduction of the cost of the machine. We did a kind of technololgy specification
of what they should be looking for. They have to specify what and where they are going to
buy, and repay it from their salaries. So it's not much of a gift, but it does take away a
barrier. Very few take the RM package because it's expensive.[MC]

The benefit was not confined to Mosser teachers. The Askill teacher speaking below
was delighted that his wife, a teacher at Mosser, had been helped to buy a computer.

Having it at home was quite a significant difference.To be honest there's quite a lot of work
to be done outside of school, and since I'm a family person I like to be home. It's difficult for
me to spend the time after school doing work, and you can take your time about doing stuff
at home. I suppose in educational terms they get a lot more out of it with you being able to do
stuff at home, because you tend to spend a bit more time, and you feel a bit less stressed at
home. Now we've got our own, it's something we've wanted to do for a while. My wife is a
teacher as well: the school she's at actually offered financial incentives in terms of interest
free loans for people to purchase computers. Up to a certain amount, and they had to be a
recommended range of computer, rather than just any old thing, and so we decided that now
was the time to bite the bullet. Now it's a matter of me trying to find my time to use it, and Jo
is much more interested now because she can actually produce materials. One of the
problems I used to find, because I didn't have a printer, I had to save it, bring it in to school,
print it out and that was a bit of a problem. But its nicer now, I can just print it out at home,
and use coloured resources.

It is quite expensive. Principally we bought it to help with our jobs. I have used email for
work related purposes, not a huge amount. I've got some work back from students on courses
who are emailing me things, files and things, that's good, and it encourages me to regularly
read it. My wife may use it eventually. It's early days for her. Just getting used to how to use
the system and improve her typing skills. It's going to be a matter of making resources and
that's going to be the most important.[QL]

Teachers were motivated by finding something they enjoyed or found of practical
value. This interview took place at Drigg in December 1998.

I have the Internet, but I'm still not that keen. I've got the sort of family that they are all
dead into it, and I'm the twit that doesn't know anything. I think I've looked at the NGfL, -

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there's something on there called 'Literacy Time'. I've used that when I was doing the book order. I went into one of those sections and I downloaded all the stuff that each year group could have, that was recommended, and then I'd go and look out for odd things for Literacy hour.

LD You're the first teacher I've talked to that's used the VTC

Really? You see I see myself as a computer illiterate. When we were being OFSTEDed I looked at OFSTED reports, because I wanted to know what they looked like. What standard things they said, it was quite interesting. And there's a little club for kids I look at: Tufty. it's National Trust and I like that. My husband laughs at me because it's got this little hedgehog and tweety birds and things, and he thinks I'm mental. I'd show it to the kids here at school it I got the chance because it's their level. It's nice[CD].

Before schools were connected to the Internet, teachers used their home machines to begin international projects.

I have email and I email one of my kids at University and I've got a friend in California. She emailed me, and that's when we got on to the idea that maybe our classes could do it. It's so quick, and better than the phone because you can't get the time zone wrong. They can just pick the email up when they are ready. Yes. I do use it [CG].

The Humanities Co-ordinator at Askill continued to find computer use at work very difficult, and had enrolled in the first group to take the NOF training. Working at home seemed a good way to learn.

The best way of me doing anything on computers is to start at home where I've got more time and feel more comfortable.

I would definitely use it at home, then I would come in here and use it. The colleagues I know that are into computers and use computers a lot are ones where they've got good computer facilities at home, like Helen, that have used them a lot at home and experimented a lot at home. However I also know colleagues in school that are always in the IT rooms... but they tend to be.......but this is my stereotype and I may be wrong, but they tend to be the Technology teachers and the IT teachers. They are working with computers all the time. Now we've got these IT rooms and all these IT teachers, it's all very well, but I feel that I'm being de-skilled because I don't take the class up to the IT room any more. [ET]

iii)   Discussion

A significant change of context occurred towards the end of the research period. Unfortunately it was too late for its influence to become evident in any of the study

schools. This was the announcement in January 2000 of a further NGfL initiative: Computers for Teachers.

> 'Computers for Teachers is a Government initiative that aims to help as many teachers as possible participate in the information age. It recognises, in particular, that teachers, like other professionals, will benefit from access to a computer. Computers for Teachers is a three year, £20 million initiative to assist teachers to buy their own computer by offering a subsidy of up to £500 per person. The main aim of the scheme is to enable easier, better and cheaper access to the Internet and National Grid for Learning by teachers.[...] The purpose of Computers for Teachers is to raise teacher competence and confidence in their personal use of Information and Communications Technology. This in turn will benefit their approach to the use of ICT in the classroom, in this way standards will be raised across all subjects, and school administration and management will improve' (DfEE 2000).

Ignoring the rather lax use of puctuation, the final sentence provides another indication that the purpose of the NGfL - its driving force - was largely to do with 'raising standards' (by which government generally mean improving pupil's test scores). This in turn could be expected to generate a computer literate work force. Another purpose was stated as that of school improvement.. The critical involvement of teachers is recognised –'teachers will benefit from access to a computer'. Supplying some teachers with less than half of the cost of a computer (£380 after tax deduction) was a *positive gesture, though not overly generous;* a gesture designed to encourage the achievement of NGfL aims. The 'competence and confidence' of teachers with technology is a secondary aim, a means to achieve the primary aims of better test scores and accountable administrative procedures. The best case scenario – that government provided all teachers with computers as some recognition that the professional profile of the job requires such equipment – unfortunately did not happen. Perhaps this indicates a residual negative perception of teachers by government. But I have no data in which teachers express this viewpoint. The only teacher in the study who has a 'Computers for Teachers' machine was delighted with it and looking forward to the end of term when there would be chance to learn how to use it.

The Phase 2 data supports the findings of Phase 1, strongly indicating that ownership of a computer is crucially important to gaining familiarity with ways of working with new technology. No teacher reported dismay at the idea of working at home: teachers have always worked at home. One teacher thought her home would be more like an office if the computer was part of the furniture, and of course she was right.

6. The Internet: problems in use

i) Context

As schools acquired an Internet connection, teachers began to use it, sometimes before taking formal training. It is possible that most people using the Internet have had no formal training to do so. Different uses of the Internet require different sorts of expertise, or in some cases no expertise at all: people can become involved with the Internet for such activities as recreation, shopping, browsing, gambling, or business. Teachers looking at the Internet must decide how it can support delivery of the curriculum, or how its use can help learners to achieve established objectives. As new users of this medium, teachers and pupils trying to benefit from its perceived advantages reported a range of problems. Some of these were trivial and easily addressed. Concluding that 'schools should be teaching safe cyber behaviour' (by 'schools' the TES means teachers) this TES report highlights a more profound problem.

> 'Take Susie and Sara for instance. By day they are two normal 14 and 16 year old school girls. In the evening they become Sexy Sadie and Winsome Wendy, claim to be 16 and 18, and team up with their chatroom friends. Most of their friends are hooked on chatrooms too [...] Without strict policing, paedophiles could target chatrooms and more youngsters could be lured into arranging meetings with their new "friends". The worry became a reality for two families in Cumbria last week when their 15 year old daughters disappeared from home to meet up with chatroom friends in Manchester' (TES 17.3.2000 p. 9)

This is not an isolated incident: The Guardian (25.4.2000) reported that a 13 year old girl from Milton Keynes had arranged to meet her Internet boyfriend, supposedly aged 15, but actually aged 47. The child's mother accompanied her and was able to retrieve her daugher: 'saved from an uncertain fate' as the Milton Keynes Citizen reported (27.4.2000: 'Mum's fury@love.con'). The media depiction of a brighter high-tech future with educational computing (see Appendix 7) continued to ignore the problems technology can create, and made no concessions to the way that technology's 'solutions' can not alter human nature, or make change definitely for the better.

ii)   *Findings*

This section provides a summary of points raised by teachers in which use of the Internet by themselves and their pupils was a learning process for everyone. The problems indicated here were 'teething troubles' which might be expected to cause teachers to alter their practice to ensure effective use of new technology. Some quotations from interviews are included as illustrative.

- Children might conduct time consuming and unproductive searches. Teacher input is essential in order to ensure educational purpose in Internet use.

> You could keep students occupied for hours searching the Internet, but is that a valid educational use of time? [HN]

> We have debated Internet use quite a lot at management level and the general feeling is that for the majority of lessons, searching the Internet would not be valid. Because it's so time-consuming and it doesn't have an educational purpose other than teaching them the skill of searching on the Internet. So it is valid, if that is your teaching aim. The teacher should do it beforehand, and download to allow students to inspect a selection of sites. The teacher should look at the reading level and content and so on. [MC]

- Irrelevant or overwhelming amounts of information are available
- Material is unsuited to the reading abilities of pupils
- The prevalence of marketing material is distracting and its effects should be discussed since this sort of advertising has not previously been part of the learning environment

> I wanted some information on Monet and I couldn't get what I wanted. I could have a Monet coaster or mug or whatever but I actually wanted to know about Monet's life and I was obviously in the wrong place, and how many hours are you going to spend?[HI]

- Inappropriate material seemed hard to avoid

> Well it's being filtered but things get through that shouldn't [ET]

> We have this piece of software called iGear. A group of Year 11's tried to hack their way through and the best they got was about the top quarter of Samantha Fox and then it just chucked them off. It makes us more confident of not being sued - fact of life, now, isn't it. [DX]

- It is time consuming for teachers to search for and bookmark sites

  There is any amount of information, but it's not organised for teachers. There is still time to be spent on it. You could get information from newspaper sites, but then you might just as well buy a newspaper[EX].

- Unreliable or slow equipment makes Internet use even more expensive
- Inflexible timetabling makes it difficult to follow up promising leads
- Plagiarism is a problem
- Children are likely to print information without reading it

  You might find them highlight the right area, but, you know, you still get a spiel. Some of them have wodges of paper they've printed off. They have no idea what it says. [LH]

- Sites are available which encourage students to 'cheat', for example when writing essay questions

The uses of email

Pupils used email at two schools in the study, Askill and Drigg. Teachers at Drigg reported some initial difficulty in finding appropriate partners. A teaching aim was to familiarise the children with the process of sending and receiving email before using it as a tool to undertake curriculum projects. Just who it was sensible to talk to online was a difficulty at both schools.

It's finding partners and a purpose, because they email their friends, you know, 'Hi, Holly I'm sat next to you -'[ME]

When I looked at what was happening it was all rubbish. No, about ten percent was work related, the rest was having a look round. Socialising. Sending each other messages. I caught one group, one boy sat next to another, and they were sending each other messages. That's really - as I said to them, that's really sad, you've got to do that rather than just talk. And they were 6th formers, and they both had no time to spare, they both owed me work.[DX]

Parental approval was sought in the form of a signature before children were allowed to use email at school. Teachers in the study found it more practical to look at their email at home than at school. The nature of the school environment means that teachers have little time to work through email. Email use in school during this study was generally precluded simply because few teachers had personal computers at work.

School managers expressed the worry that teacher time might be spent on sending personal messages. This issue requires discussion to establish professional codes of conduct. In other work places, personal use of email and the Internet may be well established: the possibility of the time and attention of teachers being siphoned off in this way would be a new departure from the current system, in which (for example) even the personal use of a telephone during the working day is strongly discouraged. The Deputy head at Mosser school had found that one member of staff had sent pictures of grandchildren to a relative in Australia, and was very concerned that this was the 'thin end of the wedge' in terms of social use of technology in the school.

> It's a work environment. We have to educate both students and staff about what is acceptable here.[MC]

iii) *Discussion*

Policy making to ensure good practice in ICT use may draw on teachers' experiences of problems such as those detailed in this section. In the drive to ensure that educational institutions are provided with the equipment which will make the future workforce employable, some implications of ICT use may not have been fully considered. Debate based on an understanding of educational aims coupled with teachers' professional expertise may be essential to establish new ways of working. Beacon schools elsewhere in the UK such as Linlithgow Academy in Scotland (a European ACOT school) has its staff and pupils sign a 'responsible use agreement' for the Internet (Sloan & Johnstone 2000 p167). This covers areas such as accessing pornographic or racist files, creating and uploading computer viruses, using copyrighted material without permission, and sending threatening or obscene messages. The agreement also binds users not to waste time by looking for irrelevant information or playing games on the Internet. Such restrictions are unfortunately essential in learning establishments.

7. Establishing educational uses of ICT

i) *Contex*

> 'We need to know more about changes of teaching styles'

(Dominic Flitcroft, DfEE, speaking at European School Net Seminar: 'Classroom Practice' and Education Research': 7.3.2000)

The research basis for a pedagogy of ICT use is under establishment, and co-ordination of research initiatives is under way. The British Educational Communications and Technology Agency's recently established 'Evidence and Practice' Directorate is current compiling a database of research evidence (June 2000). It is positive research evidence which will enable the government to declare the NGfL initiatives a sound investment. For teachers, the outcomes of research might provide a clearer purpose for engaging with technology. The opportunity for practice to evolve in a direction which is demonstrably educationally effective would be attractive to teachers.

'Where is the evidence to demonstrate the effectiveness of ICT in education? [...] this question is being asked so that huge investments are effective, and so that the insights can be fed back into classrooms to help the people who are supposed to be making ICT and the NGfL a success – the teachers'(TES Online 11.2.2000 p 3)

The demand for research evidence had become urgent, three years into the NGfL's five year span. The involvement of teachers in generating best practice was acknowledged.

'Practice in teaching and learning in UK schools could change radically if the teaching profession grasped the opportunities available through the use of the Internet and other forms of communication technology'

(Leask & Meadows, 2000 p xiii).

'In making effective choices about when, when not and how to use ICT to strengthen their teaching the crucial issue is how teachers can harness ICT effectively'

(Moseley et al, 1999 p.6)

'Many (teachers) are unaware that even a small amount of ICT can save a disproportionate amount of the time normally spent on humdrum admin tasks. It's time that could be spend more creatively developing lessons which use ICT' (educ@guardian, 11.1.2000 p.2)

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Whether ICT can support educational objectives is the fundamental question: unless this can be shown to be so, the visions for enhanced learning practices remain wishful thinking by technophiles. It is hard to believe that such powerful machines could not be put to good use in schools, but it is also hard to demonstrate immediate gains for pupils.

ii) Findings

This section is of paramount importance. The evidence collected from teachers provides strong indications of change taking place during the period 1997 – 1999: with impetus from NGfL initiatives, teachers had new opportunities to use and evaluate various applications of ICT. Their reflections on such experiences demonstrate how professional expertise was applied to new knowledge in order to ensure that changes proceeded generally towards fulfilling the aims of educational establishments.

The extract below is from an interview with a teacher at Drigg. The teacher had imaginative ideas for ICT use to support curriculum work. In practice however technical problems meant that use of the equipment was excessively time consuming. In the absence of training or technical support from a 'ICT buddy', such experience is disheartening. Without support, teachers may find it expedient to revert more achievable, conventional methods. The will to change is expressed in this quotation, along with clear indication of the reasons why the hopes of teachers may often by frustrated by new technology. It is important to realise that the teacher must constantly ensure that work is available for children to engage with: faced with real obstacles when trying new machines, the teacher has no choice but to revert to tried and tested alternatives. The inability to make a digital camera work is a real obstacle. Such things cannot be quickly mastered by everyone (or anyone!).

> Like - we did some Picasso work in Art, and I thought a really nice idea would be to use the
> digital camera to get the photo on the screen and mess about with it. Sort of pull the noses
> out of place, as we were doing Picasso - but we never got round to it, because I tried to use
> the camera and it all went wrong. I just couldn't work it. So I thought, 'that's it' and that

particular night, the battery went flat, so we gave up in the end. And I've never tried since. Some of the children wanted some Spice Girls pictures, and we thought we'd scan them - but the scanner wouldn't co-operate and since then I've never found time to fix it. It is frustrating in some ways when you've got an idea and yet you don't have the time to sort out whether it's going to work or not [HN].

Active professional development in ICT use

Further extracts from Phase 2 interviews which provide a cumulative picture of the involvement of teachers in ensuring the educational effectiveness of ICT are included in Table 7.3: *The Educational Application of ICT*. These findings support a model of teachers as learners, and indicate professional development within a community of educational ICT use. These extracts are included as representative of the views expressed.

In Table 7.3 the teacher's school is identified by its code letter, and the teacher's status using the model described in Chapter 5 is included as context. Teachers in this section necessarily have experience of educational ICT, therefore they tend to be from the schools where this was possible with the equipment available at this time. Quotations are grouped to illustrate teacher's comments under the following headings:

- On working towards a pedagogy for ICT use
- On the successful use of ICT for administrative purposes
- The role of the teacher as critical to the effectiveness of ICT use by pupils
- Integrating classroom computers into the pupils' day
- Management strategy to facilitate change

Table 7.3: *The Educational Application of ICT*

Teacher's school & ICT category	Quotations taken from interviews with teachers
On working towards a pedagogy for ICT use	
A: Integral	It's much further than skills. Skills is the easy part.
D: Participant	I don't forsee any new problems when we get the new ones (computers).There will be the question of schemes of work, and progression. There are signs that people are beginning to realise what we can use the computers for.
M: Adept	I think there is a danger of people seeing ICT as a tool and not actually using it that well. Because with the old computers, they were largely being used as word processors. Now people don't have time to research the best programmes. You can get them to use it, but to get them to use it to actually enhance learning is another stage. So now, we're not being too fussy about what staff use it for, because we're trying to make the step of, 'I use it'. But the next stage is, how is it actually used to enhance learning? The answer we feel, is that it often isn't. Yet.
D: Participant	I need time to fiddle with that to see how best to use it with the children. That's the essence of the training we need now I think. How best to use the Internet. Perhaps the cynic comes out in me. I'm just a little worried that we may be jumping on a bandwagon. This is something wonderful, this is new, this is a *new way of learning: when in fact at this young age, actually using books* and so forth might be more immediate, more useful, less time consuming. Although computers of course can be much more fun.
G: Adept	Now that we're doing it in Year 1, pushing them up the skills ladder, we are working from the DfEE curriculum - in a few years time it should be quite good, as the skills come through.
A: Adept	It's a bit like people using video in lessons. How does it help my lesson: does it make it better - is it a more effective way of delivering material, or is it a gimmick? And there are some who still think it's a gimmick. And I mean in many ways IT is still a gimmick, because of the ways it's being used at the moment. For instance, take an English lesson. There's lots of things you can do with IT. It isn't just about desk top publishing, and copying work out in best. You can start using the Internet to research things - but this use hasn't developed much yet. Just making work look tidy by word processing, that's not all that can be done
E: Involved (a)	I think the key thing is, anybody will use something if they think it gives them a good lesson.
J: Participant	IT has to offer something you couldn't do by other means. There is still that problem, that a lot of software does things you could do with a book.

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E: Adept	It's all very well you looking at a programme at home and thinking 'Oh yes I could use it this way or that way.' It's like any lesson, until you actually see the children doing it – because you are a teacher and you think on your feet, you can adapt it as you are going along. But computers: it's like all things, even the computers in the offices here, when they go wrong the adults get very uptight and frustrated about it.
D: Involved (a)	With the five computers, I do one group at a time. Actually I could probably get them all squeezed in while I do the introductory teaching bit, so that they could go off and do it, and I could help with problems

On the successful use of ICT for administrative purposes

A: Involved (a)	We are a technology college. We must be at the cutting edge in some things. Like electronic registration. I mean and now we're using Grade Book. You put your homework in when you set it. And then say when it's done. Brilliant. You get a print out for each student to send home. The parents get feed back every half term. No longer can they say 'Well you didn't tell me little Johnny wasn't doing this or that' because they are getting all the information. And if they are worried, we are worried, and we can speak to each other.
H: Involved (c)	We use the SIMS, you know. Makes everything easier.

The role of the teacher as critical to the effectiveness of ICT use by pupils

D: Involved (a)	I rely on parents coming in, taking a few over to the computers at a time, but then the problem with that is the children are doing stuff with the parent and you don't actually know how well they are getting on with it. You don't teach it. It would be better if you could sit there and do it with the kids. It does get frustrating.
D: Adept	The kids like it just because they were using the computers, and they were getting these pages up and the whole concept of it was so different. Especially if they haven't got the facility at home, but, in terms of what they would learn about the weather, if I wanted to do it as a 'weather' exercise, rather than a 'using the Internet' exercise, I don't think they would get much from it at all. The only time I would use it perhaps is if I'd set it up so they could find out what the weather was like in certain places regularly to compare with the weather here. It would be an idea to use it, because we can do that.
B: Adept	If I have my way Year 7 will be doing email and using the Internet for a six week project during the summer term. There is fantastic interest among the children. We've just done six weeks doing PowerPoint. I introduced them to it and they think its fantastic, they are really into it - and the *enthusiasm*....
D: Involved(a)	It's like putting them in an enormous library and saying, 'find something out'. You wouldn't do that, you would give them the Dewey number or something. May be you tell them how to use it first, then they find things.

D: Involved(a)	Once you feel confident with an application, well then it becomes, ok: how do I use it in the classroom. Maybe just to produce worksheets, or to produce interactive worksheets. Put hot links in and kids can click on and get the Internet and that sort of thing
A: Integral	Then there is Vector For Language. We've been using that, that seems to be helping the language people; all the Year 8's get an hour on Vector during the week. That is with the language teacher, not the IT teacher. They're not linguists and couldn't help if the kids got stuck
C: Involved(c)	I'm hoping they'll plan what they are going to do if they're going to do a lot of searching. Actually teach kids how to use the Internet. So that eventually kids will be able to use it themselves in lessons and for research, but I think first there is a lot of teaching to do. Teaching them to use search engines properly, and research skills, and whether what they find is any good anyway. Just because it's there doesn't mean it's right, does it. You know, what they see in a book they might think is true, but the Internet, it's different. They'll have to be taught. It's not just a game, you know, spending an hour surfing the web.
D: Involved (a)	I do one group from my class at a time. So I have to say the same stuff four times. So next time I might squeeze them in to look at the screen to do the introductory bit, so that when they go off and do it I am actually helping with problems, rather than teaching the whole thing again.
Integrating computers into the pupils' day	
C: Involved (a)	Yes well when you think about the pressures of the literacy hour and numeracy hour and what have you, you have to balance what they're doing. The kids that are on the computer in class are always missing something, or distracting others, that sort of problem.
D: Involved (a)	I think, they could do that on the computer, but there's only so much time with parent help, that you've got to do it, so I haven't actually done it because I couldn't guarantee all of the class getting a turn
D: Involved (a)	Sometimes I do a class lesson on what I want with them all sitting on the floor and me explaining. And then most of the class come back to our room with me, and a parent stays in there with five kids, and as they come back to class I send another one. It works well except that now the parent has got more idea of where they are than me
G: Involved (a)	You plug it in to the computer and whatever is on the screen, the children can watch all together and see. So, you can actually squeeze a class in there to watch and then timetable through the week different groups to go in and actually do it themselves. So that is a great use of having all those computers together
D: Adept	When I took my class in there today I had a whole page of URLs that I'd given

	the children and I just asked them to look round and find what they wanted on those. There was no specific task. They saw what was there, went through it and came back. A useful skill in itself, I thought. Last week we looked at different search engines
Management strategy to facilitate change	
E: Adept	Staff enthusiasm is variable. Some are very keen. Those with their own computers.
A: Adept	With my colleagues we've been starting to bring a lot more stuff into classrooms. We are using the Virtual Factory on the network for 6th form students and incorporating it into schemes of work. We have a business studies room with a series of computers there, so - and with science it's much more hit and miss really. The PCs in the rooms are quite slow. I used them a lot more before we developed the IT here. I used to take classes up to the IT rooms, but now they are always being used, and there is less opportunity. We've got more but they are actually always taken up in lesson time. It will change - there's been money invested into the system and it will change. But it's not just the equipment, it's the software to go with it. Now I've been here five years and I'm almost one of the old timers. A lot of people have moved on. Now a lot of NQTs are coming in to science and they are keen to incorporate IT. So I think uptake is a lot higher in other lessons than it is in my own
A: Involved (a)	I used to take the young ones up with an assistant. Now every child has IT lessons so we sort of delegate that work to IT. So they do my spreadsheet lesson as part of IT and I don't get to go up there. And booking sheets for the rooms are all filled with IT. some people are glad to get rid of it, but for someone trying to develop their skills - I actually felt it was a step backwards, because I was making progress with Excel, and I haven't been able to use it for two years now
A: Integral	They get an extra 1/2 hour either before school in the morning, after school or during lunch.They have to turn upo at 10 past 8 or stay till 10 to 4. It's not an option.Year 8. They haven't got a choice. The head had his initial talk to parents, it was, this is what we're offering to help your child; if you don't want this then you need to go to another school. We're so over-subscribed that we can say things like that and get away with it. We haven't had any trouble
M: Adept	I've worked in four schools and this is slightly different here. As for confidence, it's better if someone who isn't very confident starts with taking a group in to word process something. That's a first stage. Then the next is perhaps searching a CD ROM, and then the next is getting a package. But you know some 'educational' software isn't all that good.

iii) Discussion

The ICT Co-ordinator at Askill was the only teacher to achieve what I have termed Integral status during the course of this research. The opinion of this teacher was that an understanding of the pedagogical issues was essential to ICT use. The Deputy head at Mosser considered that teachers might work through an initial phase where ICT was used for various purposes before good educational practice became established.
High quality equipment coupled with comprehensive training at Askill meant that staff use of ICT for administration was largely successful. A full time administrator had been appointed to co-ordinate electronic registration. The Involved and Adept teachers believed that their role was critical to the effectiveness of ICT use by pupils. This role included devising, discussing and implementing strategies to integrate computers into the working life of the school.

Thus the findings in this section demonstrate and effective pedagogy for ICT use in education emerging from the transactions between teachers and technology. The teaching community is shown as accepting the responsibility to help establish purposes for computer use with pupils. However such a process was not to be hurried. The work of research communities in universitites and higher education establishments was beginning to provide support for teachers. A fledgeling learning community was generated.

8. School management and ICT

i)   Context

'62% of primary schools and 93% of secondary schools have Internet access and the number of primary and secondary teachers confident in using ICT within the curriculum has increased to 67%' (BECTa 1999).

School managers were responsible for ensuring that conditions in schools supported teachers through change, providing the framework for the increase in ICT use as reported above. Managers had many issues to consider as the integration of ICT into schools began. Some changes involved the creation of learning opportunities for teachers, and the establishment of support systems. Other more visible changes involved physical alteration to buildings (see Chapter 8). School managers had to

make decisions about whether to centralise computers in a single room, or deploy them around classroom areas. Financial management to ensure that initiatives were sustainable, and security issues, were considered. In doing so, school managers had to ensure that as change became possible, its purposes were understood and accepted, and that practical problems did not defeat these aims. As Bennett et al (1992 p1) put it: 'An important management responsibility is helping one's colleagues to cope with the changes created in their work.'

ii)   Findings

Head teachers in the study schools were responsible for changes to the structure of the school to accommodate ICT.

> We've had a new classroom built for IT under government funding because, you know, we've always been one Home Base short of a school. So we are trying to get computers that are the same and set it up so that you use IT in a cross curricular way but also have time to teach IT skills. So that's the plan but have we got the computers? No! [BI]

Teachers reported their evolving practice in management of equipment.

> As I'm next door I can go in and use it when it's not being timetabled which is quite useful particularly if something just comes up and a kid wants to do some research.[HN]

> It will be lovely when the new room's done, because there will be enough computers to take the whole class in. They won't all be the same, and they won't have the same programmes on, but at least you'll be able to do something with them all at once. I do find it difficult at the moment.[UC]

> We have twenty computers in the library on a networked system. We've got another eight the kids can use when the network is busy. We're creating a multimedia centre in this area with two computers, a scanner, music keyboards, and the digital camera. And Internet connection[FN]

The Deputy Head at Mosser and the senior management team had decided on strategies which they felt would be inclusive without being threateneing, involving change in practice by management first, and then a gradual diffusion of skills

competence. The expectation was that all teachers would be involved in change within a span of one or two years.

> The whole network over the past year has been completely revamped. So what they (teachers) could see was a lot of building going on, nice shiny computers coming in. The Senior Management group this year - the target has been that they have to communicate with computers. So they are given one in their office and we are not allowed to use pieces of paper. So they were trained and they are the first group, leaders, the ones that are going to start it off, and it would start to spread, next year

> We've appointed more technicians to support the network, we have three, and a support technician in the role of supporting staff and students to use the computers. You can book them. [MC]

iii.   Discussion

The effect of management in enabling change is evident. At Causey, Eskdale and Knotts, little change towards ICT integration took place, because management did not give this priority at this time. This could be construed as avoiding involvement with initiatives, but in practice it was an effective management strategy for ensuring that teachers were not overloaded with change. The sustainability of change was more likely to be achieved by phasing in initiatives. At Laurel, management decided to defer change. In April 2000 building began on the new classroom which would free space for a computer room, and this would be ready for use by September 2000, with teacher training taking place before that time. This is coherent planning – however for the Year 7 pupils leaving the school in July 2000, lack of familiarity with new technology was the result of the delaying decision. They would start at secondary school with that disadvantage. Such decisions, affecting lives, have to be made by teachers and managers. The management at Mosser seemed especially clear in their planning for change. Although teachers may not be individually powerful in their capacity to change and develop their school, groups of teachers can make a difference. The teachers at Drigg school were dissatisfied with their computer room, and discussed it, deciding with management what alterations might improve the situation. Purposeful management of change is critical in that only when circumstances are altered can action within them alter. The social and physical contexts enabling change are largely under the control of school management.

Chapter 7: Summary

Chapter 7 gives details of the findings of interviews with teachers in Phase 2. Some of the issues reported as barriers to development in Phase 1 still arise, such as lack of equipment and lack of relevant training, and time management problems. The NGfL initiatives had begun to take effect in some schools. Progress in some areas was accompanied by problems which had to be resolved in order to integrate new technology. The findings of Phase 2 include a growing awareness amongst teachers in the study schools of what input would be required of them to make educational ICT effective in use. The new themes that arise from Phase 2 data indicate a growing awareness of the issues of home use of computers by teachers; The Internet: problems in use; the role of the teacher in establishing educational uses of ICT; and whole school management of ICT.

These themes arose from the growing knowledge and understanding of ICT amongst the teaching community. The teaching profession during 1997-2000 was in transition, from patchy ICT use by early adopters, to a wider uptake by those whose expertise had been gained informally at home or from colleagues. From this new basis of emerging practice it was possible to envisage integral use of ICT by a well-equipped and thoroughly trained teaching profession of the most educationally valuable applications of technology. The ideas and opinions collected from teachers during Phase 2 could not have been possible before the advent of the NGfL. They are the comments of professionals intent on generating best practice, and willing to share and negotiate experience in order to do so. The concept of 'teacher resistance' seems inappropriate when considering this steady and measured uptake of ICT by a profession at last provided with at least the basic high quality equipment under the NGfL strategy.

These findings and those of Phase 1 will contribute to the discussion around theoretical issues contained in Chapter 9. Before this, Chapter 8 provides a summary of the findings which strongly indicates that change (or development or improvement) took place in the study schools due to the NGfL between 1997 and 2000.

Chapter 8: Outcomes: Changes in the Study Schools Over Time.

Introduction

This chapter summarises further findings of Phase 2 within the framework provided by Stake (1967), in which evaluation is undertaken as a process whereby *description* and *judgement* are based on a study of the *outcomes* of innovation. Chapters 5 to 7 have provided the findings and analysis of this research which clarify the first two of Stake's *three aspects of the educational process* (also see Figure 3.1):

1. Antecedents: any existing condition which may relate to outcomes of change
2. Transactions: interactions between people, and between people and contexts
3. Outcomes: interpreted in its widest sense.

Chapter 8 *describes* change in the study schools over time by interpreting the discernable **outcomes** of change in the light of antecedents and transactions. I have however limited *judgements* concerning the changes to subjective evaluation of what development appears to have taken place. The time scale of the study, three years, seems lengthy, but was not been long enough to allow sufficient development of outcomes, with changes of such complexity, on which sound judgement might be based. For example, some observed changes may not be sustainable for long: and some outcomes are still in the future.

Two aspects of change are described in this chapter:

1 Development of schools

2 Professional development of teachers

1 Development of schools

An indicator of change in schools was found in the physical management of ICT resources. Table 8.1: *Changes to school buildings* shows that all but three of the twelve study schools made alterations to their buildings which they felt would enable effective ICT use. Eleven of the schools shown here are primary schools. Of these, eight had newly built or planned a designated computer room during 1997 –99.

Table 8.1: *Changes to school buildings*

School	Change to physical environment during study period
Askill	Library converted to Integrated Learning Centre. Extra staff area with computers provided.
Banna	No change (computer suite predated study)
Causey	None. Development plan to build a new room is under discussion.
Drigg	a) Small classroom converted to computer room b) Courtyard area covered in to house further machines
Eskdale	Television room converted to computer room
Fleetwith	Space in a shared area used to deploy 7 machines
Gable	a) all computers stolen b) Stock room converted to computer room with security devices
Honister	Classroom converted to computer room with networked machines
Isel	None
Jopple	Some changes to library area to accommodate computer
Knotts	None
Laurel	Extra classroom being built so that an existing room can house networked computer suite

Table 8.2: *Upgrading of hardware and connections* details changes in provision made to schools under the NGfL funding. In this table an asterisk by the school name denotes that the school was in the first cohort to receive NGfL funding. Those primary schools not provided with NGfL funding (E, I, K, L) can be seen to have made little progress in acquiring essential hardware and connections. Askill is a Grant Maintained Technology College and so has other sources of funding to purchase equipment.

Table 8.2: *Upgrading of hardware and connections*

School	Hardware and Connections
Askill	Integrated Learning Centre set up with 60 computers. All computers networked to LAN with Internet access.
*Banna	Further computers in teaching areas networked to existing suite of computers in the library area. Internet connection via Askill.
*Causey	One multimedia computer acquired. Connection not established.
*Drigg	6 multimedia machines acquired, with a further 5 machines from parental contribution
Eskdale	Two Acorn computers acquired and one digital camera
*Fleetwith	7 Xemplar Toolbox machines acquired Internet connection established
*Gable	10 RM Window Box machines acquired Internet connection established
*Honister	10 Time Computers acquired Internet connection established
Isel	None
*Jopple	2 Xemplar machines acquired Internet connection established
Knotts	None
Laurel	None

Table 8.3: *School Development for ICT use* describes various ICT related changes made by the teachers at the study schools. The table shows that no school has remained unchanged, with those waiting for funding using the time to clarify development plans and decide how to match acquisition of equipment with training opportunities. This table indicates that February 2000 was a very frustrating time to stop collecting data in these schools. Training was about to begin, and it would soon be possible to observe and evaluate the next stage - changes in teacher use of ICT with pupils.

Table 8.3: *School Development for ICT use*

School	School Development
Askill	Established as a training centre for ECDL computer training for teachers, and for TCT training under NOF funding. Employed a new ICT Co-ordinator (from Banna.)
Banna	Established after school clubs for children to learn how to use presentation software, design web pages, etc. 3 Teachers undertaking ICT training.
Causey	Discussion of development plan. New (temporary) ICT Co-ordinator appointed
Drigg	Whole staff training under NOF funded scheme from February 2000
Eskdale	Acting Head teacher starting April 2000 is very keen to increase ICT use in the school and has promised laptops for staff who do not have their own machines
Fleetwith	New ICT Co-ordinator appointed
Gable	Whole staff training under NOF funded scheme from February 2000
Honister	Ongoing staff training under the direction of the Adept ICT Co-ordinator. International web-based projects undertaken.
Isel	Raised awareness of possibilities for change. Development plan in place.
Jopple	Whole staff training under NOF funded scheme from February 2000
Knotts	Decision to defer involvement with NGfL initiatives until April 2000, in line with school's post-OFSTED Action Plan
Laurel	Planning for purchase of hardware once NGfL funding available. Whole staff training under NOF funded scheme from February 2000

2 The Professional Development of Teachers

The model described in Chapter 5 and used as a structure for data throughout Chapter 6 can provide information with which to monitor the professional development of teachers

as their school context develops. The information contained in the graphs of Chapter 6 show that two thirds of teachers felt that their professional use of ICT was hampered by poor equipment and lack of training.

As teachers acquire equipment and undertake training, the model acknowledges their increasing expertise. The Adept and Integral teachers in the study, however, provided data which indicated that once teachers use ICT for administrative tasks, for their own purposes, and to support delivery of the curriculum, they can perceive further barriers. This could be a starting point for further research. The model requires some modification if it is to depict the exact professional situation of such expert teachers. But this may not be such a useful thing to do – at the level of Adept or Integral, teachers can specify exactly what they require in order for their practice to develop.

Boxed information below summarises factors which teachers indicated present continuing barriers to ICT use by Adept and Integral teachers.

Barriers to ICT integration

- Hardware at home becomes obsolete or does not match hardware at school (for example, a teacher with a Macintosh over 5 years old may not be able to send attachments on email which can be opened by the school office)
- Software at home does not match software at school, making file transfer difficult
- The printers at school seem to be always busy, broken down, or out of ink
- Once you have a multimedia computer, other devices become requirements – especially mentioned were scanners, digital cameras, CD-ROM writers, data probes, extra floppies, more memory, better filtering software
- The school's idea of what to put on its web pages may create heated debate
- Email escalates in volume and urgency
- Technical support is required in lessons, and it is important that each lesson with an ICT component has a non-technical back-up option
- Classroom assistants, supply teachers and other support staff require training in the school's systems, because otherwise the teacher must train them before, during or after lessons
- Good practice requires classes of pupils to agree to a code of conduct for computer use. There must be a whole school approach to enforcement, backed up by parental support.

The model can also be used to describe the development of individual teachers as they move through their teaching careers (see **Table 5.4:** *Individual teacher profiles of change*). I will now describe what Huberman (1993) calls the career 'trajectory' of three of the teachers in the study. I would like to describe all of the teachers, but there were rather too many: these serve as examples of what sort of development is taking place, the time scale, and the outcomes for individuals. These descriptions show how professional development in ICT skills, knowledge and understanding goes on in parallel to other sorts of learning, and the tools that ICT offers can enable development in other areas.

The teachers' names have been altered.

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1. Blake

Over the three years of the study, Blake can be seen to move from strength to strength, accepting promotion, fitting an MA degree in around a full time teaching position, and enabling innovation. Blake's early ICT expertise and ability to organise school contexts were put to use to provide a sustainable ICT environment for colleagues and pupils at two schools. The eventual promotion in 2000 involves a considerable loss to both schools and to pupils who might have been taught by Blake.

Pre 1997 Adept	Systems Analyst in industry Completed PGCE (Primary) Joined Banna school as ICT Co-ordinator and helped to set up the library computer suite of 15 networked PCs. Provided INSET training for colleagues and supported their work by providing each year group team with a plan of Information Technology work for the school year.
1998 Adept	MA (Research topic: gender effects on technology uptake by primary school pupils) Having successfully applied for first wave NGfL funding for Banna, accepted a position as ICT Co-ordinator at Askill
1999 Integral	Highly regarded by colleagues as Askill. Involved in the provision of ECDL & NOF funded training for colleagues. ICT-based lessons studied by BBC researcher for 'Computers Don't Bite Teachers' program
2000	Offered research position at a university and left teaching.

2.	Darcy

When the study began, Darcy never used computers. After acquiring a laptop Darcy immediately began to use this to facilitate administrative work. Darcy's management skills were requested by other schools and the ability to streamline paperwork using technology meant that as a consultant Darcy was in great demand. After accepting an acting Headship, Darcy became a Head Teacher.

Pre 1997 Potential	Special Needs Co-ordinator in a Primary School.
1998 Participant - Adept	Provided with a laptop computer. Asked to stand in as Acting Head in a Primary school, to cover illness
1999 Adept	Asked to take over as Acting Head of a further primary school and supervise the school through its impending OFSTED inspection –previous Head unable to do so through stress
2000 Adept	Asked to move to a school under Special Measures to help staff implement their Action Plan – previous Head left with stress-related illness.

3.	Lucas

Lucas provides an example of how the context in which teachers find themselves affects their professional development. Moving from one school to another altered the opportunity for Lucas to engage with ICT. In fact there was no choice but to do so, and this benefited the work Lucas undertook with pupils. This short history is perhaps less dramatic than the two previous examples, but indicates the steady way in which many of the teachers in the study schools took up ICT use once it became possible, gaining practical knowledge as they made use of the new tools. In turn this contributes to the expertise held within the teaching community.

Pre 1997 Participant	Owned home computer but little use of ICT with pupils.
1998 Participant	Moved to a different school in which ICT use was expected, encouraged and facilitated. Undertook LEA one-day training course.
1999 Adept	Began to use ICT for project work with classes and for personal professional uses (eg. liaison with other teachers to organise sports fixtures)

Comment on these profiles:

The three profiles indicate learning and development taking place, supported by NGfL initiatives. None of the three teachers above undertook the TTA NOF- funded training, which is specifically designed to encourage professional development. (Few teachers in the study schools began this training during the course of the study). Development was the result of school and home situations enhanced by ICT, and increased opportunity for change. The *profound* change in the teacher Rudduck (1990) deems essential for sustainable change is hard to discern, but the trajectories above show that the conditions for such profound change are beginning to arise within the teaching profession. They arise not just for isolated teachers, but generally. This finding is a genuine outcome of change. The trajectories also show that teachers are *taking up* the available opportunities. This outcome confirms the first part of my research hypothesis:

Opportunities provided by National Grid for Learning initiatives will allow teachers to integrate ICT into their practice, and enable development for individuals and the teaching profession. This development will make it more likely that the NGfL aims for schools and for pupils are achieved.

The data has no examples of a teacher who rejected the chance to upgrade equipment at work or at home, or refused training, or was shown a relevant educational use of ICT which they would not use with their pupils out of 'anxiety', 'reluctance', or 'fear of technology'. Perhaps the sampling does not allow access to such teachers. But since the research involved the entire staff of eight primary schools the findings support a consideration of the teaching profession as open to change and open to individual development. That is, teachers act as learners. Given that all teachers come to the profession having achieved at least reasonably well in school themselves, and that all are graduate, this finding is unsurprising, but runs counter to the received 'wisdom' inherent in media depiction of teachers (see Appendix 7.)

Findings indicate that the NGfL initiatives during 1997 - 99 enabled a process of professional development towards ICT expertise to begin. This is one of the *outcomes of an opportunity for change* as in the title of this research. The complexity of the initiatives and the individual nature of the outcomes means that it is possible to describe a spectrum of response to change, but findings indicate that the overall outcome for the profession is in the direction of increased ICT use in practice. It seems that such 'upgrading' of the teaching profession through association with ICT might lead to further benefits. The most useful of these might be better recognition and appreciation of the actual role of the teacher by society. The next chapter, Chapter 9, continues the discussion of professional development in relation to the research data, drawing together issues and ideas to do with change, community, and computers.

Chapter 9: Outcomes of An Opportunity for Change

Chapter 9 draws conclusions from the research in three areas:

1. Theoretical implications.

Conclusions from the research support a re-conceptualisation of professional development using the concepts of community and contextualised learning. Also discussed is a consideration of the effects of sharing ICT expertise (that is skills, understanding and pedagogical applications) across the teaching profession.

The findings are used to inform a critical appraisal of the usefulness of measurements of teacher attitudes to change, specifically change involving the use of technology. The model described in Chapter 5 is offered as a framework allowing a deeper understanding of professional development and teachers as learners. A discussion of the influences on change in education is based on research findings.

2. Implications for methodology.

Some of the above points have implications for methodology. For example, a decontextualised measurement of attitude when considering change in schools may provide little insight into current situations, and thus little chance to influence future innovation. Alternative investigative methods are suggested. An ICT audit of situational factors, coupled with a method of enabling teachers to highlight their perceptions of the limits of their change agentry as individuals offer teachers and researchers a different perspective on how change might be managed.

3. Implications of the research for the integration of ICT into schools.

The research findings are used to discuss the research questions. An evaluation of the outcomes of the NGfL opportunities are based on the findings and evidence presented in previous chapters.

1: Theoretical Implications:
Professional development in the teaching community

This section discusses the understanding of professional development of teachers in ICT, drawing on theories which provide insight into the actions of teachers as learners, especially the modified apprenticeship theory as detailed by Lave and Wenger (1991) as discussed in Chapter 2.

The basis of apprenticeship theory is that people learn by being with others who know. As people with knowledge do things and talk about things together, learners can copy their actions and reflect on their words. In their classrooms, teachers attempt to create communities of learners who build knowledge amongst themselves by discussion, reflection, and sharing expertise. The teacher in a school setting is also a learner of new knowledge: the teacher gradually and continually acquires the practical wisdom necessary to teach effectively. New teachers learn by being with those who have gained experience. Experienced teachers moving to a new school learn about its distinctive style from established colleagues. The subtle and complex skills and understanding which are required learning for those who wish to be effective teachers are thus embedded in the actions, structures, and discourse of the profession. The teaching profession constitutes what Wenger (1998) refers to as a community of practice in which different forms of knowledge - personal knowledge, knowledge from research, craft knowledge, common sense and wisdom - are continually transmitted between practitioners (Selinger 2000). In this setting, professional development for individuals takes place within the context of development of the profession as a group, or community, of practitioners.

New technology seems to offer great potential benefits to the professional community of teachers. For example, computers can now provide communicative links between schools, whereas early in the 1990s their uses were limited to such applications as slow and poorly designed 'teacher proof' software. Some teachers have managed to keep

abreast of developments. Others have had little opportunity to do so. The consideration of learning as community-joining means that to induct new learners, the community must have ownership of relevant knowledge and understanding. In the field of educational ICT, very few of the community sampled by this study held significant expertise, until recently.

It is important to recognise the profound difference community knowledge can make to the perceptions and actions of practitioners. If we consider other examples of communities of practice in which knowledge is embedded, it is possible to see that learning is a product of being within the community, and has very little to do with aptitude, skills, - and attitude, though attitude will be considered in greater depth later in this chapter. The examples I am thinking of show how people situated in communities can simply join in with what is happening; can expect to share ideas using mutually intelligible vocabulary and concepts; and are effortlessly included in practice as an outcome of 'being there'. The two examples I would like to offer are the male voice choirs of Welsh miners, and children playing traditional playground games.

Perhaps there is some genetic reason why men whose occupation was coal mining made especially lyrical singers, but that seems unlikely. Yet male voice choirs were a feature of Welsh mining communities. It seems that singing in harmony was an embedded practice, so that singing was almost a part of the job and community profile: no doubt there were 'better' or 'poorer' singers, but the practice itself generated choirs of men who did not consider their attitude to singing, or whether they had the required skills. Because they lived where and when they did, what the others did was what they did. In the same way, children in school playgrounds pass on the knowledge and understanding of games such as variations on 'tag', clapping games, and skipping rhymes. Again there are probably experts and slow learners, but the practice goes unquestioned, and a child in a playground (who might or might not join in with games) can largely be expected to understand such practices which are a feature of playground life.

The point of these analogies is to highlight that in the teaching profession in the early 1990s, *there was no such community of practice of ICT use*. Therefore expecting teachers to include themselves into it was expecting the impossible. The community first had to be generated. Once communities are generated, those with access to them can learn within them. We can see this in some families where the parents are musical and play instruments: their children tend to do so as well. We can see it in the creative power of communities such as groups of artists, writers or sculptors. The way young Australians play cricket to such good effect, and the way people generate ways of being on the Internet together are further examples. Immersion in a community is a reliable way to learn, and so, for example, people who want to speak Italian go to live in Italy, people who want to pass their driving test go on a residential course, and people who want to stop drinking alcohol choose to include themselves in a community of fellow abstainers.

Teachers who wished to integrate ICT into their practice until recently would have found it difficult to access such community support. Instead, they have had to become founders of a new community. The success of such a new community - a learning community - depends heavily on its social and physical contexts. The social context of the community of educational ICT users is critical: learning is a social activity. The chance to discuss new experience and new information is the chance to make meaning and to consolidate knowledge. The tendency of society generally to cast people who work with computers as 'techies' or 'nerds' has not helped the teaching profession to value its early adopters, as my findings from Askill school indicate. An increasing familiarity with personal computers and computer-operated technology in the home and in the world generally may mean that prejudice, where it existed, is eroded. The physical context of an emerging community is also critical. In the past, contextual factors have made it impossible to create a substantial community of educational ICT users. With schools hampered by obsolete equipment, such an aim was of course ridiculous.

The New Community
Creating a new community involves risks. One risk is that in order to assimilate new knowledge a teacher must be ready to question what it is they already think they know.

They must unlearn some aspects of practice, and accept the chance that new or supplantive knowledge will enable development of thinking and practice (Atherton 1991). This process is the same for learners in any situation. However, teachers carry a specific and unusual responsibility. In taking the risk supplantive learning involves, they take a vicarious risk on behalf of their pupils. There is no guarantee that the new way (in this case, providing learning tasks with an ICT component) will be more effective than current practice. Pupil time in school is limited and the curriculum they are expected to follow is concentrated and sequential. If one step in a sequence of learning outcomes is not taken, or taken falteringly, subsequent learning might also be undermined. For a teacher who employs a range of tried practices, the leap of faith required to set them aside and use untried methods instead is seriously demanding. The teacher has to assess the risk of damaging the pupil's development.

A further set of responsibilities also operates to give the teacher pause for thought. On the success of the pupil's performance in standardised tests rests the success of the school measured relative to others. A position low down in the nationally published league tables of SAT results is a demoralising experience for all members of a school. Media publicity attracted by this position is swift and harshly judgemental. The only way to avoid the acquisition of the labels 'failing school' or 'failing teacher' is to ensure that pupils know how to do well in the tests. Unless ICT can be shown to help in this process, teachers must question its use. This point is not really to do with educating children, but to do with the way their education is managed, which necessarily affects teachers' involvement with ICT. The school community of governors, managers, parents and pupils rely on the teacher to ensure that the school is well placed in the league tables, because this is how they and the school will be judged. This is not to say that harnessing ICT uses to the delivery of a mandated curriculum is in any way using technology to its best advantage in teaching and learning, but rather an attempt to depict the current situation for teachers. If methods of assessment changed, ICT uses could change.

Community joining as re-conceptualisation of professional development

In the three linked study schools, the effect of community support was clear. Banna School with its close relationship to Askill benefited from the technical advances made by the secondary school. Hardware provision, connection to electronic networks, and teacher training were all facilitated by this link. However Causey which had the initial starting condition of weaker links with both Banna and Askill (as reported by teachers in this study) and was further isolated by internal staff changes, gained no benefit and made no technological progress. The inclusion in a community must be sustained and dependable in order for learning to take place and practice to become what might be called normalised. The process of replacing learning with new learning is easier once the learner is with people for whom previous practices have diminished meaning or rationale.

An example from the research data can illustrate this point. A teacher from Eskdale school took up a new post at Honister School. At Eskdale, the teacher's Year 7 pupils used the classroom computer sporadically for word processing, and were never taken to the computer room with its 'mixed economy' of ageing and unreliable machines. Research assessment categorised this teacher as 2: Participant, since the teacher had a home computer, but saw no real educational purpose for ICT use with pupils. When I visited Honister school, the teacher's new class were involved in a complex project involving data bases and Internet links: the teacher was using the SIMS electronic registration system fluently. When asked how this had happened, the teacher said, 'Ah - everyone does IT here.' This response reinforced the finding of this study that the teacher's *attitude* was entirely irrelevant when it came to using ICT. All that had really changed for this teacher were the circumstances: the ICT context.

ICT use - consistent, sustainable use in practice - can be best learnt by those who are in communities where such use is commonplace. To paraphrase the famous opening line of L. P. Hartley's novel *'The Go Between'*: ICT is a foreign country: they do things differently there. Teachers are both creating and entering this 'foreign country', and doing things differently (with its excitements and pitfalls) is one descriptor of current ICT practice in schools.

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Sharing expertise across the community

Before the advent of the NGfL, ICT expertise was held in individuals who had either trained to use technology, or had a strong personal interest or purpose to do so. This is not unusual: in secondary schools especially, the same phenomenon operates to provide pupils with expert teachers in physics, history, Physical Exercise, music, and so on. The perception that computers might enrich the educational experiences of pupils in all subject areas meant that either the expert ICT teachers must begin to use ICT to teach in all curriculum areas, or that all teachers must become experts with ICT. Initially, and to the dismay of subject teachers at Askill, the former system operated. The pitfalls, however, soon became apparent, as ICT teachers were unable to help pupils asking questions about the *content* of programs designed to offer French, or the skills of geographical enquiry, or design. At primary level, the IT expert could offer to teach the pupils IT skills in weekly sessions, but there was little point in doing so when no transfer to other areas of the pupils' work was possible. The solution, which is beginning to take place in schools under NGfL provision, was to diffuse ICT expertise amongst the community of practitioners. The major difficulty, the literature indicated, would be the 'resistance' teachers would offer to this change to their set of professional skills. However, the findings of this research support the conclusion that a community of teachers provided with reliable equipment, skills, and professional purpose, would offer only creative resistance. That is, resistance if it is to be called such, is a positive force ensuring that change has educationally sound purposes.

An example of anxiety concerning teachers and ICT can be seen in a report called 'Ways forward with ICT' which looks at examples of new uses of technology during the early NGfL period. Discussing the willingness of teachers to bring about change, the report categorises some teachers as having ' a pro-ICT attitude', stating:

> 'Teachers who said ICT made them feel good about their teaching tended to be the more effective teachers' (Moseley et al, 1999 p xiii).

However 'a pro-ICT attitude' was found to be neutral so far as learning gains were concerned. Also, the learning gains of pupils whose teachers held a pro-ICT attitude (all of whom were ICT Co-ordinators) were largely in mathematics. The authors interpret this to mean that these teachers are more effective, and that:

> 'their attitudes to ICT are a reflection of their skills and willingness to try to improve [...] The use of ICT in the classroom is dependent upon a teacher's particular skill and confidence in using the technology and in understanding how it can be beneficial' (Op.cit. p xxxv).

The conclusion that those with ICT skills are more confident in its uses is self evident. However the conclusion that positive attitudes to ICT 'are a reflection of willingness to try to improve' and are an indicator of teacher effectiveness has the consequent implication that teachers who do not appear 'pro-ICT' are less effective, and unwilling to change and develop their practice. This gains no support from the findings of my study. An alternative interpretation based on theories of learning as community joining, and applying the categories suggested in Chapter 5, would be that barriers to ICT use in some schools created contexts in which teachers could not be 'pro-ICT'. Only the ICT Co-ordinators were working in conditions in which they might be considered Involved: other teachers had no alternative but to remain Potential or Participant users of ICT. It is also possible that management which did not encourage teachers to integrate ICT into practice did not encourage teachers in other areas of their working life. This could be a focus for further research.

Considering the idea that teachers' *attitudes* are in any way important in their uptake of ICT, the work of Potter and Wetherell (1987) indicates that reliance on reported attitude is unsafe. The notion of 'attitude' is doubtful, given the contextualised nature of people's thinking. The Moseley et al. quotation above is a good example of this. ICT Co-ordinators were more likely than other teachers to think ICT could benefit education. It is possible that teachers with this positive approach had in common their technical skills or aptitudes. But as teachers the more important things they shared were access to up-to-date equipment in their classrooms, relevant training, opportunities to practice and reflect on ICT use and to discuss issues with other ICT Co-ordinators regularly.

The next section suggests implications of a rejection of attitude as a focus for approaching teachers' professional development in ICT use.

Measurements of teacher attitudes to change: an alternative framework

Findings reported in this study indicate that a teacher provided with sound, supportive working conditions could be expected to report a positive *attitude* to ICT use. Teachers in the study schools and those in other studies (BECTa 1998a: DfEE 1997b) indicated clearly that ownership of a computer, or having access to new equipment in schools, helped them to see how technology might be used productively in classrooms. So, personal access to hardware is an essential contextual factor for people expected to use technology with pupils.

The willingness to change - to accept opportunities for professional development - is not a question of attitude. Reported attitude to ICT tells us much more about what equipment the teacher has access to, what training they have had, and what sort of community they are part of, than it does about the willingness of the teacher to learn about or use ICT. The information that attitude scales provide can not be helpful for a community trying to establish itself as inclusive. A categorisation of some teachers as 'Pro-ICT' means that others must therefore be 'ICT neutral' or 'Anti-ICT', all three of which are inappropriate. The teaching community is now a community of ICT users, in the same way as the Welsh mining community is a community of singers, and the playground community is a community of games-players.

If we consider that learning is social or that learning is community joining, the description of a community is a way of describing social context. Attitudes are so dependent on context that the concept of attitude is of extremely limited value when trying to describe or understand *learning as professional development*. The teaching community is in a time of change, and is generating its new knowledge, and what Wenger (1998) describes as new peripheries and new boundaries. Categorising teachers as anti-ICT, or assuming that attitudes are deeply held and immutable, creates the potential for premature and permanent exclusion of some individuals. The community

overwhelming consensus was that the acquisition of skills, knowledge and understanding was essential if they were to take control of the technology. Teachers were determined to undertake training before using the machines with pupils. The prevailing notion that because children like computers and are motivated by them, nothing is required of the teacher but to stand back and fold their arms, may have had credibility for IT firms, but not for teachers. Such action is analogous to buying a box of string and wind instruments, and handing them over to a class of children to play with. They would no doubt enjoy themselves for a while. There would be little chance that any of them would come nearer to making meaning of music. Teachers generally will not forgo on their pupils' behalf the chance to help them make meaning, although sometimes that would be a much easier course of action.

There was also the question of classroom management for sustainable change. This may seem trivial, but it is central to ICT integration. The classroom can be an anarchic place where learning is fortuitous. Or learning can proceed from a purposeful, orderly atmosphere. The literature indicated that surprisingly little machinery or technology was to be found in modern classrooms. This lack of technology leads observers to conclude that teachers cannot use technology, or prefer not to, or are averse to it in some way. The research findings however indicate a strong impulse towards technology use in classrooms, with teachers determined to access new opportunities for and with their classes. The barriers which prevent this may be beyond comprehension unless the fine detail of the teacher's situation is sympathetically examined.

'Low-tech' machinery has been in the teachers' toolkit for generations. The vignette 'Technology as Solution' below illustrates how even the simplest machines require sensitive classroom management.

Technology as Solution

School policy required the class to use pencils for work in their books. These were kept sharp with small metal sharpeners. After the first week of term most of these had vanished, either to the children's homes or into the bin with the sharpenings. Problems occurred as pencils did not work properly any more, and disputes about the remaining sharpeners took place. This wasted time and created distracting incidents. The teacher decided to buy an efficient desk sharpener. The children liked this so much that pencils were entirely sharpened away with enthusiasm. During one break time, the contents of the sharpener's plastic drum was scattered about the classroom. Shopped by classmates, the culprit created a menacing atmosphere. Pencils became scarce as the sharpener was used at every available opportunity, and the children in the queue for its use chattered and disrupted others. The teacher realised that again learning was being affected.

The teacher considered some choices.

- To remove the desk sharpener and require children to provide their own sharpeners
- To appoint a monitor who would sharpen pencils at break and lunchtime
- To wait and hope the novelty would wear off and the desk sharpener would indeed turn out to be useful
- To remove the desk sharpener and ask children to make sure they came to school with at least three sharp pencils
- To discuss the problems with the class and ask the children to produce and agree to a code of conduct
- To sharpen the children's pencils for them
- To allow only those who had completed work to use the sharpener

Each of these options had some disadvantage:

- To go back to previous practice would not solve the original problem
- 'Monitors' would miss their social break time to do a menial task
- Waiting would waste even more pupil time
- The children were unlikely to bring pencils from home and parents would resent being asked to support the school in this way
- Another set of rules would have to be policed and enforced
- For the teacher to become a pencil-sharpener did not seem the best use of time.

What the teacher could not do was to ignore the situation, because of its detrimental effect on learning. The teacher realised why colleagues had not installed desk sharpeners.

The management of classroom computers is a little more complex than that of pencil sharpeners; but some similar principles apply.

The introduction of technology is not inevitably a solution to a perceived problem. The nature of the pencil sharpener problem was not to do with the equipment, but to do with the children's behaviour. Thus the new technology generated new sorts of inappropriate behaviour, and the aims of the change (sharp pencils, therefore streamlined learning) were never realised. The children were motivated by the technology - to sharpen pencils, not to use them to complete work in their books. Computers can create this effect, too. Hedging the sharpener around with agreed codes of conduct, classroom monitors, and rules in which it is used to reinforce 'good' behaviour were not what the teacher intended, but these may be essential initial strategies if the sharpener is to become part of classroom life. This is the reality of teaching in institutional settings. Those who envisage computer technology 'breaking down the walls of the classroom' seem to forget that classrooms contain children, who are wonderful, imaginative and fascinating beings, but who are also selfish, anarchic and illogical (like the rest of us), being, after all, human.

Inappropriate behaviour might, of course, be the result of asking children to do work that is too demanding for them. But as adults we have decided on a curriculum which all children must follow, and we have handed over the delivery of this curriculum to teachers. However all-singing all-dancing the teacher's presentation of the work may be, there will still be times when the demanding nature of learning means that children will want to opt out and take a break. So, technology is never a solution for human nature, because this is not the problem. But technology can create problems if human-machine interaction is not taken into account. People can fall in love with machines, or they can hate them, or they can use them. In schools, teachers have to create the right conditions for the last of these responses: no mean feat.

The impact of the introduction of multimedia computers linked to the Internet into classrooms can be enormous. Two of the options above involved abandoning new technology altogether. There are reasons why this may seem expedient to teachers, most especially the perception that learning is adversely affected. The research finding that teachers were determined to undertake training is an indication that they wished to avoid taking this step: to learn and discuss ways to make ICT educationally effective. Adept

teachers could ensure that ICT use was not circumvented by those desiring constant distraction or novelty, who were happy to limit themselves to 'edutainment', or who were motivated by technology use for its own sake.

Outcomes of an opportunity for change

In summary, then, I have proposed that research into the integration of ICT into teachers' professional activities should be focused upon the concept of 'community of practice'. I have also argued that such research should avoid the concept of 'attitude' as a decontextualised explanation of teachers' involvement with ICT. Instead, investigations of teachers' relationships with ICT should be made with reference to their responsibilities and their status as members of a professional community, and with reference to the issues of access to ICT tools and relevant training.

True professional development involves sustainable, 'deep' learning. In the field of educational ICT, there is little point in individual, isolated professional development. The potential for ICT to enhance the delivery of education, and enable knowledge and understanding for all rather than for an advantaged few, requires development of the entire teaching profession. The coherent National Grid for Learning initiatives have created supportive contextual conditions allowing the generation of a new community, that of teachers as learners and users of ICT.This fledgling community can be expected to generate new uses of ICT, basing practice on the aim that use of technology has discernable learning outcomes for pupils. Such uses might therefore include the streamlining of administrative procedures, the delivery of the National Curriculum, or the enabling of communicative collaboration and learning conversations between groups face to face or at a distance.

The crucial factor on which consolidation and continuance of the community of teachers as ICT users depends is that of the ICT context within schools.

Contextual barriers to ICT use include lack of equipment, technical support, training, time to practice, and lack of community support (within the teaching profession and within society). Contextual supports for ICT use include ownership or access to up-to-date equipment, relevant training and time to reflect and try out new skills and ideas, constant and accessible technical support, and inclusion in a community of practice.

The outcomes of the opportunities offered under NGfL initiatives for individual teachers include enhanced practice, an increase in personal skills, competence and understanding, and access to community support. A further outcome lies in the creation of a context of ongoing opportunities for teachers. The assurance that the NGfL will continue after the year 2002 is an acknowledgement that factors like government targets to impress the electorate should not be allowed to condense major evolutionary change into a very few years. Some of the outcomes - what was possible - have been achieved, and serve as foundation for the future.

Judgement of success or failure of the NGfL is subjective for teachers, depending on the situation they have found themselves in over the years 1997 -2000. Some have had very positive experiences, while others have found that the difficulties associated with change have proved demanding on a spectrum from a little to a great deal: others have felt no impact of the NGfL, but have deferred involvement with change until they can seriously give wholehearted attention to ensuring its best outcomes. Change generates such turbulence: 'Change is not made without inconvenience, even from worse to better' (Hooker, 1554 - 1600: ODQ p252). Whether actors or spectators, teachers have moved towards integrating technology use into their profession in a way that might have the side effect of helping society to value more highly the people to whom it entrusts the education of its youngsters. However the main outcome of integral technology use is professional development, undertaken with the force of the purpose that teachers usually bring to their own learning: that is, the desire to teach.

When considering ICT integration as a directed change, its success or failure rests on the way that contexts are altered. Change, professional development and learning are all

context dependent. Attitudes are so context dependent that they cannot be relied on as indicators of behaviour. The NGfL initiatives were designed to alter the professional practice of teachers by altering crucial ICT contexts in schools. This context for professional development has allowed teachers to perceive purposes for ICT use, and to generate educationally effective uses of ICT. Concurrent changes in education policy and in society have both supported and interfered with the NGfL. There are other forces working against change, such as the growing realisation in society that though the Internet is an amazing thing, it can be misused. A force which is notable by its absence in this research is that of 'teacher resistance to change'. If teachers cannot be convinced of the practicability of ICT use then it may be that change was ill conceived or unworkable. If the initiatives acquire the momentum of considered community endorsement, teachers may find themselves convinced. The professional wisdom of teachers may act as a frictional force, slowing change, but its best effects are creative, ensuring that when change is implemented it is both sustainable and educationally effective within its context.

2. Implications for methodology.

A model for establishing teachers as users of ICT

Some of the above points have implications for research methods. For example, the measurement of attitude to ICT use may provide little insight into current situations if not firmly linked to a consideration of context. The model for categorising the professional development of teachers as users of ICT described in Chapter 5 provides an alternate investigative method which is sensitive to the status of teachers as learners within an emerging community. The difficulties of engaging with supplantive learning, and in tackling learning which might (initially) adversely affect pedagogic practice are acknowledged within the structure of the model.

The model proposes a categorisation of teachers as users of ICT within a community of practice. The descriptions of categories acknowledge the special status of newcomers to

the community, reflecting an inclusive ethos in which community joining is facilitated by both the processes and actions of the community, and by the stance of members to one another. Newcomers to the community are categorised as 'Potential' users of ICT even before any skills training or understanding of educational applications has taken place. Moving on from this position initially requires ownership of the technology. 'Participant' users may not envisage an educational purpose for ICT use, and require opportunities for professional development in this area. 'Involved' users are faced by barriers to progress such as lack of training and lack of school equipment. 'Adept' users enjoy a supportive ICT context for their classroom work: with a final barrier, that of lack of allocated time, removed for the 'Integral' group. Movement between the categories depends on changes at school and classroom level, with the entire community's participation in educational uses of ICT enabling a sharing of expertise across the range. Learning for teachers in this model is social, by community joining, and by open sharing and transfer of craft skills, knowledge and understanding.

The model is intended to allow teachers and teacher educators to envisage progress into ICT competence and confidence ('network literacy') as dependent on the management of the school ICT environment. This model anticipates that teachers as learners will be provided with realistic training, suitable support networks, and the means to identify their own requirements for professional development. This positive approach reflects the enthusiasm and interest expressed by teachers in the study. It is intended to provide an alternative to approaches in which teachers who have had no opportunities to become familiar with ICT are categorised as 'technophobic', and those who have spent their professional lives in schools wrestling with outdated equipment with no support are labelled 'resistant to change'.

An audit of the ICT context of members of the community

The circumstances in which teachers find themselves, few of which are under their direct control, make a marked difference to their use of ICT (and no doubt to their other actions). For individuals, an audit of their work context or situation can therefore provide a way to evaluate what are barriers to development. The identification of relevant individual barriers is essential if teachers are to be supported in their drive to integrate

ICT into classroom practice. I have compiled a document, based on the research findings, which teachers can use to construct a profile of their ICT situation. This instrument has proved a practical tool for ICT Co-ordinators, supporting productive discussion and planning with their colleagues (see Audit of Situational Factors: Appendix 8).

Other audits of skills and understanding enable training to be well focused (Dawes & Leask 1999: 2000).

These audits are based on *teachers'* criteria for judging the outcomes of NGfL, which can be summarised:

Change is likely to succeed when -

- Training to use new equipment is provided. This must be relevant, based on individual requirements, comprehensive in its scope, and should include time for practise
- A peer tutor ('ICT buddy') and a more expert mentor are formally established
- Equipment is available, user-friendly and works as it should
- New equipment provides a direct means to address educational objectives
- New equipment provides a means to streamline administrative tasks
- Technical support is accessible
- The teacher has personal equipment at work and/or at home
- The whole school has a policy of development in ICT

Change is not likely to succeed when -

- Several other mandated changes are introduced simultaneously
- Teachers are neither consulted about change nor well informed about its aims or rationale
- Change creates insurmountable problems for classroom management
- Pupil learning is adversely affected, even in the short term
- Change is confined to some of a team or a school staff, and excludes others

These criteria can be used to judge the outcomes of ICT innovation in terms of professional development or otherwise for individual teachers, and to look at development across the profession.

Teachers indicate that the *context* for their professional development is thus the critical factor on which the success or otherwise of the NGfL initiatives may depend.

What can teachers change?

The audits of contexts can be coupled with a method of enabling teachers to highlight their perceptions of the limits of their change agentry as individuals. This offers teachers and researchers a different perspective on how change might be managed. Teachers in the study wishing to implement change, who could see a purpose to do so, indicated that factors which had to be altered to realise the aims of change agents - including themselves – were often *out of their immediate control*. The method for eliciting teacher's thinking on prospective change described here, emerged from analysis of the Phase 2 data and would be a way forward for further research.

When considering 'change' as a phenomenon I was reminded of some poems by the Japanese poet Lady Murasaki (c.973 – 1020) called 'The Poems of the Pillow'. The poems are lists of things, for example, 'Things that should be kept clean', 'Things that should be blue', 'Things that should be still.' Compiling lists can usefully enable individual teachers to check whether their perceptions of what they can and cannot control (or change) is accurate. Teachers might first consider three questions:

- What change do I wish to make?
- What are my aims in initiating, joining in with, or rejecting this change?
- What are its intended outcomes?

In order to describe how they are placed to effect change, teachers can then compile two lists for discussion, under the headings of

'**1. Things I can change**' and '**2. Things I can not change**'.

A teacher from Eskdale provided illustrative data.

Example: [UM: Eskdale School]

- What change do I wish to make?

I want to use the computers in the computer room with my class to support numeracy

- What are my aims in initiating, joining in with, or rejecting this change?

I am an 'expert teacher' in maths, but I never use computers with my class. I know that other teachers have found this of value. I think my children should have the chance to have computers help them to grasp maths concepts.

- What outcomes do I intend this change to have?

a)   learning gains in Maths SAT tests for most able

b)   raising standards across the ability range

c)   support for basic number work with weaker children

1. Things I can change

My ICT skills

My knowledge about what software I could use

The grouping of my class

What the classroom assistant does

2. Things I can not change

The computers which are old and no two match

The way my time is taken up with paper work

The fact that I don't have a computer of my own and can not afford one at present

Action

The items in list 1 can be discussed with the professional development co-ordinator and with colleagues. Training, time to confer with colleagues, and suggestions for management of administrative tasks would all enable personal development. The acquisition of a personal computer is essential and school managers can help teachers who require information about this.

The items in list 2 are issues for discussion at management level, and if management are alerted by similar responses from other teachers, with governors. The school's ICT development plan should reflect an awareness of these barriers.

In summary, the research methods employed in this study involved the use of grounded theory in which analysis, data collection, and theory building proceeded simultaneously. The findings arising from analysis of the research data allow conclusions about the suitability of methods for research into the effect of imposed change on practising teachers. The most apposite methods involve a consideration of the complex, organic nature of the teacher's workplace. The concept of a community of practice of teachers allows both an overview of the teacher's situation and an individual assessment of status, whilst respecting the teacher's individual actions.

3. Implications of the research for the integration of ICT into schools.

The National Grid for Learning initiatives comprise a mix of opportunities which are experienced differently by individual teachers. But the NGfL from 1997 onwards provided a coherent and significant opportunity for the teaching profession. This chapter draws conclusions indicating how well (or otherwise) the opportunity has been grasped, based on the research findings in the context of the literature reviewed. One conclusion to be drawn from findings reported in Chapters 4 to 8 is that key supportive contexts must be present *in combination* to enable sustainable change towards integration of ICT into the practices of teaching. Critical supportive contexts for teachers as users of ICT during this study included:

1. Provision of hardware in schools
2. Provision of electronic connections in schools
3. Provision of better educational software and web content
4. Teacher training for ICT skills and pedagogical understanding
5. Partnerships established between business and industry and schools
6. Support for purchase of personal computers for teachers
7. Managed services made available
8. Curriculum 2000, representing the mandatory aspect of change, introduced

9. Changing salaries for serving and trainee teachers initiated, that is, society overtly valuing teachers

10. Computers becoming ubiquitous in the workplace and in homes.

Change and the National Grid For Learning

The NGfL was designed to support the development of the teaching profession so that teachers could and would adopt the use of new technology. That is, implementation of NGfL initiatives might be expected to change the experiences of teachers, and promote changes in their practice. The NGfL can therefore be regarded as a strategic management by a new government intent on implementing policies after eighteen years in opposition. In order to generate change, the government provided resources to alter significant aspects of the work context of teachers. The NGfL initiatives were based on the thorough and sensitive McKinsey and Stevenson reports (see Chapter 1), endorsed by consultation with educationalists and representatives of business and industry. The initiatives addressed some of the core issues which constitute the environmental ICT conditions of teachers:

- Provision of hardware
- Provision of electronic connections
- Provision of software and web content
- Teacher training
- Partnership with business and industry
- Personal computers for teachers.

Substantial amounts of money have been used to generate conditions for change, with the promise that future funding is planned (Wills 2000). The findings of this study provide early evidence of discernable effects of NGfL funding and energy on the factors listed above. The early effectiveness of the NGfL strategies have perhaps depended on a combination of reasonable financial security, the generation of initiatives based on an

understanding of initial conditions, and an understanding of what change can usefully be mandated.

Considering the third of these factors, research indicates that some aspects of change must be mandatory if it is to be successfully implemented (Leask 1998). The coercive pressure for change towards integral use of ICT may lie in the statutory orders of Curriculum 2000, with the OFSTED inspection process policing its implementation. Curriculum 2000 has an integral ICT component for all curriculum areas. However the findings of the interview study indicate that there is another factor at work supporting the same direction of change: a perception of opportunity amongst teachers and school managers. A further force for change lies in the communication of the purposes or aims of the change. The purposes of the NGfL may not have been clearly communicated to serving teachers, but its effects have been to provide teachers with objectives of their own which act to support the change. The provision of up-to-date computers and other equipment has allowed teachers to perceive educational purposes for their use. Fullan argues that in order to initiate change:

> 'You can not mandate what matters. The more complex a change, the less you can force it'
> (Fullan, 1993 p.22).

This implies that even if all the core issues are addressed, change remains something of a gamble. It is best therefore to address what it is possible to address, and acknowledge that there are other, more subtle factors which may generate an additional momentum, carrying change forward. The perception of purpose by teachers was one such factor, which could not be mandated, but arose from the new ICT contexts of schools, such as better equipment, and personal computers for teachers. The NGfL came at the right time for the teaching profession. Earlier, the machines would have been less user-friendly and less capable of enabling communication. Later, and the profession would have lagged behind the uptake of computers by society. The research findings indicate that many teachers considered ICT to be a technological lifeline, providing new approaches to teaching and learning. There remain huge problems – purchase of equipment, equality of access, ensuring sustainability and development, learning how to share good practice -

and more - but the NGfL has provided opportunities for focused change and development, which the teachers in this study largely welcomed.

The intended consequences of increased ICT use are detailed in *Connecting the Learning Society* (DfEE 1997a). There was an expectation that increasing ICT capability would result in a higher proportion of literate and numerate pupils, who would leave school with marketable skills and a better understanding of how and why to contribute to society. However no change is all positive and critics raised such issues as the fear that ICT could compound disadvantage, reinforce inequalities, and have a harmful effect on the mental or physical health of young people experiencing too much exposure to small screens generally. The findings of this study indicate that the consequences of increased ICT use have not, as yet, achieved all positive or negative outcomes. The academic community and teachers conducting action research continue to investigate the potential beneficial effects of ICT use for pupils, with an emphasis on the search for a link between ICT use and 'raising standards'. Teachers in this study valued the applications of ICT which streamlined administrative tasks, and enabled them to locate relevant resources for work with their pupils. Ultimately though, the use of ICT saved no-one any time. Teacher anxiety about the possible detrimental effect of their own supplantive learning on pupils was reflected in their identification of good training as critical. To date increased ICT use has largely meant that computers are employed more systematically to help pupils and teachers develop the skills necessary to operate them. Innovative uses are generated once skills are in place, and this next phase is just getting under way.

Teachers who cannot rely on technology may make the sensible professional decision not to use it in their teaching. ICT is not especially reliable, and may be even less so if technical support in unavailable, and if there is no systematic updating of hardware. It may be that it is too soon for teachers even in well-provided schools to feel that ICT is so reliable that they can use it as an every day tool.

An example which might be considered a missed opportunity in the past is that of software design for schools. Simply put, much software which purports to be

'educational' is not. The involvement of teachers in the design of software, and in its use in classrooms, is of crucial importance to its effectiveness. So, for example, generic software such as Powerpoint and Microsoft Publisher can support teaching and learning very well, even though not produced for the education market. Conversely maths drill or spelling tutor programmes can be a waste of time if not used within a coherent framework for learners. A problem for education until recently has been that many teachers with their limited experience of ICT applications have found it difficult to locate, choose and use software effectively. A solution to this problem has been the central purchase of software by LEAs or ICT Advisors. However removing teacher choice addresses the symptoms but not the cause of the problem.

An example of lost opportunity experienced by learners using the Internet in schools is detailed by Selinger (2001):

> 'My thinking about lost opportunities was particularly related to the case of the Internet, where teachers have an opportunity for students to use the web to answer questions rather than 'finding out all about', so causing them to analyse and extract from the information found on the web rather than cutting and pasting. Teachers who do not let children use the Internet because they cut and paste, are missing opportunities for children to draw from a rich source of data and develop the information handing skills needed for digital literacy. By posing questions, children can search for answers, compare material from different sources and put answeres in their own words, demonstrating comprehension and ability to search for and question data sources' (Selinger, M. 2001 pers.comm.)

As more software and content is developed for the UK education system, it is to be hoped that teachers' increasing sophistication in the uses of ICT will enable them to select appropriate software and generate good practice in its use. At the same time, developers are more likely to include teachers who are perceived as having essential expertise in their design teams. The era in which poor software was used to little effect by a untrained profession is almost over, with its lost opportunities for learners, teachers, and the UK software industry.

A corpus of experience promoting the knowledge and understanding of how, when and why to use communications technology to good effect with pupils is not yet embedded in

the teaching profession. Not enough time has gone by for this to be so. The entire profession is still in a process of internally generating knowledge, and disseminating what is learnt. This process is difficult for a community: those who have first encountered new knowledge may wish others to benefit from their experiences, but how these 'early adopters' attempt to share their understanding with others may be of critical importance. Within any school, the pace of change is different for everyone. Some teachers in the study reported gradual acclimatisation to change. Media reports mentioning the National Grid for Learning introduced them to the phrase, without explaining exactly what it entailed - not surprisingly, given the range of complementary but woolly descriptions of the NGfL issued by government (Chapter 1). For example in February 2000 a highly successful Senior Teacher at a large secondary school, who had just purchased a home computer under the NGfL Computers for Teachers scheme, said to me,

> 'You'll have to tell me some time what this National Grid for Learning actually is. I keep hearing about it but I can't pin down what it means.'

The outcome of change for this teacher was the benefit of owning a home computer, and the catchy name for the government's strategy facilitating its purchase was irrelevant.

The NGfL changes come into the category of 'top-down' mandated change, especially since integral ICT use is required by the Curriculum 2000 orders. The literature indicated that imposed change could not be sustainable if in their hearts and minds those who constituted the profession remained unconvinced. However the NGfL initiatives offered some opportunity for teachers to avoid being passive 'adoption units', and instead to act change agents on their own behalf, a strategy advocated by Fullan (1993). The nature of the Internet is also a force for change, allowing teachers opportunities to exchange opinions and ideas about what was happening, and providing open access to information.

A particular problem for teachers when considering the NGfL initiatives was that the Learning Grid, a 'flagship' enterprise of the government, was introduced at the same time as other high-profile mandated change. Primary schools had to assimilate the literacy strategy and the numeracy strategy over the period 1997 - 2000. Secondary schools were adjusting to such initiatives as change in funding for social inclusion policies, and a

broadening of the post-16 education system including a review of 'A' levels. In addition all teachers were subject to the continuing pressure of OFSTED inspections, an increasing volume of administration, and reforms such as the introduction of performance related pay. For teachers finding change difficult, a variety of simultaneous changes was very difficult. For example a teacher at Mosser school reported: *'It's a general thing. People overloaded with change, you know - you must do it this way now, do it that way now - may end up making only the changes that seem to them most urgent or most achievable.'* Thus the NGfL may initially have had a diminished impact because of competing priorities.

The NGfL - successful or unsuccessful change?

One set of criteria (adapted from Ridgeway and Passey, 1995, pp 65 – 66: see Chapter 2) for judging whether change is successful or unsuccessful is included here in order to comment on some aspects of NGfL initiatives. The Ridgeway and Passey criteria are considered under the two headings:

Change is likely to succeed when -

Change is not likely to succeed when -

After comment, I have indicated whether this analysis linked with the research findings indicates the likelihood of success or failure of NGfL initiatives. This assessment indicates success on six of the criteria, failure on one, and an indeterminate response on two. This method of assessment is very generalised, but is included here to provide a structure for discussing some of the important issues highlighted by the research findings.

Change is likely to *succeed* when:

• *it lets one achieve goals which are hard to achieve in other ways*

For teachers, setting goals with an integral ICT component may be the way forward. It is possible to envisage how this condition might be fulfilled by acquisition of multimedia computers and connections (Success).

• *it makes life more fun*

Many people would say ICT does make life more fun. Unfortunately this is not a question asked at interview. Definitions of fun may differ, and the overlap between fun and learning is hard to quantify. Observations during the study indicated that however well-resourced, ICT rooms contained both children and adults having fun at least some of the time. Individual teachers reported how rapidly time went by while looking for resources. on the Internet. ICT can be infuriating and difficult, but for children and teachers computers can add interesting interactivity to teaching and learning (Success).

• *it makes life easier*

The Head teacher at Causey said that the NGfL had proved a considerable headache. Others found that it streamlined administrative paperwork, and made communication much easier. As the General Advisor for ICT said : 'the jury is out on this one' (-)

• *it is seen to be desirable by the community at large.*

Findings (e.g. from Drigg school) indicate that parents (representing the community at large) were in favour of their children having experience with computers at school. The drawbacks such as the potential to encounter harmful material or individuals via the net were beginning to emerge. Teachers at Askill put the school's overwhelming popularity with parents down to its delivery of the curriculum through technology.(Success)

Change is likely to *fail* when innovations:

• *challenge fundamental values and practices*

Advertisers claim that the *role* of the teacher is challenged by ICT. The media's constantly reinforced misperception of the role of the teacher as that of deliverer of information is based on unreflective acceptance, by those with little understanding of schools, of such stereotypes as 'Teecher' from The Beano. (See Appendix 7 for a further discussion of this issue). The role of the teacher is a complex one. Indeed the role of ICT could be considered to be that of deliverer of information. The findings indicated that teachers envisaged some changes to their role, but that fundamentally, their role as

responsible for creation of an effective teaching and learning environment would not alter. Practitioners welcomed opportunities to evaluate and change their practice. If the work of Schon (1983:1987) and Erault(1994:1995) is accepted, practising teachers do this most of the time.

However, when evaluating the effect of the NGfL in relation to the Ridgeway and Passey criterion, it is possible that ICT could be used to support fundamental values and practices as easily as to challenge them.(-)

• *are associated with over ambitious claims by advocates*

This is certainly the case. However teachers in the study paid little attention to the 'hype' surrounding computers. They were well aware of what ICT could and could not do, and saw themselves as instrumental in ensuring educational application of the machines. An example of the 'hype' effect is offered here, drawn from television advertising: the scenario depicts a young man with a small mobile phone capable of accessing the Internet. The advertising rhetoric claims that the device can help its owner to visit other worlds, showing a cartoon surfer riding freely between planets. The young man is then shown looking at a web site providing information about music in the charts. Despite the new device being really impressive, finding out what is No.1 this week while standing in the middle of a city square hardly constitutes fluent interplanetary travel. Much ICT advertising at this time attempted to portray a technology-dominated future as a new and better world. Those using school ICT during the late nineties found this unconvincing.

The challenge to established practice engendered by aspects of ICT use is recorded in the findings as positive, with teachers indicating a shift away from isolation towards a more collaborative culture. Over ambitious claims characterise the writings of ICT enthusiasts, and perhaps create unrealistic expectations in some teachers, but also in parents and others (Failure).

• *underestimate the practical constraints of resources such as time and support*

The estimate of overall financial resources and other support required to deliver the NGfL aims is not available. Therefore it is impossible to tell if an underestimation has

been made. However the NGfL is based on a consideration of such issues. No doubt any amount of resource would always fall short at some juncture: but the NGfL has been generously funded: 'is privileged under this government' as Michael Wills, Minister for Learning Technology, put it (Wills 2000). The constraint of time as a resource is interesting: an individual's perception of time is subjective, and each of us measures time differently (Hawking 1988: Leask & Younie 2000). Leask and Younie found that those who integrated ICT into their practice did not report time as a limiting factor or constraint, accepting that time was well spent once its outcomes were considered (Success).

• *ignore the starting point of individuals involved*

The starting point of the teaching profession, thoroughly detailed by Stevenson, was taken into account by government. An assessment of the starting points of individuals was built into the TTA training programme, so that training would be based on needs identification. The school context of individuals was also checked to ensure that the teacher's training could be put into practice (Success).

• *fail to monitor progress and adapt the programme appropriately.*

Monitoring progress has been a concern of government. The British Educational Communications and Technology Agency in 2000 was asked by DfEE to compile a database of positive research evidence for teachers using ICT to enhance their delivery of a range of National Curriculum subjects, across all Key Stages. This database provided ministers with evidence of NGfL outcomes, and unfortunately has not been released for general use. It comprises approximately 1200 studies. NGfL strategies have been adapted over the last three years; for example, the Computers for Teachers scheme in 1998- 9 was a response to findings such as reported in this study that ownership of a home computer was crucial (Success).

A further opportunity for sustainable change

The National Grid for Learning initiatives have been timely and well-resourced. The findings show that schools have benefited directly from the initiatives. For example an indicator of the sort of changes the last three years of NGfL funding have brought about appears in Table 8.1:*Physical change to school buildings*. Schools have installed up-to-date technology in specially designed rooms. These changes are mirrored by the less visible changes taking place within and around teachers who have acquired their own computer and enrolled on training courses.

Therefore the research conclusions provide some answers to the question, 'What are the outcomes of the opportunities available under the National Grid for Learning?'

Outcomes, as I have indicated above, can be thought of as to do with the acquisition of equipment, and the development of personal skills and understanding. The findings reported and discussed in Chapter 7 indicate that there is a range of outcomes:

- Intended NGfL aims have been realised for some teachers.
- Others are working towards computer ownership, network literacy, and pedagogical knowledge.
- Others have yet to begin this process but demonstrate a raised awareness of the potential benefits of change.
- Others are observing the effects of the outcomes on the work of their colleagues before finalising plans for change.

This spectrum of outcomes is to be expected. Most of the teachers in the study were in the first two groups listed above.

The research allows description of a more subtle but very substantial outcome of the NGfL opportunities. Because of the NGfL, a variety of related supportive and innovative opportunities have arisen, have become established and are continuing. Real opportunity thus lies in this *establishment of perpetual opportunity*. By perpetual here I do not mean 'forever' but 'self generating'. For the teaching profession, this 'perpetual opportunity' effect means that development can now continue to take place within an evolving

learning community of ICT users. Barriers to taking up newcomer status are lowered by contextual changes such as increase in hardware and the increase in awareness of chances for change. Such opportunity was available to very few teachers before 1997. The coherent strategy of upgrading school equipment, ensuring that every teacher is entitled to at least basic training, and the provision of educational content on the web, appears to have begun a chain reaction of teacher involvement and development for individuals and the profession. In summary, the answer to Question 3 is that the outcome of the opportunities available under the NGfL is the establishment of an ICT enhanced teaching community with embedded ICT-related opportunities.

Summary and Conclusion

The initiation of the National Grid for Learning presented timely, urgent and substantial opportunities for education, with aims which could be realised through the mediation of the teaching profession. Its first effect was to allow teachers the opportunity to interact with technology, so that they can then envisage how to generate educational uses with pupils. The perception of *educational purposes for ICT* by teachers is a critical factor in their professional development. This perception could not be mandated, but arises from the enhancement of ICT contexts of schools, such as provision of up to date equipment and personal computers for teachers. The acquisition of skills, knowledge and understanding allows teachers to take control of the technology and use it effectively. This is why teachers in the study were so determined to take training before making use of the machines. Teachers wishing to implement change, who can see a purpose to do so, may feel that much of what needs to be changed to realise the aims of change agents - including themselves - is *out of their control*, therefore they may require the support of management in order to formulate plans for change.

Teachers who wished to integrate ICT into their practice until recently would have found it difficult to access community support. Instead, they have had to become founders of a new community. The entire profession is in a process of internally generating knowledge and disseminating what is learnt. Learning how to make ICT educationally effective can

be a product of being within this community, and has very little to do with aptitude, skills, or attitude. The question of whether to use ICT with pupils does not primarily rest on issues such as personal beliefs. Reported attitude to ICT tells us much more about what equipment the teacher has access to, what training they have had, and what sort of community they are part of, than it does about the willingness of the teacher to learn about or use ICT.

The use of ICT in the classroom *superficially* depends on a teacher's skill, confidence and understanding. More profoundly it depends on the development amongst the teaching profession of a supportive ethos, a community of practice enhanced by use of the tools ICT offers, which is inclusive of all teachers. This in turn depends on a complex set of situational factors, and on whether ICT can indeed address educational objectives. The success of the new learning community depends heavily on its continuing social and physical contexts.

A variety of related supportive and innovative opportunities have arisen, have become established and are continuing. This *establishment of perpetual opportunity* means that development can now continue to take place within an evolving learning community of ICT users. The outcome of increased technology use in schools is professional development with the purpose of enriching and enhancing the practice of teaching and learning.

The research has examined the professional development of teachers as the early NGfL initiatives were introduced, and found a community optimistic about the educational benefits of ICT, and determined to undertake training in order to ensure that pupils could gain whatever advantages were possible as new technology became available. Initial teacher training and training for serving teachers is now under way, and the logical next steps for research are to investigate the effects of teachers' developing ICT expertise on the learning of pupils. There are many areas which merit detailed investigation, such as: the advantages and disadvantages of computer suites in primary schools; the effect of altering assessment processes on practice; learning based on involvement with virtual

communities; whether initial differences in starting conditions as the NGfL progresses compounds or relieves exiisting disadvantage: and more.

The years 1997 to 2001 have seen significant and rapid changes in ICT provision in schools, coupled with an upsurge of awareness amongst teachers of its potential for pupils. That ICT offers potential for teachers has also become evident. The role of the teacher during this time has not, as predicted by the media, diminished to that of 'network manager' or 'ICT facilitator' but has been consolidated as that of mediator between pupil and subject knowledge, of learning manager for pupils, - as teacher. Teachers have applied their professional knowledge to uses of technology, and generated sound practice to share with their colleagues. Teachers remain immersed in the learning of their pupils, now with the support of ICT tools. The years 2001 onwards may see a consolidation of the early gains, or may see financial support and government drive channelled elsewhere. Either way, it will be fascinating to look at evaluations of the NGfL in 2002. In that year the aim that all teachers will be competent and confident to teach using ICT should have been achieved. The conclusions of this research allow the prediction that in any school, teachers who have had training to use the ICT provided will have integrated its use into their practice, if they perceive a sound educational purpose to do so, and especially if there is a supportive school ethos.

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Glossary of Terms: Acronyms and Abbreviations.

ICT as a subject has its own shorthand in the form of specialised language, acronyms and abbreviations. A list of the terms used in this thesis is included here for reference.

Glossary of Terms

Computer Conferencing: Based on communication software, a text-based group communication system.

Cyberspace: The conception of the Internet as a space which can be 'inhabited' by those communicating.

Data-logging: The recording of information in a systematic and structured way. Advantages of using computers for data-logging are: speed, large memory capacity, perseverance, useful manipulation of data, and graphic communication of meaning.

Database: An organised collection of information. On computers, storage of large amounts of information in a compact form for rapid retrieval is possible.

Desk Top Publishing: Flexible programmes allowing text to be presented with integral graphics and text enhancements. 'Document Processing' rather than Word Processing.

Hardware: The solid components of a computer.

Information Noise: Excessive volume or poor quality information accessed electronically.

Interactive: The user is involved in some action, and may have choices available to them, such as control over level of difficulty of a task. In this way the learner is involved in decision making and management of learning.

Listserv: List Services, or automated emailing lists.

Modelling: The representation of systems and processes by a computer.

Modem: Modulator/Demodulator. Device allowing transfer of information between computers.

Networked Computers: Two or more computers linked so that information can be transmitted between them.

Online: Using the Internet

Software: Programmes which operate the computer

Spreadsheets: A programme which deals with information in the form of a table, with rows and columns. Data can be readily manipulated - altered or linked to other data. Spreadsheets are used for sorting and displaying stored data and for creating and

manipulating mathematical models. They tend to be easier to inspect, update and edit than databases, but do not offer such powerful search and sort options.

Word Processing: Using a computer to produce text. This allows the writer to draft, edit, format, save, and print the text, with many functions available to enhance the accuracy and appearance of the work.

Acronyms and Abbreviations

CD-ROM Computer Disc - Read Only Memory

BECTa British Educational Communications and Technology Agency

BERA British Educational Research Association

BBC British Broadcasting Corporation

BT British Telecommunications plc

CAD Computer Aided Design

CAL Computer Assisted Learning

CMC Computer Mediated Communication

DTP Desk Top Publishing

ECDL European Community Driver's Licence (computer training)

EDSI Education Departments' Superhighways Initiative

FTP File Transfer Protocol

ICT Information and Communications Technology

IT Information Technology

LAN   Local Area Network

LEA Local Education Authority

LOGO A computer programming language

MK Milton Keynes

NC National Curriculum

NGfL National Grid for Learning

NOF New Opportunities Funding

NOP National Opinion Polls

NQT Newly Qualified Teacher

OFSTED Office for Standards in Education

RM Research Machines

SAT Standard Assessment Task

SEN Special Educational Needs

SENCO Special Educational Needs Co-ordinator

TCP/IP Transmission Control Protocol/ Internet Protocol

TTA Teacher Training Agency

VDU Visual Display Unit (e.g. computer screen)

VR Virtual Reality

VTC Virtual Teacher Centre

Appendix 1
Questionnaire 1: Teachers and the Internet : April 1998

All information recorded here will be treated as strictly confidential

Your name:
Job description:
Specialist subject:

1. Do you have, or have use of a computer at home? **yes / no**
If **yes**, do you use any of these programmes?

	frequently	often	infrequently	never
word processing				
email				
internet				

If **no**, what factors would encourage you to buy a computer?

2. Do you use computers during non-contact time in school? **yes/no**
If **yes**, do you use any of these programmes?

	frequently	often	infrequently	never
word processing				
email				
internet				

If **no**, what factors would encourage you to use a computer?

3. Do you use computers in your class work with children/students?

frequently   often   infrequently   never

4. What do you like about computers?

5. What do you dislike about computers?

/please continue overleaf: question 6

6. What aspects of your work do you consider to be your priority for your professional development at the moment?

7. Please say how you would describe your skill with computers:

brilliant/good/sound/adequate/trying/could be better/hopeless

8. Have you had training for any of these?

	recently	not recently	no
Word processing			
Using email			
Using the internet			
Using the school's computers			
Using computers in class			

9. Circle any for which you plan to take training.

10. Has the development of the World Wide Web had any effect on your teaching career so far?
yes/no

If yes, can you say what effect?

11. What use do you think the World Wide Web will be in your teaching, in the next year?

12. What do you like about the idea of using the Internet?

13. What do you dislike about the idea of using the Internet?

14. What services or information would you like to see included
in a "Virtual Teacher's Centre" ?

15. Would you agree to a short (10 minute) interview about how the use of computers affects your work?

- thank you for your help in completing this questionnaire -

Appendix 2
Questionnaire 2: Teachers and ICT
all information recorded here will be treated as strictly confidential

	yes	no
1. Do you have a home computer		
2. Do you share it with anyone		
3. Do you use email at home		
4. Do you use the Internet at home		
5. In the coming year: •Will you increase your present use of ICT in school •Is ICT training a first priority for your professional development		
6. In the last year: •Have you had ICT training •Have you found this useful in classroom practice		
7. In school: •do you feel you have adequate ICT equipment to support the work you do with your class •do you have technical support •do you have support in your planning for ICT use •do you have time allocated to plan, prepare or practice using ICT		
8. Do computers create problems sometimes		
9. Have you used email : •to communicate with other teachers •for pupils to communicate		
10. Have you used the Internet to find resources •Did you encounter any problems		

What do you think are barriers to further use of ICT with pupils?

What do you think facilitates use of ICT with pupils?

Appendix 3
Semi structured interviews with teachers: schedule

1. Personal information
What age children do you teach? What is your position of responsibility within the school? What is your specialist subject? How long have you taught here? Have you seen many changes during that time?

2. About the school
How many staff are here? How many pupils? How are classes organised?
Do you and your colleagues work in a team?
What computers do you have in school?

3. Computers
Where are computers sited? How is use of them organised? What sorts of software do you use? Do you choose your own software?
Are the children taught IT skills? Is this timetabled?
How often do you expect to use computers with children?
What sort of things do you think they are useful for?
Do you have a home computer? What do you use it for?
How did you learn new things on it? What are its disadvantages?
If you don't have one, are you considering getting one?

4. The Internet
Have you ever used the Internet to find information for work? What sort of sites are useful? What do you think of the Internet?
Do you use email at school? At home? Do you find it useful?
Have you had training for this? Have you undertaken email / Internet based projects with classes?
What do you know of the NGfL? Virtual Teacher Centre? What would you like to see happen with ICT in schools?

5. Training
What courses are you going to undertake in the near future? Is training for ICT use a priority at the moment? What sort of training have you had so far and how effective was it? What is the school policy about in-service training?

6. Colleagues
What do you think staff attitudes to ICT are within your school?
How do people feel generally about new opportunities to acquire/ use ICT?
Do you feel that the school system for organising its computers works well?

7. General
Do you think ICT is going to change education?
How will it alter the role of the teacher?
How will it affect teacher - pupil relationships?

## Appendix 4 Study Schools Final Questionnaire: December 1999

School:	
Number of teachers:	
Number of pupils:	
Number of computers:	
Are any computers networked:	
Are some computers in a suite:	
Do you have an Internet connection:	
What ICT equipment have you acquired under the NGfL funding?	
Have any teachers started their NOF funded TTA training?	
If not, when will this happen?	
Do you feel that it is possible to deliver Curriculum 2000 with the ICT equipment in your school?	
If not, what will you need?	
Did you find the ICT profile of teachers I sent you useful in any way (please be strictly accurate here in the interests of research validity!)	

Any other information about the ICT status of teachers at your school that you feel could inform the research:

All information strictly confidential: thank you for completing this form.
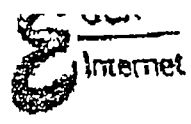
Please complete and sign this form and return, with the Technical Questionnaire to Xemplar Education Sales Desk, The Quorum, Barnwell Drive, Cambridge CB5 4RE
Tel: 01223 724 7200 Fax: 01223 724 300

APPENDIX 5

We must have the original returned to us.

Order Date	Agency	Edex job number(for Edex)	Customer Site Contact Tel.
8.3.99	WINDIS		(01908) 663561

Customer P.O No	Order taken(Agent Salesperson)	Edex contact	Customer Site Contact Fax
SP03 095809	A THOMSON		

Invoice name (if different from installation site)	Educational Site name
	BROOKSWARD FIRST SCHOOL

Invoice address	Site address
Brooksward First School	TOWER DRIVE
Tower Drive	HEATH HILL
Milton Keynes	MILTON KEYNES

MK14 6JZ Postcode	Limited Company Reg. No.: UK. 1556878	Postcode MK14 6JZ

Do you have an ISDN line installed already for you?	(Yes) No (please circle as appropriate)	Customer Site contact (Name) Mrs Guest + Mrs Wilkie	Technical contact Telephone

Will you use Schools Internet Caller (SIC) 0820 service?   Yes   No
(please circle as appropriate)

Technical contact (Name)	Technical contact Fax.

Please state your ISDN phone number: ISDN Tel. No.: ?

Notes:

Qnty	Xemplar Product Code	Product Description (All prices quoted exclude VAT and do not include telephone or cable connection)	Annual charges	Setup charges	Min Period (months)
	MATINET01	Single user modem dial-up - 3 email accounts	£120	FREE	12
	MATINET02	Single user ISDN - 3 email accounts	£120	FREE	12
1	MATINET04a	Routed ISDN 64-5 (inc. managed router) - 5 concurrent users - 20 hours p w av use	£750	FREE	12
	MATINET04b	Routed ISDN 64-13 (inc. managed router) - 6-13 concurrent users - 20 hours p w av use.	£995	FREE	12
	MATINET04c	Routed ISDN-64-U (inc. managed router) 64kbps unlimited use	£1,500	FREE	12
	MATINET04d	Routed ISDN-128-U (inc. managed router) 128kbps unlimited use	£2,500	FREE	12
	MATINET05	64kbps Leased line - Outside London (Includes Circuit, Optional Managed Router - £1300pa)	£7200	£1000	12
	MATINET05a	64kbps Leased line - 0171 London (Includes Circuit, Optional Managed Router - £1500pa)	£8000	£1000	12
	MATINET05b	64kbps Leased line - 0181 London (Includes Circuit, Optional Managed Router - £1500pa)	£6500	£1000	12

For Networked Connections		For Single User Dial-up
Number of computers on your network: Now? In 3 years? 10 (anticipated) Are you running TCP/IP across the network? Yes No (please circle as appropriate)	Do you have a domain name? If "Yes" Please state: With whom is your domain name registered: If "No" please specify your required domain name. (e.g. schoolname.region.sch.uk) .sch.uk>>	What Operating System are you using? (e.g. Windows 3 11, Windows 95, Windows NT, Mac OSR, *Rise OS) * You will need a web-browser for use on an Acorn computer

I apply for the Xemplar services indicated above and accept The Education Exchange Ltd and Xemplar Education Ltd. terms and conditions a copy of which I have read. I acknowledge payments for services are due yearly in advance (leased line services quarterly in advance) I will ensure our accounts department is aware of this I acknowledge failure to pay on the due date may result in suspension of service or delay in connection until payment is received. A reconnection charge may be made

Customer	Lyn Hollinshead	Customer's Preferred install date for Edex Services:
Job title	Head teacher	Xemplar Name ___ Edex Name ___
Signature	[signature]	Signature ___ Signature ___
Date	1/4/99	Date ___ Date ___
Xemplar Order Ref.		Signed on behalf of Xemplar Ltd Signed on behalf of Education Ltd

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Appendix 6
EDSI 'Features of Institutions' and 'Markers'

The Education Departments' Superhighways Initiative (EDSI) report (DfEE 1997b p. 28) lists seven *features of institutions* which the evidence indicates might affect the benefits gained from ICT use. (The report points out that there 'at least' seven such features). Each of the seven features (such as 'quality of management' ' stance towards IT' 'dominant educational and social philosophy') is subdivided into 'markers' - issues that had been found to make a difference (such as 'a prior needs analysis' 'reliablity' 'suitability for the educational purposes of the particular school'). Thirty-two factors were identified as just some of the influences which affect whether direct learning benefits can be gained from ICT use. Table 1:*Features of Institutions* summarises these factors. So, although making equipment available is one step towards integrating ICT into educational practice, the EDSI report showed that many conditions had to be met in order to utilise the educational potential of technology in institutional settings. Any or all of these factors may influence what happens in the classroom, and thus whether direct learning benefits are actually gained. Teachers concerned to use pupil time to maximum advantage are therefore likely to avoid ICT use, if they judge that 'markers' such as those in Table 1 are not addressed in their work situation.

Table 1: Features of institutions which make a difference

Features of institutions which affect benefits gained from ICT use	'Markers' (issues which make a difference)
1. Quality of management	- a high - level supporter for ICT use - one or more effective 'doers' properly resourced and timetabled and with access to senior management - an effective steering group for projects - a prior needs analysis - a development plan for innovation that runs beyond initial stages - an overall development and training strategy into which the innovation fits
2. Quality of other project partners	- effective human networks - establishment of clear management frameworks - clearly articulated roles for all participants - teacher control over curriculum content - relevant training provision - support in creating resources - awareness that the setting up phase is often longer than might be anticipated
3. Stance towards IT generally	- numbers of staff actively using IT - existence of a clear IT policy - percentage of annual income spent on IT - existence of arrangements for prompt and effective technical support
4. Current and anticipated levels of financial and physical resources available and required	- level and predictability of long term running and maintenance costs - moving from temporary trials to permanent provision

5. Quality of new technology available	- ease of use by learners - ease of use by teachers - reliability - the amount of relevant resources available - purchase and maintenance costs and depreciation rate - the immediate obviousness to teachers of the educational potential
6. Dominant educational and social philosophy	- relative emphasis given to vocational education, subject learning, research skills, social development and community involvement aims - approach to obtaining funding (entrepreneurial or public service) - approach to developing local, national and international links - stance towards other institutions (co-operative, competitive or self reliant)
7. Match between the technologies available and the circumstances and priorities of the educational institution	- suitability for educational purposes - compatibility of new resources with old - compatibility with project partners - physical location within the institution

(Adapted from DfEE 1997b page 28)

Paper presented at BERA conference, University of Sussex, August 1999

Chalky And The Interactive Whiteboard:
Media Representation of Teachers and Technology

While many British teachers are 'network literate', that is, adept users of technology for enhancing the educational experience of their pupils, many others are still in the process of preparing themselves and their schools for the integration of Information and Communications Technology (ICT) into classroom practice. This paper examines some images of teachers as computer users in cartoons and comic strips, and argues that these images reflect unfortunate and unwarranted stereotypes of teachers and their relationship to ICT. Teachers are essential to the success of the National Grid for Learning (NGfL) initiative. In this paper it is argued that representations in the media of the relationship between teacher, subject, learner and computer reveal attitudes to the teaching profession which may adversely affect the implementation of the costly and high-profile NGfL proposals.

1. Introduction

The National Grid for Learning(NGfL) initiatives intend to enable all teachers to become competent and confident users of new technology. This reflects an awareness that the educational effectiveness of computers in classrooms is largely dependent on the teacher's structuring and framing of tasks for the pupils (Watson1993, Littleton1999). In itself, this focus on teachers' professional development represents an improved understanding of the role of the teacher by those wishing to make changes (Stevenson 1997, DfEE 1997). The attempts of teachers to temper technological dreams with practicalities have meant that such initiatives have been adapted, transformed or even ignored; the result has been that teachers have acquired the reputation of 'Luddites and reactionaries resistant to progress' (Cuban 1986 p. 61).

Current information for teachers involved with ICT is to be found in media outlets such as the Online section of the Times Educational Supplement, and the Educ@guardian. Such publications contain the usual mix of news, opinion, information, cartoons, and advertisements. The advertisements of IT firms are an important source of information for teachers, along with professional networks and LEAs (Leask 1998). Further, as Selwyn (1999) argues, the commercial marketing of ICT is necessary to convince teachers of the worth of the NGfL and the many claims surrounding it. Such media depictions of the relationships between teachers and computers help shape ways of considering new technology (Selwyn, Mercer and Dawes 2000).

As I have argued elsewhere (Dawes and Selwyn 2000) it is clear that advertisers draw heavily on cultural images of teachers in their attempts to sell the new technology. But given the uneasy relationship that teachers have had with technology in the past, it is crucial for the success of the NGfL initiatives that the positive contribution of the teacher is both acknowledged and valued. This paper sets out to examine some depictions that teachers see of themselves and their relationship to ICT.

Comic strips and cartoons in news media are used to raise issues, reflect immediate events, and comment on them, in a format which is rapidly understood by the target audience. Their humorous quality allows the presentation of contentious ideas whilst evading presentation of a rational evaluation of complex issues, in the 'only joking!' tradition. Comics tell stories (Berger,1997) and the story of the relationships between teachers and computers is an interesting one, because it contains conflict, unpredictability, highly technical and expensive machines, and teachers, who are after all something of an enigma, being both powerful and of low social status.

Reviewing recent research, Pachler (1999, p. 4) discusses some ways that ICT can support teaching and learning in schools. He emphasises that such findings support a consideration of the role of the teacher as 'pivotal' in ensuring effective use of new technology. The Government's NGfL initiatives (DfEE 1997) were designed to encourage business and industry to work in partnership with educational establishments in order to improve technological provision in schools. The success of the NGfL rests partly on the transformation of the teaching profession towards competence and confidence with ICT. The TTA curriculum for ICT reflects the duality of teachers' engagement with

ICT: teachers must learn the skills necessary to use the machines, and they must also learn how to deploy technology to enable their pupils to achieve stated learning objectives.

Cartoon depictions of the relationship between teachers and ICT almost invariably show teachers as laughably and ridiculously inept: in this chapter I argue that this unremitting message cannot but be detrimental, undermining as it does the confidence of 'newcomers' to a community of practice (Lave & Wenger, 1995). Doubt is created in the capability of the profession to tackle the task of integrating ICT into classrooms. This is reinforced by accompanying advertisements which persistently present IT firms as expert in education.

Warburton and Saunders (1996) examining cartoon depictions of teachers' professional culture, consider cartoons as embodiments of public opinion. They stress that many cartoons produce depictions relevant to the reader rather than the subject: in the cartoons studied, teachers are both. This means that the image teachers receive of their profession is doubly powerful. 'The term 'image' is applied to the range of understandings which count as [a] reasoned conclusion' (Warburton and Sanders, 1996 p323). Images gain currency by repeated use: repetition coupled with the concise nature of the cartoon provides a powerful means of transmitting ideas. Humour may act as a 'mask' (Barker 1989, p271) a device to deflect serious commentary on the cartoon's content, however deserving of this it may be.

2. Collection of Data and Methodology for Appendix 7

1998 was designated 'UK NetYear' by the IT industry and the press, in order to present the idea of the NGfL to teachers and to encourage them to engage in the process of buying new equipment. Beginning in UK NetYear data was collected by accumulating all cartoon material from the mainstream educational publications TES Online and Educ@guardian. More recently, books for teachers dealing with ICT use in classrooms have also become available, some containing relevant cartoons. A total of 41 cartoons which depicted teachers and computers were collected.

Sociologist Martin Barker, in his book 'Comics: ideology, power and the critics'(1989) offers these questions for the analysis of comics:
'How should we understand this? What should we say about any messages it might be offering to its readers? The problem is to know how we may locate 'messages' within a (cartoon) story. [...] Do we need to look to see 'whose side' the strip is on, and how would we know?' (Barker, 1989 p.11).

Barker points out that the fundamental nature of comics is that they tell stories. I examined the comics and cartoons in the data by using Barker's method of looking at the rules for construction of the narrative that underlie the form of the story. That is, each of the cartoons has a 'formula' that governs the characters, their actions and speech. This formula can be made explicit by examination of the portrayal and treatment of 'common elements' in the narrative form. Features that might be considered common elements include the predicaments of the characters, their motives, dilemmas they face, and an appraisal of their 'positioning' in relation to other characters. Another and crucial common element is that of the assumptions that are made about the reader.

Those compiling cartoons must assume that their readers will understand the messages they convey: that is, they assume knowledge of both the medium and the context of the narrative. Common elements influence what Barker (1989 p. 45) refers to as the 'social closeness' of the character - their ability to trigger recognition of aspects of reality. In this case, the context is the introduction of ICT into educational settings, and one aspect of the commonly held knowledge is that teachers know how the media usually portray them in cartoons. 'Chalky', a cadaverous creature torturing the cheerful kids in the Daily Express Giles cartoons: 'Teacher', forever at the mercy of the Bash Street Kids in the Beano: teachers drawn as a version of Jimmy Edwards' Headmaster character in 'Whacko!' - male, middle aged, with gown, mortar board, cane, and a covertly sadistic attitude to children.

Three key common elements which might be expected to contribute to the 'social closeness' of the cartoons were chosen for analysis: the appearance of characters and their motivation, which combine to construct the cartoon's narrative, and the positioning of the teachers as professionals, in which lies the 'point' of the cartoon, or its humour.
4. Findings

The 41 cartoons were examined using the common elements criteria. Table I *Extract from analysis of cartoon data* is a brief but representative extract showing the interpretation of cartoons in the analysis. It shows that the images of teachers are relentlessly negative in such cartoons; teachers using (or just standing near) computers are commonly portrayed as inept or unskilled. These characteristics are conventionally attributed to teachers in cartoons, but the addition of computers to the context also allows the portrayal of teachers as fearful, anxious, and phobic about technology.

Table I: Extract from analysis of cartoon data

Character	Appearance	Motivation	Positioning	Source
Two teachers	Dismayed by computer. Request help from small boy.	Fearful of technology. No wish to engage with it.	Inept. Incapable of learning.	TES
29 Teachers	All worriedly reading computer Manual	Hopeless attempt to gain computer skills	Unskilled and incompetent	Educ@g
Teacher	Using computer cable to skip	Found a 'good use' for the computer	Inept. Novice acting in ridiculous manner	TES
Mouse	With shark's teeth	Dangerous for teachers to use technology	Unskilled and incapable profession	TES Online
12 Teachers	'2001' apes leaping around a keyboard and throwing bones at the screen	Dangerous for teachers to use technology. It is beyond them	Unskilled and incapable profession	TES Online
Teacher	Looking cross and telling off a computer while children look on, bemused	Fearful of computers which challenge his 'authority'	Luddite. Novice acting in ridiculous manner.	Educ@g
2 Teachers	Dancing with joy: money available - they haven't been told it is for ICT	Rejection of ICT initiatives. Lack of interest. Fearful of computers.	Luddite Unskilled and incapable profession	Educ@g

5. Discussion

It may be that cartoons such as these are seem of little significance, but taken in conjunction with the tenor of the advertising material previously mentioned, their message accumulates to present a concerted image of teacher incompetence. Whilst all cartoons collected were analysed, I offer here a selection of headlines and text which provide the context for the cartoons. These have been selected to indicate how the persistent underlying theme of teacher incompetence is reinforced.

Headlines:
'M is for .....Mystified? Why it's time you got a grip on the mouse' (TES 29.1.99)
'Teachers Fail Computer Test' (Independent 4.4.98)
'Five steps to Fearlessness' (TES Online 14.5.99)
'No Room at the Front for Technophobes' (TES 10.10.97)

Text:
'Lorry drivers do IT. So do gas fitters. Now it is time for teachers.
Computers are here - now.' (TES 29.1.99)

'The signs are that tomorrow's teachers will be better equipped to use technology in the classroom.' (TES Computers Update 10.10.97)

Advertisement text:
[Picture showing high-specification computer]:
'Meet the Competition'. (TES Online 9.1.98)

Since all examples are from the educational press, some cartoons could be examples of the profession laughing at itself. The may be self-deprecating rather than malicious. However, whatever the motives of their authors, the end result is still likely to be the same. The teacher audience, and others, see the reiterated theme of teacher unease with ICT, and are influenced. The prevalence of an image is its verification. Such is the power of the press. Thus the cartoon depictions of teachers with technology strongly indicate that teachers can not use ICT, they can not learn how to do so, and do not wish to.

Teachers, the cartoons tell us, cannot accept change. The notion of 'teacher resistance' to change is prevalent in the literature to do with schools as organisations, and particularly in work dealing with the introduction of new technology. But teacher resistance is a convenient phrase arising from lack of understanding of the work that goes on in schools. It is a simplistic way to dismiss the phenomenon of teachers' evaluation and adaptation of untested ideas. An alternative way to consider what happens during implementation of change is that armed with their professional knowledge, teachers make informed and rational choices about programmes and materials they are asked or required to use. They take decisions which are intended to ensure the educational effectiveness of innovations. And in fact practicable innovation and organised change happen constantly in schools. Rather than 'resistant', teachers might more constructively be considered selectively welcoming of suitable change.

'Teacher resistance' is a stereotyping of the profession. Cartoons deal in stereotypes, and interestingly Barker (1989) points out that it is *stereotypes* that resist change. The depiction of teachers as Luddites or computer illiterates reflects an unwillingness to accept the development that has and is taking place. The rationale behind this unwillingness is unclear, but it may simply be traditional. Warburton and Sanders (1996) indicate the history of press denigration of teachers through cartoons.

Linked with 'teacher resistance' is the idea that, as reiterated recently, 'Schooling has changed very little since Victorian times' (Guardian Education 15.6.99 p.3) Showing a picture of 36 children in rows writing on slates juxtaposed with 3 children in a row using portable computers hardly supports this assertion, but the headline reinforces the myth. The accompanying article adds:
 'changes to classroom teaching are unlikely to see the light of day much before 2004....schooling is no longer 'delivering the goods'....education should better prepare people....teachers are a profession largely seen as resistant to change'.
All the conditions which operate to maintain homeostasis in the organisms that are schools are ignored in favour of the notion of teacher resistance. But there are valid reasons why some changes, like the integration of computers, happen more slowly than the innovators would wish.
 'Views of teaching and organisational compliance ill-fitted to schools and classrooms and married to feckless strategies aimed at coercing teacher to use the innovation explain limited use of the new technologies' (Cuban, 1985 p 56)
The use of cartoons to depict teachers as incompetent novices is another 'feckless strategy aimed at coercing teachers' which has its equivalence in the 'name and shame' ethos of the OFSTED approach. Teachers in schools with little or no equipment have had few opportunities to examine applications of new technology, and as yet have not trained to use ICT. They have been given other pressing administrative and teaching priorities. The NGfL initiatives and New Opportunities Funded training are intended to address some of the genuine barriers to real and sustainable change towards integration of ICT. It is too soon to evaluate their impact. Meanwhile the cartoons doggedly present an assessment of teachers as incompetent with ICT, and suggest that the will and capacity to learn is absent.

The NGfL initiatives are currently enabling teachers to acquire computers on an unprecedented scale, and learn how to use them to good effect with classes. However, while educational use of such applications as the Internet are only just beginning to be explored, one commentator notes that:
'There were several other reasons for viewing the reality of the net, as opposed to the inflated rhetoric surrounding it, with a certain cynicism' (Winston, 1998 p. 335).
The Internet was not set up to service educational aims. The wrench it requires to make it do so is considerable, and teacher caution is justified in the face of its various drawbacks, which include

commitment of huge amounts of time and expense, the variable quality of overwhelming quantities of information, the activities of unscrupulous commercial interests and of pornographers and other 'assorted deviants' (Winston, 1998). Even the use of e-mail, highly valued for its ability to support useful communication, creates associated problems - time remains the biggest problem, and the creation of a volume of correspondence which cannot be thoroughly dealt with by an individual.

Returning to the idea that cartoons tell stories, three dominant themes can be discerned in the cartoons.
Examples of cartoons are given in Figures 1, 2 and 3.

(i) teachers are fearful of technology
(ii) computer illiterate teachers make ludicrous errors
(iii) students are 'better' at using ICT than teachers

How justified are these claims?

(i) Teachers are fearful of technology.
An interview study of practising teachers (Dawes 1999) indicates not fear of technology but anxiety about personal lack of expertise. Coupled with unreliable classroom computers, lack of training, lack of technical support, lack of time to practise, and lack of a culture supporting computer use, this anxiety contributes to a context in which lack of confidence could be regarded as reasonable. It would be, in other professions. It is difficult to believe that other professionals would being conceptualised as inept or redundant because of lack of skills for which they have received no training, especially when they have no access to the technology in question. Parallels to the idea of 'teacher resistance' are hard to imagine - Solicitor Resistance? General Practitioner resistance? Perhaps the more generous finances of other professions can guarantee that the technology they are required to work with stays up to date.

(ii) Computer illiterate teachers make ludicrous errors.
The 'dopey teacher' in the cartoons is perhaps not a depiction of the school ICT co-ordinator, but a representative of *other* teachers. Cartoons effectively 'segment' the audience into 'us and them' in this way (Fowler, 1991 p.53). The novice teacher is an 'eavesdropper' in the world of computers, and therefore gets things wrong in a comical way. This may have the function of reassuring the ICT Co-ordinator - 'at least I'm not *that* inept' - whilst reaffirming the main point, that teachers cannot and do not wish to learn about ICT. Largely lacking resources, teachers have necessarily adopted an observer's role, equivalent to that of 'lurkers' in online debates. But listening is an effective way of learning (Perkins, 1994). The engagement of teachers with computers has been restricted by many factors, inducing inexperience and lack of confidence. Theories of situated learning indicate that the status of novice, or newcomer to a community of practice, should attract respect: without newcomers, communities disappear. Teachers faced with the task of making computers educationally effective are learners, and as such are legitimate participants in the community of educational computer users. Jokes about novices, with the function of stressing the expertise of adept members of the community, are only to be expected. There are two ways in which individuals avoid having 'novice' jokes directed at them: either they learn rapidly, or they avoid learning at all. The cartoons maintain teachers do the latter. However the 'Multimedia Portables for Teachers' pilot project (Phillips et al, 1999) concludes that when provided with the right resources, teachers learn rapidly.

(iii) Students are 'better' at using ICT than teachers.
The logic of this is that young people have access to computers and enjoy playing with them, so they are good at using them. Teachers generally do not have computers, so they cannot use them with confidence. Therefore students are better than teachers. There is no doubt that some students are adept computer users, and some teachers have very little working knowledge of computers. However, much computer use by students is for leisure activity, and of limited educational value (Selwyn, 1998). Teachers wishing to integrate computers into classroom practice require two sorts of knowledge: technical expertise, and the ability to use ICT to meet teaching objectives (TTA,1999). This latter is entirely absent in students. The crucial enabling role of the teacher is absent from the cartoons. Recognition of this obvious factor, which would completely spoil the joke, is a change to which it could be argued there is *media* resistance.

6. Conclusion

The 'features of a teacher' encoded in the cartoons summarise negative media attitudes to teachers, and indicate that such attitudes are present in the larger community. The cartoons are responsible for keeping 'alive and familiar' (Fowler 1991) notions of lack of expertise in the teaching profession, even in publications designed to promote ICT use. Three themes - teachers as fearful, teachers as inept, teachers as less capable than student - are regularly transmitted in the authoritative context of the national press. It is the unremitting similarity of the cartoons which eventually points to the sterility of this presentation of the relationship of teachers to ICT. There is no reason to suppose that once real barriers are overcome teachers will be unable to use computers effectively. Perhaps the portrayal of teacher incompetence masks a wider social anxiety about the penetration of technology into all areas of life; some sense of disquiet about the uses to which technology is put, and particularly its potential effects on our children. Debate about such issues is essential. Meanwhile, cartoon images appear designed to ridicule efforts of teachers as learners by continually and perversely reproducing images of a profession limited by entrenched hostility to new ideas. Learners may make amusing errors, but this does not mean that they are incapable of learning, developing and changing.

6

Figure 1. Teachers are fearful of technology

a) TES Online 12.2.99 p.17
b) IT Across the Primary Curriculum (Crompton & Mann 1996)
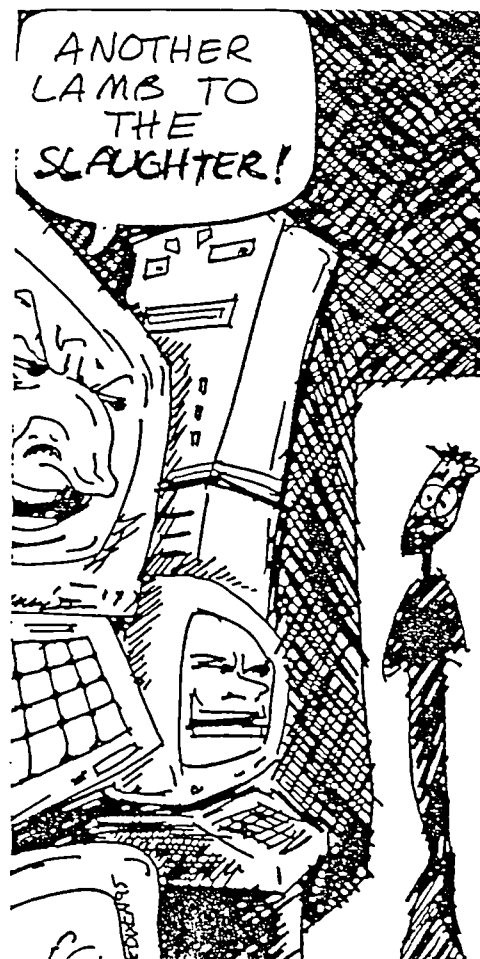
'Welcome to the IT Centre'

Figure 2. Computer illiterate teachers make ludicrous errors
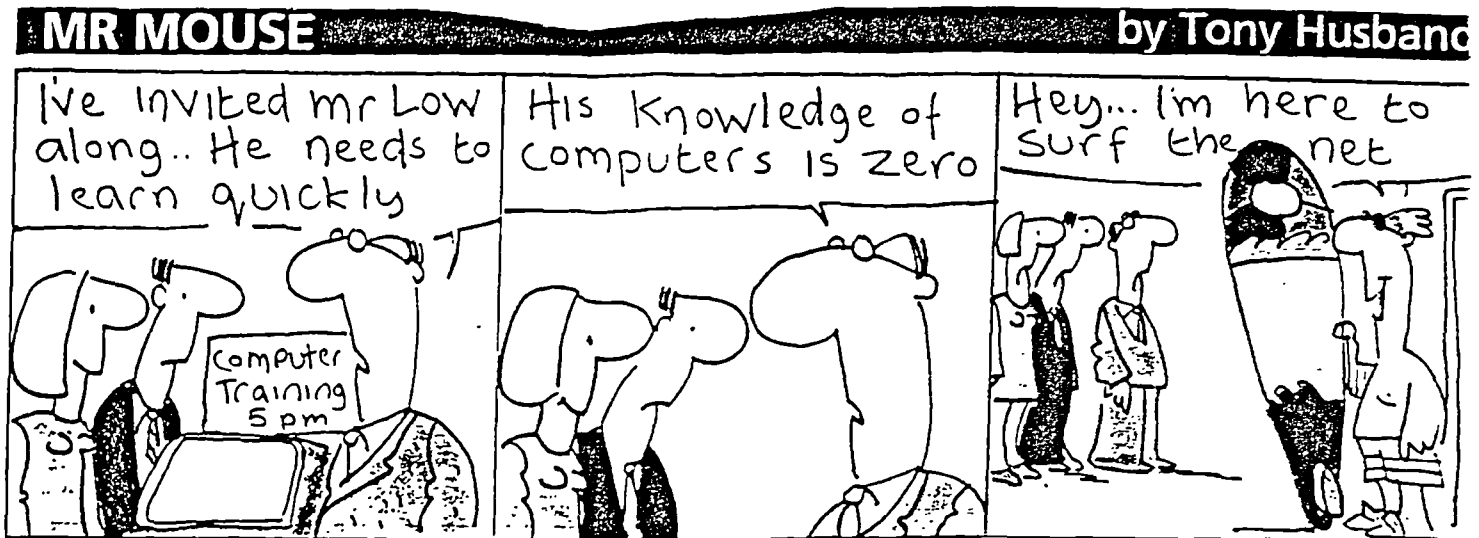
a) TES Online 8.1.99 p. 3
b) educ@guardian 12.1.99

MR MOUSE — by Tony Husband

Panel 1: I've invited mr Low along.. He needs to learn quickly. (sign: Computer Training 5 pm)

Panel 2: His knowledge of computers is zero

Panel 3: Hey... I'm here to surf the net
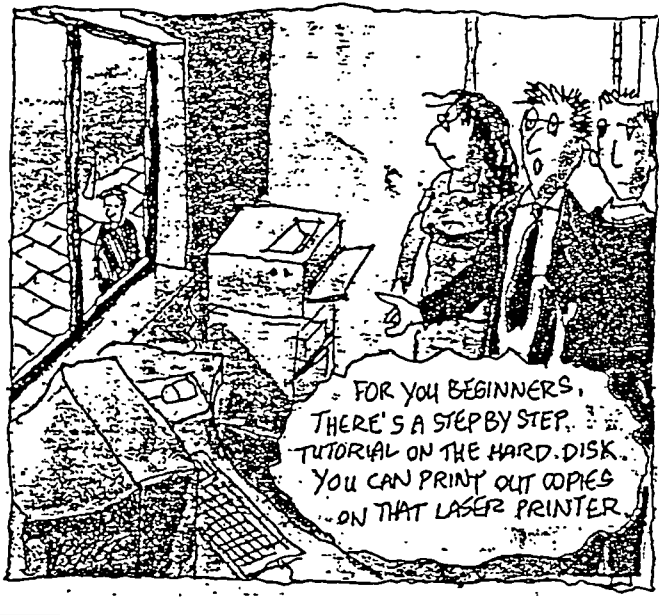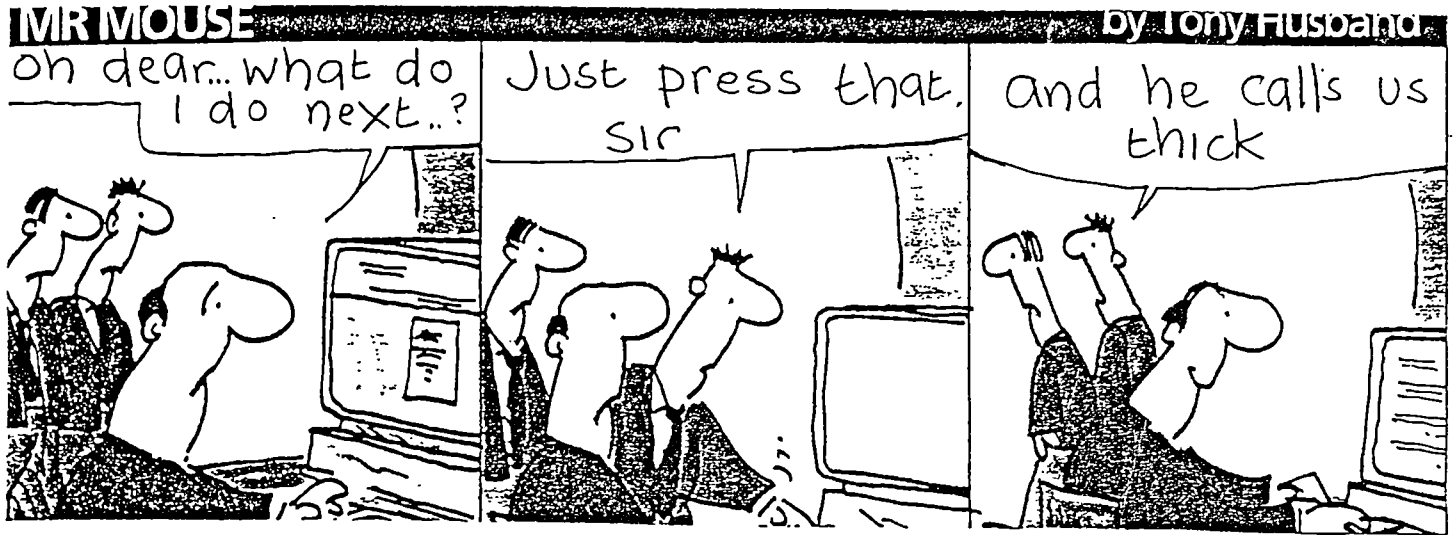

Just get this straight. I'M the boss

Figure 3. Students are 'better' at using ICT than teachers

a) TES Online 12.2.99 p. 3
b) TES Computer Update 10.10.97

Appendix 8: Situated ICT audit for practising teachers

The answer 'no' to any question suggests that action is required.
General action points are suggested. These may sound expensive, ambitious, or highly unrealistic, but unless these conditions are in place, you may not be able to integrate technology into your teaching as you would wish. Essential action can best be decided by discussing your work context with colleagues before completing the last column.

Your ICT situation	yes or no	Suggested action	Your plan for action
1. Do you have a home computer		It is essential that you acquire one. Arrange to discuss with your ICT Co-ordinator the choices available and possible support with finance.	
2. Is your home computer solely for your personal use		You may require a second computer, or a non-negotiable time when it is entirely for your use	
3. Do you have a computer for your personal use at work		You need access to an Internet-capable computer in your non-teaching time (not in competition with pupils)	
4. Do you have an email account which is inexpensive or paid for by your school		It is essential that you have an email account which you can access whenever you wish.	
5. Is there a specific item which you wish to use and do not have: e.g., digital camera, fax, special software, ohp, electronic whiteboard, CD player		You must have it in order to use it: this is an issue for school management / governors	

6. Do you consider that ICT has the potential to enhance your delivery of the curriculum	You require the opportunity to look at, use and evaluate new applications of technology, new software, and different work practices. Visit the BETT show (Olympia, London, January). Your personal development plan must enable you to visit other schools, the local ICT centre, to look at relevant web sites (TeacherNet, Becta), and to discuss ICT uses with other teachers.
7. Do you have an 'ICT buddy' - a person who is currently learning similar things to you and who you can talk to often	Peer tutoring in ICT is invaluable - find someone who is doing the same things at about your level. Discussion can help both you and your ICT partner to make meaning from experiences
8. Do you have an 'ICT mentor' - a person who is more adept than you who will help you patiently	It's important at any level of ICT expertise that you enlist a more expert colleague, friend or family member. You will probably repay this by undertaking this role for someone else.
9. Do you have accessible technical support for ICT which you commonly use	Fixing things is time consuming and cannot be part of the teacher's day. Technical support is essential.
10. Do your head teacher and others in school management actively encourage ICT use	The stance of head teachers and managers as 'high-level support' is strongly influential for teachers. Discuss with them their involvement with and understanding of practical classroom ICT use

11. Have the majority of staff at your school integrated ICT into their working day (or started to do so)	Being a 'lone voice in the wilderness' is a difficult: enlist support. The school's ICT policy should reflect a strongly positive ethos. As a staff, you and your colleagues might evaluate and rewrite the policy. Guidance can be found on the QCA/DfEE sites.
12. Are financial resources in place to purchase/lease, maintain and replace ICT	Your school's ICT development plan must reflect awareness that current ICT provision is the tip of the iceberg, financially.
13. Do you know what percentage of the school budget is spent on ICT	If you are aware of this, then you can influence it. Arrange for this information to be open to all.
14. Is ICT a high priority for your professional development	Competing priorities cannot often be shelved. However ICT use is a legal requirement and as such your moves towards increased use should be supported. A personal development plan should reflect this, with time for ICT development as well as your other responsibilities
15. Does the school timetable support integral ICT use (that is, are there workable timetables for your classes, yourself, and the equipment)	It is crucial that you negotiate changes which you feel will support your use of ICT to help you to address the learning needs of pupils
16. Have you undertaken the TTA needs identification (or similar)	This can clarify items for your training action plan

17. Have you undertaken the TTA lottery-funded training	This can provide you with further skills, expertise, and access to a network of ICT- using teachers like yourself
18. Computer hardware: does your school have up-to-date equipment: e.g., a networked suite of multimedia computers: high specification classroom computers: Internet connections: other specific ICT equipment	You must have them in order to use them.
19. Do you regard the equipment at school as reliable	To enable learning, unreliable equipment should be replaced
20. Is school equipment located where it is useful for you	It should be moved or other changes made so that use requires no effort
21. Do you have the support of governors and parents in your use of ICT	They may require information about NGfL initiatives, the school development plan, etc.
22. Class size: in your work context what is the ratio of a) teachers to pupils b) adults to pupils c) pupils to machines Do you consider these favourable to the educationally effective use of ICT	Classroom management for effective ICT use is complex and subtle. Consider what circumstances (e.g. ratio of pupils to machines) you think is ideal. Stressing that the use of ICT is otherwise educationally ineffective, negotiate changes
23. Do your pupils use equipment with you more often than they use it with other adults (e.g. parent helpers, classroom support assistants)	They should, unless you have specific meeting times (timetabled) with other adults in order to ensure the relevance and quality of work done without your direct involvement

24. Computer software: do you feel that the software you have is of good quality, and adequate to support learning	Look at sites which provide software evaluations (see Becta Software pages). Plan to make changes
25. Computer software: have you seen any new software you would like to use	You should have the opportunity to look at developments in at least your curriculum area. Consult the TEEM website (not in your own time) www.teem_org.uk
26. Time: do you have time to read, practise, reflect, prepare ICT-based resources, look at Internet material, and discuss ICT with other teachers	Negotiate some time for this, at least occasionally. Use of Email, and Internet searches, are especially time consuming: this is work not leisure activity, and as such should be reflected in your timetable.
27. Have you established high-quality project partners to undertake email/ICT projects	Start with the Virtual Teachers Centre web site (not in your own time) to find partners at a distance.www.vtc.org.uk/
28. Does your school have an inclusive ethos in which everyone is enabled to use the tools technology offers	Equality of opportunity underpins best practice
29. Do you find that computer literate pupils are a great help	You can use their support. What they might need first is you to teach them how to help others learn
30. Do you find technology always easy to use, totally reliable, straightforwardly educational, intrinsically interesting, and feel very motivated by the mention of ICT?	Even techies use the help option. Everyone struggles with ICT, often. It doesn't matter whether you like technology or not: ICT use is part of the profile of the teaching profession. Identify the real reasons which make you wary of it. Try to think of ways round them.
Do you like computers?	Get yourself and your class a new top of the range computer each! You might change your mind.