The Association *for* Information Technology in Teacher Education

What does our past involvement with computers in education tell us?

A view from the research community

Michael Hammond *with*
Sarah Younie, John Woollard,
Vicky Cartwright and David Benzie

PREFACE

This project has provided the opportunity to collect 'voices' of some of our colleagues who have contributed to the life of ITTE and to reflect on the last 30 years of computers in education. Writing as current Chair it is an honour to see the threads of these experiences being woven together, to capture the stories and record the significant moments. The Voices project has provided a unique mirror on those things that have been enduringly important to us.

This book helps us become more aware of the tradition in which our work takes place and the contribution of ITTE, alongside other associations, in making research into ICT, become not just respectable, but at times ground breaking. The idea of the ITTE community is something we understand and experience, yet hitherto this has not been articulated. We need to go on explore our shared values, we need to leave further traces of our own. This book makes the start and as Chair of ITTE I would like to thank Michael Hammond for his vision in suggesting the project and capturing the story.

Sarah Younie

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in Teacher Education

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1 Introduction: what is this book about?

This book reports on the Voices Project, exploring the experiences of teacher educators who have engaged with developing the use of computers in education for most of their professional lives. The aim of the project has been to give voice to the achievements and concerns of participants and to draw conclusions for further development of computers in education.

The participants in the study are colleagues who have worked to develop computers in education over an extended period of time, in most cases twenty five years or more. All have for some of that time used computers in their own teaching; carried out research; worked with teachers; and have had some association with ITTE. The project has, hence, had a greater, but not exclusive, focus on how the history of computers in education has looked to those in higher education rather than agencies such as Teacher Development Agency (TDA), Ofsted (Office for Standards in Education) and Becta (the government supported agency for developing computers in schools) and its forerunners. We should say at the outset that within this introduction, and within the booklet as a whole, we are as far as possible using the term 'computers in education', rather than *CAL, ICT, IT, TEL* or any other similar term. This has the advantage of providing consistency across different phases of policies and consequent 'rebranding' by government. However, it is used in the absence of a better alternative and implies more of a focus on computers as desk top machines than we, and several, of our participants would like.

A project such as this one is bound by time and resources. There are a great many people, perhaps over 300 individuals, who could have met our criteria for this study but because of time constraints we constructed a sample of 15 colleagues with a broad balance of gender and field of interest. All participants gave their active consent and freely of their time. They were happy for their involvement to be recognised in the acknowledgements to this booklet and on a project web site. However, in the main text, following normal convention, all quotes have been anonymised – though both participants, and ourselves, recognise that it would not be difficult to identify speakers in some instances.

Our sample included seven women and eight men all aged over 50. All but two spent most of their professional lives working in a higher education institution (HEI), the other two had extended experiences of teacher support agencies. Twelve had taught in school or further education (FE) college for several years. They have developed an interest in all phases of education but three have been more involved in early years and primary (children aged 5 - 11) education; four in secondary (11 - 18) education. Out of the sample seven have regularly contributed to academic journals and saw this as a key part of their professional activity while eight have had a greater interest in professional projects and professional reporting. Five are

professors in HEIs. All have been based for most of their professional lives in England. None are members of ethnic minority groups.

Interviews with the participants were loosely structured around: their career in general and in computers in education in particular; observations on the use of computers in education; thoughts on where we are now in the use of computers in education and on what the future holds. A striking feature of the interviews was participants' eagerness to engage in the process. Each had reflected in advance on their careers and, to an extent, set their own agenda on what was to be covered. Each interview lasted between 40 and 150 minutes and was recorded. After carrying out and transcribing the first round of interviews, the research team compiled a large list of initial codes which were finally condensed into six overarching themes, namely: Biography; Technology; Application; Philosophy; Policy; Community. Each member of the team then worked with all of the data within a specific theme, breaking that theme down into further sub-themes, or categories, using *NVivo* qualitative data analysis software. For example, the theme philosophy was broken into three major sub areas: personal philosophy of teaching and learning; value of ICT to teaching and learning; and connections made between personal philosophy and interest in ICT. Each of these sub themes generated several further themes, for example personal philosophy was broken down into twelve areas including creativity; challenge, practicality, provisional nature of knowledge and contribution of ICT. With all the data aggregated it was then possible to look for similarity and difference within the sample. For the most part it was the consistency that struck us but there were at times divergent experiences, for example in levels of engagement in designing software, and in viewpoints, for example the value of *Logo* and in the importance put on academic activity. The five different themes are clearly interrelated but the book has been carefully edited to reduce duplication and signal links between different chapters.

In this booklet we aim to provide an overview of the major and sub themes and offer some commentary for debate. A key concern of the project has been to establish participant and community feedback on work in progress through a series of exploratory work in progress reports, a process to which this present booklet contributes. However before reporting on the findings of the project, it is useful to give the reader a brief overview of the chapters and a background to some of the issues being raised within each chapter.

Biography

The biography chapter provides an overview to the themes of the book by looking at participants' professional engagement during their careers. It describes their involvement in education, their motivation to teach and / or support teachers and teaching. It describes their first experience of using computers in education and their motivation for doing so. It looks at the various types of role the participants took on and again how and why they did so. The chapter is very much concerned with professional lives rather than life history but shares with

life history a concern over 'agency and environment', have these professional lives been shaped by the world in which they found themselves or have they developed careers through 'entrepreneurial' undertaking?

It is helpful to look at this section in the context of historical changes in UK education. One key point of reference is the *Plowden Report* into primary education set up in 1963, and reporting in 1966. Central to the report was the idea that 'at the heart of the educational process lies the child' and hence the need to see children as individuals. The report argued that schools and teachers needed more freedom in how they taught and what they taught; highlighted the importance of play and learning by discovery and of appropriate evaluation of children's progress. The report was written at a time of change in education. Selection for secondary education (the 'eleven-plus') was, in many local authorities, being abolished and this enabled a broadening of the primary curriculum which Plowden supported. Meanwhile in many schools streaming was being questioned. In a wider context the work of the Schools Council was becoming influential on the school curriculum. One particular innovation here was the Humanities Curriculum Project (1967-72). The project, jointly funded by the Nuffield Foundation and the Schools Council for Curriculum Reform and Examinations, sought to address the problem of large-scale disaffection from learning of students, deemed to be of average to below-average academic ability, as they approached the school leaving age which was being raised to 16. The project had a specific focus on learning as inquiry rather than the traditional instruction-based pedagogy. It also was prepared to engage pupils in discussing more relevant and at times controversial issues. Relevant is that in 1973 the Schools Council also funded the first Computers in the Curriculum Project, based at Chelsea College. So-called 'progressive' innovations in education perhaps reflected wider changes. Society had become less deferential. Youth was becoming more clearly identified and more distinctive. Aspirations for some were enhanced by the expansion of higher education, the establishment of new, often campus based, universities, following the *Robbins Report* (1963). Whatever the tensions and moral panics reported at the time, and whatever recurring levels of poverty and disadvantage, there was a widely reported sense of optimism sustained by rising affluence and increasing mobility.

This sense of optimism and prosperity stalled in the 1970s and 1980s, with concerns over the underperforming UK economy leading to a recurring sense of crisis, and real concerns over the 'governability' of the country. The view from the right was that there was too little order in schools and too little preparation for work. Conservatives were supported by a 'Black Paper' in 1969, followed up in succeeding years, arguing against the 'excesses' of progressive education and for a return to more traditional teaching methods. Mass circulation papers were able to denigrate progressive thinking and seized upon cases such as, in 1975, the William Tyndale School. This was a primary school which had engaged in some radical ideas about pupil voice. However the school was widely seen as badly run and the press had a field day. Meanwhile, in 1976, the Labour Prime Minister of the time, James Callaghan, delivered what is

often seen as pivotal speech to Ruskin College expressing his unease about the weakness of vocational preparation in school and floated the idea of a national curriculum. The pendulum was swinging back from 'fitting the curriculum to the child' to 'fitting the child to the curriculum'. The incoming Conservative Government led by Margaret Thatcher (1979 - 1990) and later John Major (1990 - 1997) carried out a programme of economic liberalisation, alongside several measures which led to more central control over education. These included: the introduction of a national curriculum in 1988; the introduction of an inspection regime (Ofsted); and, in 1992, a curriculum for teacher training again backed up by inspection. Meanwhile local authority influence on education was undermined by encouragement of so called 'opting out' and, in 1990, the break up of the influential, Inner London Education Authority. A new Labour government came into power in 1997 with education seen as a priority. Alongside a noticeable increase in resources to education and a whole range of policy innovations the idea of central control over school, and over the curriculum, has continued. If anything this has been enhanced by top down interventions such as the Literacy, Numeracy and ICT strategies. At the time of writing there have been some steps to 'free up the curriculum' in the revision of the National Curriculum (2008) and 'lighter touch' Ofsted inspections but no sustained change of direction.

Turning to higher education there has been a continuing commitment to expanding numbers of students. Inevitably perhaps, this has not been matched by a proportionate increase in resources so that academic work has become more intense and more managed than in the past. Another significant change has been the research assessment exercise introduced in 1986 which set out to audit the research output of institutions. By marshalling research spending into the most 'research active' departments a wider gap has grown between those colleagues or departments with a focus on research and those with a focus on teaching. These changes mean that many in the sample who have been involved in teaching education see their work as more controlled, more intensive and as being given a lower status in their institutions than in the past.

Technology

This chapter leads us from considering the careers of individuals to exploring developments in technology and how participants responded to those developments. It is a chapter about consistency and change, consistency in beliefs about teaching and learning alongside rapid change in the speed and storage of computers.

Ours has often been termed a Technological Age referring to the application of developments in science in every aspect of society. Indeed this application seemed in the 1950s and 1960s bound up with rising prosperity and the break down of class structures after the privations of the war. The basic needs of everyday life seemed to have been met. The widespread use of antibiotics and immunisations had provided redress against life threatening disease. Food

production was expanding with modern fertilisers and more efficient production. Manufacturing industry was more productive, many households began to own cars, telephones and television sets. An iconic challenge for the time was the space race and the pursuit of the first 'man' on the moon. Science and technology seemed to offer previously unimaginable ways of seeing the world and progress at every turn. Riding this wave was Harold Wilson's reinvention of the Labour Party in 1964 as committed to modernisation and to the 'white heat of the technological revolution'.

However, technology carries both promise and critique. Mass advertising and mass consumption was unsettling to some. Sociologists of labour fretted about the alienation of modern mass production. There was increasing awareness of the destructive power of science and its application in the development of atomic weapons and its impact on the environment. A young person watching television in the 1960s could have seen alternate visions of technology played out. *Tomorrow's World* (which started out in 1965) offered, especially in its early days, an uplifting vision of technology but more unsettling scenarios were provided by dramas such as *Doomwatch* (1970 - 1972). Meanwhile, other science fiction such as *Dr Who* and *Star Trek* often hammered home the point that human beings had to use wisely the technological power they had accrued. This tension between the constructive and destructive power of technology continues in recent controversies, for example, concerns about genetic crops, global warming, the surveillance culture and the integrity of electronic data.

Computing power has clearly played a central part in the recent history of technology. Pioneers in industry saw that mainframe computer could not only tackle complex issues but could make huge efficiency saving by mass processing of routine calculations. Computing was from today's perspective incredibly long winded. Coding sheets and hand-punching cards were needed. These were taken to a mainframe computer for processing and the results, perhaps some days later, were provided in the form of computer printouts. The process was considerably speeded up, though still laborious, though the use of teletype terminals. Computing was cumbersome and expensive; its use confined to industry and specialist units in higher education.

The breakthrough came with the introduction of the microprocessor at the turn of the 1970s leading to a fledgling mass market in the home, school, and small business. Some of the first personally owned machines in the UK were made by Sinclair and Commodore. To give an idea of the specification of early machines the Sinclair ZX80 and came with 1 KB of RAM and 4 KB of ROM containing the Sinclair *BASIC* programming language, editor, and operating system. A household television was need for display and an ordinary cassette recorder could be used for programme storage.

To increase national awareness of IT, 1982 was designated 'Information Technology Year' by the Government. Consequently the BBC Computer Literacy Project was launched; this

involved a book, a television programme, a course on the programming language *BASIC* and the 'badging' of a BBC computer. This machine, produced by the UK company Acorn after an open call for tenders, was released as the BBC Microcomputer in late 1981. The BBC model A had 16 KB of RAM; the Model B had 32 KB and came with several input / output interfaces. It was seen as robustly built and, though at today's prices, expensive it proved popular in the home and in school, with over one million machines sold.

In the same period another hardware company which later became Research Machines, and now RM, began to have a strong share of the educational market. The Research Machines 380Z was manufactured from 1978 to 1985. It was sold mainly to schools and was a more expensive machine than the BBC but coming with 56 KB of memory. Later, RM adopted the Microsoft operating system and maintained its stake in education.

A key development in the recent history of computers was that of the Graphical User Interface (GUI) pioneered by Macintosh and developed in machines using the Microsoft operating system in 1985 and, as Windows, in 1990. From this time onwards so called PC machines began to take over with global competition driving down prices. Acorn was squeezed out of the schools market despite producing its own Archimedes machine (at the turn of the 1990s) with GUI and a faster processing speed than other machines of the day.

A further key reference point in the recent history of computing has of course been internet enabled technology allowing communication and sharing of resources across previously unimagined distances. The underlying principle of the Web go back to 1980 and the CERN laboratories in Switzerland. By 1990 the first Web browser and Web servers were ready and in 1993, CERN announced that the World Wide Web would be free to anyone.

The impact of the Internet on the world of industry and commerce has of course been huge. For example E-retailing in 2007 accounted for an estimated 15 billion pounds worth of sales with particular importance in the field of travel, electrical goods, food and entertainment. The impact in the home has been, if anything, more marked, notably in the UK, with very high usage of site such as *My Space, Beebo* and *Facebook*. Young people regularly turn to the internet for both leisure and study. Schools have traditionally lagged behind, rather than led, developments in the wider world but nearly all schools are now networked and produce their own sites. Intranets are widely used for storage of pupils' work; rudimentary e-portfolios have been introduced; many teachers are involved in creating their own online resources and distributing them during their teaching. Pupils can often access and complete work off site and share their work with a wider audience including pupils in other schools, parents and the world at large.

Future application of computers in schools and the world at large are unpredictable. Recent history tells us the processing speed, memory capacity have increased at exponential rates and may well continue to do so. At present there is a lot of interest in mobility and personalisation

of devices particularly through the use of wireless mobile devices with phones, internet access, camera, MP3 player, and Global Positioning System (GPS).

Application

This chapter looks at the application of computers in school and in education. It looks at what participants see computers as offering learning and the reasons why their use has been so problematic. Not surprisingly in- service training and CPD are seen as essential to promote what is described as the desirable use of computers. The types of training that best support teachers are considered.

Some general background is helpful here. Computers came into many schools with no clear *educational* rationale, and it was easy for many teachers to see them as a solution looking for a problem. This marked the beginning of agencies to support schools and also the beginning of a do it yourself culture with some teachers writing their own programmes As storage became more robust teachers and advisors could develop and share 'small' programmes though floppy disks to assist with particular skills or provide more exploratory learning. Some of the examples mentioned in the chapter include *Micro Smile, Eureka, Granny's Garden* and *Suburban Fox*. *Micro Smile* was a set of simulations and games initially to support the school mathematics programme SMILE which originated in London schools. *Eureka* contained several simulations (such as showing a bath filling up) to illustrate how variables such as time and volume could be graphed. *Granny's Garden* was an immensely popular educational adventure game, the aim was to find the six missing children of the King and Queen while avoiding the evil witch, through a series of logic puzzles. *Suburban Fox* was a simulation of a fox population which allowed users to explore the impact of altering environmental conditions. Alongside simulations and games such as these, content free programmes such as word processors, spreadsheets and databases were designed for schools. At the same time less ambitious programmes were developed which sought to give children practice in particular skills and some writers at the time worried whether the introduction of new technology might take schools back in time to drill and practice.

The programme *Logo* provides a key talking point in any discussion of the early application of computers. At first sight *Logo* was simply an accessible introduction to programming which had its most popular application in the management of a 'turtle'. This was a screen pointer or a small turtle shaped robot which the user could direct through simple controls such as *Forward, Backward, Left Turn, Right Turn*. It was always intended by its designers that *Logo* should be offered to learners in a very open ended and learner centric way. This, it was felt, would result not only in some mastery of programming but would serve as a context for developing important thinking skills such as planning, de bugging and habits of engagement and persistence. In a sense *Logo* provided a powerful metaphor of the user's control over the machine. A controversial area here was the role of the teacher. While most recognised the key

role of the teacher in framing activity, some very much saw the interaction of the learner at the machine as the key to learning rather than learning in the context of the triad of learner – teacher – technology. The great strength of *Logo* was its low threshold, high ceiling nature, users could get started very quickly but take programming wherever they wanted to go. However, in practice *Logo* became very much sidelined as occasional activity for the mathematics classroom.

A key reference point in the application of computers in the classroom was the National Curriculum. In the first document (1988) Information Technology appeared as strand of the curriculum and it was expected to be taught within a cross curricular approach. Whether by design or not, this led to increasing use of general purpose programmes, rather than subject specific software. The thinking here was that the same software could be used repeatedly which in practice led to the 'Microsoftisation' of school software as *Word; Excel* and, in time, *Access* became increasingly used. Small programmes remained but became less attractive as they did not make use of graphical and later multi media capabilities afforded by the new machines with greater memory and processing speeds – though of course the idea of educational software was continued by more commercial providers producing CD ROMs. The National Curriculum was revised in 1995 and *Information Technology* got its own subject status which it has kept, though later re branded *Information Communication Technology*. Reflecting concerns in the teaching of the subject a national strategy was introduced in 2002 and guidance materials appeared in the months that followed.

This brief overview highlights that there has never been a settled view on what we want computers to do for education and it not surprising that evidence to assess their impact is contentious. A landmark report, the *Impact Report*, appeared in 1993 which sought to compare learning outcomes between pupils with high access to computers against those with low access. It concluded that computers did have a positive impact on learning but not a consistent one. A key reason for a lack of impact was felt to be the absence of a threshold for access which could only be addressed with more machines in the classroom. A later study, ImpaCT2, was conducted between 1999 and 2002 and involved 60 schools in England which explored the relationship between the use of computers and attainment from a wider range of criteria. Evidence suggested, at least to the satisfaction of Becta, that the use of ICT did impact positively on attainment. This argument was strengthened in another large scale study – the Test Bed Project which ran from 2002 – 2006. The idea here was to provide 30 schools and college with enough equipment, if not to take access out of the equation at least to reduce its influence, in assessing impact. Teachers were also supported with professional development opportunities. Again there was felt to be an association between attainment and the use of computers, though greater in primary than secondary school. At the time of the project there was a lot of interest in the use of Interactive Whiteboards (IWBs) as a tool to support whole class teaching. There was an underlying impression that teachers wanted to use technology to

support, and extend their existing practice, rather than radically overhaul it and some of the tensions to which this gave rise were reported.

Whatever the case, there is ample evidence from a host of studies over the years that there are important benefits for pupils and for teachers in using computers in education but also important barriers to their use. These barriers include lack of curriculum fit, access, difficulties with equipment and technical, in-service training. There is often a common sense view that computers are a good thing but a deeply divided agenda for just where this 'goodness' comes from and how or whether schools should accommodate to computers. This raises some general questions about securing change in schools. Indeed the development of computers might be viewed in terms of a more general literature on the importance of stakeholders' perspectives on change. Computers are far from a special case of educational reform.

Philosophy

A driving force within participants' careers has been an interest in teaching and learning both from a practical concern as practitioner but also an intrinsic interest in how we think and learn. The chapter highlights their understanding of learning and how knowledge is acquired. It discusses the responsibility learners have for their own learning and the role of the teacher in framing activity. It suggests that computers both support and reinforce a philosophy of teaching.

Again to see these ideas in a wider context it is useful to return to the *Plowden Report*. This drew firmly on Piagetian theory. This is hardly surprising as during the 1960s the influence of Piaget and his interpreters was very strong and his ideas were widely accepted. Clearly the idea of looking at how young learners make sense of new information, rather than viewing the mind in terms of input and reinforcement stimuli, was going to appeal much more to the intellectual spirit of the 1960s. Coincidentally Piaget was a very deep influence of work on Papert, who co-founded the MIT Artificial Intelligence Laboratory, and worked with the team that created the first version of *Logo* in 1967. However, by the end of the 1970s ideas of social cultural learning were taking over from the constructivism associated with Piaget. Here the work of Vygotsky was central. Vygotsky was, like Piaget, concerned with mental processes but put into the focus the tools which the learner uses and the support for learning provided by 'significant others'. Vygotsky's work became ubiquitous but was hitherto almost unknown and *Mind in Society*, only appeared in English in 1978. Since that time the social cultural view of learning has informed new approaches such as Activity Theory and Community of Practice and, more recently, Actor Network Theory.

Policy

This chapter looks at phases within policy from early support and experimentation in the 1970s, to a more prescriptive phase in the 1990s and beyond. It describes what participants see as strengths and weaknesses in policy and highlights the distinctive perspective they have on developing and assessing the use of computers in education.

The use of computers was given Government endorsement when in 1981 Kenneth Baker, the newly-appointed Conservative Minister for Information Technology, launched the 'Micros in Schools' scheme with an emphasis on the vocational aspect of computers in education. The Department of Trade and Industry (DTI) provided £16 million to subsidise the purchase of British computers in schools, in part to kick start a UK computer industry. The Department of Education and Science (DES) provided £23 million to launch the Microelectronics Education Programme (MEP), which ran until 1986. This programme was influential for several of the participants. It was run from a small building in Newcastle, under the directorship of Richard Fothergill. It produced materials, crucially software for direct use in school, and some support was offered for teachers at least as far as resources would permit. Its focus was on both computing and on cross curricular use.

To increase national awareness of computers, 1982 was designated 'Information Technology Year' by the Government. This was followed by another major initiative launched by the Conservatives in the early 1980s, entitled the Technical and Vocational Initiative (TVEI), which provided further financial aid for schools to purchase computers. TVEI was an initiative that radically altered the focus of control in education; imposed, as it was, by central government without consultation with the Local Education Authorities or the teaching profession.

In 1986 another initiative, 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 to carry on the work of the MEP. Its remit was broadly similar though with a greater focus on a cross curricular approach and on producing support materials rather than software. MESU explicitly set out to commission research in this new area and establish links with academia. The White Paper, *Working Together - Education and Training'* (1986) announced national expenditure of £90 million over ten years to extend the TVEI programme, further strengthening a centralised approach. Around the same time the Government funded an interactive video project, Interactive Video in Schools, from 1985 to 1987. Eight packages were introduced: *Challenges; Design; Disco; Environmental Education; Geography; Life and Energy; Missing the Obvious;* and *Siville.* Six of these projects focused upon primary and secondary classrooms and two upon teacher education including in-service education. The major limitation of the programme was technological – the programme was carried out before the analogue – digital crossover. Another interesting development during this period was Neris

(1987 – 1989) or the National Resources Information Service – an independent trust, supported by government. Neris was a teacher resource database available on line, via the *Prestel* and *Campus 2000* networks, or through a CD ROM. In addition to details of educational suppliers, films, software and so on, Neris also contained lesson plans and worksheets for direct use in the classroom and was a precursor to the National Grid for Learning.

Along with mainstream support for computers, Government initiatives in the 1990s included support for the use of *Integrated Learning Systems* (ILS) which offered an individualised route through material very often in the context of numeracy and literacy. In addition multimedia laptops for teachers were supported via a pilot project (1996-98), £4 million to supply 1,400 teachers; followed by a main phase 1998, £23 million to supply 10,000 teachers and heads.

A further initiative towards the tail end of the Conservative government included The Education Departments' Superhighways Initiative (1996 - 98). This highlighted the development of the Internet and the educational opportunities this offered. It was also the first time policy makers, ICT providers, researchers and practitioners were brought together to examine ICT across every sector; primary, secondary and higher education.

The development of computers in education received a further boost with the new Labour Government (1997) committed to new projects and increased spending. A major influence on the Labour Party as it prepared for Government were the *Stevenson* (1997) and *Mckinsey* (1997) reports which argued that there was enough evidence to make it worthwhile going for a 'step change' in levels of funding for computers in school alongside training of teachers. Accordingly, a new training initiative was introduced financed through the lottery and its New Opportunities Fund which became known as NoF Training. Trainers were independent organisations, with quality assurances in England from the, then, Teacher Training Agency (TTA). Local Education Authorities were directly involved; over 75% were either accredited training providers in their own right or were receiving direct funding for supporting providers. In England, very nearly all eligible teachers signed up for the programme and in total over 390,000 teachers and virtually all schools took part. Alongside this, the National Grid for Learning in its first phase (1998-99) provided £100 million for hardware, software and Internet connectivity for 8,000 schools; between 1998 and 2002, £657 million of grant funding was made available to schools in England through the Standards Fund to help develop provision (infrastructure, services and content) and a further £710 million of expenditure was allocated between 2002 and 2004.

Consequently the government's NGfL and NoF Training initiatives were relaunched as the ICT in Schools Programme (ICTiS), which continued funding for schools to purchase hardware. Other significant projects and funding schemes have included: Strategic Leadership in ICT (SLICT) – a programme of in-service training for senior school staff; Curriculum Online – a learning materials scheme with approved software and funding. A related flagship

policy of Labour has been the Building Schools for the Future (BSF) programme (set up in 2005) to help local authorities and schools invest in new or revamped buildings with appropriate computer infrastructure. Over £3 billion of funding was released in 2005-06.

As with previous Governments some renaming went on. IT became ICT (stressing the communication angle) and NCET, the government supported body to promote computers, became Becta with a more specific focus on policy, partnership with other bodies and commissioned research rather than production of material, or the providing of in-service training, in its own right.

Community

In this chapter we search for key features of the research community and its distinctive contribution to the development of computers in education. It looks at how a research community grew, what benefits members got from it, its achievements and areas of tension and weakness.

A spur for research for some participants was ESRC funding and their Programme for Information Technology and Education. A related development here was the setting up a new academic journal, *Journal of Computer Assisted Learning*, edited by Bob Lewis, in 1985. The brief of the journal was wide and like other journals of the time saw teachers as part of its core readership.

A catalyst for others was Project INTENT coordinated at the Centre for Applied Research in Education, University of East Anglia to support the use of computers in ITE. The project was concerned with the quality of teacher education; providing support for educators; and developing management strategies and was supported by both NCET and individual institutions. It was set up in response to concerns about student teachers' preparation to use computers as expressed in the *Information Technology in Initial Teacher Education Report* or *Trotter Report*. Project INTENT created its own journal (*DITTE*) and encouraged colleagues new to research to publish their findings. There were clear connections between *DITTE*, which ran from January to June 1992, and the publishing in the same year of ITTE's *Journal of Information Technology for Teacher Education* (JITTE), from 2002 *Technology, Pedagogy and Education*. Of course there were other longer established journals. *Computers & Education*, set up in 1976. It was originally based in the USA but has been co-edited for a long period by Jean Underwood in the UK and has regularly included case studies of UK based research. The *British Journal of Educational Technology,* set up in 1970, had its roots in the National Council of Educational Technology (not NCET), chaired by Sir Brynmor Jones, Vice-Chancellor of the University of Hull.

ITTE itself was set up in 1986 and while having a general brief to 'promote the education and professional development of teachers and….to improve the quality of teaching and learning

with ICT', it has had a niche role in supporting the initial teacher training departments of universities and colleges of education. It has organised its own conferences and a biannual research conference. It has largely institutional membership, including nearly all HEIs in the UK.

ITTE members have networked with comparable international organisations, most directly through SITE, the ITE arm of the Association for the Advancement of Computing in Education (AACE) in USA. SITE was founded in 1990 and has a similar interest in both theory and applied practice as ITTE. Another international organisation mentioned by participants is the International Federation for Information Processing or IFIP - an 'umbrella organisation for national societies working in the field of information technology'. Its journal is *Education and Information Technologies.*

Participants also spoke of their involvement with more practitioner based associations, including MAPE, Mirandanet and Futurelab. Micros and Primary Education (MAPE) formed after a conference in 1981 at Exeter University for primary teachers, headteachers, advisors and lecturers. MAPE produced an influential newsletter called *MicroScope* which was circulated to local primary schools and later to LEA advisors. Membership reached a high of over 5,000 in 1993 but fell back as teachers turned increasingly to official guidance (e.g. QCA schemes of work) and NoF training. MAPE eventually amalgamated with NAACE. NAACE was established in 1984 following an HMI Conference for IT Advisers at Newman College. It had a strong focus on practice and sought to support ICT advisors in schools and in support services. In 2004 it became Naace made up of the old NAACE, MAPE and CEG the Computer Education Group, publishers of *Computer Education*. The new group had over 3,000 members in 2007 and several 'partners'. The MirandaNet Fellowship was founded in 1992, as an international network of policy makers, teachers, teacher educators, researchers and commercial developers. In 2008 it had over 800 members in 40 countries worldwide. It has put on a wide range of seminars and conferences, supported projects and online forums. It publishes an E journal and many reports and case studies. Finally, Futurelab is a not-for-profit organisation working with partners to generate new ideas about teaching with computers and carrying out its own research and support for teachers. Again it publishes reports and has commissioned some influential literature reviews.

Discussion

The final chapter of the book contains a reflection on the issues raised by the team working on the Voices Project. The aim is to provide not so much a summing up but a diversity of reaction to stimulate further debate within the research community at large. The idea is to

stimulate a conversation rather than draw one to a close and you are invited to add your viewpoint at a Project Blog.

About the book

This introduction has given the reader a background to the development of computers in education. The following chapters biography; technology; application; philosophy; policy; community tells us what it looks like from the perspective of people engaged in both the practice and research of teaching and learning; and who see value for teachers and learners in the application of computers. It is of course a partial perspective and perhaps a different book would be written if we had spoken to classroom teachers and to policy makers. This book will interest those with an interest in pursuing a career in research, an interest in technology and indeed anyone who wants to understand a little more of what has happened since computer met school.

The Voices Project was carried out by Michael Hammond, University of Warwick, Sarah Younie, De Montfort University, John Woollard, University of Southampton, Vicky Cartwright, University of Warwick and David Benzie, University College of St Mark & St John, Plymouth. Michael Hammond wrote the introduction and chapters on biography, philosophy and collaboration. He also edited the book into an overarching narrative. Sarah Younie contributed a chapter on policy, John Woollard on technology and Vicky Cartwright on application. Penny Nunn assisted with the final production of the book.

We gratefully acknowledge the contribution of many people to this project including Margaret Cox, Margaret Danby, Partick Dillon, Tony Fisher, Chris Higgins, Graham Jarvis, Roger Keeling, Marilyn Leask, David Longman, Avril Loveless, Richard Millwood, Martin Owen, Christina Preston, Bridget Somekh and Jean Underwood.

2 Biography: the making of a career

This chapter provides an overview of the professional careers of participants with a focus on their interest in developing computers in education. It describes how they got into teaching in the first place; looks at their first involvement with computers and their experiences of using ICT. We go on to look at the different roles participants took on during their careers and their reflections on these roles. We note highlights and difficulties in their careers.

Getting into teaching

It was very clear from all the interviews that participants held a deep interest in teaching and learning which informed their later interest in computers and with computing. The first question is where did this interest in teaching come from? For a small number teaching was something they knew they were interested in for a long time. As one recalls:

> I don't know, it's difficult to say...certainly throughout the time I was doing my degree...and I went from school knowing that I wanted to be a teacher. I'd had happy experiences at school and there were a number of teachers who I had either consciously or unconsciously adopted as role models.

However, for most teaching had not been a long held ambition, rather it was something they had settled on and usually from a mix of motivation. It was something that involved people, it enabled them to develop their subject knowledge; it involved social commitment and it gave them a job. Here, one participant highlighted subject involvement:

> What got me into to teaching, whether in school or HE, was a essentially an interest in the subject and wanting, because I'm a mathematician, wanting to pursue the subject more. And I found from a very early stage that the best way to find out more about something is to teach it to somebody else.

Two of the participants particularly highlighted the opportunity to 'make a difference', one felt:

> And I suppose the motivation there is…has always been…still is that kids deserve the best education they can possibly have. You know they all deserve the best start in life they can have. And if what they do with their lives after that is up to them but it shouldn't be determined by any failing in the quality of their education. Really why I wanted to go into teaching was to help get them on their way.

There were more pragmatic motivations too, three in particular spoke about having young families and the need to earn an income, as one put it:

> I got into teaching because I was single, divorced, and I had to work to earn for myself and my two children and in 1970, I think it was, I couldn't think of any other way I could cover the school holidays other than being a teacher.

Thirteen of the participants took a teacher training course in most cases a post degree one year certificate (PGCE) but in two cases a four year degree focused on education with a teaching qualification (BEd). Two went directly into teaching from full time study, one from doctorate study into Higher Education and another into school without formal training. They began work in different sectors, primary (4); secondary (9); further education (1) and higher education (1). All were able to go on and describe satisfying experiences of teaching often based on establishing relationships with those they were teaching and productive interaction in the classroom. They found the job of teaching was one in which they could innovate, develop professional knowledge and gain a wider perspective on the societies in which they lived. All developed an intrinsic interest in teaching and learning and spoke about the fascination of observing how pupils learnt. This was put forcefully by this participant recalling her first experiences of teaching in inner London:

> And I loved it, in fact that has been a theme throughout my professional career. I've always loved it, I've found it, it's what Papert calls hard fun. And we'd be in work at 8 o'clock and we would leave at 4, go down to the teachers' centre for a course and then socialise with each other in the evenings. We lived and breathed what we were doing.

Another drew attention to the personal insight she gained from understanding children's perspective:

> I became fascinated by the interaction between myself as a teacher and the children and a whole revelation about how what I was hoping to do was often not what was understood by the people I was working with…..I find teenagers, I still find teenagers, completely fascinating.

However others were able to recall more mixed experiences of teaching, as one recalls:

> So the truth is I never really had much time as a teacher to settle into any kind of routine… Some of the things I was doing I was really pleased about, went very well. Particularly areas like teaching mathematics, teaching English, and playing with the use of computers. Some things didn't go well, I had a few difficult classes, I had to sort out all the usual problems with behaviour management.

One who had gone into teaching without formal training found his first experience in a city school a challenge and was pleased to move out:

> Teaching maths at an intercity London school at that time wasn't easy. I found myself not well equipped to taking on all the problems of classroom teaching then, I think I'd be much better at it now.

Getting started with computers

For a small minority an interest in computing, or electronic technology in a wider sense, had long been there, as one recalled:

> In the 60s there was a powerful belief, the Harold Wilson thing, that the future lies in the white hot heat of the technological revolution. I can remember reading a book talking about communication technology. I was an undergraduate doing electronics; I was also interested in politics and a member of SocSoc (*Socialist Society*), also the University film and television making club – technology mediated experiences were important to me quite early on.

Three could recall seeing computers during their studies. One of these had attended a course in artificial intelligence while another saw an effective modelling with computers within his subject, geography:

> The lecturer had access to data and we used that as part of this multi-variate analysis. We used a programme for a technique called trend surface analysis whereby you've got your factor for your multi-variate analysis and then what you can do is effectively create a kind of 2D representation of the landscape of that factor, hence trend surface. And what you could do is get a representation with contour lines of where the outliers were and so on so this enabled a kind of visual presentation. It was really fascinating because it enabled you to make visible something that wasn't actually a visual phenomenon.

Another recalled how she and her colleagues had become 'very excited' about the first word processors introduced at university:

> It was amazing ….we all talked about can we use it to type up our theses using that machine because at that time universities were leading the field.

Others too recalled the important role Universities played for teachers by offering courses on computing and use of facilities. One participant recalled a chance encounter that led to collaboration between his school and the local polytechnic (now university):

> I taught in a secondary school from 1967 to 1973 and I was teaching kids one day about distance, time graphs and I thought 'I know we could take the coach out and stop it at points and we could actually end up with a distance time graph from a real life scenario'. But I wanted somewhere to take them to on the trip so I took them to the local polytechnic and the computer centre.

In spite of the work being done in higher education only two could recall any mention of computers in their initial teacher training - one of these went on to encounter an early enthusiast for computing in his placement school:

> The computer was an item in the classroom because I was placed in a school where there was a teacher who was also very keen on computers. So he was the one that had

> to 2 or 3 Commodore Pets and it was a case of finding useful and interesting things to do with them.

However this very early involvement with computers was rare. For most, their awareness came from the media and very often through friends or family. Five participants mentioned the role of husband, wife or boy friend in this. Two were married to teachers who had brought home a computer from their school which they had looked at together. A further three participants had partners who 'worked in or with computers' and described how they came to meet up with people with an interest in technology. Two describe developing a shared interest with their partners, one recalls:

> My husband was made redundant in 1979. Coming home on the tube that dreadful day, he picked up a newspaper it said 'Have you been made redundant? Would you like to become a computer programmer? Join TOPS' (*Government supported Training Opportunity Scheme*). We continued in parallel careers ever since.

While many participants did not rush into using computers nearly all had very immediate reactions to software they had seen, indeed it was striking how many saw a potential value straight away, as this speaker put it:

> It was just one of those things and it grabbed my attention, and I just immediately saw as a mathematician what a great tool it was.

In contrast, a few felt less sanguine. This participant was disappointed by what the machine offered but at the same time she did not want to ignore it:

> We looked at these tennis games and peculiar things like that on the computer and how they were teaching the children to programme and I kept thinking 'I'm sure theses things are going to come into primary school before very long and I haven't really got a clue what they can do for primary education'.

Computers arriving in school

Most participants were working in school in the late 1970s and early 1980s when the first microcomputers were arriving in schools. A small number sought out uses for these machines from the start, but for others the process was more gradual:

> I was taking my early steps with the use of computers in teaching and learning in schools, there was increasing wider interest in that as well. I couldn't pick out one thing, or one person or one element that was particularly influential, I'm just aware that the kind of climate that was changing - there were more courses, or if it was a course that wasn't specifically to do with the use of computers in subject teaching, nevertheless there would be more mention made of them, there was more activity generally, more networking of ideas around that.

All, to varying degrees, saw almost an inevitability about the use of computers, as one put it:

> Computers were beginning to be thought to be everywhere in business, you know it was obvious it was going to grow.

Early applications

For most that initial interest was focused on 'small' programmes, often simulations, and content free packages, such as databases, word processors, and *Developing Tray*, a text revealing package in which pupils construct a text by predicting words and phrases. Simulations often involved modelling real life events, giving the learner an opportunity to interact with the model:

> In history there was a range of very imaginative ideas from things like being in a situation where there is a war about to break out between these two nations and what are you going to do about… so you then make a judgment about… so you then get the consequences about the war.

Amongst content free packages databases were valued and three recalled census style projects:

> We had basically a database programme. It would handle census data. And the BBC, or whoever published the programme, supplied it with some data for a village in Lincolnshire. What we wanted the kids to do was interrogate a database about our local village, which was just next to where I was teaching. So we'd got access to the local census data.

Three had particularly strong interest at the time in *Logo* and other forms of direct programming by the children themselves. One described programming using a Commodore machine:

> So for example, on the early computers you'd take the sort of the *Logo* principle, if you like, and give the kids a few commands that are easy to understand and let them make stuff happen. Well you could do stuff like that with something like the Commodore Pet because it didn't have the same kind of graphics system, but it had a system where, what we call Year 5 children now, could easily learn some of the Commodore Basic commands to make things happen on the screen, to draw simple pictures basically…..It was rather *Logo* like in the principle that it was open ended it was investigatory problem solving type learning as opposed to just following a work sheet. And it would keep the kids engrossed for quite a long period of time.

From the start, their interest was fuelled as they saw (or strove to see) something in the use of computers, which seemed to support ways of teaching and learning which they found appealing. We discuss this in more detail in the philosophy section but, put briefly, desirable teaching and learning very often involved learners taking responsibility and exploring something they would find interesting or relevant. As one participant explained when talking about a new integrated humanities course in which computers were going to be used:

> There was a tie in with the computer. We were experimenting with ways of giving kids more, people now would talk about, ownership of their own learning ... a phrase that wasn't particularly current at the time, though I don't think we used that word, but we wanted the kids to take responsibility for what they were doing.

Pragmatism and falling into roles

There were pragmatic considerations in everyone's interest in computers in that they sensed computers had a high profile and this provided career opportunities, but this did not drive their interest. Over and over participants speak of a combination of circumstances which lead them into roles, very often ones which they had not sought out, developing the use of computers. For example for two, this falling into a role came about from their interest in mathematics and the belief widespread at the time that computing was almost a branch of the mathematics curriculum. Ideal was an interest in both mathematics and computers:

> Like many other things it falls on you, in those days it fell to the maths department and I came to join a maths department, and as I was interested in ICT too it fell to me.

In contrast two other participants were quite deliberately asked to teach computing because they were not mathematics teachers and were not men, countering another widespread assumption that computers were for boys. One described this as follows:

> The principal at the time walked in and said we have mostly female students. We need a female who will do the computing. You're it. So that was my first introduction to a desktop computer which was of course the Commodore Pet.

However, no matter their route into using computers, or their uncertainty, they all quickly became identified as the natural person to approach in their institutions when computers were mentioned. As this speaker put it:

> I took on being interested in ICT in the classroom and then it sort of naturally grew like, every time there was a new project or topic I was one of the obvious ones to be involved in it.

How others assisted them in developing an interest in computers

Although at times participants were thrown into roles all had some quite striking support, or at least encouragement. Very often this was 'just in time' support with someone having a considerable impact on their career often through relatively small acts. One, for example, discussed the support from the head for a one year secondment:

> I was talking to my head teacher about it and he said 'well why don't you apply to go on a computing course because apart from anything else we could do with somebody in school who knows something about it'.

A similar experience was shared by this participant who remembered her head teacher putting her forward for an LEA initiative:

> And my head said to the inspector I've got a teacher who knows about computers and so we were the only school in the LEA at the time who were part of the first pilot scheme for Computers into Primary schools, that's where it all started.

Another recalls the encouragement of a colleague to take part in what was then a ground breaking international project:

> The NUT (*National Union of Teachers)* rep at my school, said, I've just seen this thing that's come through from the NUT you might be interested in. And it was to apply to be part of something called the UK USA communications project and the NUT was looking for 20 teachers who could be part of a two year, collaborative project with the United States with the NEA which was the American union. So I applied for this and took part in it.

Sometimes participants could recall practical help – someone providing equipment or programmes to use as in this case:

> About 1977 when we got micro computers and our first engagement with them was actually with the company that produced this 380Z and they said they could lend us, or rather give us basically, six 380Z's which we could put into local schools.

And some received direct invitations to take part in projects:

> It came through that they (*the project coordinators*) were wanting teachers as authors of educational software and because I had a background in writing and in publishing poetry I thought I would do it…. And so off I go and find there is me and 11 men who are science teachers who were all very good at coding the BBC.

Assistance also came in the form of courses put on at Teachers' Centres and other forms of in-service. Two had one year secondments in which they were able to develop their interests. HEIs were influential in the very early days, one reason was that they could house mainframes and schools could not. One recalls a lecturer leading one of these courses:

> She ran a course for teachers in London to learn how to write computer programmes for educational purposes. She was a computer studies lecturer. What was stunning about her course was that she had read the papers from the National Development Program of Computer Assisted Learning, which was a higher education project that ran in the 70s. She took the theories …and applied them to secondary education.

Maintaining an interest in computers over time

Participants' interest in computers was strengthened over their careers by their growing confidence with the technology and their emerging status as knowledgeable about computers. Their roles in education were changing and their work involved a greater focus on the use of

computers, something which, not surprisingly, strengthened their commitment and interest. They were often using technology for their own purposes too and could see its usefulness, for example word processing their own writing, and, in many cases, the hold the home computer had over their own children's attention. However, they would not have developed a professional interest without their positive appraisal of computers in school even if, over time, they gained greater awareness of the difficulties teachers had in using them. Many came to write more formal appreciation of these opportunities and difficulties in the various reports or papers, but all shared the experience of some striking examples they had seen in the classroom. For example, one remembers:

> And I think some of the things that I've seen since that I think were little landmarks ... things where you think 'yes, there's something really useful here'. Things like *Logo* or the old sort of *Developing Tray* activities that really mean that children have to think through to find the answers …

Several participants spoke of computers providing activities which allowed hitherto unsuccessful learners to 'shine':

> I remember a child who had very severe behavioural problems, who was just totally engaged and worked with others in the team to work the answer out in a way that he wouldn't have done normally. It's something that captures their attention.

Taking on new roles and experiences of those roles

All the participants at some point moved from day to day teaching roles to become developers of software and / or advisory teachers and lecturers in higher education. In nearly all (12) cases they had a strong involvement with initial teacher education and teacher professional development in different contexts.

Developing software

With the introduction of computers in schools came a demand for software. The technical limitations of storage meant that only small programmes could be developed – ones which made rudimentary use of graphics and sound – but this had the advantage that coding could be carried out by small teams of enthusiasts and amended quickly. Very often there was a close connection between teachers and designers and between designers and coders. Seven of the participants had an involvement in creating software, either by trialling software produced by colleagues or in three cases becoming closely involved in the design of software. Participants were often invited to take part based on their growing interest in computing and education, two had technical knowledge of programming but for others it was design that was an attraction as with this participant asked to help a small production company based at a school:

> So it was this sort of little group of teachers with computer programmers, who were actually their own former pupils and they were doing really well but they decided that they needed someone with more pedagogic knowledge who would handle the trialling of their software and input into the design.

Often the programmes were simulations of some kind, for example one recalled the modelling of a snooker game which he had designed and another a simulation of an archaeological dig in which you had to deduce what lay beneath the surface from clues acquired as you advanced through the programme. Two were involved with the MEP software and a further participant taught on computing in education courses. He helped teachers develop their own programmes for use in school, some of which became available to other schools.

Those who took part in developing small software recall this time fondly. It was a very creative, engaging period as one put it 'I thought it was one of the most interesting things I could think of doing at the time.' They were also aware that the software was making a difference to schools and could see the impact it was having in the classroom. However software projects were invariably short term and exploitation of ideas became much longer, expensive and commercially riskier as the technical sophistication of machines increased. Some (two in particular) maintained a career long interest, within a wider role, of creating software and later multi media content for learning resources but nobody held a development role full time. They moved on to other roles.

Advisory work

Nearly all had some part in advising teachers and five of the participants had taken on the role of advisory teacher. These five had extended experience in the classroom and were particularly confident about their teaching. They recalled feeling very positive about working with children and, not surprisingly, they had some reservations about leaving the classroom. However, they shared a motivation to get a wider view of what was going on in schools and this seemed a logical step:

> It did make me understand that it was possible to work across schools rather than within a school, because up until then all my experience had been within the one school.

Again participants spoke fondly of this role. They felt they were having some impact in classes, they were working in teams and their involvement with computers often made them feel that they were on the cusp of educational change:

> I loved being an advisory teacher, being part of a team, all of whom I adored. We really did love working with each other, so there was again that strong social sense. And we were dong stuff that nobody knew how to do, nobody had done this before, we were running these courses.

While they missed their own classrooms they found working with adults an attraction of the job, though it took some adjusting to:

> I really enjoyed working with teachers…I enjoyed working with teachers more than I enjoyed working with children in all honesty. Except that the further you go away from the classroom the longer it takes to see the results of what you're doing. And that takes a bit of getting used to because in the classroom you get fairly immediate feedback. When you're working with teachers you can…they're not always as revealing as children. Perhaps being older they've learnt to keep things under their hat a bit more. It's only a bit later really that you find out from them, not just whether they've taken on what you've been trying to teach them but whether they've been able to use it in the classroom and how that's gone.

Higher Education

Two began their careers with posts in Higher education, rather than school, and a further three had been encouraged to apply for posts in initial teacher education very early on in their teaching careers as they were seen as having specialist computing knowledge which the institute needed. One participant found himself teacher training after only two years in schools:

> Yes, it was a case of tutors who I had met when I was a student inviting me to apply. And other little things had happened. So for example, after I qualified and went off into my first job, I was putting on odds and ends which involved promoting the use of IT. Because clearly it was a new thing and everyone was starting to get into it. But there was a great shortage of people who had anything at all to say about IT.

Others followed into HEI, in some cases pushed by the changing role of the advisory teacher, but very much pulled by their need or 'passion' to 'find things out'. Many went on to speak about the enjoyment of the work with student teachers and the in-service work they had carried out. They enjoyed the time to carry out their own research and a greater sense of autonomy:

> I think it's fantastic that part of my work is to read stuff, and find out stuff and so on, and that's a really positive aspect. One of the things I really like about working on the courses that I work on here, and the nature of the work that I'm doing, is the opportunity to meet people from a really wide range of backgrounds, people who perhaps are living in other countries over here for summer school for example. Just to be part of that exchange of ideas and life experiences that you get in a higher education context - I'm not suggesting that that doesn't happen in a school, it does but of course it happens in a different way.

They, too, felt the satisfaction they had always felt that as teachers they were making a difference, for example when seeing:

> some of the things that some of my students now do in terms of producing resources that actually support their teaching, using video clips or still pictures in particular programmes. Students coming back and saying 'Hey, I was able to do that.' That's something in all of us, why we teach, whether it's trainees of children that they come back and something that you've taught them, or worked with them on has actually succeeded and really done well.

However, the move to higher education involved a sense of loss and most spoke about difficulties of adjustment – much more so than with previous roles. One felt guilt 'for the first 6 months' about not being in school; two felt at a deficit in their teaching skills when working with student teachers; several felt a lack of control and creativity and others missed the more permanent nature of the relationships formed with students:

> I had this sense that being a higher education tutor was all about getting close to people then them abandoning you.

Reflecting changes in Initial Teacher Education during the 1990s one spoke about the routine nature of the role particularly strongly:

> I can't believe it I did 10 sessions a week of introduction to computers. I had a flask of tea down in the computer room because I didn't have any time for any breaks, and it was just awful, looking back. And then moving, it was 'I can't bear this any more, I can't believe what I've come down to', to be honest after working where there'd been a view of curriculum and excitement and all of this, well coming down here I was in tears for the first 18 months, I hated it. Because it was very boring and I didn't realise I had any power to try to change things.

Researching computers in education

All of the participants were driven from the very beginning of their careers to know more; to know more about teaching and learning; to know more about themselves; to understand the contribution of computers to learning. As teachers they saw it a natural part of their practice to reflect on what they were doing and the impact it was having on learning. Even if they were no longer teaching in school they all saw a close connection between research and practice, between their interest in research and being close to teachers concerns and achievements. This involved several participants with a long lasting interest in action research. However differences emerged between those wanting to continue their close association with teachers but develop their work in a more 'academic' direction – at least in terms of engagement with research methodologies and approaches to learning at a more theoretical level - and those who were more focused on practitioner audiences. Six became very much involved with finding an academic voice; they wrote regularly for academic journals, joined editorial boards, carried out larger research projects and were asked, at times, to present key notes for research conferences. Seven were less engaged but nonetheless developed an interest in academic output, at least as measured by the RAE, and three were much more focused on practitioner

research publications, newsletters and offering direct support for teachers. This range of activity seems likely to have been through a mix of personal preference and features of the environment in which they worked. Several commented that they felt it was very difficult to engage in academic research fully because of teaching work loads and here there was an added complication as they felt teaching really mattered to them and they wanted to devote their attention to it. All were aware of the different cultures of education departments; here this participant compares his institution to others:

> There are people around doing good work but they are largely in the research universities with a research ethos more inclined to say if you want to do that go on and do it but here we don't have that ethos we are a teaching institution.

What qualities did they need to develop their careers?

We can see that the environments in which they worked created opportunities to develop an interest and, in many cases, a passion for developing the use of computers in education. At the same time these opportunities would have been unfulfilled if they had not been alive to them and willing to take advantage of them. One participant explains this in terms of a door being opened:

> I mean I do try to be a reflective person and I think I do examine myself and what I do at times but what drives my career...its' probably been an adaptation to circumstances - that's not a *driver*, that's a capacity - but you know I haven't set out to be adaptable. I've also been highly fortunate in that various opportunities have come along, and I guess to some extent I am pre-disposed to say yes if an opportunity presents itself - so you know back in school I said yes to being involved in the writing of a series of text books. In a sense I said yes when the opportunity arose to become an advisory teacher, but I hadn't said to myself early on 'oh I'm going to be a teacher for a certain period of time, and then I'm going to be an advisory teacher as a stepping stone to doing something else'. I've never been that strategic about it, but what I have tended to do is when a door has been opened, and I say been opened as I haven't necessarily opened it myself, I've tended to go through it. I could have gone back to my job in school full-time at the end of my secondment but actually I said no, I'll give the work at university a go.

What do comments like this tell us about the way participants developed their careers? First, they were prepared to try things out – to learn by doing as illustrated by this participant talking about using computers with pupils for the first time:

> I went into one of these [schools] where my wife taught and met the head and I always remember … I got the kids sat on the floor, I got the machines on the table and the monitor for them and just got on with it.

All accepted a sense of responsibility for their own development and did not mind taking a lead. They were amongst the first to use computers in schools, they were instrumental in setting up networks, in designing new courses and in research groupings.

Second, in learning by doing there was a willingness to take calculated risks. These risks were rarely dwelt on so that there is a 'matter of factness' in their accounts of doing something for the first time, taking on something they might not know a lot about, or moving jobs. However, many did take career risks, accepting short tem contracts for example, and worked in insecure environments. Some faced funding crises of one kind or another and around half the sample had difficult periods in their careers in which their futures were uncertain. Four expressed frustration over changes in their institutions which had made their roles precarious. Most recognised that they lost out financially by moving out of school.

Third, running through the accounts was a sense of being driven both in their teaching and their commitment to 'working it all out' for themselves. There are many examples of this in their accounts, for example their willingness to take computers home and learn how to use them in their free time, working late to develop bids for funding, finding time for writing and taking higher degrees. As one put it 'you clearly had to do a lot of learning yourself. And the way to do that in your own time, weekends, things likes that'.

Fourth, in developing their work with computers all were instinctively collegial, something we consider in the community chapter in more detail, and looked for opportunities to work with others, in and beyond a single institution. For example, they describe developing and maintaining research networks, sharing ideas, offering practical help.

High points and low points

Not surprisingly, high points in participants' careers often brought together collaboration, flexibility and creativity. As one comments in recalling an in-service course he ran for teachers:

> It was really an extremely good period of time. We weren't telling them the answers, we were trying to work out together what the potential was. We were teaching …doing programming and all the rest of it so that gave us quite a lively environment in which to develop ideas really with three or so staff here and plus 12 – 16 teachers all with the same interest, same agenda.

In contrast low points, and we failed to find anyone who had serious reservations about the choice of career, included feeling thwarted by controls over the curriculum, over their working practice, over the scope for innovation in schools. Nearly all spoke of their satisfaction with their work but a recurring theme was a disassociation when their concerns for autonomy and for collaboration were not addressed. This is expressed by one participant here looking at the difficulty of team work in a new environment:

> But now, trying to use that team to build complementary skills, we were forever thwarted by bureaucracy. And then I tried to do the same when I came here, but the halcyon days of team work that I remember have gone … I perceive that in formal education now there is a closing down in favour of a conformity to a particular way of working. That is very evident everywhere.

As we explore in the policy section low points tended to be associated with the more recent past and high points very often early points in their career. Is this a case of experience tempering youthful enthusiasm? Often they recognise that their early careers were particularly exciting - it was a new field, they were new to their roles. As this speaker noted:

> I think as you get older is the realisation that there are things that you are just not going to be able to do, it does actually dawn on you. Whereas when you are younger you think everything is possible.

However, the participants continued to be motivated to explore new technologies and took very seriously the idea that there has been a closing down of educational innovation in the more recent past.

Summary

This chapter gives an overview to the careers of the participants and introduces the major themes of this book. The participants describe their early association with computers. Often this fits a pattern of awareness of technology; perception of its opportunity and application in an educational setting. Their careers are products of an interaction of person and environment. We can see a great deal of consistency in their attitudes of technology, their motivation to teach, to work with teachers and to reflect on teaching, but there are contrasting roles and different types of commitment to research activity. These have been satisfying careers in many ways which have engaged participants' imagination and creativity, though they have also felt thwarted by institutions and policy.

This chapter leaves many questions unanswered which we will return to in the following chapters:

About technology:

Can we identify what has been gained and lost, particularly in the development of software, during their careers?

About application

Why is the introduction of computers so problematic?

About philosophy

How do beliefs about teaching affect the use of technology?

About policy

How has policy helped develop and helped constrain the use of computers in school?

About community

What are the achievements of the research community and what are the challenges?

3 Technology: le plus ça change, le plus c'est la même chose

This chapter looks at phases in hardware and software since the introduction of the first mainframe computers in the 1960s and participants' reactions to those changes. It describes the associations made with each of these phases and looks at the challenges arising from the changes in the speed, storage and connectivity of machines.

Phases of hardware and software

Participants sense they have lived through phases in hardware and software – though these phases merge into one another ('they come and die away'). In order participants highlight: exposure to early main frame computers and early programming up until the end of the 1970s; the introduction of the micro computer and development of small programmes (late 1970s – end of 1980s), with some detecting as a further phase the introduction of Windows graphical user interface in 1991; and a final phase with the rise of schools networks and the application of the Internet in schools in the mid 1990s. While it is useful to consider technology in this way participants did want to add a number of caveats. First, these dates are not precise and there was a time lag between the introduction of a new technology and its exploitation in school. Second, there was so much going on that it was difficult to pin down just how to characterise each age (for example, is today the age of the Internet or the age of the IWB?). Third, it was very difficult to talk about technology without considering parallel developments in policy and in pedagogical thinking.

Early mainframe computers

As we have already seen in the previous chapter some of the participants could recall using mainframe computers and writing short programmes using punch cards either as part of their first degree or through short courses studied at university. Popular higher-level programming languages at the time were *FORTRAN, LISP, COBOL* and, later, *BASIC*. The process of programming was a laborious one, algorithms could be designed, coded and often sent away to be processed with the result returned perhaps a week later. The technology of the time seemed rudimentary and unreliable compared with today's machines. One participant remembers the problem of over heating valves in one HEI:

> This was a computer with valves. We were putting paper in it and it was not working and the technician walked in and opened two windows and walked out and said, 'it is OK it is too hot in here and it will be alright in five minutes!'

However, the technology was judged against what else was available at the time. Two, in particular, enjoyed the experience of programming which gave them an early awareness of the power of the computer to process a set of instructions quickly. They looked to develop programming along with computer studies in school. In contrast, most participants lacked this early exposure while several others recalled being put off, this participant remembers:

> I'd done a bit of computing at university as well, I did a bit of *Fortran* programming on punch cards and I was bored by it, and I got my boyfriend at that time to do it for me. So it wasn't the programming that interested me at all!

Micro computers in school

For all the participants the introduction of the micro marked the first decisive moment in the use of computers in school. The new machines offered immediacy and interactivity and allowed much greater complexity in use of graphics. Participants recalled their first use of machines such as the Commodore PET and Sinclair ZX80. For the first time there were widely available computer magazines aimed largely at young people with sample programmes which users could copy and embellish. Teachers' centres and professional associations also published small programmes in code for teachers to copy and use in school. A key technological breakthrough at the time was the introduction of disk drives and the move from cassette tape to floppy disc. Several participants, as below, noted the unreliability of tape:

> The cassette recorder turned off a whole generation of very frightened teachers, because it failed so often in the classroom. They put it in even before it was anywhere near reliable. When we got disk drives the world changed, but you'd already lost a whole group of teachers. It was a long, long hard job getting those back in again.

The introduction of micro computer and reliable storage devices provided the opportunity to shift the concept of educational computing from programming, within specialist computer studies lessons, to using computers to support the curriculum using prepared software. Of course curriculum application did not begin with the micro. Some participants were experimenting with simulation programmes and testing possible storage devices long before this.

A common experience for many of the participants, if they were teaching in school, was being faced with one or two computers and wondering what to do with them. In response, as already seen in chapter two but expanded upon here, they developed their use of programming, *Logo*, simulation software, and content free packages.

Programming and Logo

While interest in programming per se is rarely mentioned outside of the two participants who had a special interest in mathematics and computing as a subject, *Logo* remained an interest for several. They saw it as a deeply engaging context in which children could learn generic

problem solving, alongside some mathematical content, in a playful context. Implicit here was that use of *Logo*, with its 'low threshold and high ceiling', was a qualitatively different to other programmes. Participants talked about their enjoyment of seeing pupils 'programme' each other around the room as a preliminary to on-screen work with the turtle commands and of giving what they felt was control to pupils over the computer. One, in particular, was strongly committed to the vision of *Logo* offered by Papert, while others saw it as one very interesting application of computers amongst others. *Logo* however did not provide a consistent response from participants and some saw it as very much a minority interest; as put by one participant, he 'simply did not get it'.

Content free programmes

Participants used a variety of content free software designed for schools in primary or secondary contexts. Programmes mentioned included *Branch*, a sorting programme, offering a first step in the idea of artificial intelligence, often use in primary school; *Grass* data base; *Cricket Graph* - a data display programme for Apple machines; and the spreadsheet *Grasshopper*. Those with an interest in science education became interested in data logging. One had extended experience of *HyperCard*, an early mixed media database for the Apple Macintosh, which gave him an introduction to the idea of hyper links. Word processing was perhaps the most obvious application of content free programmes in the classroom but was not used as extensively as might have been given its growing role in office and for personal use. Participants were excited by the possibilities but early word processors were often unwieldy and needed rudimentary coding or tag-based markup for document formatting. Two had experience of using the Amstrad PCW 8512, a dedicated word processor produced in 1987, which became quite popular for a time before being superseded by all purpose personal computers. A further two spoke warmly about *Scoopnet,* a newspaper front page simulation programme and the text revealing programme *Developing Tray* was spoken of with great enthusiasm by three participants.

Simulation programmes

Many programmes were mentioned which were aimed at modelling real life contexts, allowing the user to interact with the software and to draw conclusions from the output. Along with *Eureka* mentioned in the introduction participants recalled some of the MEP software. Another recalled a snooker game in which you could alter the speed and direction of the cue ball and an archaeological simulation called *Dig*. A further programme *Droplet* simulated the passage of rainfall through the hydrological cycle and, like others, contained a randomising element in it so that the user would get a different output each time the programme was run. Much later the sophistication of simulations was enhanced by the use of multi media - first in the form of interactive video discs and then as CD ROMs. One participant recalled involvement in the IVIS project and drew attention to the use of different media to enhance the sensory range of learners. Interactive video was costly and time consuming to produce and

a step change in the use of multi media came with the capacity of computers to handle digital images and film.

Testing and designing programmes for the microcomputer

The introduction of the microcomputer created possibilities for participants to design, and help in the development of, software for schools. For some this kind of work predated the micro computer but not surprisingly the introduction of the micro created further challenges. Here one participant recalls the impact the micro had on programme design:

> All the work that done to that point had been for teletype terminals. An example of one that they'd written already was throwing a stone from a mountain top. How fast would you have to throw it so it hit you on the back of the head when it came back around the earth again? To simulate that they would show numbers that showed the stone's altitude as it was thrown through the atmosphere. When it came to writing it for a microcomputer we had the opportunity to show it going round a sphere on a picture. Immediately we were into a new realm of complexity.

The technical limitations of storage meant that only small programmes could be developed – ones which made rudimentary use of graphics and sound – but this had the advantage that coding could be carried out by small teams of enthusiasts and could be amended quickly. Very often there was a close connection between teachers and designers and between designers and coders. Seven of the participants had an involvement in creating software, either by trialling programmes produced by colleagues or, in three cases, becoming closely involved in their initial design. Some of the participants had coding skills or background technical knowledge but for most it was their pedagogical knowledge which was sought. One described the set up in which she worked:

> So it was this sort of little group of teachers with computer programmers, who were actually their own former pupils and they were doing really well but they decided that they needed someone with more pedagogic knowledge who would handle the trialling of their software and input into the design…. We developed a whole series of titles. Water balance in plants, cliff erosion, a programme called fishing, something called menstruation and pregnancies. So there were a group, I was heavily involved in some of those in trialling them in classrooms.

A further participant taught on computing in education courses and helped teachers develop their own programmes for use in school and which were later sold to other schools. Two had some involvement with the MEP software mentioned earlier.

The PC goes GUI

A follow up phase in the pre internet days of the microcomputer began with the introduction of a graphical user interface (popularly known as Windows) as a replacement for the less friendly command line interface for the PC. In one sense the introduction of a GUI should not have made a big difference to education but, coupled with other developments, it was the

spur schools needed to go PC. Of course, Apple Macintosh and Acorn Archimedes had already introduced a GUI. However, PC compatible machines (i.e. ones running the Microsoft operating system) were widely used in the home, were the dominant platform in industry and came to permeate schools. This take over was viewed differently by participants; some saw it as long overdue and one felt strongly that the split between educational computing and mainstream industry 'held the development back in the late eighties, early nineties for sure'. In contrast others felt the Acorn machine was ahead of comparable PCs at the time and was 'a really wonderful computer to learn on, it was brilliant.'

Whatever the merits of this move, it meant that schools would increasingly use commercial software such as *Word, Excel* and *Access* rather than equivalents produced for the educational market. Again, this was as resented as it was welcomed. Important in this transition from small programmes towards general purpose software was the introduction of the National Curriculum in 1988. In addition, the growing capacity of machines allowed much more sophisticated and expensive programmes to be made which only more commercially minded producers could manage. The close link between teachers and developers was being lost and this was marked with regret by all participants. One summed up:

> We lost an age when …there was something enviable not only about the software but about the relationships between teachers and designers and the input and the idea of educational software. Of course those same programmes can quickly re-appear and some are easily available but principles behind it are lost.

Several went on to mention programmes such as *Suburban Fox* which were no longer being used:

> We had a programme here called *Suburban Fox* and it was about how the fox survives in the city. It was simulation. It was written about, and people raved about it at the time, but once the graphics moved on it looked very dated and it got dropped. And if I take you though 30 or 40 programs of the 1970s… it is still conceptually sound but if you see some of the software today it is orientated around what you can do in a sort of Windows environment or in object oriented programmes but it has lost that teacher input.

Another noted the shift to a 'more business' perspective:

> At the end of the 80s when computer applications such as word processors databases and spreadsheets became increasingly prevalent, there was a shift to a business perspective, which has been endured ever since. It has gone up and down in the degree in which it is articulated. All I'm saying is that that has become predominant we have completely lost some of the stuff I was talking about.

The networked age

A new phase of educational computing came with the networking of suites of computers and the introduction of the Internet. This re introduced a preoccupation with content (what should teachers produce for learners and what children should pupils be allowed to access?) and communication (how should children present ideas and to who?). Participants reported on the technical issues involved and tensions with IT services departments in their institutions. However the trend felt unstoppable. Communication between learners across and beyond schools was now centre stage. As one explained:

> So the paradigm today is its all about expressing yourself, so I guess the modern paradigm IT as a medium of self expression, if it's anything.

Several spoke about discussion forums and support for teachers including the international network Teachers.Net and Mirandanet. On a much smaller scale one recalled linking schools within his ITE partnership using *First Class* conferencing forums and occasional video conferencing to contact trainee teachers in partner schools. One recalled a networked space for pupils Think.com which she saw as an educational forerunner of social networking sites. New forms of electronic communication allowed practical sharing between participants and, at a deeper level, encouraged members to articulate ideas and be challenged by others. However all were aware of difficulties with forums no matter how organised. Teachers had legitimate concerns about the lack of reflection in some contributions and felt a need for moderation of content. As one participant pointed out teachers needed models as to how they could promote forums with pupils yet teacher forums themselves were susceptible to *flaming* and anti social practices. Similar issues were raised in the context of using and displaying information over the WWW. Participants felt that schools were often much too over protective and denied pupils access to many valuable sources of information. However, the worry over unfettered access was legitimate and children often lacked information processing skills. Rather than being an age of communication there was a danger of pupils become uncritical receivers of content.

While this was the age of networks participants were aware that it was also the time of large scale introduction of IWBs in schools. Of course the two were not unrelated, teachers could acquire resources from the Internet to use with the IWB but with IWBs the focus shifted back to the teacher and his or her interaction with the whole class. Feelings about IWBs were mixed. Some worried about encouraging more didactic teaching through overlong presentations while some felt that used well the IWB was an 'incredibly powerful, useful recourse'. Again it depended on how it was used.

What about the future?

When asked to talk about future applications of computers in education all commented that this was very difficult. They had not been very successful in their predictions in the past. However in terms of technology they suggested that mobility was going to be a key feature

and this would offer opportunities for creativity, personalisation and support for out of school learning. One saw the possibility of:

> distributed cognition in that sense is to have access and to collect and collate and manipulate and I hope that's the way it will go in the future. So that it is more creative and playful and exploratory. Yes that's how I hope we would use the technologies in education in the future. And that the design becomes much more accessible and cheaper, yes. Rather than in suites where you go and worship stuff. So ubiquitous, tangible stuff that you can use in as and when, I hope that's the way it would go.

As we discuss in more depth later future scenarios carried worries as well as opportunities and the future of educational computing was very much in the hands of policy makers and practitioners:

> It is both incredibly liberating in terms of thinking about what the future may hold and incredibly sinister. Because you can see how that can be misused as well. And I don't know, I'm not entirely optimist about the future technologically, nor am I pessimistic, I'm somewhere in the middle ground. You know, a typical liberal position I would guess. With responsible management and behaviour we could have a good world but you know, human history tells us that people don't behave particularly responsibly.

Making sense of developments in technology

One of the most striking features participants noticed about developments in hardware and software was the rate of change. In a short time span participants moved from working with costly mainframe computers, to chunky micro computers, from tape to more reliable storage, from Acorn to PC machines, from analogue to digital images, from stand alone to networks and now to wireless hand held devices. Software has encompassed programme such as *BASIC*; small DIY programmes; large industry scale commercial packages; multi media authoring. Rapid change had in many ways attracted them to exploring computers in education but, not surprisingly, such change posed challenges and was wearying. As one summed up:

> I just think that technology is moving, it makes me feel almost sometimes like I'm running to stand still. I could, if I didn't have anything else to do, spend all my time learning and playing and finding out how to do things and so on.

Each technological development required thinking about pedagogy (what has this to do with education?); acquiring practical knowledge (how does this work? What can / cannot it do?); and offering a view of its use to teachers. As we see in more detail later, participants held on to remarkably consistent beliefs about teaching and learning throughout their careers but they did so within contexts which were forever shifting. These shifts were not driven by new understanding of pedagogy, but by technological innovation itself, and this deprived participants, and education at large, of a coherent narrative of what computers in education was all about. Technology appeared in school because things were now possible (e.g.

discussion forums and VLEs) and had become affordable (IWBs). Things were dropped because they were no longer fashionable (*Logo*) or economic (small programmes). None of the changes were leading to a more reliable infrastructure as expectations of technology were always relative – except perhaps, in retrospect, nothing could compare for unreliability as the cassette tape.

A second key refection on the use of technology in education was that, no matter the pace of change, schools were invariably running behind the changes in the outside world. It was, as one observed, an astonishing world we lived in where you could now, for example, carry around a single portable device to view the WWW, the phone, to take and send pictures, to listen to music and watch film. The Internet had transformed commerce and social activity but, in contrast, schools were recognisably similar to how they had been when participants had first started teaching. As one observed:

> So actually in the wider society it's led to kind of, the music industry on its knees because there are people like me who don't want to go and buy albums anymore. The travel industry has all been upset because people don't need travel agents anymore. All these things are a transfer of control in incredibly significant ways, to people. So it absolutely has to be is that the crucial question has to be, why is this not having the same kind of transformative impact in schools?

Summary

This section has looked at changes in hardware and software that participants have experienced and how these have constituted phases in the introduction of computers in education, even if each phase cannot be clearly defined. It describes what has changed (hardware, software, what has a high profile) and what has stayed the same (participants beliefs about teaching and learning, the nature of schooling). The chapter helps explain the mix of optimism, pragmatism and scepticism with which participants viewed the application of computers in school (as developed in the following chapter) and how they viewed government policy (as developed in chapter 6).

Our key question for this chapter was 'can we identify what has been gained and lost, particularly in the development of hardware and software, during their careers?'

What has been gained has been astonishing increases in storage and speed of processing, in connectivity, in the use of multi media and consequent opportunities for enhancing the nature and range of communication and information. What has been lost is a distinctive educational feel to the development of the technology. Not just the software but a way of working with teachers and of responding to teachers.

4 Application: a labour of Sisyphus?

This chapter looks at the application of computers in school and in education. It reiterates the idea that computers found their way into schools without a clear rationale. It looks at what the 'desirable' application of computers in school could look like and draws out the factors necessary in order for this to take place. These factors are key to understanding why curriculum change with computers has been slow. Some thoughts on the future development of ICT are given.

How did computers get into school?

The application of computers in schools has always been problematic. This is hardly surprising as *new* technologies are necessarily unpredictable, but participants repeatedly see a lack of preparation in advance of their use in school. In the early days teachers were expected to work with computers when the hardware was unreliable and only a very limited range of software was available. As this participant recalled:

> I started teaching in 1970 in Primary schools. The first time I was really involved in any computing was when the BBC's arrived in school. I still remember because there was all this talk about all this money and I remember that whoever the secretary of state was said that 'we need children to grow up knowing about technology for their work and jobs and so on. And that seemed to be the rationale. But nobody for weeks seemed to actually know what to do with these things. They sat in boxes…

The same participant recalls 35 years later:

> An ex student phoned me and said 'would I be willing to go and do some Smart Board training for them at their school'. They've got ten classes and there was a Smart Board with an attached laptop in every classroom and they'd been installed nearly 12 months and only one of them had been used in that time. Now that when you think that each system is probably two and a half thousand pounds, they'd been standing idle because somebody had decided that they'd put them in but again there was no support or rationale, no discussion.

While this creates obvious difficulties for schools it gave rise to many opportunities for the participants and, of course, for others wanting to use computers. They could start from a blank page, could take risks in using computers and could use the computer as a catalyst for thinking about teaching and learning. In short, they could work out the desirable application of computer for themselves. But, what was desirable?

The 'desirable' application of computers in education

Firstly, desirable use of ICT often supported activities that went beyond the routine and set children a challenge, as this participant commented in talking about using *Developing Tray* with her pupils:

> With those sorts of programmes the answers aren't there, you've really got to work them out. And that seemed to me to be….and I saw in the children, you could almost hear the wheels going round in their brains because they were really having to work hard at doing it but they were really motivated to do it as well, it set a challenge for them.

Secondly, the desirable use of computers involved the pupils in doing something they would find purposeful. In this example pupils are given a role and their products are being created for real audiences:

> The project that followed was Tesco funded and was called Tesco School Net 2000 and was the two year run up to the millennium. We had children be journalists and write up stories and make web pages about them. It took place in primary and secondary schools. Hundreds of thousands took part.

Thirdly, desirable use involved communication. This could be communication within teams (for example unravelling text in *Developing Tray*), between teams (as in developing short films and uploading them onto a web site) and across schools.

Fourthly, in desirable application children were given an element of control, they had choices in the decisions they took and could see for themselves consequences of those decisions; they could retake steps if they liked. It is:

> giving them an opportunity to enquire, which is where I like the idea of enquiry based learning and using the Internet for that kind of thing. It's not for doing things that you could do easily in other ways. And so much of what we've seen over the years has been of that sort.

Fifthly, several went on to emphasise a game like element in desirable application, for example, early simulation software had:

> the word I'm thinking of is a 'playfulness' about it. Because I'm thinking about things like the Mary Rose and the design and technology pack and stuff like that.

Put together desirable application often carried a sense of 'extension' and 'enhancement'. Extension at its simplest could mean offering the teacher different ways of explaining something, for example though the use of multi media projected on an IWB. In terms of pupil activity enhancement could mean giving pupils greater control and more enjoyment. Several felt that enhancement came about when you could not (easily) 'do it' otherwise and pointed, for example to the possibilities opened up by digital storage and the speed of processing. One

coupled enhancement with 'widening the sensory range' not simply in terms of different media, though this was a recurring theme, but also in the accessing, and communicating, of data across distance. Enhancing carried for most participants the idea of changing the curriculum – both the content of what was being taught and the range of teacher and pupil activity.

Desirable application could be recognised when children were *engaged* - a loose word often used in the sense of capturing attention and being productive. One participant describes how children became engaged in writing poems supported by word processing and relates this to the Csíkszentmihályi' s idea of flow:

> And so we would put a poem in a particular genre and then they would go away at the word processor and come up with their own to try out on each other. And those sessions you had to beat them off with a stick to go away at the end. They would have stayed there for hours if you let them. I think looking back on it now it's the first time I wanted to use the term 'Flow' of absolute attention to the task with no idea of how much time was passing, being absolutely in the moment. Those are the kinds of things that ICT gives you that are very difficult to do otherwise.

The idea of desirable application becomes clearer when set against the undesirable use of computers. Here activities were often designed solely to develop computer skills, did not extend and lacked purpose. One participant recalled the dry, didactic teaching about computers in the early computer studies courses he taught. Several commented on routine word processing lessons. This participant observed a class in which pupils were making posters using a desk top publishing programme but there was no audience in mind and hence no discussion of fitness for audience:

> The question I asked them was why are you making a poster? The problem with this sort of discussion is that there is another question Which is: if that activity of making a poster in *Word* has got no real meaning, then why are you doing it?

Is teaching of the subject undesirable?

Very often lack of purposeful use was associated with the teaching of ICT as a subject or the timetabling of ICT in computer suites. One noted the prevalence of skills based approaches in ICT as a subject:

> The one thing I have kept up all this time is supervision of school experience, I have been into primary and secondary schools but if I see another disco spreadsheet I will scream.

Another lamented the routine use of packages in ICT lessons in a school with which she was associated:

> They don't teach ICT, they don't think it is necessary they teach word processing and spreadsheets, I don't consider it ICT, I say you should be teaching, handling information, modelling, analysing, communicating information, they look at me as if I'm mad.

No-one specifically said that ICT should not be taught as a subject, even if this was implied by one or two participants particularly when stressing the cross curricular use of computers and the constraints on other subject teachers wanting to access machines. However most felt the problem was one of sticking too closely to schemes of work provided by agencies rather than the idea of the subject itself. Schools should be teaching capability (the purposeful use of computer skills to solve problems) rather than skills. In addition, two out of the participants wanted ICT as a subject to have more computing elements to it and saw the teaching of programming as being both academically challenging and worthwhile, not simply defended in terms of vocational value. Another supported a much more rigorous approach to modelling and saw this as the key to unlocking the subject.

What makes desirable use of computers possible?

If we know what desirable application looks like, what needs to be in place to bring it about? Nearly all participants held the broad view that the use of technology was neither good or bad in itself it all depended on the use to which it was put: hence the role of the teacher was crucial. Of course the teacher needed to be resourceful in accessing facilities - in the early days this sometimes meant 'strong arms' as participants recalled carrying equipment to and from classrooms which they knew would not appeal to many colleagues. Organising access meant negotiating with coordinators and support staff. It meant managing pupil access to machines in the classroom and had implications for whole class teaching. But none of this was any good without the confidence and pedagogic insight to 'frame' an activity which would provide purpose and engagement for pupils and the confident to intervene as required. You could not rely on the software to drive the activity:

> And that the crucial thing in application was the way that teachers interacted with the software. So it's what I later called a kind of framing task if you like. It has to be set up with some kind of reasoning, it has to be embedded to show the before and after, and the teacher has to be not interfering all the time, but actually be aware of what is happening.

While the teacher was needed to frame the activity he or she needed to adapt to events in the classroom, teaching was necessarily unpredictable and using computers meant trying something new and therefore risky. Teachers needed to accept a level of risk and do this in a public space. One participant recalls her first attempts at teaching word processing and illustrates the value of learning by experience:

> I was given a word processing manual, no computer mind you, and told you teach them word processing on Monday and I spent the whole weekend doing flash cards with 'Save' and 'Edit' things like that and then of course on the Monday the children whopped past me and started to use the key boards. And I said 'stop, stop I don't know what you are doing' and it was in that period that I saw a complete change in what children actually do when left to their own devices. And when the teacher actually knows less than the children and eventually after about four weeks of this one of them said 'I am bored' and I said 'I am bored as well but at least you have a computer but I don't have one, what do you suggest?' and they said 'before we did this, we were doing a magazine with you and wasn't what this is for and the moment I got to that idea all this business of teaching skills went out the window.

This idea of knowing less is an interesting one, the teacher needs to know that children have certain skills, and often may have more skills than they themselves have, but as in the above example this does not mean abdicating their pedagogic role. This point re-emerges when talking about social networking and online games - applications widely used by young people but rarely used by most participants. One notes about game playing:

> And I think there is less to this than meets the eye because it is still avoiding the purposes of its use and the difficult questions about how do we conceptualise learning in the twenty first century. You know, just playing games I know raises important questions about hypothesising and planning and what have you but the victory narrative that is ascribed to games I think is getting us off the hook a bit.

The teacher then is seen as the key factor in the desirable application of ICT as one summed up 'it is not the technology, it is people that matter'. However the technology was important and not surprisingly another key factor was access to reliable hardware and appropriate software. Cassette tape did not offer reliable storage, hardware was often seen as unwieldy and there was too little of it. Some of the software was similarly unchallenging, especially the early drill and practice programmes and, later, ILS which was seen as 'deskilling' teachers.

Providing training and support for teachers

Given the barriers and the need for pedagogical understanding, teachers needed training and support. LEA advisors had a key role in helping teachers share ideas across schools and to act as an intermediary between teacher and expected practice. A constant criticism was the lack of support for teachers; money invariably went into equipment rather than training. Some could find examples of good practical support though very often this was achieved through unconventional means:

> One school I know they'd taken on a parent helper and she's got a little bit of an interest in computers but they developed her and sent her on courses so that she at least understood all the hardware and whatever so she could sort out initial problems that would happen. But she was involved in the planning, she was an integral member of the team, she understood what the school was trying to achieve. She was available

> whenever a class went into the suite, working alongside the teacher, to support the teacher all the way through so that it meant that it did away with a lot of the fears the teachers had because they knew that there was somebody there to support them. And that's really important. But some schools haven't quite twigged that yet.

Teachers needed to work to an appropriate time frame; they would not get it right first time:

> After the technology goes in, you get a dip because teachers are so busy with the technology that they actually close their practice down, they are less innovative. Once they have controlled the technology they can expand and go on.

This often meant it was important to work with what you had, and what you knew, rather than chase new technology - the latest developments may offer less than imagined:

> There is keeping up, and also there's the problem of the red herring. Bits of technology that come up and we pursue them to see what happens and it fizzles out because we thought they were a good idea so there is always this bit about all needing to keep up with the latest thing and then we actually find out that we wasted effort.

A sensible time frame could create a virtuous cycle in which a department started with a modest aim, succeeded in that aim and found the confidence to take the next step. This participant recalled a department that began with digitising images as they were short of textbooks, not a ground breaking move but something that led on to other things:

> But they found that once they got into it that it took on a life of its own because people were beginning to use the resources that they were collectively developing and finding that they were going down so well that it motivated them to do more with ICT.

The disappointing impact of computers in education

Nearly all the sample were agreed that that there were many examples of desirable and inspiring use of computers but overall impact was not as great as they thought it would be when starting out:

> I think the thing that would surprise me is actually the slow rate of progress. You know if I think where we were in 1980 and I now think we are 20 plus years on and really how is the classroom radically different now? How is the teaching radically different? Really I would have expected far more progress in that time scale? We are still talking about how we engage more teachers, how do we manage the resources.

In contrast a minority of participants held a 'glass half full' perspective:

> So you know, why should we expect it all to happen quickly? Why should we expect sudden impact. You know, the pace of uptake of this innovation has probably, despite everybody's complaints about how slow it is, has probably been faster than anything else ever!

The idea of impact is a difficult one, but key was supporting changes in teaching and learning and not just the introduction of technology per se. In fact a lot of technology had entered school:

> Every school you go into these days has got a significant technological element, obviously secondary schools pretty much are on the internet and do make regular use of it. Every secondary school will have several clusters of computers some schools will have hundreds of computers, so there isn't an issue about schools embracing technology, and interactive whiteboards and this that and the other. What I think is the problem is the slow rate of change in embracing a different model of knowledge.

This is reinforced by another participant comparing local resources to those he had seen elsewhere in Europe:

> I thought ICT would be here but I certainly didn't think we'd have computer suites in my local primary school and smart boards and white boards. You know, a week ago I was in Germany and there was ICT in schools, one computer that was in the staffroom, for the staff to work on. There was none in the classroom at all. No whiteboards, nothing like that.

Why, then, was it going wrong? A key concern was that in different ways schools were, to use a much repeated phrase, 'locked down'. They were controlled in what they could teach and in what they should assess. Learning was further bounded by an outdated delineation of subjects. One participant gives an early example of curriculum control constraining teachers:

> There were a number of times where things became a little down…around about then 1989, when I was teaching an MSc course when we'd had a wonderful evening with the teachers, absolutely tremendous evening. We'd done some really good stuff on spreadsheets and we'd really been enjoying ourselves. I said to one of the guys I was working with 'You gonna try this out on Monday morning?' He said, 'No, it doesn't match the National Curriculum' so we could get over all the technical problems, we could solve all the other problems, but that was a real put down.

Another participant reinforced these concerns over curriculum control but saw, that in a wider context, the tide had gone out on the kind of progressive ideals associated with his first use of computers:

> But certainly it was obvious to me, around about '86, that the Logo paradigm didn't really have much of a chance, because the influence of progressive views on daily classroom life was quite small, and in fact what happened by 1986 it was quite obvious that the concept of having a computer room in the school where children were allowed to be fairly self directed in their playing with *Logo* and turtle graphics was simply never going to happen. Leaving aside equipment problems there is the mindset of the teacher and schools.

A common refrain was that while technology had had a huge impact on leisure and social activity in general, schools were not keeping pace:

> And nothing has changed except that divide has got more profound, I think, and we are just giving prescriptive education in schools. But the things that are really important to kids, the real experiences that are going to impact on their lives happen elsewhere. And that's going more so for me, not less so. So schools in a sense are just not keeping up with the changes.

Participants were careful not to blame teachers for this. Two, for example, emphasised that schools were a moral force in a society in which there were terrible examples of discrimination and fear. Schools were important to address disadvantage, as one recalled in her early teaching career in London:

> When the heating broke down and they should all have gone home why did many children stay in school? Because their homes would have been colder and more bleak than what was going on in our classroom that afternoon. And there wouldn't have been parents at home for them, you know. And I came up against a social experience, should I say, I came up against class, deprivation, an urban environment and political systems, political realities.

In spite of this recognition, exasperation with schooling crept into several comments:

> And I think secondary schools, we really have a problem. Not all, some are wonderful, but its very hard for them to be wonderful. In general teenagers are treated as if they were idiots they are really put through regimes as if they were in a prison they're told what to do, you can sometimes go past a classroom and you hear patronising voices talking to them, no kind of challenging language, low level language, boring tasks, …..and that's really frightening. My granddaughters say to me 'they really don't like us at the school, I don't think they like us'.

In-service training and CPD – a means for developing desirable use of computers

While there were serious constraints on teacher development, in-service training and CPD could help support teachers through change. However, the training needed to be appropriate. First, CPD should be focused on pedagogy as well as technology. Most HEIs and most LEAs offered a range of skills sessions but while these might have value they did not prepare for the application of computers. However, getting the balance between skills and application was not always clear:

> And in a way I could break that down to if somebody's going to use a new computer application then training in how that application works is sufficient to enable them to use it, but they need education in order to be able to make effective use of it. And I think that you can use different techniques depending on what you're trying to do but that we haven't always been very good, and I include myself in that, at discerning the difference.

Second, teachers should be given the time and space to think their application of computers through. Good CPD hands over to teachers. It 'does not tell them what to do' but encourages them to apply principles of teaching and learning for themselves. This participant tells a story against herself:

> One of the teachers on the course said that she'd really like to do some work on databases with her children but that it was going to be difficult to do with one computer, so could she arrange to bring them into the centre and use all our equipment? And we said yes no problem. I was shocked when this teacher brought her class in to find that she did as a lesson with them exactly what she had done in one of the training sessions. And I was thinking 'well this isn't right because we didn't design that with children in mind'. We'd designed it trying to make sure that the teacher understood how the programme worked and have some insights into it, rather than having any specific subject objectives connected to it. And that was quite a salutary lesson and that quite changed the way that we approached INSET after that.

Third, CPD needs to engage teachers in using ICT in the classroom and reflecting on that use, it should not be seen as a one off event – though many could remember offering just such events!:

> So its not the one-off day course that we all used to run where we take people out of classrooms and showed them something or other and filled them up with 32 different things they could have done with it and send them back with no time to engage with it. It's much more about a longer process of CPD where people are given a time to explore something and try it out and exchange with others.

Fourth, the change process needs to be supported in school and this is easier if this is done as a team and supported by senior management in school. Sometimes, as one observed, teachers needed to be told to use the computers:

> We started looking in terms of INSET where there might be sticks in education that could be useful in order to get teachers going. They weren't resentful about it at all because they were saying that actually having to do it has made all the difference. There needs to be some kind of collective understanding and collective support because if you're going to insist that people do things in a certain way, you've got to make sure they know how to do it and that the support mechanisms are there.

Fifth, CPD needed to be responsive to teachers and this often required differentiation of needs. This was frequently discussed in relation to the shortcomings of NoF training:

> So we've got ICT coordinators who've got loads more experience and understanding of ICT than many other people still going through this course and berating it all the way because they don't need it basically, it's not doing anything for them.

Future application of computers

In the previous chapter we mentioned some future scenarios for the use of computers, but how hopeful were participants about realising curriculum change? There were contradictory feelings. On one hand, the disassociation of school from changes in society was becoming more and more marked and perhaps this meant we were reaching a 'tipping point' leading to a less regulated approach, more collaborative learning, and new forms of assessment around the use of computers. On the other hand, participants could see that even applications such as word processing, which were long established and universally seen as useful, were not being used to anything like their full potential:

> But above all, they (*teachers*) need, what I needed when I had my first word processor, they need a sense that what they're doing is purposeful that it's going to be useful, that it's going to make a difference to them and their students. And how can any teacher feel like that, how can an English teacher feel that it's a good idea to get all their kids to write essays on a computer so that they've got the power of being able to create text with internal development rather than just …. how can they seriously do that when as one English teacher said to me three months ago, I've got to do two timed tests a week in the three months going up to GCSE's and they're going to have to do the exam in handwriting.

Summary

This chapter has looked at the application of computers in school, the opportunities participants saw and the difficulties they experienced and observed. It discussed both desirable application of ICT and desirable types of in-service training. It drew attention to the nature of schooling and binds the development of computers to pedagogic as well as technological change.

We posed the question 'Why is the introduction of computers so problematic?'. The response is that participants see a complex interaction of factors involving individual teachers, hardware and software, school and policy decision. There is too little clarity and shared understanding over what we want computers to do and how we can achieve this.

5 Philosophy: a coming together of technology, application and learning

The previous two chapters have looked at developments in technology and what these developments seem to offer for teaching and learning. Technology in school had changed dramatically in nature and scope but this had not had the expected impact. This chapter brings together ideas about learning, about teaching and about technology. We begin by exploring participants' ideas about teaching and learning in more depth, we look again at desirable application, and, finally, ask 'where do the computers come into this?'.

What is learning, how do we learn?

Underlying ideas of desirable application are three big ideas about learning: it requires active engagement, it is unbounded; and it requires reflection.

The active engagement of the learner

To learn something is to strive to make sense of it. As one put it in relation to her own learning 'finding things out needs to be driven by some sense of curiosity and passion'. Learning is about setting yourself challenges and 'expending intellectual energy' in trying to meet those challenges. This has implications for both learners and teachers.

Clearly as a learner you need, if not to be driven and passionate about knowing, at least to take some of the responsibility for making choices and taking the next step. It is not enough to take on trust something that has been given to you. For example, in the previous chapter we looked at the case of the teacher who had replicated in the classroom what she had seen on an in-service course. This was a criticism of the in-service course but it also exposed the teacher's own short comings as a learner. In a similar way learners had to be critical of information they accessed via the WWW, they needed to enquire further: who was saying what; what grounds do they have for saying it; how does this apply to me?

While all participants expressed a commitment to meaning making they also recognised that the meanings they made were provisional: what was known today might prove to have been misunderstood tomorrow. This was a general principle for learners – there was more to know and, for example, teachers should not step experimenting and trying out new things. Participants had a heightened sense of the provisional nature of knowledge through their engagement with computing, which was continually changing in nature and scope, but as a general principle many took it as a given that they may have got it 'wrong':

> That's something that is personal and I might need to revisit this. On a deep level, what drives me is a fear of I keep getting it wrong. I keep getting the script of life

> wrong. I mean even though I know on another level this is the script, you know its complexity theory, it's a complex system, this is the script. But somewhere what's driven me in my life and my career is the sense that I'm not doing it well enough, I'm getting it wrong, I have to keep on trying.

Learners need to make personal meaning of new information and this meant as a teacher you needed to provide opportunities for learners to take responsibility and make explicit the importance of doing so. This often meant framing activities so that learners should transform what they find out for particular audiences or particular circumstances. For example, one powerful way to support professional learning was to invite learners to apply what they were learning to a work setting and communicate outcomes to peers. These principles underlay a course for teaching assistants designed by one of the participants:

> Module one would be a factual description of the work setting. The second is being critical of the work setting, reflecting. The introduction to action enquiry would be to improve something in their work setting et cetera. The second year of the course would be more of the same, more action enquiry, more reflective practice, but a higher level, looking more in depth. In the third year, doing even more action enquiry, but this year looking even more at undergraduate level, creating an exhibition of their work, identifying an audience for that exhibition, they would expect to gather evidence from that set of stakeholders and evaluate what happened at the end. So they would be expected to be very outward as well as inward with their studies.

An implication here is that if the learner is having to take an active part in learning then the teacher needs to provide a context for enquiry that will be found meaningful or simply playful and engaging. The teacher cannot do this without setting up dialogue with the learner. Already we have seen how important this principle is in designing materials, courses, software or activities. We see it again here as one participant recalls designing a TVEI funded course:

> So what we tried to do there, was to look at how the curriculum could be constructed differently and the children could really work on things that interested them. And we used the money to construct a curriculum which was very open, very shaped by young people, following our own nose, and developing the projects that interest them, using the technology to record it, but also using technology to connect with kids in other schools. You have seven or eight schools that were networked up, an early version of the internet.

As seen when looking at the desirable application of computers, it is the teacher who has the vision for an activity and the imagination to frame an activity for learners. This requires planning not just 'hoping for the best'. This is a point illustrated by this participant in relation to an integrated humanities course his team had organised:

> The idea was that you would choose your area of content, your topic if you like, and you then would infuse into it the learning experiences that you would identify as being the development of particular skills, or the exploration of certain attitudes, or the development of certain conceptual understandings. So that was how the model

> worked, and that was how we worked. We worked in this way very explicitly. I can't remember, but I think that a local authority advisor suggested this to us. Certainly we found that a very useful way of working, because what it meant was that our choice of topics always had a deeper justification, it meant that we couldn't just capriciously say 'oh we'll do something on x, or y, let's do something about the Egyptians, that would be fun'- I mean we didn't actually do anything on the Egyptians as far as I can remember but had we chosen that as a topic area we would have had to base our justification within the skills, knowledge, concepts and attitudes that we wanted to develop through that. So actually it was quite a rigorous and fine-grained approach to curriculum planning.

But beyond this general principle there were variations in the kinds of roles ascribed to teachers. Much depended on context. For example, at times, as a teacher, you could take the position of a co-learner, particularly in relation to CPD work. At other times you might be guiding learners to know how to assess their learning for themselves. On other occasions teachers had a much wider pedagogic role in the class room instructing, explaining, directing and challenging pupils on top of their responsibilities for everyday classroom management. However, all were agreed that the teacher needed to supply learners with a rationale behind a task, and be clear in their own mind about what they are hoping will be achieved. All recognised the value of well timed questioning to develop learners' thinking.

Learning as unbounded

A second idea about learning is that it cannot be easily confined to a subject, to one way of delivery, or to one physical environment. Of course, there might be all sorts of pragmatic reasons why boundaries exist but as far as possible learning is about making new associations which cross boundaries. For example, here is one participant explaining his own learning in these terms:

> I mean if, what drives me on in everything I do is trying to find a new angle. It's making connections and finding a new configuration from those connections. I think that summarises everything I do. All of the papers I write, I like bringing ideas together and finding where the connections are and what new emerges from them. It was the same with the technology.

This led most to feel that subject boundaries were artificial and often outdated. Many had a commitment to cross curricular working, where this was possible, and a few felt particularly strongly that subject boundaries were out of date, as offered by this participant below:

> The model of knowledge basically that is still replicated in teacher training colleges across the nation is out of date. We still teach knowledge, we still teach subjects, we still teach students that there is something called English. And English is taught in this way or that way. But the subject cultures that exist in departments in teacher training and that replicate an epistemological model across the profession is completely out of step within important aspects of how knowledge works in the world we now live in. There is much less boundary maintenance, so for example, the whole thing we

> grappled with in the 60s and 70s of topic teaching of breaking down curriculum boundaries which was one of the hallmarks of the so called progressive educators, always challenge this notion that knowledge can be segmented, well now we have a technology that intrinsically breaks down that segmentation. It doesn't easily allow you to build walls between geography and history. But that particular potential of the tools of learning is almost deliberately ignored, because nobody wants to deal with the fact that the school curriculum can no longer go on being divided into geography, history and English, mathematics we know that's true, we don't know what to replace it with.

In discussing boundaries most talked about the tension between school knowledge which was bounded by the text book, and organised in one principle format - that of text - as against the unlimited resources offered through the Internet. Some made a more general point that even with Internet access teachers and children should not feel bounded by the physical classroom:

> Yes, that's right, not through actually going out and running round the streets like we used to, that's true. But with responsible parenting that expands, look at what museums are offering and galleries, countryside centres. You think of all the educational facilities there are in the non and informal sectors and I think they make formal education look like the poor relative. So for me, that's the way it's going. And it's always been the same, the real learning happens out of school, doesn't it?

Knowing comes through reflection

While participants believed strongly in the importance of learning by doing (you learnt to teach by teaching; you designed good software by trying it out; you learnt to write by writing) activity needed to be designed and activity needed to be followed by reflection. Sometimes this reflection was almost spontaneous. For example, some felt that in working with *Logo* children were drawn into reflection, say, on where they had gone wrong, without the intervention of a teacher. However in general it was felt that reflection needed supporting by a more knowledgeable other – this could be a co- learner or teacher. Several made the point, as below, that, say, it was not enough to have an on line discussion, it was important to have a framework for the discussion and prompts for reflection:

> There is all this hype is it's fabulous to have these discussions but it only works when you've got a fairly sophisticated group who are having the discussion. So I think teachers need to think about how do you alert your pupils to use the discussion and how do you get them to engage in discussion? And there is more than one kind of discussion, we need to get into that, what kind of discussions there are, how do you run this kind of discussion and what's the benefit of the discussion. So it isn't inherent in the fact that having a discussion forum produces outcomes because they don't just happen, there needs to be moderation.

Knowledge, learning and desirable application of computers

Summing up, most participants in the study could be said to hold a broad view of learning in which knowledge is acquired through 'scaffolded' reflection on purposeful activity. Not

surprisingly when talking about the application of computers they have highlighted activity which very closely supports these principles (table 5.1).

Desirable application involves;	**This is because:**
a challenge, going beyond the routine, giving an element of control	knowledge is personal, it is about making personal meaning
doing something the learner would find purposeful.	making meaning requires purposeful activity
going beyond what is generally taught and how it is taught	knowledge is unbounded
communication	knowledge is not acquired spontaneously it requires reflection

Table 5.1: desirable application and view of knowledge

Table 5.1 provides a tidy way of linking application to theories of learning but these are general principles which apply to many contexts in which teaching and learning take place, they are not confined to a discussion of technology. This is not surprising as participants had wide interests, for example participation in networks of action researchers or initial teacher educators which did not have a particular focus on technology. However, they also spoke about many special, if not unique, features of computers which seemed to contribute to their vision of teaching and learning. The most frequently mentioned of these are described below.

Computers support creativity

Creativity was often bound up with the idea of 'creating original products with personal meaning'. Creativity involved authenticity and control. Creativity was explicitly discussed by some in relation to programming and putting the learner in control to plan and implement their own products. As one put it:

> If you give it symbolic instructions you can make the computer do anything. And that anything can include not just making pictures on screens, which is brilliant, So that the computer can be made to do things and the limit is more or less your imagination.

Often creativity was associated with the transformation of artefacts, texts, sound or as below pictures, all of which could be easily achieved at the computer:

> Learners have such cheap technology that allows them to do things like take pictures, video and dictate things and whatever. And having it very swiftly beamed back to your website and having that kind of digital artefacts to play with. That's very exciting. The kind of questions that allows you to ask is, take a picture of what we're looking that will encapsulate what we want to get a picture of. So you've got to do lots of high level stuff, very quickly you've got think about what's this picture telling me, why am I taking that picture and not that picture, why should I do this to this.

Computers allowed creativity because computer plus person was more powerful than person alone:

> The growth in power continues to provide tools that are ever more powerful and more useful because of the way then can deal with real things. Such as digital cameras. I can store my life in order in my computer. I'm diarizing my life with the media and the tool is allowing me to do that. The pictures the sounds etc. is carried around and is there for me to remember and enjoy in the way that somebody could have a diary habit. The augmentation of my creativity that has come about from the tools that allows me to design. Creating things that please my eye that I could not do by hand. I think children benefit from that enormously.

> From my own point of view ICT is in some way a liberator in as much as I have become a far better writer since having access to a word processor, so I do the draft and re draft. I have become a far better mathematical modeller through the use of spreadsheets, it enables and, the thing I have not really mastered myself, I could become a far better designer, I have the technical know how to do that but I actually need someone to give me the artistic skills. No doubt there are other people who have been liberated in musical terms who cannot write notes but who compose and other people who are now budding film directors who can do things with the digital camera which they could never do in the past, in that respect it is liberating.

Computers support talk and communication

Communication was discussed in several contexts, including more recently, Internet supported online discussion between learners and participation in social networks such as *My Space, Bebo* and *Face Book*, which offered hybrid forms of communication, part web publishing, part discussion. The web, according to one, provided a 'symbol of the horizontal layering of communication, anybody can talk to anybody, releasing this concept of anyone can publish anything they like'. Going back further in time, many could recall the talk generated among pupils when working on *Developing Tray*, simulations, carrying out joint enquiries of data files. Here one participant recalls pupils working on a simulation programme at a BBC computer and:

> watching a group of teenagers sitting in front of a screen which has got a calendar on it, with a teacher sitting beside them, imagine 13 year olds being told about the menstrual cycle and being asked to see if they could help this woman to become pregnant. So telling them when the woman ovulated and, sorry, when she started menstruating and then saying now when do you think would be a good idea for her to have intercourse so she can get pregnant, And what date shall we do this on. And then they'd put the 'I' on that date and then the teacher would track through each day and little messages would come up, the woman felt a bit sick today, and then sometimes there would be a miscarriage and the kids were really upset. And I think that was the magic thing, because you could see that they were all looking at the screen and therefore all the embarrassment of talking about all these embarrassing things was no longer an embarrassment because in some senses, it's like the interactive whiteboard now really, it's a shared space.

Cooperation and collaboration

Talk almost inevitably implies possibilities for cooperation and collaboration. (An association is often made between cooperation as working together on individual products and collaboration working together on a shared product or outcome but this is not applied consistently in the interviews or in the literature at large). The simulation above provided an example of collaborative decision making and participants offered further examples including a snooker game in which pupils started 'to estimate angle and size of force, arguing with each other about that because they were always working in pairs or threes.' More recently, others had seen pupils collaborating to make products, for example short films in which 'they took on roles: interviewer, camera operator and director'. Working together was not necessarily planned, for example ease of editing made it natural to seek comments from peers as these could be immediately acted upon. One felt:

> when children are working in a group, and the computer's involved, they are working collaboratively as part of a team. Whereas a lot of group work in schools where the computer isn't used, children may be sitting in groups doing the same activity but doing it individually. So you might have the red group on this table who are all doing number bonds to twenty or something like that and blue group over there who are doing a different aspect of maths but it doesn't mean that they're working collaboratively. So that what they're gaining form working with the computer is that they're working much more collaboratively and developing team skills.

The computer supports a shift towards higher order thinking

Participants discussed the way in which computers could carry out routine procedures to enable pupils to focus on higher order skills of synthesis and analysis. For example, pupils could search data files on the BBC computer and comment on what they found out, and today pupils could locate information very quickly via the WWW. One participant discussed how literary analysis could be transformed if you had electronic texts, for example pupils could quickly search out how Dickens tells us about the changing character of, say, Uriah Heep in *David Copperfield*, something that would be extremely time consuming without electronic text. This idea of freeing up time re-emerged when discussing analysis of numerical data. Examples included using spreadsheets for automatic processing of data and producing 2 D and 3 D displays. The simulation programme recalled earlier about throwing a stone from a mountain top could not be done without the computer. Another participant recalls *Eureka*, a small programme mentioned in the introduction:

> *Eureka,* how lovely that was, do I need to explain that….. We did it on screen we also did physically and visually around the classroom. We did Eureka, we then drew our own stories and made graphs of our stories and they were up around the classroom as well.

The computer provided alternative ways to support explanation

The multi media capability of the computer was discussed in relation to both teacher and pupils use. The general point was that podcasting, video clips, images, text based communication had all changed the context in which teaching and learning took place and there were opportunities for engaging learners in more ways than in the past. One recalls working with interactive video:

> You sit there, you watch it, you engage with it at some sort of personal level. The question was how can we use that same set of images for different educational outcomes? How can we actually chop it up if you like, that was a term we used at that time, and interface the images with very simple graphics, mainly text screens, to break it up, to carve it up into bits that could be used for different educational purposes?

A catalyst for changing the roles of teacher and pupils

Finally, the computer often led to teachers to re think their roles. For teachers it did this by freeing teachers up as:

> it takes responsibility away from the teacher of having to keep everything going. You no longer have to run around spinning plates. You can give kids much more freedom knowing that their interactions with the technology will sort of keep them on task better, so then the job becomes, still inspiring them … but having a different kind of context where you really can teach in different ways and you really can change the roles radically of students.

Computers, application and learning

In table 5.1 there was shown to be an association between application and ideas about learning but no mention made of computers. It can be seen now that that the computer appears to participants as a tool for supporting creativity; for talk and for collaboration; for focusing on higher order skills; for offering alternative formats and offering alternative approaches to teaching and learning. These 'affordances' mean that computers are integrated into a vision of learning: computer, pedagogical application and theory of learning each reinforcing the other (table 5.2).

ICT offers:	And supports desirable application which involves:	This is because:
support for creativity; a focus on higher order thinking	a challenge, going beyond the routine, giving an element of control	knowledge is personal, it is about making personal meaning
support for creativity	doing something the learner would find purposeful.	making meaning requires purposeful activity
changing the teacher role and providing alternative means for explaining and clarifying	going beyond what is generally taught and how it is taught	knowledge is unbounded
a focus on higher order thinking; support for talk and collaboration	communication	knowledge is not acquired spontaneously, it requires reflection

Table 5.2: the relationship between computer, application and theory of learning

Thinking about practice

Participants were asked about examples of teaching which had particularly impressed them or activities they had enjoyed in their earlier teaching. Examples included field trips in which pupils were using mobile technology to help in their exploration of an area and to communicate with others; young children making short films, using *Digi Blue* cameras, about the windmills they had made and posting these to the WWW; and some referred back to *Logo* as in this example:

> We had the one 380Z in the corner…it was fun, it was fun, we had a huge turtle that we made out of papier mache stuff?. Yes, we made this big turtle that we put on the wall. It was a glittery one, we made it out of silver foil and colour foil, a mosaic for its shell. So we had this coloured turtle with left and right on its paws that could spin. So that was slapped on the wall, by the computer. And then we had corrugated cardboard, you know tall cardboard, I am waving my arms around for the benefit of the tape, around the computer, so there was a snug little space for two children to go in. And then pinned to all this corrugated card were lots of instructions about try this, and do this and switch on this and have you thought of, so there were lots of visual props around. And I remember doing a little flowchart of doing switch this, if this happens then put that and if that doesn't work do this, etc. So it was a lively visual space. We did a lot of *Logo*, physical *Logo* so they programmed each other around what we did and then displayed their ideas of, this is what I wanted to do, I thought it would be a lorry and it ended up as a firework and all of that. So there was a play with the *Logo* I think.

This activity rests on the idea that learning should be a search for meaning; it should be purposeful and fun. In this instance learning is confined to the classroom but the classroom is transformed into a lively visual space. Pupils are asked to reflect by working with each others,

for example, explaining why 'I thought it was going to be a lorry but ended up as a firework'. It is desirable application in that it offers an activity beyond the routine. It involves collaboration and gives an element of control to the pupil. The computer offers a support for creativity and collaboration. Hence it integrates ideas about computers; about teaching; and about knowledge creation. However it is impossible to track what came first: for example, did the teacher adapt the use of the computer to fit an existing philosophy of teaching or did *Logo* in some way open possibilities for handing over responsibility to pupils?

Summary

This chapter set out to join up desirable application of technology with perspective on teaching and identification of affordances of computers. It outlines core beliefs about knowing as meaning making; about activity as purposeful and technology as a tool for creativity and as a support for reflection.

The key question was 'how do beliefs about teaching affect the use of technology?'.

The chapter suggests that beliefs about teaching and learning need to match the affordances of the technology. Examples of classroom teaching seem to integrate the two very well.

6 Policy: looking for a magic bullet?

We have looked at what led participants into developing such a strong interest in teaching and learning and how they have viewed the opportunities presented by the introduction of computers in education. We have also seen some of their concerns about the introduction of computers into school and the impact of policy on their careers. Policy is explored in more detail in this chapter. Two key phases in policy making are identified leading to a contrast between the concerns of policymakers and those of the 'research community'.

Early Policy

As highlighted in the biography chapter participants draw a line between an early phase of policy aimed at developing networks of support and experimentation in the use of computers to a more prescriptive phase beginning towards the end of the 1980s. However there are consistencies between these two periods. For example policy makers had always seen a vocational value in putting computers in schools– many could remember, for example, Kenneth Baker as a Minister for Information Technology talking about providing 'young people with skills they needed for working in the new industries'. And then there was the recurring difficulty that initiatives were being announced without proper consideration. In chapter three it was seen that in the early days teachers were being encouraged to use computers when there was not the reliable hardware, appropriate software or training to support their use. One participant recalled being told that in 1982 that 'there weren't any schools up to speed yet for a pilot programme of putting 380Z's into primary schools'. Much the same comment could have been made in very many local authorities at the time. One participant provided the example of initial teacher education: new teachers were assumed to be able to spearhead change, but the implications were not thought through:

> Nothing had been put into teacher education. And the minister had apparently told a group of teachers that they needn't worry because all these new teachers were coming through and they would all be fine with IT and there had been laughter.

Despite these shortcomings policy makers were seen as reactive to the difficulties that schools encountered. For example, one participant recalled being encouraged to develop a project to support children with special needs:

> It began with working with children. it was unbelievable, this was just drill and practice software, eight in a class - they had severe behaviour problems, and I wrote an article about it in The Times. A Member of Parliament got hold of it, so my colleague and I were asked to go to talk to a cross Parliamentary committee on technology to tell them about how you use computers to help with disaffected children. We then got a bid together, we got five different secure establishments for children who had committed

> murder and things like that to develop CAL for these children - we put in a bid for about £100K but they came back and said it had to be bigger - it was too small!

However it was not all reactive and policy makers wanted to support teachers through programmes such as NDPCAL - National Development Programme for Computer Assisted Learning and MEP - Micro Electronics Programme. The NDPCAL was set up, it was recalled by one participant, because:

> In 1973 the Government wanted to investigate computer assisted learning (CAL) called National Development Program for CAL (NDPCAL) they invited people to bid for it. It was a bit like a more academic version of Becta, but the central team was only eight people… From 1974 to 1978, thirty projects were set up. Most were for higher education people, because a computer terminal cost £4000, the cost of a small house at the time. The NPDCAL were supervised by CET (Council for Education Technology) and there were common overlaps with CET, but they focused on the technology of teaching, the methods.

The legacy of NPDCAL was two-fold:

> Looking out for new things was one major outcome. The second major outcome was the group of people who got a lot of experience who then went on to initiate things or be involved in things - there was something of a cascade effect of this body of people.

The striking features of this programme were the small number of people involved (the programme was directed from 'a small house in Newcastle'); the importance of networking (see the later chapter on community); and a concern for dissemination.

In 1980 MEP was set up as the first nationally funded initiative for developing computers in school:

> The Government decided to launch the Microcomputer Electronic Program (MEP), which again was to be supervised by the CET…The project had two and a half million over 4 years to fund the developments of micro electronics. They decided to have three strands, training of teachers, curriculum development and software development. MEP ran a 24 hour workshop to get key players together - that seeded the establishment of the MEP.

Again this is small scale support but it was seen as helping to establishing networks of collaborators ('magical combinations' according to another participant) and 'catalysts' for development. It also helped establish a cultural legacy for thinking about computers:

> Their legacy... there are traces of that all over, I think. In materials and the people they influenced at that time… the early adopters, the courses that were run, the little booklets, making connections, all those early MEP packs, you know the *Mary Rose*, all the simulations, we worked with them, so that legacy influenced us.

Another speaker noted the 'progressive' principles underlying the software:

> The software we developed under MEP was absolutely wonderful. It was incredibly visionary it was pedagogically straight out of the post Plowden and one might say the post School Council curriculum development. There was such a strong tradition before 1988 for innovative curriculum development work and sort of excitement about how to make schools places that kids would really buy into … The early work in the 1980s had come out of progressive educational ideas, and a lot of knowledge about how children really learn.

While the above quote shows the optimism of those taking part a couple of further quotes show the growing realisation that there was something of a misfit between school and computer. Participants were aware of the enormity of the task in seeing computers used in school (at least in the way that reflected their potential) without changing the nature of schools in some way. Reflecting on MEP this participant noted that:

> One of the lessons to really draw is that you cannot change a whole institution by getting some pioneers and educating them and then expecting them to change the institution. The second outcome we ought to learn is that the kinds of ICT used by teachers, what they were most able to take on board, were ones that they could relate to their curriculum….what we learnt was that the software, or the techniques that were most possible for teachers to use, were the ones of manageable size in terms of changes to the teaching methods.

The successor of MEP was the MESU - Micro Electronics Education Support Unit, it was recalled that:

> MESU was set up with a five year life span…The role of MESU was to support teacher-trainers in ICT. So in that respect our role to start with was to liaise with advisors in local authorities, lecturers in initial teacher education, to provide what support we could to help them with their job of training teachers. And to that end we got out and visited…because there were various teams and each of us had about twenty LEAs and about twenty institutions to support. We went out; found out what they were doing, what they needed and then we devised plans to develop resources to meet that. Then the DFES announce the ESG … education support grant, where they were going to put significant funds into local authorities for them to appoint advisory teachers to go out and support schools with ICT. And MESU was given the job of training all those advisory teachers.

NCET - National Council for Education Technology was later to replace the MESU and some felt this transformation endangered a close link that had developed between the agency and teachers:

> MESU had always been very focused on developing teachers' use of ICT, working with the people on the ground who were working directly with teachers, sort of an intermediary in a way. But at that stage we were also acting as an agent if you like for pulling together the best ideas from around the country and making those available to people. And there are all sorts of pluses and minuses about that. It did get a lot of good material out there. It did encourage people to share ideas but then there was

> what you might call a regime change and we were told we had to start charging for things. So immediately people who had freely given us their time were not necessarily so keen to do that. I think it was a difficult time really.

Summarising this first phase of policy

These accounts show that policies were being taken at a national level to introduce computers in school. The need for support and development was acknowledged but on nothing like the scale required. Schools were beginning to spend serious sums on computers but in comparison very small sums were spent on research and development to support this. Those responsible for supporting policy interpreted their role in a particular way, one which meant: networking innovators; developing a pedagogical vision; a concern to work *with* teachers, not *on* teachers.

Understanding the climate of change 1980s onwards

It has already been noted that a shift in the climate in which schools operated occurred in the latter part of the 1980s. There was a sense of a 'closing down' of possibilities. Participants used word such as: 'playfulness', 'experimentation', 'innovation', 'flexibility', 'creative', 'imaginative', 'excitement' and 'vision' to describe their first involvement with computers but 'somehow this got lost'. One added that this earlier period was easy to over-romanticise but:

> It does kind of have a golden age feel to it, because of course a lot of that capacity of teachers to own the curriculum in that way has now been taken away from them.

A few viewed this later shift as a 'necessary', or perhaps a corrective phase, but all were aware of the losses and a 'closing down' of possibilities and freedom. The introduction of the National Curriculum was seen to have been instrumental here:

> The introduction of the National Curriculum, which I think has, on balance been deeply problematic for the education system in this country... that experience has been intellectually 'de-skilling' for the teaching profession… what's happened to teachers over say the last fifteen years, the kind of autonomy and responsibility that teachers had for the conception of the curriculum has now largely been taken away from them… so they are now responsible for implementing the curriculum that somebody else has designed.

And again some felt these were difficult times as teachers had felt under attack:

> At that stage I think teachers morale had been so battered that they were sitting back, saying 'the governments' trying to tell us what to do, just tell us what we have to do, we'll do it'. And that creative side of it suffered a lot. So it wasn't easy for people - they'd got out of the habit of taking ideas and reinterpreting them, not everybody obviously, but it, the culture, had changed.

A further quote reinforces this sense of closing down and perhaps the profession's own complicity in letting it happen:

> I can remember, and this was later when I was working at the university, completely horrifying a geography teacher from another institution because he wanted to observe every dot and comma of the national curriculum, and felt that we were under a requirement to do that; whereas I felt that I'd looked at the geography curriculum quite carefully and saw that it was an absolute mess. So my message to teachers was if you've got to do the geography national curriculum, by all means go with the spirit of it, but don't try and do the detail or you'll drive yourself mad, because it's incoherent, it's not do-able. So this guy was completely gob smacked that I would say that publicly.

Of course one aspect of the introduction of the National Curriculum which seemed to favour the use of computers was its inclusion. However this had drawbacks as well as benefits: it obliged some to do it what they would not have done otherwise, but at the same time dampened and constrained others from taking risks:

> The National Curriculum thing is a kind of two-edged sword I think. Because I do think it was important when ICT got recognition in the school curriculum but then the actual process of writing the curriculum for it was a bit of a negative thing because for many people it wrote into stone what ICT was about and then it became teaching to the curriculum. And that in some sense allowed people off the hook as long as we're doing that then we're ok. We didn't get the experimentation happening. It also let people off the hook because it was all they had to do. We're still seeing many things go on partly because of what the curriculum says you've got to do and partly because of the way teachers just want to tick boxes… but we aren't getting the really good extending stuff…

It was long known that the creative opportunities provided by computers did not fit easily into school but this became exacerbated in a climate in which inspection and exam results had become high stakes. Assessment was part of this 'locked down' culture:

> We have a system that's so locked down by league tables and performative criteria based on national testing systems and so on that that actually stifles creativity in more places than it fosters it and actually what you've got is little blossoming of creativity within a system that actually doesn't encourage creativity, and yet that's what they say they want in schools for the future. So I think there are contradictions in the system, profound contradictions.

A change had come over the status of support material – the tradition had been of creating material with teachers and leaving them free on how, and if, to use it. Now the guidance from the government was almost seen as compulsory. What had been offered as an exemplars (such as the school disco spreadsheet mentioned in chapter 3) had become uncritically accepted as the norm. Yet this was the safe option if you were being inspected. The process had created an 'instrumentalism' in education; a 'tick box' mentality, teachers 'playing safe', complying so you 'won't get kicked'. They lacked 'ownership' of a curriculum; they were compelled to 'deliver'.

New Labour and new initiatives

From the view point of a political historian a change of government represents a step change in thinking and culture but for many participants there was a consistency as well as change in the policies of the incoming government. They were, of course, aware of changes in nomenclature, indeed one participant noted that it was because computers were so problematic for policy makers that they were for ever changing names of the 'thing' itself (CAL / IT / ICT and so on) and the bodies to support it (MEP / MESU / NCET / Becta) and, she added, the people to lead these bodies. They were also aware that the acceptance of the *Stevenson* and *McKinsey* reports led to increased funding into school:

> The Labour government when they were in opposition actually commissioned the Stevenson report and then it influenced policy when they came into power. So I think they've invested in technology in education in a way that the Tories were never going to. Now I'm not saying the Tories were not interested, they were, but they weren't I don't think, prepared to make the kind of commitment financially that the Labour government has. So I think that's very influential as well.

However, there was a consistency in terms of a commitment to, even an enhancement of, central direction, and a focus on accountability at the expense of creativity:

> We're in such a locked down system at the moment that we've got loads and loads of kit, but in a way we haven't got the freedom to use it in a way that people might find exciting and thoughtful and so on…this is the quid pro quo, you know we've got the investment in education, because we've now got a much more accountable education system. The system is imposing, not intentionally but inadvertently, constraints on this kind of exploratory practice.

A recurring issue in discussing Labour Government policy was NoF training. In an earlier chapter it was noticed that NoF lacked differentiation but other criticisms were made which seemed to capture all the concerns which participants felt about policy initiatives. There were, of course, positives for some teachers and particular schools but nearly everyone conceived of 'NoF' as a lost opportunity. Several reasons for this were put forward. It was, for example, too directed (NoF was just 'bossy') and too unresponsive to local needs:

> It was a great opportunity missed for lots of reasons. A mismatch of what the providers thought it was about, what the audience thought it was about…People weren't ready and when you think of the effort that was put into it, it was a massively missed opportunity.

For others it was short term and did not engage strategically with the support teachers needed:

> …but I think there wasn't always a clear understanding and rationale of what was going to be done with this money and how it was going to be used. But for some schools, and indeed our colleges as well, the money arrived and there wasn't the back up or support that there might have been or not in the right way.

A range of approach was needed, not a 'one size fits all':

> Over the years we have seen a whole array of initiatives and actually it is not possible to predict in advance which are going to succeed and which aren't. There was tremendous enthusiasm about NoF, it was going to be the be all and end all but in retrospect it did not turn out to be that way.

Support was being shaped to fit funding requirements and not vice versa:

> Because the NoF training was ostensibly not about teaching skills and the reason for that was because it was lottery funded and the lottery could not be seen to be funding something that realistically should have been provided by the educational services…to meet lottery criteria the scheme was not allowed to teach teachers ICT skills… equipping them with the wherewithal to understand when it is appropriate to use it and when it isn't. It wasn't really a very satisfactory approach. I mean if you're going to be expected to use something then you need to know how to use it

Another focus for disappointment was the Schools of the Future programme. Again government thinking was ambitious and a huge investment in infrastructure had already taken place. However, this was a very good opportunity missed to think about how schools could be different and how the use of computers could be built in from the start:

> There are so many horror stories about that, that I dread to think where it's going. I think what people think looks exciting is nothing to do with learning both in the architecture and the technology. I am very concerned about a particular video that is doing the rounds which everybody says is this wonderful new academy, when in fact what it shows is technology being used as surveillance of children: 'we know where this child is a every moment of the day, and it can't get away with anything'.

Reflecting on ICT initiatives

Participants have seen policies come and go over 25 to 30 years: what conclusions do they draw? On the credit side most see 'Policy' as necessary ('to shake things up') and to move on with implementation:

> You can't keep experimenting with all sorts of things all the time. There comes a time when you have to say 'right this is…our best options and that's what we're going with'.

Policies were important to address inconsistency; you had to have a top down approach sometimes as 'everybody's going to get a basic entitlement'. Without consistency you would get 'pockets of activity in different classes but that doesn't really impact on all'.

An element of compulsion was needed to ensure computers were being used - you need a stick as well as the carrot. Inspection was part of that process:

> Because after an inspection schools have to create an action plan and deliver on that. If work in ICT in schools was at a pretty low level, if Ofsted identified that schools needed to do something about it, there was a better chance that something would be done.

There were some policy successes in the take up of computers in schools and in consequent curriculum development. The UK did not compare badly with other countries. There was an acceptance that policy makers were faced with an incredibly difficult task, calling for coordination at different levels: macro agencies, such as government departments (DCSF, TDA), meso level agencies, often operating at a regional level (Local Authorities/ Advisory Teachers), micro agencies of individual schools. Blocks could appear at any level and were exceptionally difficult to deal with.

Shortcomings of policy

However, there were many more criticisms of policy than plaudits. There were always problems with funding, it was too short term:

> A problem throughout the period has been the kind of sporadic approach to things where there has been little pump priming activities. And a few privileged people have been given money and there's been a feeling that this would then permeate through the system. TVEI got loads of money and then two years later everyone was expecting to do what TVI did with no money. That kind of short sighted policy decision I think has not helped.

And it was too focused on equipment rather than training as in the Schools of the Future programme:

> The World Bank says 50 per cent on hardware and software and 50 per cent on training but it is only possible to vire 10 or 15 % into training, but it is not compulsory and it is frequently not done.

There were strategic errors, for example, in the way in which teachers and ITE tutors had not been given ICT equipment:

> I think one of the lost opportunities was not getting computers into the hands of teachers sooner…we would have had a much more highly IT literate teacher force a lot sooner if we'd have found ways of getting computers into the hands of teachers as individuals… So for me that's a fairly important thing. And you can also judge from that I see the teacher as being crucial to the implementation of ICT in schools.

There was 'initiative overload', not just regarding ICT but education in general as in these quotes from three different participants:

> Politicians… they all wanting their own initiatives. Then education is plagued by initiative.

> …the fascination really was in how, the longer you're in IT and education the longer you realise that it's constantly having new starts.
>
> The system moves on to new initiatives like the white board and forgets the earlier bit that we need to be doing.

Some were ready to accept inconsistency if this led to creativity so long as:

> the unevenness was known, that, say, my school was not very good at music and that any parent passionate about music would not send their child to my school, we have to ask what would work if you trust your managers, your head teacher. But we don't trust them we keep a tight control on them really so the creativity goes, some do manage to get round the system but some are very wary and fearful.

However, some felt it was the not the policies but the culture in which the policies were introduced which caused the difficulty:

> It wasn't the schemes of work, it was the climate in which such things were produced, where there is a sense of prescription and 'Do this and you will be OK and you won't get kicked', and all of that… It's the sense of that period of prescription, which emerged when the National Curriculum came in the late 1980s.

Above all recent policy suffered from a top down approach:

> You need to find out on the ground what the impacts of these things are going to be before you can really move it on.

Indicative of the problem was that the changing role of advisory teachers'. Participants knew from their own experience the LA advisory service was a useful intermediary between policy and school:

> …we had the advisory teachers scheme which independent reports had said had been very effective at helping to move teachers on, when they'd got someone who could come into their classrooms and work with them and help to move it on.

However, the role had became much more of one of inspection and local knowledge was being ignored. And here there was a pressing need for intermediaries as there was a basic confusion between government and schools. As all participants observed policy makers were primarily interested in the vocational rationale and the contribution of computers made to school standards, as for example measured in attainment tests and examinations, but teachers wanted to know how computers would support them in the everyday work they carried out in the classroom:

> I think there were two agendas…at a sort of macro government level computers were becoming common in the workplace and it was important that young children learned how to use computers because it was going to be a work skill… I think that was

> probably a key motivator for government level, but at an educational level it was…how can we use them to help children learn?'

This difference of perspective emerged when considering the impact of computers. Governments wanted to know if those with access to machines 'did better' than those without, educational researchers wanted to know more about the activities and thinking processes computers supported:

> Still the government wants the pre-test/post-test experimental analysis to prove that a difference has occurred by using ICT. This doesn't actually measure what the children probably learnt - better creating writing skills, argumentation, and interpretation of literary text. They don't measure those; they just used standard English tests.

> The problem is of course that what governments often take as evidence are things like increases in exam scores those kind of things, we've all agreed these are not the things that ICT is going to improve. So we're all interested in the soft end of things and that's the really difficult bit to prove.

A difference of cultures

Underlying these criticisms of policy maker and policy making is a difference of culture which is set out in an accentuated, but not caricatured, form in table 7.1. Policy makers like announcements; clear and measurable targets and focus on the decision not the problematic nature of implementation. Participants see complexity at every stage. Policy makers see vocational value and impact on standards, participants want to know how the computer will affect what is taught and how it is taught. Policy makers are too often looking for:

> a talisman something you could hang on to that could make you feel better a branding, a magic bullet that was going to solve everything.

Participants knew it was just not like that. Ironically by pushing too hard in an over prescribed fashion policy was having less impact than it could:

> Actually what we've got I think is a bit of both… that teachers appeared to be getting confusing messages, and that the confusion, was one of the factors resulting in perhaps slower implementation, slower uptake, less impact than maybe the policy makers would have wished.

Ways forward

These differences of perspective are deep rooted but participants very much wanted to 'broker a new kind of partnership with policy people' and a 'better connection between policy makers and researchers'. Participants had of course contributed to the development of policy in many ways; they had worked with government agencies and carried out small and large scale

research. They could mention policies which they felt they had influenced, for example support for networks of teachers, liaison with subject associations.

Domain	Policy perspective	Participant perspective
purpose of computer in school	vocational preparation; contribution to 'standards'	enhancement of what is taught and how it is taught, contribution to change
initiatives	high profile; easily understood; 'compelling'	timely, long term, complex
orientation	optimistic; 'magic bullet'	sceptical, aware of complexity
implementation	top down	bottom up / top down
driven through	exemplars; consultants; inspection	networks of support, including independent intermediaries
in service	showing how to do it; equipment prioritised over training	negotiating how to do it; training a priority
evaluation	multi methods, concern with experimental methods: 'do children with computers learn better?'	mixed methods but focused on understanding of teaching and learning process

Table 7.1: comparison of policy makers' and participants' perspectives

Further, they could name initiatives such as Creative Partnerships, and Best Practice Scholarships about which they had been enthusiastic:

> One of the best things I think the government ever did was the Best Practice research scholarships and I am trying to revive a form of that at the moment, where the teachers could decide what they wanted to study within the school remit and had a little bursary to make those studies possible including the supply cover to go and see and work with other people. The original idea of best practice research scholarships is that teachers never left the school, why not do some intellectual work while you are continuing to teach thirty children, you know do it in parallel, so there are some very confused thoughts about what kind of spaces teachers need in order to change their practice.

Many hoped for a change from the current curriculum and assessment 'constraints' and 'obstacles':

> I think we need to be more flexible… about the curriculum and as long we adopt a mentality which says your institution is subject to Ofsted inspections, league tables, parental interference, as long as the school has all these shadows hanging over it, it will be very difficult to change

This 'interchange of ideas' was a key theme and the majority of participants articulated that it was networks of people, operating at all the different levels that facilitated ICT policy. This process of change was understood by one to be:

> …like a diamond type progress where you need to sort of open out and explore, experiment and all sorts, but then there comes a point where you need to distil that and refine it so that you're clear about 'right we now understand what we can get out of this, this is what we've got to do to go on'.

The key factor in the success of an initiative was the connection between the levels and layers and participation from multiple users:

> We need more energetic exploratory workshop feeding links between policy makers and researchers and schools. But then you have to involve, teachers and parents and governors. They have all got be part of it, because you can't change one little bit of this system… you need the involvement of senior managers, enabling things, these management people helped to make sure it gets embedded

Future scenarios

We have noticed in previous chapters disappointment in what has been achieved, one participant added wryly that, attending a conference in 1998, she was aghast to find the phrase 'we're on the launch pad':

> What? We're on the launch pad? I'd been working on this since 1984; we can't still be on the launch pad! This was about 1998, so since then really my focus has been on why change hasn't happened and how you might make it happen.

The fact that change takes time led to a hopeful optimism by some ('you won't get the really great stuff everywhere, but you're getting some quite good stuff') but for others:

> We don't seem to have got much beyond that... in some sense the saddest bit about ICT in teaching and learning is that many of the things you know would be really exciting, aren't happening for lots of children.

Several felt the wider cultural context was leading towards a more central and more creative use of ICT. Surprisingly the vocational argument for using ICT now brought with it an impulse for change. The wider agenda of globalisation and need for 'a highly trained ICT literate workforce' could steer policy into unexpected directions. Technological developments were so pervasive as to overcome even the most ingrained culture of schools and current assessment practices:

> I am hopeful because I think that although structural change is very difficult, in the end the transformative power of technology is washing over, while policy people are phaffing around with setting up nice little projects… The transformation of the larger world, globalization, all the things that are happening, that's happening as chaos theory or complexity theory would say, things are spontaneously reorganizing themselves

> around us and so we can't stop it, so in the end even the structure of secondary school, is not going to be able to stop it finally I think. Even the national curriculum, even GCSE, these things are not going to last forever, they seem like one of these things that will last forever but they won't. They cannot last forever so that's one thing to be said.

Summary

This chapter has drawn out two phases in policy making though noted consistency as well as contrast between them. It looks at the assumptions that participants make about change and contrast these to policy makers' concerns. The need for closing the gap between policy makers and educationalists, in the widest sense, of the word is drawn out and some thoughts on the future direction of policy are given.

The key question underlying this chapter is 'how has policy helped develop and constrained the use of computers in school?' Policy making has driven the use of computers, supported the resourcing of computers and provided the 'stick' for their use. However, policy has paid too little attention to support for teachers, has been too top down and this has constrained development.

7 Community: together we can…or can we?

The book has taken us through the ways in which participants saw the contribution of computers to education and raised the 'disconnect' between their perspective and that of policy makers. In arriving at a vision of using computers, and articulating that vision, the notion of belonging to a research community has loomed very large. In this final chapter we look in more detail at what is meant by an educational research community; what has it achieved and where should it go from here?

What is the ICT research community and what does it look like?

Community was used by participants in a broad sense to refer to people who shared their interest in technology and pedagogy, and whose work they might have some professional knowledge of. They might look on members of the community as potential collaborators on projects. This shared interest was in researching the educational use of computers. This took in both practitioner and academic research and, for the most part, they did not want to draw a too rigid distinction between the two or privilege one over the other. The research community was distinguished from a practice community (which might, for example, focus on the immediate needs of teachers); a policy making community (which would be directly interested in the making and implementing of technology policies); or, indeed, a commercial technology community (which might focus on the reliability, technical viability, and ultimately the profitability, of developing certain software and hardware). Again distinctions were not rigid and, of course, teachers, policy makers and technologists could feel a sense of belonging to the research community and participants could engage deeply in the concerns of teachers, policy makers and technologists. Community then rested on a sense of engagement with like minded others, based on a shared interest in research. It did not rest on occupational role but a sense of community was strengthened by regular face to face interaction between different members through place of work, membership of professional associations, international teacher associations, academic boards, advisory bodies, co-participation on projects. Indeed, among the fifteen participants, there were examples of co authorship of papers; shared membership of editorial boards; co-participation in the same teacher education programme; co-participation in the work of ITTE and so on.

Distinctive feature of the computers in education research community

The distinctive feature of this research community, as we have seen throughout the book is that it put pedagogy at the heart of its research into the use of computers. This was because the technology:

> presents you simultaneously with the need to implement something practically but also it generates all this other thinking and discussion about pedagogy and how people learn at the same time.

This was not alignment with 'any old' pedagogy but a concern which was both broad, yet distinctive, with the desire to make learning more engaging, more learner centred and more playful. The interest in both technology and pedagogy had left participants overwhelmed at times, but it had also privileged them by leading them to constantly rethink pedagogy in the classroom and the relevance of school to the wider world. This speaker saw the research as:

> on the edge of educational thinking, actually, the notions of tools and a changing society and changing roles. Somehow this technology, I don't whether we have used it as a vehicle or have recognised its role, is pushing the edges of what is education for these days.

Another distinctive feature of this research community was its concern for practice. Participants felt close to the teaching profession, valued their own practitioner experiences and attributed their knowledge of teaching and learning to participation in teaching and teacher education as this participant explains:

> Interviewer: So how about you as an individual, who's been most influential in developing your use of ICT in education...so anybody that's been...?
>
> Participant: It would be loads of people. I almost need to name check everyone or no one. So it would be loads and loads and loads of people. You know it would be my colleagues back in the Humanities department at the school where I used to teach, it would be the kids we used to teach because my use of ICT has always been embedded in some social context, some set of purposes. So yeah, so there wouldn't be one person, one sort of opinion leader, there would be so many people, including me because you know I've had a certain sense of curiosity that I've brought to it and I've wanted to find out about it so we don't just have to look outside of ourselves for those influences, you know, I've been an influence on myself but I wouldn't claim any greater status than all of those other people.

A third distinctive feature of the community was the obvious warmth they felt for its members:

> They're immensely social and affectionate, there's a lot of affection, I feel for people and the ICT communities I've worked with have always been really open, interesting people.

Another was asked to compare the ICT research community with other subject areas - would they would have similar stories?

> I think they might have similar stories but the ICT ones do tend to have particular characteristics. Things like, experimentation and having a go at things and also a high level of playfulness I think characterises most of our group everybody is fairly light hearted in wanting to see the fun in the activity it's about having fun.

Another frequently used term to describe the community was 'idiosyncratic', 'independently minded', 'frustrated with being tied down by bureaucratic structures'. As several acknowledged perhaps this reflected that they came to computers in a less 'locked down' age:

> You've got teachers who've come into the business since then. Well, they've never known anything other than the national curriculum and the QCA schemes of work, the national strategies and so on, are they in a good position to be visionary about schools of the future?

How did this research community grow?

The context is a given. There were astonishing developments in technology and decisions taken at micro and macro level to seek to develop that technology in, and for, teaching and learning. A research community grew because projects and programmes were set up, posts were created, courses funded and schemes devised. It was almost inevitable that on the back of this networks of interested colleagues would develop. However, networks had to meet a need. Researchers and developers were drawn together because they were 'working from scratch'. They needed the information and stimulus that others could supply. This explains the networking that was described in the previous chapter in programmes such as MEP. Here one participant recalls seeking a means of networking tutors in ITE:

> This contact has been very important for me. From the early days I think it was the case that we were all isolated we all tended to be working alone in the early days. Perhaps a bit later on people got less isolated. It was very much a self help group. We got together because we were the only people who were doing it so we needed to talk to other like minded folk original meeting I can remember, when it was all about micros going into schools, those first meetings were because the government said the only way we can have the kit was if we put on a twenty hour course for our students and I remember [ ] who called those first meetings, he said 'Come on what's the curriculum for a twenty hour course? And we kind of bashed around, what are we going to do for these twenty hours that we've all got to deliver? What should we do what software?'. Very much self help.

But to understand why these networks were such 'magical' combinations we need to understand the self belief members had in what they were doing and the value they put on working together. Participants throughout their careers believed in collegiality, in schools, in advisory work, in developing programmes; or, as below, in carrying out research projects:

> Well I certainly remember them and I met some wonderful people through those projects. I would say that in a sense the projects were doing almost what the technologies enable us to do now, they created the early networks. And those networks were important, so the important thing about those projects for me were not the technological outcomes, because I don't think they were very profound. We were making incremental changes through those projects. The important thing was the networks they created, the people, the connections. And I am still in touch with

> people that I worked with twenty years ago ….OK, I'm not in daily contact with them but when I see them we have a common point of reference and we talk about change, and reflect upon things. So connecting the people, for me that's what those projects did.

This seeking of collaboration arose even on holiday as one participant illustrates in talking abut networking with teachers in Australia

> I called in on people in the education department to find out what they were doing around technology. And I came across their Teachernet initiative. I called in to see them because I could see that the Internet provided opportunities for joint international projects, so I called in to say, 'hey guys would you like to be involved in some joint international project kids sharing across the internet?' And they said oh yes, and as it happened the British Council was interested in exploring all of this as well. And they picked up that project and took it forward.

As informal networking developed participants recall becoming engaged in well established academic traditions, what might be seen as 'ritualisation'. Journals were set up, papers sought, reviewed and published. Bids were written, seminars organised and conferences took place. However within these rituals some still sought informality, as this speaker describes in this early network of researchers:

> These were twenty four hour events, they were deliberately inter disciplinary. Our colleague had a vision of setting up an inter disciplinary group who would be supportive of IT in education. And each seminar was on a specific topic, and he would invite about 20 or 25 people to these. We went lunchtime one day, we stayed overnight, we left lunchtime the next day. And they were more or less totally open ended events nearly always ended by the end of the first day, half the people there absolutely furious with the coordinator who used to sit at the front and he was very good at taking criticism and abuse but he was wonderfully facilitative so of course out of these people who were mad keen to tell him what we should have been doing and he just let them get on. They were all wonderful events, and there I met many of the people who have remained a hugely important group for me ever since. And it gave me a much more interdisciplinary way into it than I otherwise might have expected.

An important early stimulus for academic research for some was Project Intent. This was set up to support tutors in initial teacher education and helped contribute to an academic tradition in writing about computers, one recalls being told:

> You need to establish a literature, for IT and teacher education. And so we had that little series called DITTE and they were actually refereed in the sense that we had an advisory panel they were reviewed and went back to the author. I think we did some little job, that at least set a vision and something towards a quality standard as DITTE ended, JITTE started. And (*my colleague*) who had been in Project Intent became very prominent in JITTE from the start. So I think there was some kind of, I don't want to claim too much, but I think there was some carry over there and I think also that the initial group of people who were very prominent in ITTE had a part in project Intent.

> I think it helped to establish the idea that it would be a good idea for people to be researching and writing about this.

Another key focus for research in the professional lives of many of the participants was the founding of ITTE:

> I should mention, as I have missed out a key point, I think about 1986 there were a number of tutors who were working in teacher education trying to promote the use of IT in teaching. We were all experimenting basically and I called them together here for a conference and I cannot remember exactly who came but we had about forty tutors and at the end of that ITTE was formed, we decided that we needed to set that up. So ITTE started as a result of the conference.

And how did the research community maintain itself?

Again context is important. Developments in technology meant new opportunities, new questions, new contexts. The policy makers' commitment to computers in school stayed and grew. Research was an ever expanding field, rivalries must have existed but remarkably few are reported and chasing research funding did not feel a 'zero sum game'. However community maintenance was not inevitable and again emerged because the community continued to meet needs and participants were community minded. You continued to learn by participation and working together was better than working alone:

> I suppose I have worked here thirty years and throughout that time I have more or less kept up with changes in technology so sub consciously I have pursued a line of my own CPD basically. If I say how have I done that it has always been through the association, I have learnt through colleagues in MAPE, in ITTE, by going to shows like BETT, if you are working in IT particularly in teacher education, and you don t make the effort to join the association this would be a lonely environment and if you want to keep you really need to be part of external networks. I put a lot in to ITTE and MAPE but I have got a lot from them and I am sure if the institution wants …I know this has been in its way my CPD.

Without that close involvement with others participants felt they would lack the drive to engage with research:

> I need it for my own intellectual energy as a researcher, I need the excitement of discussion of things and I got that from ITTE I got it from IFIP conferences. The conference last summer in Norway was absolutely magical for me…The whole thing is about community, really none of us could achieve anything without the elaborate networking that goes on.

A sense of community provided participants with the imagined audience they needed to write – or as one put it, the 'audience in her head'. Without networking participants would not have access to the necessary collaboration in order to develop their work and their careers:

> And on a personal level I now have this working relationship that come out of ITTE with the four of us have worked on any number of projects over the last few years. That came about because our paths crossed within ITTE and we've now done all this stuff with FutureLab and those things. And that's been a level of discussion and collegiality I couldn't have got within the institution because there is nobody else that involved …so it was the ITTE community that got that side of things going for me.

What has the research community achieved and where has it fallen short?

Participants spoke about successful outcomes of the research community and its weaknesses, they tried to account for the difficulties they had experienced.

What has the research community achieved?

Do communities need a wider justification than maintenance of identity for their members? Whatever the answer to this, participants could point to some outward looking achievements. The engagement with practitioners has been charted throughout the book and participants felt, at different levels, they had an impact on practice. A key contribution here was impact on initial teacher education. Even when successive governments tried to marginalise the role of higher education in teacher education they kept coming back to the need for an academic input into developing the use of computers:

> It has actually kept teacher education on the map at a time when it was disappearing, as we moved to 'everything must go on in school'. Teacher education became a lost ground and the one area I think the government realised that they had to have help was within ICT. So ICT actually kept teacher education on the map, not just for ICT but for the other subjects as well because people were saying 'oh yes, people don't know how to do that yet, there must be somebody else.' And that somebody else was the training colleges and the universities.

Then, there were the academic achievements. In particular the research community had established an academic foundation for the study of computers in education as these three participants describe:

> We started off as practitioners. We were just doing things in the classroom exploring playing with things with students and it was a colleague [ ] who was one of the first people to bang on about the need to really do some kind of respectable research into this area and not carry on with anecdotes. He said we must start to try and put it on a proper footing. This must have been the 90s I suppose.

> This is a considered view that what is published now in the journal, if you take the recent issues and compare them with the early issues, there is now maturity and ….a mature research community has been created.

> When we look back to where we started it was just a few folk working together because otherwise we'd all sink, to where we are now, with a relatively respected voice. I'm quite proud to have been engaged in that all the way through. Looking back from where we were and where we are now and all the people who have been involved I think in the group there are some really talented folk.

Finally, in spite of all the difficulties discussed earlier, participants felt that the research community had engaged with policy makers, had had some success in contributing to policy by showing that the introduction of computers was more complex than imagined, and had assisted when asked in helping implement policy through projects and programmes and through CPD work with the result that:

> There is a recognition now that it takes more than just the kit, there has to be a pedagogy too, but it has taken us a long time.

Where has the research community fallen short?

The academic achievement was considered by many to be incomplete. Many felt that the research community had been weak in discussing and developing theory, or to be more accurate, theories. For sure, participants had engaged with theory and had found distinctive interpretations of, say, Activity Theory, Community of Practice and ideas of ecological perception. However, there was a worry that theory had not been developed by, or within, the community and theorising borrowed from other non computer related contexts: As this speaker noted:

> I would say that there are no major figureheads in our community. Now that may not actually chime very well with what other people may say but for me there are no major figureheads. There is no one or two or three people that stand out as names that I would say 'Ah, this person'. I think collectively this community has generated whatever we have got, however we define ourselves now. And it is very difficult to put individual names to it. Unlike other branches of education, and again this relates back to the fact that we haven't developed our theory. If we had developed this leading edge theory then I think that names would be associated with it. But because we haven't there are no major names.

This fitted a general feeling that the research community was at a deficit compared to other disciplines. As one put it 'education research is not theoretically strong and ICT research is less strong than other work in this sector'. They had built up a lot of empirical evidence about the application of computers but had not adequately theorised or come up with a convincing account of technology:

> We haven't had our theory sorted out, strengthened. We as a community were people who did what worked to start with, weren't we? We weren't theoretically strong. I think we are getting a bit stronger but I'll come back to that but I think there's been a weakening recently.

This was reinforced by another participant who had long experience of reviewing papers for publication:

> I still think that much of the research is still patchy and inconclusive. I don't know what the answer to that is I've struggled with that for a long time because almost by definition its going to be inconclusive because we are doing small case studies not vast longitudinal stuff. So …..a lot of the things we're reviewing for the journal come up with a conclusion of 'I'm against evil. More research should be done!' I think that's really bad, doesn't really nail anything.

Some, however, had vastly different views on this and felt there was too strong an engagement in research and theory and too little engagement in technology and supporting the practitioner:

> My own view is that ITTE has got a bit too research oriented for my liking….for example I was really expecting to hear about Wikis and blogs from ITTE, from tutors who have done it on courses or in schools and I think ITTE needs to get the balance right between allowing members to develop their research interest but also to do this other work…...

While this was not the majority view all realised that the research community was not impacting on practice in the way it could and indeed should. Of course it was not researcher's fault if their insights were sometimes ignored by policy makers and practitioners but they could offer both audiences greater coherence and a better account of what technology could be expected to do and not do.

Why the success and why the difficulties?

The achievements of the research community had come about by the proactive work of its members; their willingness to take risks; willingness to straddle pedagogy and technology; and an instinctive orientation towards collaboration. The community was felt to be welcoming and inclusive:

> I think almost without exception everyone I know who is involved with ICT is involved with the research side as well, so I think it has been a success.

So what had caused the weaknesses? In terms of practical impact it had always been a matter of size. Talking about MAPE one observed:

> I think it has been recognised …we have always had good feedback from teachers. The problem is MAPE is 300 teachers, at its height 500 teachers, and out there are a quarter of a million teachers and 500 is neither here nor there…

In a similar vein, talking about ITTE one observed:

> When any initiatives in ITTE get discussed; we just don't have the critical mass. It just sustains things over a long period of time. An obvious area might be you take the initiative like the ICT tutors website, well look how difficult it is to keep something like

> that going. And that's got money behind it. Sometimes if there was to be a major undertaking it would be something like getting ITTE to have a method for sharing its expertise, I mean that at all different levels. The most obvious thing being why there can't be some project to pull together the five best teaching sessions that you've ever taught. To build a library of resources, and archive of resources, for example, that would give a real insight into how other people do stuff. I have only a marginal understanding of how you work in your place. And I'm not sure to what extent I need to have a better model. Sometimes I feel that that is an oddity about the type of organisation we are. We only really know about each other in a very general way. I don't know what you'd do about it. You'd have to have somebody go around these places and get the data.

In terms of developing academic research, the community was too small; members had too little time; they had over extended professional lives; and they faced a context that was shifting too quickly. In addition, several noted the 'newness' of the field and most members had not grown up thinking about technology but had adapted to it. Looking further, such strong practitioner roots could be a weakness as well as a strength:

> People come in with different values and different backgrounds - it's a question of biography, you know what had I been doing for the past eighteen years when I became a full time member of staff here? Well I'd been doing other stuff, I hadn't been doing research. What has somebody who has done a first degree and then a higher degree and then become a university lecturer what have they been doing for a comparable length of time? They've been doing research. So, I extend that out to education departments in general where, by and large, people have got a background as a teacher, people come in after being a teacher, and you don't come in to that world prioritising research, but prioritising teaching.

Perhaps there were weaknesses in the community itself and was it as inclusive as they imagined?:

> Areas like the obvious ones, networking is good but I can't say there is any major or long term and sustained relationships I've got with colleagues at a distance as a result of being in ITTE.

And the tension between practice and academic engagement could prove a weakness as well as strength:

> I think there is a dislocation between colleagues who are engaged in the theorising and the research and colleagues who are engaged in designing these modules and teach them.

In spite of intention perhaps the community could appear closed to newcomers:

> I was involved and went backwards and forwards for a few years, I was always on the periphery. I think as a young person at that time I was still suffering acute insecurity.

Or certain colleagues might appear careerist in orientation:

> And actually I know some people have been critical of some of the chairs of ITTE, using it for their professional advancement. Because quite a number of chairs of ITTE have ended up as Profs, for example. But I really don't think that the people in ITTE take on those responsibilities and go on the committee and do all that for personal advancement. That's one of the few communities in education and higher ed that that is not part of the deal. And it's not surprising that the people who have that kind of commitment and engagement end up in positions of responsibility and influence and power.

All noted the age profile needed shifting. For example, many who had been involved in ITTE were approaching the end of their careers together. This created problems of continuity and, intriguingly, one noted perhaps members were not 'at home' with technology in the same way as young people:

> The way a teenager operates in social networking with groups of people they've never set eyes on. They are working in a fundamentally different way, it seems to me, and we are stuck with the legacy of working in the way we do simply because that's who we are and that's where we are in the timeline. And it's very difficult to break out of that….. I mean potentially we could be doing more of the open network. And I'm still the same. I will only start having exchanges of papers and ideas with people I've met and talked to. If somebody comes online and says 'Look I'm so and so and ..', I'm wary, because it's the way we are and it's characteristic of our generation. Whereas my eighteen year old daughter would be open to that, much more than I am.

Where to from here?

In discussing the future many of the participants realised that though they still had many projects and issues which engaged them another generation was needed to move the work of the community forward. They were pleased to have been engaged with computers in education and proud of the tradition they had helped create for the research into computers. This tradition valued educational reform; stayed close to practice; believed in collaboration; sought to be serious, critical, playful and enthusiastic. There were gaps. Over time some had sensed that their initial vision was unachievable but worth trying to achieve any way and to go on trying.

Summary

This chapter has looked at the idea of a community committed to the research of computers in education. It has described membership of the community as founded on a sense of belonging and suggested some distinctive features of this particular community. It describes both achievements and shortcomings in the community.

The key question asked of community was 'what are its achievements and what are the challenges?'

The achievement is to have established a tradition of support for each other; to have made research into technology respectable; to have looked both at technology and pedagogy; and to have had some impact on policy and practice. The difficulties are weaknesses in developing theory and low impact on practice. The challenge is to develop theory and develop practice while recognising the constraints on activity.

8 Discussion: Voices Project reviewed

This book arose out of work on the Voices Project. We conclude by giving members of that project a say on the six questions raised at the start of the book with the aim of stimulating further debate in the community. The speakers are Vicky Cartwright (VC); Michael Hammond (MH); Sarah Younie (SY); John Woollard (JW). Each speaker is offering a personal not 'an ITTE view' on the issues raised.

Can we identify what has been gained and lost, particularly in the development of software, during their careers?

MH: Yes, reading this section again I want to reinforce that it is not about the resurrection of small programmes, but someone do that for *Suburban Fox* please, but it is that close working with teachers that has been lost and needs to be recreated. I guess I am also a bit nostalgic for school's hardware and software though I know that will not come back. I get upset when I see schools using *Access*, because it was bundled with *Office*, when they would be much better off using things like *Pinpoint* or other databases designed for curriculum use.

JW: OK, I agree with that but there is another view. I remember, a couple of years ago at an ITTE Research Conference, a whole group of people saying 'we, as teachers, should identify what we want to do, what we want to teach, what we want the pupils to learn, and then design the technology to do it'. I wanted to say 'we should get the technology and then see how it can be imaginatively used'. As one colleague put it in the book the affordances don't really emerge until someone tries to use them. By all means get that close working relationship but it is not just providing what teachers want, but also providing what they don't know they want until they see it or have tried it.

MH: Within this way of seeing things, do you think that Logo is something lost?

JW: Well, we have that view represented in the book; one colleague in particular is really interested in *Logo*. He wants us to go back to the idea of understanding the technology, not just being a user of technology. I like the parallel with *Second Life*, for example, he says, more or less, that you can have this fantastic time playing games in *Second Life* but it's how you manipulate and build and change the worlds which is important. So *Logo* left a tradition which is still there, it is not so much talked about today, and to be truthful does not really get a space in ICT as a subject which I think really is a problem. I don't think this is about us becoming 'techies' it about the importance of the imaginative use of technology and doing things with it that go well beyond the designers had envisioned.

Why is the introduction of computers so problematic?

MH: I think we know all the usual arguments and they are covered in the book, but the one thing I would like to add is the importance of routines. Teachers stick with the known way of doing things but we need to understand why routines are helpful in our work and in our daily lives. We need routines, to do some things automatically, so we have time and space to think about the things that really matter. To change requires that extra dollop of energy, planning or whatever, and we might just not have it.

JW: Yes that is understood, but there is a wider point in that the technology offers the potential for all sorts of things and that has always been the case. The vision for the use of this technology is limited by our understanding of what technology 'can do' and moulded by what we think education 'should do'. Those 'should dos' seem to stay pretty constant yet the technology 'can dos' move forward in leaps and bounds. There is your problem.

SY: I think what comes over is that computers were seen as this opportunity to do something new and different; to change pedagogy. But when you look at the way they talk about these colleagues talk about their careers there was an embracing of risk; these folks were the risk takers, with the spirit of pioneers, embracing new frontiers, with an awareness of tensions, contradictions and certain romanticism. They found an opportunity to, if I could put it, fracture what has gone before: technology can provide a space for us to open up our preferred practices and engage with new ways of doing things. Now that is great place to be but also a scary one and I think what they are wrestling with is to give that vision widespread appeal so they don't end up high and dry as the hero innovator, the disappointed enthusiast. There is a real and necessary tension between being utterly respectful of teachers and the work they do and disgruntled at the way schooling takes place, and that came out I think.

How do beliefs about teaching affect the use of technology?

MH: I found the chapter on beliefs a very difficult one to write as it is absolutely clear that in some way people's ideas of teaching and learning link up with their view of technology. There is no doubt about this, but it is very, very difficult to unpick. The problem is that we are not really talking about technology as a thing in itself but what we see in it. To be provocative, I wonder if computers are not so much a tool for creativity, as suggested in the book, but instead are tools which will be used creatively by creative people. If you like, what comes first the technology or the pedagogy, is it chicken or egg?

SY: Yes, I think some of that comes over and what stood out in the interviews, we could not include all this in the book, were the metaphors when talking about technology. The images recalled the first writing on cyberspace: weaving the web, understanding the warp, weft, threads, linkages, crisscrossing, interconnectivity and multiplicities – of blending and nonlinear networks. So yes, the participants carry a sense of technology, not as bits of wire, cards, processing chips or whatever, but of actions, of connections of drawing people together. We

should have asked them what do you think a computer is – we would have got some interesting replies.

JW One of the areas emerging in some of the responses is the value associated with computing. The ITTE community is a diverse collection of those who can do powerful things with the technology, others that can make the technology do powerful things and some that feel that teaching pupils how to make the technology do those thing is important. To them, and I am one of them, the value of all pupils at all ages, at the appropriate level, understanding things like algorithm, data structure, logic, binary, instructions and procedures is as necessary as being able to understand grammar rules or manipulate number. Some of the participants show regret in the decline of computing and I agree with that and it really does open up a point of divergence with the community.

How has policy helped develop and helped constrain the use of computers in school?

MH: I think there is a real critique of policy here – and incidentally I think health professionals, social workers and so on would have very similar stories. But I want to hold back a bit and say we don't know how it looks from the point of view of politicians. If you are thinking about Labour, they remember the days when schools were pilloried in the papers all the time, public services under attack, open season on teachers, unelectability of their party. You cannot underestimate that legacy, and I am sure they will argue all this central control in their eyes, not matter how fanciful this sounds to you and me, is about saving the idea of public service, not undermining it. Then you need to recognise that is what is politicians do – they simplify a lot of complex arguments in a story which is easily understood. That is a pain, but that is the way it is. They reduce it to headlines: 'The Government has resolved to put a computer into every school', 'Government to train all teachers in ICT'; 'All schools to have a VLE'. It sounds modern, it seems compelling story, it sounds like progress, but in a way it is nonsense. We have a different story but where is it? We need to market ourselves better or, if we can't do that, just say we cannot engage in this kind of thing!

VC: I want to come in here from my experiences as someone teaching in a primary school because I've been able to interpret what participants have said to me in the light of my own experiences. Something which really began to come across as I interviewed people was a feeling that a 'golden age' had somehow been lost - a time when teachers were more free to experiment without the constraints of a prescribed curriculum or heavy accountability. I don't know if that is true but it is backed up by many of my teacher friends. They had not necessarily had much to do with ICT but those who taught in schools, pre-National Curriculum, view things in the same light.

As someone who began teaching 'post National Curriculum' I feel envious when I hear colleagues and friends talk about the way things were. Part of me feels as if I got the short straw and entered the profession at the wrong time! A friend of mine who's been teaching for

nearly forty years, who feels like this, often talks of the pivotal role the local authorities had at this time and really laments their loss of power. I had never really understood what she meant until my analysis of the interviews for this project began to merge with my own experiences. For instance, during interview analysis, a really strong concept of the role of the LEA as an important intermediary began to emerge. There seemed to exist a time when LEA's excelled at the job of both 'interpreter' and 'supporter', in that they could somehow bridge the gap between what government wanted and what teachers in schools could feasibly do. I am sure it was not always like this, but contrast this to today's, my own at least, experience as ICT coordinator in a county that has very few advisors left. If we want support with ICT in our school we have to buy in help from run-for-profit consultancies. When I contrast my current experiences of support to those of my colleagues in the past, yes, I do feel short-changed. It is that role of intermediary between policy and school which is missing, now it is all one way, policy (or strategy) on school.

JW: I'd like to go along with this, and can see it from, if you like an earlier generation. During those early years of computers in school, I was a teacher with a PET, BBC B and then Acorn Archimedes. Our successes would have been more difficult without the local authorities and the agencies like MESU, Blue File and the examples at BETT. I was fortunate to become a teacher advisor and work with schools, in schools teaching pupils as well as supporting teachers. The demise of that support was brought about by, what was very much, the commercialisation of the local authority who had to sell their services to schools. Something disappeared.

What are the achievements of the research community, where are tensions?

MH: I really agree with the participants that as a community we are theoretically weak and I think they cover why this is very well.

SY: Well, OK but let's look at the achievements first. For example what participants valued about ITTE, and other associations we mention, was the way they provided a way out of institutional isolation. Also, in the wider education community, those interested in computers were marginal, what ITTE and others did was to provide a counterbalance to this, too. Looking specifically at ITTE the idea of community is something we understand and experience, yet we have not articulated what this means; we need to explore our shared values, dig deeper, we need to leave traces for those coming through. So one thing which is an achievement is the way we care about each other, as well as the projects and technology we work with. For me the striking things is that ITTE has endured over time and with a stable set of values, which though not explicitly stated anywhere are deeply understood and shared by many. It is about supporting one another, helping to solve our problems, figuring it out; it is about lobbying when needed; and, it is not about delivering government agendas. But, we do maintain links with government agencies; we respond and give.

So looking back, what has being on the project given you?

SY: I can say something from the heart here. I guess that one lesson from this participation is to perhaps, how can I put it, dissolve the spaces more between our heads and hearts. As clearly, what emerged in the stories was a passion and caring about what we do. So, valuable for me to remember was that the opportunity exists when we meet, talk, either face to face or online through email, to carve out in both the formal and informal moments, those spaces that allow a meeting of 'hearts and minds', which bring a community of practice to life. Above all, it is when we meet that an engendering of trust emerges, re-merges or gets carved anew, for newcomers and those long around the scene. And, trust is not a decision as such, but rather grows cautiously and develops in the right spaces and interactions. It is when it is possible to share your thoughts, worries and fears, we can create a community. I am seeing this from an ITTE angle, other associations do similar work I am sure, but the message for me is that ITTE is a space where we can share our challenges and excitements, explore new and difficult ideas, ask searching questions, predicate propositions and take risks to seek something novel to us, to reinvent or awaken our curiosity with our own and others' learning through and with technology. ITTE offers a sense of working together. It gives us a sense of connectedness; alongside the opportunity to check out with knowledgeable others in the field whether I am on the right lines or need a bit of navigating in other directions, gently steered through exchanging repertoires. What feels like choppy waters to a lone yachts person may suddenly dissipate into the calm, waters of an ocean liner. Oh dear that is a bit romantic but I mean it, this is what they have done, this is the tradition we all need to understand and respect and I understand it a bit more from contributing to the project. Also, well it all sounds terribly 'luvvy', but it is important to honour the work others have done, dedicating honorary lectures and keynotes at our conferences and so on.

MH: I want to add some things. One, like you, I found their stories utterly compelling and I am so glad we did this project, that we remember the tradition. I loved those 'but yes I thought that too' moments, and I loved the fact they worked so hard and in many ways have had successful, well meaning careers and yet they could come up with so many ways they fell short! Two, the sense of engagement in work – the old distinction between work which engages the soul and labour which is thrust on you, and how it is so important to find spaces in which you work, not labour. Three, working on the project really gave me an understanding of time, remembering, for better or worse, that things were otherwise, those 'there was a time when …' moments. I am left with a feeling that what seems so fixed about teaching and learning is so much more temporary and than I had imagined, we are bounded by the times we live far more than I had realised, but knowing that is the only hope of being released from it. Oh dear that sounds like a cliché and good place to stop!

9 Where to read further

Biography

There is extensive literature on teachers' lives and why we teach but much less on teaching in higher education. Key early texts on teachers' lives were Ball and Goodson (1985) and Goodson (1992). Ivor Goodson, in particular, has maintained a long commitment to teacher life history. An NFER paper (Spear, Gould and Lee, 2000), though dated, sums up the literature on why teach. Those with an interest in why teach ICT as a subject might look at Hammond (2002). A very readable account of an earlier time for beginning to teach is Hannam, Smyth and Stephenson (1976) – it will help you believe that there has been progress in how we treat new teachers!!

The section on Plowden and the progressive legacy has been informed by Gillard (2004). Those wanting to reassess the first Black Papers go to Cox and Dyson (1969a, 1969b). Cox and Dyson, authors of the original Black Papers, were more liberal minded than those that used their work, as recent obituaries make clear, see, for example, Cox on Dyson (Cox 2002).

Wikipedia is a good repository for history of technology and its role in the media. Go there for more on television programmes such as *Tomorrow's World, Doomwatch, Dr Who and Star Trek*. An earlier point of reference on the ecological impact of science offered was Rachel Carson's *Silent Spring* (Carson 1992).

There are several web sites (addresses below) with pictures and information about early computers. These include *People History*, which is largely USA based, and the UK *Centre for Computing History*. To see examples of the first specialist computer magazines, try *Magforum.com*.

On line archives of the broadsheet newspapers and of the BBC are helpful for accessing reports and surveys for the take up of technology in retailing and social activity. They also include obituaries, including to some of the pioneers of computer in industry, for example see the Times (2008) obituary on David Caminer. This serves as a reminder that for commerce the interest in computers in the 1950s was the capacity to process routine calculations quickly.

In regard to curriculum reform, Stenhouse's work was read widely (e.g. Stenhouse 1975) and see Elliott (2006) for an appreciation of his impact on the Integrated Humanities Project.

Several academic colleagues have offered views on 'where we have been and where are we going' in the use of computing, these include Dillon (2004), Watson (2001) and Somekh (2000). Meanwhile Reynolds, Treharne and Tripp (2003) take a wide view on the hopes invested in computers.

Technology

Web sites mentioned earlier, such as *Wikipedia* and the *Computing Museum,* are very informative on technological developments over time. A review of technology in primary school is offered by Govier (2007). Rushby and Seabrook (2008) reflect on the development of early software which complements some of the ideas put forward in this book. Two editions of *Journal of Computer Assisted Learning* provide a snapshot of uses of technology at the introduction of the National Curriculum. Contributors include Rogers (1990) on science; Griffin and Davies (1990) on Information Technology, Blease (1989) on implications fro the primary curriculum; Adams (1990) and Ball (1990) on implications for the English and Mathematics curriculum respectively. More recent studies on the introduction of the Internet to schools and the use of IWBs can be found in the journals listed at the end of the section. A further important reference looks set to be the National Archive of Educational Computing – web address below.

Application

The flip side of early software – the drill and practice programmes - were critiqued by Chandler (1983). Another early voice was that of Kelly (1984). A provocative account of the early introduction of computers in one school in Canda was given by Olson (1998). There are huge number of case studies on *Logo* but see the seminal work of Papert (1980), and his follow up (Papert 1993); see also Agalianos, Noss and Whitty's (2001) attempting to make sense of it all. The *Impact Report* was carried out by a team at Kings College (Ed Watson 1993) and the case studies give a very good and readable picture of the range and scope of computers at the time. Good overviews are also provided in Underwood and Underwood (1990) and Underwood (1994). The interactive video in schools project generated several papers and a review by Norris, Davies, and Beattie (1990). Squires and McDougall (1994) popularised the idea that in choosing and using software we should consider the interaction of teacher, technology and pupil. NCET and now Becta have carried out numerous studies. One early influential document was *IT Works* (NCET 1994a) – an attempt to bring together the existing literature and try to identify what is was about computers that might support achievement. Around the same time there were important studies on *ILS* (NCET 1994b) and on interactive media (NCET 1994c). Details of ImpaCT*2* and Test Bed can be located on the Becta web site (Becta 2007, Becta, undated) including access to Harrison et al (2002); Somekh and Underwood (2006). See also a review of the thorny issue of computers and attainment (Cox et al 2003).

Ofsted (2001, 2004) give a very useful overview review of NoF training and other government initiatives. These reports support many of the points made by participants in this book though Ofsted does comment more positively on developments in the teaching of ICT as a subject. For a sympathetic account of the teacher role in fitting in the use of computer see Cartwight (2007). There is a very wide literature on barriers on the use of computers (e.g. Jones, 2004).

Philosophy

We know there is a link between beliefs about pedagogy, available tools and what the teacher does in the class but how all this comes together is a matter for further exploration. A helpful contribution to this debate is that of Cox (2004). Engeström's idea of activity theory (Engeström, Miettinen and Punamäki 1999) has been widely applied to help show the use of technology in a wider system of rules and division of labour. The idea of affordances of technology is a very powerful one – though there is a great deal of confusion as to what affordances are. Kennewell (2001) offers an imaginative attempt to apply the concept in the classroom. Sutherland and John (e.g. 2005) also discuss affordances in the context of a large ESRC supported project. A book which some of the participants described as influential in raising the awareness of activity theory and an idea of affordance was Salomon (1993). We have tried not to pigeon hole beliefs about teaching in terms of alignment with the theories of Vygotsky, Piaget and Skinner but rather a set of beliefs about what is important in learning. A similar approach was undertaken by Nixon (1994) in his study of university lectures which has been influential in writing this chapter.

Policy

John Foster at MEP provided a brief overview of his hopes for the organisation (Foster, 1971) and one view of MESU was offered by Thorne (1987). An early attempt to consider policy at a European level was made by Eraut and colleagues (Eraut 1991). Hargreaves (1994) drew out implications of these changing times for policy makers and his ideas are arguably as relevant today as when first published.

Fullan (1991) stressed the importance of understanding different perspective on educational change and has been hugely important in our understanding of why the outcomes of new policies so often disappoint. See also the influential work of Lieberman (1995). Cuban (e.g. 1986, 1993) has been a popular voice on the difficulties of using technology in schools in the USA summed up in his pithy headline 'school meets computer, school wins'. Selwyn, amongst others, has been a frequent commentator on the gap between government and practitioners' perspectives on technology (e.g. Selwyn, 1999; Selwyn and Fitz, 2001) and see also Younie (2006).

For details of national teaching strategies go to the DCFS web site (DCFS 2008) and view the *Harnessing Technology* (DES 2005) document to get an overview of policy goals for computers in teaching and learning. The *Trotter Report* was published in 1989 (DES 1989) and Project INTENT was outlined in the Journal of Computer Assisted Learning (Project Intent, 1976).

The tension between using computers to support the curriculum and to change the curriculum runs through discussion of policy. It has often been argued, and disputed, that there are stages in the use of computers, this was, for example, articulated very early on by Sendov (1986);

finding expression in the *Stevenson* (1997) and *McKinsey* reports (1997); and presently informing ideas of E maturity.

Community

Bob Lewis has been an influential figure in research into computers – see an appreciation in *Journal of Computer Assisted Learning* (Editorial 2004). Hawkridge (1999) carried out an informal review of early editions of *British Journal of Educational Technology.* Richard Fothergill was the first director of MEP. He was spoken about with affection by those participants who knew him first hand, it was reading his obituary (Anderson and Page, 2004) that planted the idea for the project

All the organisations mentioned in this section have web sites - see below for Mape, Naace and ITTE. See also Naace (2008) for a review of its history and go to the ictopus (ICT Online Primary User Support) web site, a successor to MAPE. One organisation not mentioned was ACCITT*,* an attempt to network ICT coordinators in school, which merged with the new Naace.

The idea of community of practice has been popularised by Lave and Wenger (Lave and Wenger 1991, Wenger, 1998), though our chapter steers clear of applying this term to describe the networks between colleagues. Rovai's idea of community as a sense of spirit, trust and interaction seems particularly helpful but it is an open question as to how far the research community is a learning community, a term which seems better applied in formal learning contexts.

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