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.