Children's use of home computers from a cultural psychological perspective

by

Lucinda Kerawalla

A doctoral thesis submitted in partial fulfilment of the requirement
for the award of
Doctor of Philosophy of Loughborough University

May 2002

Abstract

This thesis adopts a cultural psychological perspective on children's use of computers at home and, as a contrast, in the classroom. It utilises various methodologies to investigate the actual uses that children make of computers in these settings and also focuses on how computing practices are situated within the local ecology, or context. Seventy six, 7, 9 and 11 year old pupils from five socially and ethnically diverse primary schools were interviewed in their schools. In addition, thirty three families with children of comparable ages, from the same five schools, participated in a detailed study of the ecology of home computing. Findings suggest that, although parents had high educational aspirations for the ways in which their children would use a new computer, these aspirations were not met in reality. Entertainment games predominated and educational software was used comparatively little. This thesis explores why this was the case and finds that it was the differing ecologies of the home and the classroom that mediated the different uses that were found in either setting. The institutional context of school contrasted sharply with the context of the family home. Despite a declared motivation to use ICT for supporting school work, parents revealed very limited knowledge of how ICT was actually integrated with life at school. Moreover, they were reluctant to orchestrate ICT use at home and were not eager to engage with it themselves. Children were also less than willing to accept such joint activity and parents were uneasy about the "hothousing" that might be implied. In an attempt to map whether/how home computer use evolves over time, the 33 families were given 6 novel educational software titles and asked to use them as they wished over several weeks. Usage was logged and results suggest that the children used these titles more in the first two weeks and that usage levels then fell and remained at a consistently low level. Parents were also disengaged from it throughout the whole study period. Parents and children were also asked to give their opinions of these titles and cited several features that they felt were important in contributing to their child's use and enjoyment of it. The findings of this thesis are discussed in relation to how educational software on CD-ROM; and hence the home computer, is currently an under-used resource in mediating stronger home-school links. Suggestions are made about how this may be overcome in the future.

Acknowledgements

Dr Charles Crook: for being my ever available supervisor and providing lots of constructive feedback. Also for writing the programme for the log in window and those that analysed the Snoop data files.

Dr David Middleton: my director of research

Ayub: sincerest thanks for absolutely everything

Colleagues: Roy, Shehar, Val, Martin, Jonathan and Kyoko for cups of coffee, lunch breaks and helpful chats

Dave Barrowcliff: thanks for invaluable technical assistance with families' home computers

Jim Barton: for running the family computer help line

The head teachers, teachers and pupils of all the schools involved

The parents and children of the 33 families who let me into their homes

Educational software companies: Dorling Kindersley, Europress, Davidson and Sherston Software for their very generous donations of more than 200 educational software titles.

Omniquad: for generously donating their desktop surveillance software

Table of Contents

List of figures

List of Tables

List of appendices

Chapter 1

Introduction

Today, children are living their lives as part of the "information revolution", and ownership of electronic media such as mobile telephones and personal computers is steadily increasing. Computers are used for both leisure and study pursuits in a variety of public and private settings, such as schools, further and higher education establishments, the home, libraries, museums and cyber cafes. They are used in different ways in these different contexts and support different types of computing experience.

The National Grid for Learning (NGfL 2001) report that 99% of young people aged between 5-18 report having used a computer somewhere. This is broken down into 98% accessing a computer at school and 75% at home. Access beyond these locations varies according to the child's age. Some 5% of children in key stages 1 and 2 report accessing computers in public libraries, whereas 17% of children in key stages 3 and 4 report access in this location plus 4% at internet cafes. The reasons for an increased use of computers in public spaces with age are likely to be due to older children having more project-based homework to carry out, as well as being more autonomous and capable of using the internet unsupervised. The main reason that children use computers in public spaces is to access the internet. It is very difficult to find statistics relating to how they make of the internet in libraries as the librarians' code of conduct stipulates that all use is confidential and they are not permitted to report usage details.

Computers in museums can also support internet use but an additional use is the provision of interactive computer games and displays. Adults with children aged 5-10 years constitute 13% of all annual museum and gallery visits (mean 2.59 visits per year) (MORI 2001). Some 61% of children report that interactive computer games make their visits more enjoyable, and 58% say their visit is improved by the museum providing the opportunity for internet access. Museum and gallery web sites are also quite popular, with 27% of children having visited one (ibid.).

The research in this thesis will focus on children in key stage 2 (7-11 years). This age group has been chosen as being of particular interest because these children are not complete novices, they have some experience of computers but are still at the stage where their abilities are developing (the range of ages will represent children of varying abilities and experience). The above statistics indicate that children of this age rarely use computers outside of home and school, probably because of safety concerns and their lack of expertise. This thesis will therefore focus on computer use in the home and the primary classroom.

There is a growing awareness amongst researchers that computer use is embedded in local context so that any investigations must take account of the mutually constitutive relationship between computer and local ecology. This theoretical stance raises interesting questions about how the introduction of a new form of electronic media, into a pre-existing context, acts to remediate the activities that take place there. The PC has had a huge impact on work and leisure practices since its introduction in the early 1980's. Many children and their parents have aspired to own one. Currently, home computers are an integral part in many children's lives, and some children have never known life without one. Those without access to a computer in their home will probably have encountered one at school. Their childhood is very different to that of their parents. But what do we know about how home computers are actually used by children? What features of the domestic ecology constitute that use?

This chapter will first consider the aspirations that people in the 1980s held for this new technology to revolutionise their domestic lives. It will go on to look at the current market for home computer hardware and software and then discuss the current political climate in which this market is situated. Chapter 2 will introduce the cultural theoretical perspective which this thesis adopts, and in Chapter 3 I will review previous studies into the area of children and home computers. Chapter 4 will discuss the rationale behind the different methodologies used and the following chapters, 5 to 8, will present and interpret the empirical findings of the current project. This thesis will close with a general discussion in chapter 9.

1.1 Home computers: the dream

When microcomputers first reached the family home in the 1980s there was much fanfare about their potential benefits. "Every home should have one" ran the title of an article in The Times newspaper (Johnstone 1981). This journalist suggested that home computers will eventually be used for keeping household accounts and for "teaching aids...[such as] cookery, algebra, modern languages and mathematical games". A few years later, Hewson (1984) wrote how he "learnt to love" his new Apricot personal computer and how it "liberat[ed] acres of previously cluttered desk space" in his home. There was widespread optimism that the home computer would revolutionise domestic life as well as liberate the child learner.

Buyers in the 1980s, as today, were most likely to be at the age when they had children living at home, suggesting that children have played, and still play, a part in their parents' decision to buy one, both in the UK (Johnstone 1983, Mintel 2001, Venkatesh, Shih and Stolzoff 2000) and the USA (Newburger 2001). Children also gained access to computers in schools as education began to receive additional funding, and revolutions in teaching practices were predicted. "I think the computer will blow up the school"(p72) wrote Seymour Papert, the educationalist, in 1984. Critics of this euphoria claimed that it was no more than a passing fad and indeed no different from the enthusiastic welcome that the radio and the television had received when their potential contribution to education was first realised (Cuban 1986). But unlike other domestic electronic media, the excitement of owning a personal computer has never totally subsided. Bill Gates (2001), writing for the Sunday Times, said that "if the last 20 years have been impressive, the next 20 will be astounding". New developments, such as more powerful processing chips and improved graphics, alongside compelling advertising, have fuelled a market where enthusiastic buyers want their children to have the advantage of the very latest technological advances.

Of course, the current home computer is very different to those referred to in the above newspaper articles. They not only look different, but are also capable of running software only dreamt of in the early 1980s. But what has become of the early widespread optimism that computers in the home could revolutionise childhood learning? Have these ambitions been manifested in reality? With the exception of a now rather dated study carried out in the mid 1980's in New York, there are no contemporary studies that have investigated home computer use with a specific emphasis on children's use of educational software. This is an important area to study given that parents indicate that a main reason for purchasing a home computer is to support their children's classroom-based learning. Educational CD-ROMs have been designed specifically with this in mind. They are concerned with providing a learning experience that will support national curriculum requirements. It is therefore relevant to ascertain to what extent they are actually being used by children at home. There is therefore a renewed need for this topic to be addressed, which is one issue that this thesis hopes to fulfil.

1.2 The current home computer hardware and software market

Personal computers are penetrating more and more homes, from 13% of UK households in 1985 to 41% of households in 2001. Moreover, ownership in more affluent homes reaches 80% (Mintel 2001). In computer-owning households, those with children spend a higher proportion of their income on computer products than those without children. This is due mainly to educational use by children and also to the fact that most computer games are designed specifically for them (ibid.). This burgeoning computer hardware market is accompanied by a steady increase in educational software sales (defined by Mintel as unbundled software that teaches a topic, or is a revision aid or is a reference CD-ROM). Sales have increased from £35.7million in 1995 to an estimated £92.3million in 2000 (Mintel 2000). These market researchers conclude that "children's titles have proved vital to this growth as an increasing number of parents recognise the importance of IT in education". These statistics suggest that more and more parents are investing in home computer hardware and educational software as a support for their children's out-of-school learning. This raises the question of whether or not the provision of the hardware and software is enough to ensure that children actually use them.

Advertisers are tapping into this potential family market and advertisements for computer hardware and software, specifically appealing to the family, are commonly seen in various newspapers and computer magazines. Hardware advertisements (see appendix 1 for an example) frequently depict a traditional family (of usually 2 parents and 1 or 2 children) gathered around a single computer. They therefore convey the message that the computer can catalyse whole-family activity. In addition, these family members are typically smiling or laughing, transmitting the message that home computer use, and hence learning at home, is fun. They are engaged with what is depicted on the screen, suggesting that owning a computer can give hours of absorbing activity.

Advertisements for educational software often depict products suitable for family members of all ages. They suggest that learning can be a totally new experience by utilising vocabulary such as "fun", "easy", "exciting", and "captivating", to describe the products (see appendix 2a and 2b for examples). They promote interactivity, on both interpersonal and person-machine levels, suggesting that the child will have an engaging experience. But do advertisements portray what happens in reality or are they just depicting an ideal world?

The growth of educational software sales, and the promotion of the home computer as an educational tool, has made the issue of "learning" a visible one. It is a concern for parents, who are buying more educational software every year, as well as for schools. It is therefore important to discuss the government's position on this issue, which is what the next section will address.

1.3 The current political climate of family learning

Increasing computer hardware and educational software sales are taking place in a political climate that promotes learning in the home. The first white paper of the previous Labour government (in office 1997-2001) realised the potential role of the school and the home in the promotion of ICT as a support for learning. It was called Excellence in Schools (DfEE 1997a) and in it David Blunkett (Education Secretary at the time) stated that " we want to change attitudes towards education and foster a realisation that education matters to everyone...and it is through family learning as well as ...formal schooling, that success will come". So New Labour were concerned with raising the educational level of all citizens and, in order to achieve this, schools and parents needed to be involved.

In 1998 the government published another paper called The Learning Age. In it they laid out their plans for developing a new "culture of learning" in Britain. Part 6 of the introduction of this document describes the role that they foresaw the family would have in this broad scheme of promoting lifelong learning. It describes how "family learning can contribute to the reversal of an otherwise vicious downward spiral of underachievement..." (para. 6.2). It envisaged that the whole family would be involved, from children at school to adults carrying out evening classes. It would boost the involvement of family members in children's schooling as well as encourage children to take part in more general learning opportunities as they arose within the family. In order for this vision to be realised, the culture of homes and workplaces that have hitherto had learning low on the agenda, had, they claimed, to change.

In addition to this, it has been a legal requirement since September 1999 that every school draws up a home-school agreement. The DfES (the renamed DfEE) website states that the school-home agreement should contain guidelines on the school's aims and values, the school's and the parents' respective responsibilities concerning attendance, behaviour and homework, and what the school expects of the children. Generally, the agreements outline the role of all parties in generating and maintaining a partnership for learning. For example the school commits itself to regular parents evening to keep parents informed of their children's progress, the child agrees to abide by school rules and parents agree to ensure that homework is completed.

The government also foresees that the home computer, or more specifically the internet, will have an increasing role in children learning at home. They initiated the National Grid for Learning in 1997 (DfEE 1997b). This is a vast and ever increasing collection of hyperlinked web pages that support lifelong learning. For example, there is a secure children's club, access to museum websites, teachers' sites, links to online libraries, access to past examination papers, reviews of over 5000 educational software packages as well as practical information for parents about how to support learning in the home. This resource can be used by learners of all ages and is accessible from any establishment with a computer and internet connection.

This political climate is one in which the government wants to raise educational standards and realises the potential of the home environment to participate in this. They want parents to be increasingly involved in the informal education of their children. The home computer has a potential role in this. To what extent are parents actually willing to become involved in using the home computer as a learning tool? How much educational software do they buy? Moreover, do they actively encourage their children to use it?

1.4 The need for research into children's use of home computers

The increasing penetration of computers into homes has resulted in more and more children encountering them in their daily home lives. It is therefore important that we understand first the uses that children make of them, and secondly, the features of the domestic context that mediate that use. Given the current political and commercial climate that promotes the computer as a tool for learning, it is also expected that this issue will be raised by parents.

This thesis also will be exploring children's use of classroom computers. This is an important site as 87% of British children aged 6-16 report using a computer in school (Süss 2001), and, for 48% of children, school is their only site of access (Krotz and Hasebrink 2001). The study of classroom use will provide valuable insights into the similarities and differences in the two institutional ecologies. This will shed some light on how and why computing practices differ across these settings.

The aim of this chapter has been to demonstrate how computers have become incorporated in the domestic lives of many families and to illustrate why research into children's use of home computers is a valuable and necessary pursuit. Many questions have been raised, which this thesis will endeavour to answer. As cited earlier, the cultural psychological perspective will be guiding this research. Chapter two will introduce this theoretical perspective and give examples of other developmental research where it has been used successfully.

Chapter 2

Cultural Psychology: a perspective on child development

2.1 Introduction

The main aim of this chapter is to argue for a cultural view of children's psychological development, for this is the approach that will be adopted throughout this thesis. In order to do this effectively, three central tenets of cultural psychology will be explained, using existing studies to exemplify each one. These are (1) that the study of children's development must focus on cultural context (section 2.2.1), (2) that cultural context is constituted by the presence or absence of various artefacts that mediate activities (section 2.2.2) and (3) that mental life, or cognition, is situated within this context and is hence distributed through the artefacts that constitute it (section 2.2.3). These three points will be dealt with in turn. Following this, studies exploring children's literacy development and children's relationships with electronic media will be discussed in sections 2.3 and 2.4. These will highlight the scope of cultural psychology as being able to address various areas of child development, and bring the advantages of adopting this approach into focus. Section 2.5 will discuss the findings of some studies that have been carried out from other disciplines, outside of psychology. They explore how the use of ICT and computer mediated communication, in homes and educational settings, is mediated by local context, from anthropological and educational perspectives.

2.2.1 Cultural psychology as prioritising cultural context

The first important theme in cultural psychology, to be considered here, is the prioritising of cultural context. The traditional study of children's development and learning frequently seems to conceptualise the child as an individual actor existing separately from cultural context. Often, only a small part of the environment is taken into account to the detriment of the rest, which can sometimes be regarded as nothing more than background "noise" to be controlled or eliminated. Moreover, learning is theorised to be a private within-the-head achievement, with minimal reference to the cultural resources that exist in the child's environment. The theoretical perspective adopted here will challenge these assumptions and will foreground the cultural context in which development occurs. This environment, or ecological setting, is constituted by cultural resources that have been constructed by human beings, such as tools and technologies, as well as by less concrete resources such as architectural space, rituals, practices, traditions and genres of language. What all these resources have in common is a history of development and use by humans. A challenge to psychology is to reposition the child's learning, and hence the child's development, as being mediated by such cultural resources. This view argues that learning is best defined not in terms of an individual's private mental processes but, instead as forms of participation in mediated activity.

Cole (1995) defines culture as "a special medium of human life" (p195). He adopts the metaphor of a garden to illustrate this concept. Components of the garden such as soil type, moisture, the use of fertilisers and so on, are the dimensions of the medium that are necessary for successful plant growth. This garden metaphor usefully emphasises the embedded nature of growth and development. An organism (such as a plant) cannot be regarded in isolation from its surrounds, as it also exists as part of a broader context, such as a particular location and its susceptibility to particular weather systems. It also illustrates how life within the garden is dynamic and mutually constitutive. It operates as a <u>system</u> which means that alteration of any one constituent, e.g. water, will cause a change in all other constituent features. These features of the garden bring to our attention the fact that microanalysis of any one constituent part will essentially be at the price of taking a more comprehensive and systemic view. Like plants, children also require a medium in which to grow, albeit a more complex and varied one. It is other individuals plus the physical and ideal artefacts present in the day-to-day life of children that constitute this medium.

This notion of embeddedness, as illustrated in the garden metaphor, can be exemplified in a more human case. A useful analogy to conceptualise cultural context is that of visualising the child as being at the centre of concentric environmental circles

(Bronfenbrenner 1979). Each "layer" represents a gradually broadening context. For example, for a child using a computer in a classroom, their immediate context is the task which they are undertaking. This is embedded within the context of the lesson, followed by the organisation of the classroom, then the school, then the community and other institutions etc. This metaphor is useful but we must be careful not to think too literally of context as that which surrounds the child, but instead to envisage it as that which co-constitutes practice. What the child does is different depending upon where they do it, so the context actually constitutes what they do as well as being constituted by it. This point will be exemplified further in section 2.2.3. In direct contrast to this, traditional psychological research is often concerned with investigating individual, private mental activity so that the human subject is often situated in a laboratory setting, thus stripping away all traces of the culture of daily life. What motivates traditional psychological research is the search for core processes that are independent of the environment. Shweder (1990) writes that "the aim [of traditional psychology] is to get behind...local manifestations, and external resources to isolate the intrinsic central processing mechanism of mental life and describe the invariant laws of its operation" (p5). This traditional view is not the one that will motivate the present thesis.

2.2.2 Cultural psychology as foregrounding mediated action

The second prominent feature of cultural psychology is mediated action. In Vygotsky's writing we find that this is a salient theme (e.g. 1978). He argues that mediation should be a central concern of psychological investigation. Traditionally, psychological research has focused on the individual, which often amounts to methodological individualism. Examples of research that has adopted an individualistic stance are those that locate participants in the laboratory in an attempt to control for "extraneous" contextual variables. Taking mediated action as the unit of investigation (ie the individual acting *with* mediational means), where neither the individual nor the tool is the focus, avoids these pitfalls by spanning the gap between individuals and contexts (Wertsch 1998a).

There are many different types of cultural tool that mediate mental functioning. These consist of physical objects, such as mnemonic aids like diaries and memos. Also, more symbolic material like graphical aids such as maps and diagrams, as well as less concrete, symbolic systems, such as mathematics and speech. Human beings act on their environments through these artefacts, be it through using an axe to chop down a tree or using language to communicate with each other. This means that any account of learning, and hence development, must be concerned with how the learner co-ordinates with these cultural resources. Cole (1996) emphasises this and defines an artefact as "an aspect of the material world that has been modified over the history of its incorporation into goal-directed human action" (p117).

Wartofsky (1979) proposes a three level hierarchy of the artefacts that constitute culture. The first level is "primary" artefacts and consists of those tools that are directly used in production, such as axes and needles. These artefacts are made by human intervention and Cole (1996) also includes telecommunication networks and mythical personages on the list. We can also include televisions and computers. Wartofsky (ibid.) describes the next level of artefacts as "secondary level". These are representations of primary artefacts and, as such, preserve and transmit both ways of acting and traditional ideologies. They include such things as recipes, norms and beliefs. The last level is "tertiary" artefacts which constitute a more imaginary, or represented world, such as works of art and theatre.

These three levels of artefact constitute and mediate children's activities. In their daily lives children's actions, both physical and mental, are mediated by them. Homes and schools contain primary level artefacts such as televisions and books, and secondary level artefacts such as family and school rules governing appropriate behaviour. All of these artefacts have a history of evolving design. Architectural space is an historically designed artefact not so readily assigned to one of these three levels. Each space has its own "affordances" (Gibson 1979) which constrain and enable particular activities to be carried out there. The human history of use of a space, as well as its physical design features, work to constitute how it is used. For example, a classroom with desks arranged in rows will afford different teacher-pupil interaction compared to that of a classroom with desks arranged in groups. Likewise, it is unlikely to find a classroom being used as a car maintenance workshop, because the history of human action and interaction that has gone on in it, as well as its institutional setting, does not suggest this use as being appropriate. Similarly, in the home, most people consider it inappropriate to have a computer in the kitchen. The room's history of use does not usually afford it as there are strong cultural expectations about the right social practices that take place in a kitchen. Despite many people recognising that space should be an issue in the cultural perspective on psychology, there has been very little empirical work in this area.

2.2.3 The sociocultural situatedness of cognition

The third feature of cultural psychology to be covered here is the situated nature of cognition. This refers to the way in which cognition is mediated by, and hence embedded, in local ecology. Vygotsky (1981) wrote that "By being included in the process of behavior, the tool [artefact] alters the entire flow and structure of mental functions" (p137). This conceptualisation of cognition argues that artefacts are not a feature of the backdrop against which mental functions take place, nor are they just something that facilitates mental life. Instead they fundamentally change the mental function itself. It is in this way that mind becomes not something bound by the confines of the skull but instead extends "beyond the skin" (Wertsch 1991 p27), i.e. it is socioculturally situated. This means that people acting in different contexts will have different cognitive experiences depending upon the local histories of cultural appropriation. This is in contrast to a more traditional view that would argue that differences in cognitive performance between contexts are brought about by different core cognitive functions.

Cole (1996) cites the new mathematics project in Liberia as an example of a cross-cultural study that demonstrates how cognition is culturally situated. This project found that the Kpelle tribe, who are Liberian rice farmers, perform badly on Western maths tests, IQ tests, carrying out jigsaws and on classification tasks, compared to Americans. However they perform well on a test involving estimating amounts of rice in a bowl using their local units of measurement. The Western tests consist of abstract problems, not situated in a concrete context because they are set to investigate context free central processing. The Kpelle cannot do Western tests in their original format, but when the tasks are reset to involve the cultural resources in common use in their lives, they can successfully carry them out. This demonstrates how mediated activity is culture-specific or culturally situated. In terms of the current argument, the Kpelle's local unit of measurement is a socially evolved and culture-specific artefact, present in their daily life, that mediates their understanding of rice measurement. Taxonomic categorisation is an equivalent Western cultural practice which mediates our management of cognitive tasks. This study is an illustration of how cognition is mediated by local context and is hence locally situated. This study also reveals how cognition is distributed. The Kpelle's estimates about how much rice is in a bowl is not restricted to events at the private, computational level. In this case, cognition is "spread over" (Lave 1988) the artefacts present e.g. the rice, the bowl and the local unit of measurement.

Another example of the situated character of mental activity is a collection of studies by Michael Cole and colleagues (e.g. Cole 1996, Nicolopoulou and Cole 1993). These studies are more relevant to Western culture and investigate not macro cross-cultural differences as in the above study with the Kpelle, but instead look at how the cognitive performance of American children differs across institutional contexts on a more micro level. The researchers constructed their own cultural system called "the fifth dimension" (5thD). The central artefact was a model maze, divided into twenty one rooms, and each room contained two activities. The rooms were connected by doors through which were moved tokens representing each child's position within the maze. Most of the activities were computer programmes such as arcade and educational games, but there were also arts and crafts and physical exercise. The 5thD was initially created in four different institutional settings. The first was in 1986 within the University College of San Diego, then in 1987 three more were set up in a library, a daycare centre and a boys and girls club (Club). The aim was to provide four after-school computer-mediated programs for collaborative learning. The children who participated in the activities were 6-12 years old.

In order to investigate how the different institutional settings of the 5thD constituted different types of activity, Cole compared the scores from a game called Mystery House in the Club and library settings. He found that the highest score from the Club was a lot lower than the highest score from the library. This low score was achieved early on in the academic year and did not improve throughout the year. He also noted that in the Club, there was a high turn over of children and a low level of bonding and collaboration between children and undergraduates which meant that each new child had to start the game from scratch. In contrast, in the library setting the score levels increased over time, even when newcomers played the game. The highest score was achieved towards the end of the school year. In both settings the 5thD was identical and the children were demographically similar i.e. similar ages, genders, family background, same community, same schools. This suggests that it was the cultures of the two sites that were different. Social cohesion at the library site was stronger and had a greater level of interactional density. The rates of problem-solving interaction was higher, both child to child and child to undergraduate. There was more sharing of knowledge, or collaboration.

This demonstrates how the activities at each site were embedded in, and shaped by, the institutional contexts of each site. Each sociocultural setting was characterised by its own set of institutional, cultural and historical forces (Wertsch 1998a). The difference in the cultural resources present at each site was the key to understanding the differences in the children's mediated cognitive experiences. The same task activity evolved differently and was ascribed a different meaning in either context. The library, when it operated as just a library, was a studious, academic environment. In this setting, the children's 5thD activities were also focused and more collaborative. In contrast the Club was purposefully structured to be open and unconstrained. The children were free to come and go as they pleased and to move between activities as they felt fit. Social cohesion was undermined by the fragmentary attendance at the club. These institutional differences had a marked effect on the performance of the children; their cognition was situated.

So far, I have argued that three central tenets of cultural psychology are those of i) prioritising context, ii) artefact mediation and iii) situated cognition. These have now been discussed in turn. The next sections of this chapter are concerned with exemplifying how this approach can be applied to areas of research that have hitherto been subject to more traditional psychological investigation. In order to illustrate the scope of the cultural approach and to make a contrast between this approach and more traditional methods, traditional studies that adopt a more *cognitive* approach in the field of children's literacy development will be compared with research adopting a more cultural psychological approach in the same area. In addition, studies that investigate children's *social* development in relation to the television will be compared with those adopting a more cultural approach. These two areas of investigation have been chosen as they are good examples that allow the above ideas to become more concrete. They represent the span of interest of developmental psychology (i.e. in cognitive as well as social development) and at the same time they are areas in which a substantial amount of research adopting a cultural psychological perspective has been carried out.

2.3 The case of children's literacy development.

Cognitive psychologists have been traditionally concerned with children's literacy development in terms of their mental processing and decoding of the written word. Reading is usually described in terms of decoding visual symbols (written words) into mental symbols with a specific meaning. Many proponents of this perspective claim that individuals have an organised "internal dictionary", called a lexicon, which is a mental representation of all the words that they know. When a word is read or heard, the lexicon is accessed, or activated, and the matching representation is selected so that the word can be recognised. If the word is part of a sentence, then it is processed semantically, for example, as well. There are many models of how humans process words, and it is not appropriate to discuss them here any further. It is sufficient to recognise that this cognitive approach is popular and utilised in most student text books about literacy development (e.g. Harley 1995). This approach contrasts to studies that have investigated literacy from a more cultural perspective.

As examples of work that have been concerned with taking a more cultural perspective on children's literacy, there have been several "ethnographic" studies carried out (e.g. Baker, Sonnenschein, Serpell, Fernandez-Fein and Scher 1994, Barton and Hamilton 1998, Gallimore and Goldenburg 1993, Heath 1983, Teale 1986). These have been concerned with investigating how literacy is resourced by cultural resources. These resources (artefacts) are both concrete e.g. books and magazines, as well as more ideal, such as ways of talking about the material. As an example, Heath (1983) investigated the rich cultural resources that mediate the literacy development of young black American children. She compares the literate traditions of families in the towns of "Trackton" and "Roadville" in the USA. Children have very different experiences of literacy depending upon which town they live in. The Roadville residents rarely write and prefer to engage in the cultural practice of face to face contact. In Roadville, residents engage in frequently praising reading as something to be carried out regularly, but it rarely actually occurs. Material textual artefacts such as articles from magazines are collected, but in practice are rarely read by adults. In contrast to the adults' own literacy practices, their attitudes towards their children's literacy is very different. The children grow up surrounded by print and have numerous books. They are regularly read to and are encouraged to read. In this town Heath has illustrated both the material artefacts and the cultural practices, or ways of relating to, and talking about, literacy that are present in the homes of the residents.

In comparison, Trackton residents regularly write. They engage with such material artefacts as sending greetings cards to each other and also write short notes to their children's school or use notes as memory aids. All the adults read a lot and reading aloud to groups of people is a social practice that is the norm. The residents here do not talk about reading as they do in Roadville, and do not collect articles. Instead women read such things as dress-making instructions and the men read such things as sports articles. In Trackton the children do not own any books, and book reading is not actively encouraged. Instead, reading develops out of a necessity to function in day-to-day life e.g. recognising price tags when sent to the shop. Children learn to recognise the writing on food products and on shop-fronts but find it difficult to read the same words out of these contexts. So, not only the way that the children talk, and the vocabulary that they use, but also the values placed upon literary skills are mediated by the social and oral traditions of the community in which they live.

The cultural perspective reminds us of how these cultural, literacy practices are not a backdrop against which cognitive literary skills develop but instead are actually constitutive of them. This illustrates effectively why the local ecology, and mediated practices taking place, should be in the foreground of research into children's learning.

2.4 Children and television

The above studies have investigated how the cultural resources present in the contexts of daily life work to constitute children's literacy development. But, cultural psychology is not only concerned with problems that are cognitive, it also embraces children's social development. One area of interest that attracts public and media attention is the role of electronic media in children's lives. Traditional developmental research in this area is concerned with exploring the social "effects" of television on children, whilst research utilising a cultural approach investigates how television, as a cultural artefact, mediates children's lives. For example, how domestic ecology and children's culture is infiltrated by television. Both of these approaches will be discussed, starting with more traditional studies.

There has been a huge amount of research into the social "effects" of television, especially with reference to children watching televised violence. These have been concerned with such psychological issues as children imitating/modelling violent behaviour that they have been exposed to both in the laboratory setting (e.g. Bandura, Ross and Ross 1963, Berkowitz 1962, 1965, Donnerstein and Berkowitz 1981) and in real life (e.g. Charlton 2000, Hennigan, Del Rosario, Heath, Cook, Wharton and Calder 1982). Other research has been concerned with identifying whether watching television depicting altruism and helpfulness has pro-social effects (e.g. Lesser 1974, Noble 1983), or whether social attitudes (e.g. towards ethnic minorities) can be changed by watching television (e.g. Howe 1983). This research is definitely useful but is often criticised (e.g. Gauntlett 1995) for ignoring the broader social context in which viewing takes place. In doing so it conceptualises children as being passive receptors of televised messages, or as Gauntlett (1995) argues, as "passive, ignorant and undiscerning sponges" (p10). Why might only some children imitate what they see on the screen and others not? This reminds us that viewing experiences mean different things to different children. This variation brings the *context* of viewing into focus, so that the traditional aim of isolating a single effect from a single cause is not a true representation of the complex and embedded nature of children's cultural lives.

The second group of studies to be considered here are those that have adopted a more cultural, or ecological perspective and examine the role of domestic technology as primary artefacts which mediate surrounding activity. These studies have been carried out at a broad family level, and hence do not focus specifically on child development, but they do illustrate the potential role that these artefacts have in mediating children's lives. There is clearly scope for studies into the role of domestic media in children's development and this thesis will attempt to fill this gap by looking at the domestic ecology of children's use of home computers. For example, how do children make use of them, what ecological features are identifiable within families, and how do these mediate how children use the home computer for learning?

In 1988 Morley wrote that "too often the fact that television is pre-eminently a domestic medium, and that viewing is largely done in the family, is either ignored, or is registered only…as a backdrop to other activity…" (p27). This argument for a change in focus from the previous concentration on the "effects" of television (e.g. televised violence) on its viewers, makes the important point that viewing is not contextually isolated. The television is not a backdrop (or the "wallpaper") against which other activities take place but instead programming is embedded within society and its attitudes towards violence in general. This conceptualisation was echoed by other researchers in the field (e.g. Lull 1990).

More recently, Gauntlett and Hill (1999) have investigated, in the British Film Institute Audience Tracking Study, how television mediates what goes on around it as well as how life events affect what/when we watch it. This was a very broad and wide-ranging study and each chapter of the book looks at a different area. Briefly then, they found that television mediates the daily life of the household in a number of ways. They argue that "television is often assigned a kind of everyday priority which means that other interactions take place around and through the watching of it" (p35), and that television can be "a *catalyst* for forms of domestic organisation of time and space..." (p38 their italics). They found that television programming times mediate such behaviours as meal times, drinking, bed time, ironing, cleaning, arguments about news presenters or programme content, and relaxing. This study takes a more unilateral view of mediation in that it focuses on how television and video configure life around them, to the detriment of investigating how daily life configures how these media are used. As a result, the family does not emerge as a system of interacting resources but rather as a collection of individuals upon whom the television acts. Nevertheless, it is a useful study that locates the television as an artefact that mediates local ecology and well worth considering here.

These authors illustrate how television programmes, as cultural products, mediate or structure the routine of everyday life e.g. some people get in from work and watch the soap opera *Neighbours* every day. Gauntlett and Hill (ibid.) discuss how their participants watch television and then go and do other things while the advertisements are on or when there is a programme they do not want to watch. News programmes can also mediate family routine, and become part of the "framework of daily life" (p56) e.g. "...it's the first thing I do when I wake up in the morning..." (quote from a respondent's diary p64). The authors describe how news-watching often coincides with meal times and how, as younger viewers grow up, they become more interested in the news and are swept up into family news-viewing routines. This study illustrates that it is not difficult to foresee the role that the television has in children's social and cognitive development as it mediates their daily lives.

Other authors take a discursive perspective and examine how the television mediates certain types of conversation that go on around it (e.g. Barker 1997, Buckingham 1993, 1996, Gillespie 1995, Tobin 2000, Walkerdine 1993). All of these studies demonstrate how domestic electronic media has the potential to mediate children's development. Electronic media are part of the ecological setting in which children grow up, and in terms of the present argument, are all cultural resources throughout which their cognition is distributed. These studies focus on how the television and video recorder mediate family life in general and therefore do not focus on the children. There is clearly a need for a closer look at the role of electronic media in children's daily lives.

2.5 ICT in homes and educational settings

This section will discuss a selection of studies, from outside the psychological literature, that have taken account of how context mediates computer activities in a variety of settings. In the first study, Silverstone, Hirsch and Morley (1992) take an anthropological perspective and explore how the moral value of the home computer is constructed through its incorporation into family life. Following this, the perspective of the ImpaCT2 project will be discussed. This is a large scale, government funded study that focusses on how use of Information and Communication Technology (ICT) in the classroom can have a bearing on Standard Attainment Test (SAT) performance. The authors consider how the context of the classroom can shape ICT activity. Finally, some studies from the educational literature will be put forward as examples of how this discipline argues that context can shape how computer mediated communication (CMC), in educational settings, is used by students.

Silverstone, Hirsch and Morley (1992) discuss how families construct, or negotiate, their own meanings for technology through the "moral economy of the household". They describe how the computer is a multi-purpose machine and that its uses and moral position within the household are determined by it passing through four dynamic, interlinked phases of the moral economy. The first phase is "appropriation" and this is marked by the product becoming owned at the point of sale. The family is redefined as one that owns a computer. It is at this point that the computer ceases to be a saleable commodity and becomes someone's possession. The second phase is "objectification" and this refers to how the new computer is displayed and talked about within the home. The physical object begins to objectify the values of the family. Its location within the home, the amount of space it is allotted and the social life that goes on around it in that space, begin to constitute its moral value, and, in turn, are constituted by it.

"Incorporation" is the third phase, in which the computer's usefulness is defined in terms of how it is incorporated into domestic routines. This phase is characterised by the temporal nature of computer use; how it remediates other activities, or displaces them to another time and place. It is within this phase that the computer's ownership also begins to be defined. Is it a shared machine or does it belong to a particular family member? Does one gender use it more than another? The fourth and final phase is "conversion" which these authors define as the development of a relationship between the technology and the world outside the home. For example, children may talk about their computer games in the playground, or parents may discuss their purchase with friends. This model takes account of the co-constitutive role of context and technology. In Silverstone et al's (ibid.) words, the technology is "both shaped and shaping" (p26). However, this model does not consider the role of broader institutions, beyond the family, such as the child's school or government rhetoric, in shaping the computer's moral value. The research in this thesis will consider these contextual factors and how they mediate computer use in the home and school.

The next study to be considered here is the ImpaCT2 project. One of the aims of this ongoing research is to assess how ICT, and networked technologies in particular, impact upon the school and out-of-school environments. So far, preliminary findings have been published and many of these, at this stage, are speculative. However, they do offer a view of the contextual features of homes and classrooms that will impact upon children's use of ICT.

Lewin, Scrimshaw, Harrison, Somekh and McFarlane (2000) argue that the important elements to take into account are the pupils, the teachers and the context. They conceptualise context in terms of the potential role/s of other pupils, and what can be achieved, with a given set of resources in a particular setting. This is dependent upon how the resources are understood and viewed by the participants present in particular settings.

These authors propose that homes and classrooms, even without the presence of any ICT resources, differ in the extent to which they can support education-related activities. For example, pupils in the classroom will have a higher emphasis on learning than they will in the home, and parents will have a variable emphasis on learning in the home. Teachers will place a low emphasis on social activities in the classroom but parents will place a high emphasis on this at home. This study also recognises that control over what is learned will differ between home and school settings, with teachers having medium control in the classroom and parents having variable control in the home. However, the home setting has the potential to support high levels of individual tuition and independent learning. These examples highlight how the different settings of classrooms and homes have differing priorities and how these impact upon the types of activities that children undertake in either place.

The above contextual features are those that the authors propose exist in settings without ICT. Lewin et al (2000) have reviewed the literature and propose that there are many additional contextual factors that impact upon the success of introducing ICT into the classroom. They organise these under the headings of "teacher", "pupil" and "context". Issues pertaining to teachers are, for example, their level of training and how this affects their ICT expertise and pedagogical skills. Related to this, is their access to ICT for personal development, their confidence in using ICT resources, their attitudes towards ICT, their competence and pedagogical skills in, for example, teaching strategies and how best to incorporate ICT into their lessons.

Pupil-related factors include the type of task they are asked to undertake and whether they have the communication/collaboration/reasoning skills to carry it out effectively.

Also of relevance is the pupils' access to technology in terms of whether they have a PC at home and how much time they spend on it developing their skills. Pupil characteristics that these authors argue also impact upon their use of ICT are issues such as their attitudes to ICT, their level of motivation, their level of competence and their gender.

Issues relating to "context" are mainly institutionally related. For example, the amount of access to ICT that is available in the given time, curriculum requirements and assessment, resourcing (e.g. funding, number of machines, costs) and the philosophy of the school with regard to its emphasis on ICT and the support available. This study has identified a number of features of the classroom setting that need to be considered when assessing whether or not ICT has an impact upon attainment. It reminds us that children's computer activities do not take place within a contextual vacuum and that it is important to consider the broader contextual picture.

The next set of studies, to be considered here, are examples of those that have been carried out in the education sector. They explore the contextual factors that mediate the use of ICT in various settings. Tolmie (2001) discusses how ICT resources are introduced into pre-existing patterns of activity and how these shape the consequences that technology has on collaborative learning. He refers to Tolmie and Howe (1993) who carried out a study of secondary school pupils using physics software in the classroom. They found that pre-existing patterns of discourse between male-male (MM), female-female (FF) or male-female (MF) pairs had an effect on the types of collaboration that occurred between such pairs whilst they were using the software. They gave the pairs a pre-test that assessed prior physics knowledge and then a post-test after the pairs had used the software. Post test results were better for same-sex pairs than they were for mixed-sex pairs. These researchers argue that differences in post-test results were due to the amount and type of collaboration that the pairs engaged in. The FF pairs were more concerned with reaching a consensus of opinion, the MM pairs responded to computer generated suggestions as to why their initial answers were incorrect and the MF pairs avoided talking to each other very much. They took turns and did not collaborate on the answers. These authors conclude that this was due to different, pre-existing communication patterns between the pairs. The lack of discussion between the MF pairs resulted in poor collaboration and lower levels of learning.

In a further study, Tolmie and Boyle (2000) reviewed the literature on the use of Computer Mediated Communication (CMC) in higher education and identify the contextual factors that shape its success. They identify the size of the group as being important, with small groups being better as they promote more individual engagement and contributions. It is also better if all of the participants know each other as this promotes more effective communication within the group and between student and tutor. Another factor is student experience. Students with more experience of using CMC, or with more experience of expressing viewpoints, make more use of the facility. Various other studies also find that use of CMC is smoother and more effective if the students have a good understanding of the aims of the session and of what is expected of them. It is also better if the students themselves are involved in setting the goals. The use of CMC is also higher if students understand that it is the best way in which the task-in-hand can be fulfilled. If, for example, it facilitates communication that would otherwise be impossible, then students are more likely to make good use of the facility. Finally, these researchers found that the appropriateness of the system and student's past experience of using it have a bearing on its use.

2.6 Conclusions

Studies into children's psychological development have traditionally taken the perspective that focuses on individual, mental achievements. In order to do this, these studies frequently control-out contextual "noise" by placing participants in the laboratory. As an alternative to this, the present chapter has introduced cultural psychology as being a perspective which involves understanding that cognition extends beyond the confines of the skull and is contextually situated, and distributed throughout the physical and ideal artefacts that constitute that context. Studies from outside the field of psychology have also reiterated this point. Children live out their daily lives as active co-constructors of cultural context so that what they think and what they do are inextricably bound up in this web of co-mediating cultural resources. Psychological investigation *begins* with the rich ecological context within which activity is embedded.

This chapter has considered the cases of literacy development and electronic media and has given examples of two different perspectives from which they have been studied. These studies have been carried out from both more traditional and cultural perspectives. Studies which take a traditional perspective, whilst being informative in their own right, do so at the price of ignoring the rich contextual medium of children's lives. Studies that have adopted a more ecological perspective take account of the context in which development takes place and in doing so offer a more comprehensive picture of the whole person interacting with an artefactual environment.

Until recently, investigations into media use in the home have been focussed mainly on use of the television. It is only in the last few years that interest in children's burgeoning use of home computers has resulted in research into this area. The current thesis will adopt a cultural theoretical perspective in exploring children's use of computers. This will involve conceptualising computer use as being a situated activity so that the research focus will be on investigating children-using-computers-in-settings. The computer is a primary artefact found both in the home and in the classroom. The child sitting at it, and using it, is embedded in local context which is constituted by other primary level artefacts such as computer software, and secondary level artefacts such as rules, norms and beliefs. It is the investigation of these ecological features, as well as the computer use that they mediate, that will be the focus of this thesis. The next chapter reviews previous studies that have investigated children's home computer use, identifies what still needs to be investigated, and introduces some further research questions that this thesis will endeavour to answer.

Chapter 3

Children and computers at home and at school: a literature review

3.1 Introduction

The aim of this thesis is to investigate children's use of computers at home and, as a comparison, in the classroom. It characterised children's use of computers in these settings as an area worthy of further research, especially in the light of recent political initiatives that have funded computers in schools, and that have encouraged parents to take a more central role in their children's out-of-school education. Chapter two argues that computer use, at home and in the classroom, cannot be fully understood without recognising that it is mediated by local context. The cultural theoretical perspective adopted in this thesis encourages us to realise that different contexts mediate different types of activity and hence different computing experiences. For example, due to institutional differences, children are unlikely to be found playing a shoot-and-kill game in their classroom, but are likely to play this at home.

The aims of this chapter are twofold. The findings from previous research into children's use of computers in the home and in the classroom will be discussed and their implications with respect to current research questions will be identified. These findings often compliment or support each other so this chapter will be divided into sections that address one theme each.

Section 3.2 will describe the 5 main studies into children's <u>home computer use</u> and then focus on their findings. Firstly, it will consider the reasons that parents give for buying a home computer and, secondly, uses that children make of computers in the home setting. It will then go on to investigate how these studies take account of the home context.

In section 3.3, studies investigating existing school computer use will be reviewed. This will focus first on access and use of classroom computers. Research that has studied teachers' and children's perceptions of the barriers preventing more use of classroom computers will then be discussed. Following this, attention will be paid to those studies that have asked children about their perceptions of school versus home computers.

This chapter will close with section 3.4 which will discuss the main findings of these studies and how the present thesis will build upon them.

3.2 Studies investigating home computer use

There are five main, large scale studies that have investigated children's use of home computers, and only three of these are British. The researchers do not claim to have researched this from a psychological perspective, but are concerned with gathering naturalistic information about "what is going on". However, they do provide valuable insights into what is happening inside family homes. Previous research focuses on children, both with and without their families, of a similar age to those recruited by the current study. The children were predominantly of primary school age. There is also a body of other research, not considered here, as it focuses specifically on adolescents' use of home computers (e.g. Harris 1999, Sefton-Green and Buckingham 1998, Selwyn 1998, Turkle 1984, 1997).

Giacquinta, Bauer and Levin (1993) carried out their research between 1984 and 1986 in New York. They set out specifically to investigate children's *academic* use of home computers and do so from a broadly social perspective. Details of actual computer use were gathered from interviews. Their qualitative study was of seventy white, predominantly middle to upper class families with 127 children aged between 5-17 years. Families were studied for four months and were selected on the basis of being in social contact (either personally or through school) with the field workers, or they were recruited at local computer stores. Data was gathered from interviews with the families and recorded in written logs. Entries into the log books were later coded.

Downes'(1996, 1998, 1999) research was carried out in the mid-1990's in Sydney, Australia. It set out to explore the home and school computer use of primary school aged children from the perspective of cultural studies. Downes' research was a three year, multi-method, multi-stage study of children aged 5-12 years. Stage one was carried out in 1995 and involved same-age discussion groups with 190 children in 3 Sydney schools. These discussion groups were videotaped and later transcribed. Parents were also asked to complete a questionnaire (n=540) about their child's use of various technologies found in the home (e.g. computer, telephone, games console). Stage 2 was carried out in 1996 and involved discussions with the same 190 children, whom their parents had designated as "regular users of computers". Stage three was carried out in 1997 and was based on structured interviews with 14 children aged 10-12 years, their parents and their teachers. All the children in stage 3 were from "technology rich" families and were sampled from 8 different schools. These 14 children were also required to keep a daily written diary of their computing activities for a two week period.

Livingstone and Bovill's (1999) study was carried out in 1997 and their aim was to investigate all kinds of media use in the home by young people aged 5-17 years old. They wanted to document the meanings, uses and impact of media in children's lives, together with collecting data to inform the debate about inequalities of access and use. They therefore implicitly adopted a cultural studies perspective. They were not concerned exclusively with computers but the findings discussed in this chapter are those specific to the PC. Their methodology combined both qualitative and quantitative means of data gathering. They carried out group interviews with approximately 160 children in 13 primary and secondary schools, as well as individual interviews in 32 homes. They also interviewed 13 heads of IT in schools and interviewed an additional 36 children about their internet use. The quantitative methodology involved administering a questionnaire to 1303 young people aged 6-17 years, as well as another to the parents of these children. Lastly, 334 young people kept a time budget diary for one week.

Livingstone and Bovill's (2001) research focussed on the internet use of young people of primary and secondary school age. They made visits to 30 family homes, interviewed parents and children and used a combination of diaries and naturalistic and participant observation to ascertain what types of internet activities the children were engaged in and how features of domestic ecology mediate that use.

The final study to be considered here is the Screen Play Project. The researchers in this team were Sutherland, Furlong, Furlong and Facer. The aim of this multidisciplinary project was to map the natural history of home computer use by young people. This project was less concerned with looking at actual usage (high user children kept a diary of use for only one week) and more concerned with identifying the contextual features of the domestic environment that shape use.

The researchers carried out a questionnaire survey of 855 children in 8 schools in South West England and in South Wales. This provided a valuable snapshot of computer use and access in a large sample of homes. In addition, they selected 18 children from 16 families to take part in in-depth observation and case studies to last one year. This included interviews with children, their families and peer groups. As well as providing important data on computer practices, the questionnaire responses were used to select families for further study. The 855 questionnaire responses were ranked in terms of frequency and duration of computer use for games, homework and 'other' activities. The children in the top 200 rank positions then formed the base from which 18 were selected in terms of their socio-economic background and family makeup. So the 18 selected fell within the top 23% of the whole group, in terms of duration and frequency of use. They therefore represent 'high' ICT users. The children were 10/11 and 13/14 years old. In addition to these high users, the project also selected 46 children, of similar ages, who identified themselves as low or ambivalent computer users and carried out group interviews with these children in their schools.

These studies explore similar areas and many of their findings are complimentary. The findings will be discussed here in terms of 3 common themes: the reasons that families give for purchasing a new computer, the uses that children make of it and finally, features of the domestic context that mediate computer use.

3.2.1 Reasons for purchasing a home computer

Sutherland, Facer, Furlong and Furlong (2000) found that British parents gave 8 reasons why they bought a home computer . Three of these reasons refer specifically to their children: firstly to assist their children in school by providing "access to information", secondly to provide a more modern computer than those often found in schools and thirdly to support their children's preparation for adult life in a technology rich world. So supporting children's education and ICT skill development were important factors. Other reasons were to avoid their family lagging behind others, to enable exploration of a relatively new technology, to support parent/s' work or study, to provide an interest for the children to keep them safely indoors, and lastly to provide entertainment through games. These parents clearly identified computers as multi-purpose machines.

Livingstone et al (1999) also found that many British parents cite supporting their children's education as a reason for home computer purchase. They asked parents to elaborate this response and found that they gave 7 main ways in which they perceive that having a computer can support education: their child will have an educational advantage over others, they will have increased keyboard and Windows familiarity, they will have experience of database management, they will get ahead at school and get good marks. They also found that parents who own a home computer are more confident about their child's school success than those parents that do not own a computer. Both Downes (1998a) and Giacquinta, Bauer and Levin (1993) also found that education was one of the main reasons that parents give for purchasing a home computer in Australia and the USA respectively.

It appears as though parents have high aspirations about the educational benefits of owning a computer and that these drive forward their decision to purchase one. However, what is a common finding amongst these studies is that parents, on the whole, do not recognise the full range of opportunities for learning that the computer presents. They are concerned with buying a home computer so that they can support classroom-based learning (e.g. "supporting education", to give children an "educational advantage") and generally do not recognise its potential to support informal learning. For example, none of these studies suggest that parents recognised the potential role of entertainment games in developing their children's computer skills and thinking skills (e.g. Amory, Naicker, Vincent and Adams 1998), or visio-spatial skills (e.g. Subrahmanyam and Greenfield 1994) or of the use of graphics packages to develop, not only mouse skills but also imagination and creativity. Other studies are more concerned with games use in classrooms and how they could be used to support national curriculum targets (e.g. BECTA 2001, McFarlane, Sparrowhawk and Heald 2002). Parents appear to be concerned with replicating or supporting school computer use in the home but, at the same time, are unsure about how to fulfil this.

3.2.2 Uses of the home computer

This section will consider how children make use of home computers in terms of the types of software that they access, and will explain how the present thesis hopes to build upon these findings.

3.2.2.1 Types of software

Livingstone et al (1999) found that the most popular activity by children in UK homes was playing games (77% of children), followed by word processing (65%). Less than half the children reported using the computer for more academic pursuits such as maths/number work or looking up information. These authors also found that internet and e-mail usage (in 1996) was minimal (7%). Sutherland et al (2000) also found that playing games was the most popular activity reported by their UK families. Other uses they identified were writing, graphics, searching reference CD-ROMs, programming, email, internet and online publishing. Giaquinta et al (1993) focused on academic home computing in mid 1980's New York. They too found that most time was spent playing games and that the use of academic software was minimal.

Downes and Reddacliffe (1996) report that Australian children were engaged in several computer-based activities, such as games (40% stated they used the computer mainly for this) , word processing, homework (e.g. practise spelling), making cards and posters, educational games, practising typing skills, and using CD-ROM encyclopedias. Downes (1999) divides these activities into three broad categories: "making texts" (e.g. word processing, music creation), "using texts" (e.g. game playing, internet use) and "communicating" (e.g. emailing, chatting in a chat room). She then further subdivides these categories into two types of activity: "purposeful" (e.g. producing a party invitation) and "playful" (e.g. fiddling about with a graphics package). She found gender differences in these types of activity with girls more likely to participate in purposeful activity and boys in playful activity.

In a study that investigated children's internet usage at home, Livingstone et al (2001) found that it was mainly used for communicating (e.g. email, chat and instant messaging- all most common in children over 12 years), playing (e.g. games, shopping sites without actually ordering any goods, webpage creation), searching, learning (e.g. downloading illustrative pictures for school projects, homework in older children, informally practising surfing skills). Again, this study found that sites offering entertainment were visited more frequently than those supporting formal study. This study also supports those above that have investigated more general use of computers in the home. They all find that parents have little understanding of the many ways in which the home computer can enhance their children's education, both classroom-based and less formally. Owning a computer is perceived as a 'good thing' but defining what it can achieve is problematic. Children described their use as mainly "fun" and both parents and children were unable to identify how most of this use could be of educational value to the children.

Downes (1999) also found that children talk about a wide range of computer activities in terms of "play". She found that children's definition of games was very wide ranging.

This definition spanned not only software marketed as entertainment, but also educational games, paint, word processing, electronic books and desktop publishing. Compared to this broad definition, Downes (ibid.) found that adults define "games" differently. They refer specifically to games entertainment software. This is an interesting observation as it supports the above findings that adults and children have different perceptions of the computer's usefulness. In talking about all types of activity in terms of "play", children are suggesting that they perceive the computer as an entertainment tool rather than a work or study tool. Parents, on the other hand, differentiate between work and play, and want to focus on work. This is also a valuable point in terms of interpreting parents' and children's interview responses. The current research will address this potential problem by making interview questions about computer use explicit, and by encouraging elaboration of answers to questions so that there is differentiation between entertainment games and other genres of activity.

These studies suggest that children of all ages have a firm preference for playing entertainment games and visiting fun internet sites on the home computer, over and above using it as a tool to support their classroom-based learning. This is in direct conflict with parental expectations upon purchasing a new computer (as discussed above) and suggests a discrepancy exists between desired use and actual use. The current research will take a detailed look at precisely how the home computer is used and will also explore features of the domestic ecology that mediate that usage. Hopefully this thesis will be able to illustrate why the home computer is not used regularly to support formal education.

3.2.2.2 Categorising genres of computer software use

The studies considered above have all found a multitude of uses for the home computer. However, when considered together, their systems of categorising software types are not homogenous. Consequently, similar types of activity are described in different terms by different authors. For example, Sutherland et al (2000) use the term "graphics" and Downes (1999) includes the same type of activity in the category "paint". Also, some of the categories are not mutually exclusive. Downes (1999) reports "homework" as a category but in fact this could include diverse activities such as word processing, using a reference CD-ROM or searching the internet. In order to avoid this diversity of terms, and to aid categorisation of activities in future research, the present study will develop a system of mutually exclusive categories. However, it is important to acknowledge that some software that offers more than one activity may be difficult to categorise.

In the above studies, details of the software used by children was gathered either from group discussions, questionnaire responses, or short-term diaries. Therefore the majority of this data is based on retrospective descriptions. Unfortunately, this makes accurate quantification (e.g. hours of use per week) difficult. The present thesis seeks to overcome this. The aim is to gather accurate computer-usage data over several weeks, spanning both vacation and term time. This will add rich detail to the above data, contributing to a comprehensive picture of family computer use. The data will be gathered by installing software directly onto the family computers, which will log precisely, in real time, the applications that are in use. Therefore, not only the type of software used, but also usage statistics can be gathered (e.g. average hours of use per week, and patterns of use across the week). The technology itself will be used to gather usage data. It is also important to explore why the above patterns of computer use exist in the home. Given that computer use is embedded in the surrounding context, what features of the context act to prevent computers in the home being used more as a support for classroom-based learning?

3.2.2.3 Conclusions of section 3.2.2

All of the studies discussed in this section found that the use of entertainment games is the most popular computer-based activity for children at home. It appears as though entertainment and enjoyment are important features to children. Software that is designed to support more formal types of learning is not readily accessed except, perhaps, as a support for homework. Children do not spontaneously choose titles that support formal education. This must be disappointing for parents who had this type of use in mind when they bought the computer. This also contradicts a popular discourse that surrounds computers as having the power to transform already established practices by giving children an irresistible urge to sit at the computer for long periods of time learning and finding out about things (Livingstone 2002). This idealistic vision is not manifested in reality because it does not take account of the social and institutional context of the home. We need to take a close look at exactly how home computers are used and to listen to families talking about how the PC fits into their lives.

This section has identified the need for accurate computer-use logging as well as for a comprehensive method of categorising the genres of software that children use. Both of these issues will be addressed in the current research. In adopting a cultural psychological perspective on children's computer use, this thesis argues that computer use is contextually embedded. There is therefore a need to explore features of the home environment that mediate that use. For example, do parents encourage their children to use the computer to support formal education? Do children have the appropriate software available? Which features of the domestic ecology contribute to the relative lack of use of educational titles? What are parents and children's opinions of educational titles? What is the domestic lifespan of a piece of educational software? These questions have been identified as arising from previous research, and will be addressed in future chapters.

3.2.3 Contexts/discourses that shape children's use of home computers.

Sutherland et al (2000) take a perspective on home computer use which entails conceptualising the computer as "a cognitive tool in which the culture and context of use shape the potentials and possibilities of the tool" (p198). They argue that "one aim of the Screen Play Project is to investigate the contexts which are shaping use of the computer in out-of-school settings and, reciprocally, how patterns of computer use are configuring the settings" (p199). This approach is similar to that adopted by the current thesis. These authors identify various "discourses" present in the domestic environment that, they argue, are features of the context that shape the use that children make of the computer. They argue that the aforementioned reasons that parents give for buying a computer act as discourses that shape use.

Other features of the context that this project identifies as affecting usage are individuals outside of the immediate family, who act as advisors, such as relatives, neighbours and an office help desk (Sutherland et al 2000). In addition to this, sibling help as well as access arguments between brothers and sisters have also been identified as shaping use. Access demands often have to be negotiated between family members, such as the oldest child having first turn, or the child with homework getting priority (Facer, Furlong, Sutherland and Furlong 2000). Other contextual features include the roles of expert and novice that various family members adopt. This was particularly evident in families where parents were not confident computer users. The availability of hardware and software in the home also shaped how the computer was used. Also, the software bundled at purchase can make buying a particular computer attractive if the software matches parent's visions about how the machine will be used. Parents also have various ways of managing the home computing environment such as the creation of passwords, files and folders for separate family members so that access to certain areas of the hard drive can be policed (Sutherland et al 2000).

Downes and Reddacliffe (1996) also explored contextual features of the domestic environment that, they argue, can shape access and use. They argue that location of the computer affects usage. They cite the example of one child that had limited access due to the fact that the computer was in her brother's bedroom. Another contextual feature that they found was who is perceived to own the computer. Seventy five per cent of the sample reported individual ownership which suggests that, similar to the findings of Facer et al (2000), access can be contested between family members. Downes et al (1996) also found several types of rule in operation within the families. She found rules that ensure that children take proper care of the computing equipment, rules controlling the types of activity that the children could carry out alone, rules relating to access management (e.g. how often and how long the child could use the computer for), and those policing how disputes over access are resolved (e.g. children taking turns).

Downes (1998a) also investigated the contextual discourses that exist in the home which, she argues, shape the way in which children use computers. She defines these discourses as the ways in which particular communities construct and name their social practices, and the belief systems that surround them. She identifies three main themes: "computers as the future", "computers as personal productivity tools" and "computers for education". These are closely linked to those found by Sutherland et al (2000) and are related to the reasons parents give for buying a home computer. Downes (1998a) found that parents are concerned to provide their children with the opportunity to be fully functional in the digital future, with specific reference to employment. She also found that parents and children link computers to providing an opportunity for education. Parents believed that having a computer gave their children an educational advantage in that they encourage their children to be personally productive i.e. produce well resourced and well presented school-related work. The children in this study also recognised that the computer was a useful form of entertainment. Parents, however, did not necessarily support this, which often led a conflict of dominating discourses within the home. Downes argues that these discourses provide a framework within which children use home computers, and which shape that use.

Livingstone et al (2001) also explored the domestic context of young people's internet use. They found that with the older children, who used the internet for communicating, the internet reproduced, online, many of the communicative practices that already occur in the home. Online and offline worlds were closely interwoven in that they were mutually constitutive: online communication supported that which took place with their friends face to face, and vice versa. However, the relationship that these children had with their parents, as mediated by the internet, was mainly in terms of supervision and domestic rules. In more affluent homes the computer was more likely to located in a private space so that internet use was unsupervised and solitary, whereas in less affluent homes the computer was more likely to be in a shared space so that use was less private, more communal and casually supervised. They found that in all homes, less parental time was spent in optimising or improving their children's use of the internet and most effort was concerned with defensive measures such as monitoring the sites their children visit. These researchers also argue that family dynamics mediate children's internet use. Busy middle class children who engaged in many activities, tended to use the internet more for “mindless” relaxation (p21) and more isolated and lonely children valued its communicative functions more highly. Younger children also learn from observing their older siblings. Although they found few gender differences in internet use, they argue that individual differences in, for example, interest in new technologies, can also shape use. This is a reminder of how internet use is contextually situated.

Giacquinta et al (1993) specifically studied children’s academic home computing in mid-1980s New York. They explored the features of the domestic environment that shape how children use the computer for academic pursuits. They describe the domestic environment as consisting of “an interrelated network of forces” (p43). This network is comprised of interconnected nodes which are: the availability of academic software at home, parental encouragement and assistance, the child’s computing experience, sibling and peer support, the child’s receptivity towards academic computing and the emphasis that the child’s school puts on computing. Some of these conceptions are supported by the studies cited above. They argue that “educational software will not set the educational process in motion either at home or at school simply by having children sit in front of machines, booting up software, and letting the technology “do its thing” (p59). These researchers maintain that unless an appropriate “social envelope” (p132) is in place within the home, children will not make extensive use of academic software. They theorise that the social envelope consists of three layers: the hands on layer (actual use of the software, plus the user’s beliefs and attitudes), the social interaction layer (social interaction between the user and others) and the social ecology layer (the purposes, structure and resources of a given setting). They recognise that the child using a computer cannot be conceptualised as an isolated unit within a household of other, unconnected activities, but instead is part of a broader context, the components of which need to foster academic computer use.

A questionnaire study carried out by Kafai and Sutton (1999) in the USA in 1997 led to claims that current, educational use of home computers needs more attention. They too found that elementary school children mainly play games at home. The authors argue that “just having a computer at home does not mean that children will use it for educational purposes” (p355). They make suggestions as to what contextual features of the domestic environment might shape academic use of the computer, such as the accessibility and affordability of software, parent's familiarity with the technology and their ability to create a learning environment in the home. They note that this is not an easy task as the home lacks the institutional contextual features, such as guidance and instruction from a teacher, that are present in schools. They argue that "if educational computing activities at home are to become a reality then parents need to be prepared to provide the form of guidance found in classrooms..."(p355). Their argument is speculative but they do conclude that we need to "understand the environmental set-up of computers in homes...[and to] gain a better understanding of how computers are integrated into family practices..." (p356). In light of the present political climate, children's academic computing, at home, needs more research attention. With the exception of Giacquinta et al (1993), the above studies explore overall computer use and do not focus-in on the use of educational software. Kafai and Sutton (1999) make useful suggestions as to why educational computing in the home is infrequent, and argue that we need to know more about this issue.

This section has been concerned with identifying previous studies that have investigated how domestic context constitutes children's home computing practices. It has been effective in demonstrating that computer use does not occur in a contextual vacuum, but that it is contextually embedded. Some features of local ecology, that have been identified in previous research, have been discussed. The current research will build upon these findings by gathering more detailed responses from parents and children. For example, the above studies identify that domestic computer-related rules are present in homes but fail to document their variety in full.

The above studies also neglect the role of external institutions, such as the child's school, in shaping how the computer is used in the home. This is important to investigate as it is likely to have a bearing on the educational uses that are made (or not) of the home computer. For example, this research will ask, to what degree are parents aware of their children's classroom computing activities? What are parents' views on encouraging formal education in the home? These are two questions which this thesis hopes to answer and, in doing so, it will build upon previous findings about the domestic context of home computer use.

3.3 Computers in the primary classroom

3.3.1.Access to and uses of the computer in the primary classroom

Frequency of computer access in the classroom is relatively low. Suss (2001) reports that British children aged 6-10 years access the computer, on average, about once a week. This finding is supported by Mumtaz (2001) and Williams, Coles, Wilson, Richardson and Tuson (2000). Selwyn and Bullon (2000) found that frequency of access is significantly different across year group, with children in year six gaining more frequent access than children in year 2. He also found that types of uses varied across the two year groups, with children in year two using the computer significantly more for drawing, maths/numberwork and educational games, and children in year six made significantly more use for word processing and the internet. This finding suggests that children's literacy levels have an impact on the types of uses that are most appropriate for their year.

Access to the classroom computer is also an important issue for children. Generally they look forward to the opportunity to use it and are aggrieved when they perceive access to be unfair. Selwyn and Bullon (2000) found that more (unfair) access is often gained by children who finish their class work quickly and are then allowed to use the computer to fill in time. This means that a select few gain more access than the rest of the class. Class experts can also be perceived as having unfair access because the teacher might ask them help. Children also described how session lengths were too short and often they could not finish their work in the allotted time, which was frustrating and made use of the computer "boring".

A consistent finding, across several studies that have investigated uses of computers in British, US and European primary classrooms, is that word processing takes up, on average, most computer time (e.g. DfEE 2000b, Drenoyianni and Selwood 1998, Livingstone and Bovill 1999, Mumtaz 2001, Selwyn and Bullon 2000, Süss 2001, U.S. Department of Education 2000, Williams et al 2000). Other uses, that the UK studies report, are creating pictures, number work, internet, email, databases, spreadsheets, desktop publishing, IT skills, educational games, reference CD-ROMs and digital imaging. However these uses are minimal compared to word processing.

There is substantial variation in the uses of ICT across primary schools. For example, the DfEE (2000b) report that 66% of primary schools describe their use of computers in mathematics lessons as "substantial", 32% report their use as "little" and 2% as "none". This is an indication of how local contextual conditions vary and impact upon ICT use in the classroom.

There are critics (as discussed below) that argue that studies such as those cited in this section are a clear indication that computers in schools have not been successful. Cuban (2001) carried out a study of two high schools in Silicon Valley, which, as one would expect, were very well resourced in terms of ICT. He found that, on the whole, ICT was not utilised as a tool to transform teaching and learning but instead had been adapted to fit it with pre-existing practices. He concludes that "...use of computers in their classes had marginal or no impact on routine teaching practices" (p97). He does not blame the teachers but instead recognises that computer use is contextually situated. Cuban argues that more effective use of computers in schools will not come about without reform of institutional practices, government policy and the educational agenda. This study reminds us of the contested role of ICT in schools and of how traditional practices are resilient to change. This is similar to the position in homes, as identified above. In both settings, it has been difficult to remediate pre-existing practices.

Robertson (2002) draws similar conclusions about the use of ICT in UK primary schools and argues that after twenty years of major investment we are reaping only "quite limited returns" (p 408). He also suggests that we need to ask new questions in order to identify why this innovation is not successful. He asks whether there is a philosophical conflict between teachers and educational technologists, and whether there is something intrinsically unsuitable in the nature of general purpose microcomputers as learning tools. These questions hitherto remain unanswered, perhaps because they question the wisdom of introducing ICT into primary education.

Despite this pessimism on behalf of some critics, studies have been carried out, which will be considered next, that have identified some barriers to more effective computer use. These offer an indication of the kind of changes that are necessary.

3.3.2 Barriers to computer use in the classroom

Teachers have identified a number of barriers that, they argue, prevent them from making more use of ICT in their lessons. There has been an increase in expenditure on ICT in primary classrooms (DfEE 2000b), but teachers still cite lack of available equipment as a problem. In a Scottish study of 300 primary schools (Williams et al 2000), teachers identified a lack of computers connected to the internet as a big problem. For example, 67% reported they had no internet connection and, as a consequence, could not use on-line information sources, video conferencing or fax. Another 2% said they had no access to educational CD-ROMs and 17% had no access to desktop publishing software. This is a clear reminder that provision is not homogenous; there is wide variation between schools. Other barriers to ICT use that these teachers cite are that resources are often shared and not always available when they need them, their own familiarity with the software, and lack of skills, prevents use, the available resources are not always appropriate for their needs, the cost of buying or using resources is prohibitive, lack of technical support and lack of time. It appears as though lack of appropriate equipment, lack of expertise and lack of awareness of how to incorporate ICT into lessons are the main barriers to effective use.

The DfEE (2000b) report that teacher's self-reported ICT confidence has improved. Sixty four point seven per cent described themselves as "confident" in 1998 and this had increased to 67.1% in 2000. The percentage of teachers receiving ICT training has also increased from 45.3 % in 1998 to 60% in 2000. However, this study reports teachers' confidence in carrying out the minimal amount of computing that takes place in the primary classroom. It does not take account of whether this confidence is prohibitive of them using other applications. Teacher's perceptions of the potential utility of their classroom computer will also mediate what they feel able to use it for.

Drenoyianni and Selwood (1998) asked 37 primary teachers from six UK schools to describe the reasons why they used ICT in their classes. Seventy per cent of teachers said their main reasons were for developing computer awareness and computer literacy. Forty three per cent reported that they used a computer to support teaching and learning. Other reasons were that they encouraged collaborative learning, encouraged individual learning, it serves to motivate their pupils, is an aid in presenting new concepts, information and situations as well as improving basic skills. However, these researchers found that all the teachers were preoccupied with developing their pupils' ICT skills. This finding is supported by other studies (e.g. Dunn and Ridgeway 1991 a and b).

Drenoyianni et al (1998) report how a teacher that was discussing how ICT promoted learning, talked about their use of reference CD-ROMs but not in terms of the information that the children could find out and the discussion it could generate. Instead they discussed how it taught children how to access information in a reference CDROM environment. Another teacher, when talking about how they used ICT for the presentation of new problems, was preoccupied with the problems concerning loading, and differentiating between 'save' and 'save as'.

This study also asked teachers to explain how ICT had changed their educational goals. They found that teachers were aware that ICT *should* change their educational goals but that they gave examples that demonstrated that their understanding of *how* to carry this out in practice was poor. For example, one teacher spoke of the word processor as a tool to type out documents already created with pen and paper, rather than as a creative tool in its own right. Another spoke about how computers could save time as it meant he could print out multiple copies of the same document. A third teacher said that use of a reference CD-ROM changed her teaching because it meant her pupils could carry out a project without the use of books. Drenoyianni et al (1998) conclude that teachers' awareness of how ICT can enhance learning needs to be improved. They suggest that better training, as well as more explicit guidelines as set out in the national curriculum, could overcome this problem.

This section has identified several barriers to more effective use of computers in the classroom. It has become clear that far reaching changes at both local and government levels need to be made if children are to reap the full benefits that ICT can offer. The current thesis will build upon these findings by exploring how classroom computing practices are embedded in interpersonal, community and institutional practices.

3.3.3 Children's perceptions of ICT in the classroom as compared to home

The above sections of this chapter have implicitly identified some differences between computer use in school and at home. For example, entertainment games are more likely to be used at home, whereas educational titles are more likely to be utilised in the classroom. Children at home generally spend more time using the computer than they do at school. This section will explore how these differences impact on their opinions of computers in either setting.

Livingstone et al (1999) found that British children criticise school computers for being "boring", "out-of-date", for having only a limited use and also for having only a minimal choice of activities, compared to those they have at home. These findings were supported by the Screen Play Project. Furlong, Furlong, Facer and Sutherland (2000) found that children expressed disappointment and frustration with the computers they use at school. They cite lack of time, lack of choice, lack of flexibility and a concentration on learning specific skills rather than on achieving an outcome, as constraints related to school. Downes (1998b) also reports similar findings from her study of Australian children. Overall, it appears as though children prefer to use their home computers compared to those at school. Mumtaz (2001) reports that 85% of her UK sample of 8-10 year olds "enjoy" using their home computer for playing games, whereas 92% of them said that they are "extremely bored" when word processing at school. This raises interesting questions about the different institutional contexts (the school and the family) that give rise to such differences in use and perceptions of use.

3.3.4 Conclusions of section 3.3

This section has identified some differences between computing at school and computing at home. Access to the computer in the classroom is minimal compared with opportunities presented at home. Type of usage also varies, with word processing predominating at school and entertainment games being more popular at home. It appears as though the computer has been more successfully integrated into the home as an entertainment machine than it has the classroom as a support for formal learning. Children appear to enjoy using their home computers more than those in school.

When considering why computers have not been successfully integrated into classroom practices, several major barriers have been identified. These are more extensive than any potential barriers in the home and perhaps explain why home computers are used more frequently that those in the classroom. These studies also reiterate how important it is to understand how computing practices, in either context, are embedded in the local ecology. It is only when this is considered that we can understand the mutually constitutive nature of context and activity and why practices in either location are so different. The current research will visit both homes and schools in an attempt to compare the computer environments found in each. The adoption of a cultural theoretical perspective gives the current research scope to do this and encourages recognition that different institutional contexts will give rise to different activities due to the situated nature of that activity (see chapter 2). This stimulates some interesting questions, such as why is the use of educational software at school relatively common place whereas at home games predominate? What ecological features of either environment constitute this pattern? The current thesis aims to extend previous research by answering such questions. This will be achieved by visiting several primary schools and gathering information from pupils and teachers.

3.4 Discussion

Studies of parents report that one of the main reasons that they bought a home computer is to support their child's education. They conceptualise this as meaning that it will support classroom-based learning in the home but they have little awareness about *how* the computer can support either classroom-based learning or more informal learning. Home computers are used by children, contrary to initial parental aspirations, mainly for playing entertainment games. This is interesting as it suggests that there is a discrepancy between parents' and children's views of what a computer should be used for. It is also an indication that it is difficult to recreate the classroom context in the home and gives rise to questions concerning why this is the case. For example, what are the contextual differences between the home and classroom contexts? This is the main question that this thesis will endeavour to answer.

Contrary to those studies reviewed here, the current research will adopt a cultural psychological perspective on children's home computer use. This has several advantages. Firstly, its concepts have successfully been applied to other areas of research (e.g. literacy, as discussed in chapter 2) and have hence withstood scrutiny in other contexts. The theory is therefore generalisable to other settings. Secondly, it offers a framework that guides the formation of appropriate research questions and the interpretation of data. If a study is atheoretical the research questions are more likely to be poorly conceived and, hence, yield disparate data that is not easy to analyse. A third advantage, in relation to the current thesis, is that it will enable systematic comparison of two different settings: the home and the classroom. Data collection and analysis, in either setting, will be driven by the same theoretical principles, making comparison more organised than if different theories were driving the research in either place.

This comparative approach to situated cognition has not been adopted in previous studies in the field of children's home computer use. It has, however, been successfully used in other psychological studies, such as some of those considered in chapter 2. Nicolopoulou and Cole (1993), in their research of children's computer game performance within the fifth dimension, used this method successfully to demonstrate how practices are contextually situated. Heath (1983) also carried out a comparative analysis of children's literacy development across two towns, and illustrates how this is embedded in local cultural practices. The comparison of two settings paints a convincing picture of how context mediates activities, and of the utility of using a cultural psychological approach.

Another way in which the current research will expand upon previous studies in this field is with the development of an objective method of logging children's computer activity. The studies reviewed in this chapter have used interview, questionnaire and diary methods. These have provided valuable data but, by nature, are not precise. Questionnaires and interviews rely on children remembering, or judging, how much they used the computer and what they used it for. Diaries have also been useful but rely on children being compliant and having a certain degree of skill in, for example, reading, writing and telling the time. It might not be an appropriate methodology for young or dyslexic children. The current study will seek to overcome these problems by installing software onto family computers that automatically logs the applications in use by a particular user. This software will run invisibly in the background and store the data in a file on the hard drive. It is objective in that it requires no user input. The data will be thorough and offer more opportunities for statistical analysis. This method will also allow longer term logging of activities than previous diary studies because it does not rely on maintaining high levels of participant motivation.

The adoption of a longitudinal perspective also has other advantages. It means that interviews can be spread over several home visits. This will avoid the problem of interviewee fatigue and minimise disruption to the households involved. The families will become familiar with the researcher over several visits and are more likely to be relaxed and offer more detailed replies to questions. It will also provide the opportunity for the researcher to enter the home context and make first-hand observations of, for example, room layout and the location of the computer. Another important advantage of a longitudinal perspective is that data can be gathered about how practices evolve over time. The study will not be a snapshot of a brief instance. Instead, it will investigate how software use evolves from the instance a new product is brought into the home, over the ensuing weeks. This is a perspective that has not previously been taken, so will yield new and interesting findings.

Chapter 4

Research method rationale

The aim of this chapter is to provide an overview of the rationale behind the methodologies used in the studies described in susequent chapters. This will convey details of the areas to be researched, an understanding of what type of data is sought, and a discussion of the methodologies that have been selected as appropriate means for gathering it. Specific details, such as precise sampling activities, will be addressed at the beginning of the relevant forthcoming chapters which discuss the findings. This chapter will therefore serve as an advance organiser for later ones.

4.1 The sites of interest

The central aim of the current research was to investigate children's use of home computers from a cultural psychological perspective. Therefore the family home was identified as the main site for investigation. However, another context in which children encounter this technology, and in which they spend a considerable amount of their time, is the classroom. This was therefore identified as a second site for investigation. It was felt that it would be useful to compare the configuration of children's computing activities in each setting, in an attempt to shed light on how activities are contextually situated. Classroom computer use and home computer use have both been researched in the past, so the aim was to revisit them both from a different theoretical perspective: to provide data that could facilitate comparisons between school and home.

4.2 Participants

In this section, the rationale behind participant sampling, in both the school and home settings, will be considered. The reasons for selecting children of a particular age range, and the sample base from which they were drawn are discussed.

4.2.1 Participants in the school study

Primary school aged children were the focus of this study because they are encountering and making sense of computing technology, and learning new skills. Süss (2001) reports that 49% of 6-7 year olds and 53% of 9-10 year olds have a computer in their homes. In addition to home exposure to computers, 85% of 6-7 year olds and 90% of 9-10 year olds in the UK use a computer at school (Süss ibid.). This is a clear indication that primary school aged children are being exposed to computing technology and their serious computer use is developing. Often, they are proficient enough to be able to use computers unaided.

In order to ensure that the maximum range of experiences was explored, the age groups selected to take part in the classroom study were 7, 9 and 11 year olds i.e. Key Stage 2. This range spans 5 years and was therefore representative of a broad sphere of abilities and developmental levels. The ICT skills of seven year old children will be different from those of 9 and 11 year olds as they have less experience and their literacy skills will be less developed.

This research was carried out in an East Midlands market town. This was a predominantly white community but with an above national average proportion of Asian families. In order to ensure that the participants were representative of the ethnic and social mix of this town, they were sampled from 5 different primary/infant schools, serving different catchment areas. Four primary schools and one infant school were involved. The maximum number of children that was possible for one researcher to manage, whilst allowing the necessary depth of engagement, were recruited. A total of 76 children were arbitrarily selected: 26 children from each of years 2 and 4 and 24 children from year 6. This figure was also determined by the timetable of research access agreed with the head teachers i.e. the maximum number of children that could be interviewed within the agreed time limit. Table 4.1 gives details of participants and their schools. Further details of precise selection and recruitment methods are in chapter 5.

To ensure that a complete picture of classroom computer use was gathered, all the permanent teachers of the classes involved were also asked to participate in the study. Temporary teachers were excluded as they would not have had enough knowledge specific to these particular schools.

School	Year 2 (age 7)	Year 4 (age 9)	Year 6 (age 11)	School size	Ethnicity of catchment area
A	5	n/a	n/a	174	White working class
B	5	7	7	317	White and Asian working class
C	6	7	7	300	White and Asian working class
D	6	7	7	258	White working and middle class
E	4	5	3	515	White middle class
Total	26	26	24		

Table 4.1: Number of school pupils interviewed and schools' demographic details

4.2.2 Participants in the home study

As comparisons were to be made between the classroom and home environments, it was important to recruit children from the same school years in both of the studies. Children in the home study were therefore also 7, 9 and 11 years old. While these children were at the centre of the investigation, it was recognised that their parent/s played a significant role in shaping their home computing experiences. Parent's perspectives on home computer use were therefore as important as the children's, making it essential to recruit the whole family into the study. Thirty six families were initially enlisted. This number was felt to be the maximum that one researcher could deal with in within the time frame. In order to ensure a broad demographic base from which these families were selected, they were recruited on the basis that their child attended one of the same 5 infant/primary schools as described above. One child from each family, plus their parents, were involved in the study. Recruitment and selection details for this part of the research are described in detail in chapter 6.

4.3. Tools and procedures

This section will consider the rationale behind the choice of tools for data collection, and the procedures used in the classrooms and the homes.

4.3.1 The school study

The aim was to collect data about 1) children's computer use, and 2) the local ecology surrounding that use. Previous studies, that have researched classroom computer use (e.g. Schofield 1995, Selwyn and Bullon 2000, Williams, Coles, Wilson, Richardson and Tuson 2000), have successfully utilised a wide variety of methodologies: interviews, focus groups, direct observation and questionnaires. The ImpaCT2 project (e.g. Lewin, Scrimshaw, Harrison, Somekh and McFarlane 2000) was innovative in using pupil and teacher diaries and reports. This research took place over several months and so the researchers had sustained access to classrooms. In the current research it was agreed with the head teachers of the schools involved that interruption would be minimal; one or two days at the most. This was for several reasons; head teachers were concerned that their pupils should not be absent from classes, they wanted to keep interruption from visitors to a minimum, and year 6 were preparing for their SATs. Diaries would be unsuitable in these circumstances because previous research has shown that children access their classroom computers about once a week, and in order to gather data about the whole range of activities, the diaries would have to be kept over several weeks or even a whole term. Likewise, observing children using computers would have been too time consuming if all types of use were to be captured. The ImpaCT2 project also asked the children to draw concept maps of everything that they thought a computer was useful for. Again, this was felt to be unsuitable for the present research due to the time this activity would take and also because the aim was to gather data on actual use rather than potential uses.

Focus groups were also considered as they have the potential to facilitate discussion and overcome any fears that young children may have concerning individual interviews. However, due to the timeframe, they were ruled out as being too time consuming. Moreover, it would have meant that more children would be absent from their lessons at this important time of year (head teachers were concerned that children should not give up their break and lunch times to take part in the research).

Questionnaires were also considered, and this method would have enabled data to be gathered from a large sample of children. However, it was important to bear in mind that 7 year olds may have problems with completing questionnaires independently. They also do not allow for any intervention and prompting if the children have difficulty remembering all the different types of computer usage over the last few months. Hence, it was decided that semistructured interviews would be the most appropriate methodology to use with the children. These would elicit rich data by giving the children the opportunity to talk about their experiences beyond the confines of preset questionnaire responses. They would also alleviate the problem faced by Downes (1999) where children referred to various types of non-game activity as "games". Interviews would allow the researcher to ask for precise details of what these activities consisted of.

It was also necessary to select methodologies that would elicit information about computer use from teachers. Questionnaires were chosen as the methodology to gather information from teachers, as they had very limited free time and interviews would have been too time consuming. This was not lengthy and teachers had the opportunity to take it away and fill it in when they had time. Questionnaire items were open ended and encouraged written, descriptive responses in order to elicit as much detail as possible. Descriptions of the questionnaire items will be presented in chapter 5.

It was necessary to maintain a common experience for all of the children and to protect their responses from any unwelcome fluctuations, therefore they were all interviewed by the same researcher. The interviews were audiotaped to provide an accurate record of proceedings. In order to ensure that the interviews were consistent across children, an interview schedule was used. This was semi-structured, which gave the children, and the interviewer a platform from which to expand upon other related issues if they arose. The questions were designed to be non-threatening and clear so that the youngest children would understand them. The aim was to optimise the interviews so as to capture the most comprehensive picture of classroom computer use. It was important to ensure that the children were as relaxed and unintimidated as possible, while maintaining their animated interest. To this end, they were interviewed whilst sitting at a computer. Some of the replies were entered to appear on the screen. This placed the context of the interview firmly in relation to computers and directed the children's attention towards this technology. It also softened the interview procedure itself and allowed children to reflect on their replies and change them if they wanted to. Precise details of the whole procedure, and of the interview schedule will be presented in chapter 5.

4.3.2 The home study

There were three main research strategies used to gather ecological data in the family study: 1) interviews of parents and children, 2) objective recording of computer use and 3) the introduction of 6 novel, educational software titles into each family. The fate of these titles within each individual family was tracked. The rationale behind using these tools and procedures will now be discussed in turn.

4.3.2.1 Interviewing parents and children

Previous research investigating home computer use (e.g. Downes 1999, Sutherland, Facer, Furlong and Furlong 2000) has successfully used questionnaires, observation, interviews and focus groups with children and their parents to gather data about the home computing environment. In the current research, the alternative method of video monitoring daily life surrounding the home computer was considered. Potential problems that were identified concerning this methodology were that it would have been intrusive and would probably have given rise to recruitment problems. It was therefore decided that both the participant child and their parent/s would be interviewed in their homes. This would allow more in-depth investigation than a questionnaire study. There were many issues of interest to be investigated and a single, long interview was considered to be too demanding and intrusive into family time. Fortunately, as another aim of the study was to log computer usage over several months, this would require the families being visited every few weeks. So it was natural to spread the interviews over this period. This meant that interviews would be shorter, less demanding on the children and their parents, and less intrusive. There were a total of five home visits, spread over 10 months. The interview questions were divided into three broad concerns and carried out during the second, third and fifth visits (the reasons for this span of time, plus details of the other activities in the visits will be described in the next sections).

Children and their parent/s were interviewed separately in order to facilitate uninhibited and uninfluenced answers. All interviews were carried out by the same interviewer using 3 semistructured interview schedules (see chapter 6 for full details).

4.3.2.2 Recording naturalistic computer use

The aim was to accurately record all instances of home computer use over 30 days. This period was judged long enough to ensure that the data collected was representative of all computer activity in each family. It spanned both school term and vacation time so as to capture use across both these periods. Previous studies in this area (e.g. Downes 1999 and The Screen Play Project) have asked children to keep diaries of their computer use for 1-2 weeks, or have asked children to describe retrospectively the use that they make of their home computers in questionnaires and interviews (e.g. Livingstone and Bovill 1999). The aim of the present study was to build upon these valuable findings. Reliability of computer use records was an important consideration. It was felt that asking children to keep written diaries over several weeks was an unreasonable demand that would probably have lead to errors and poor compliance. Observing these children, in their homes, using computers was also considered. Observation would yield useful data about how children use computers in terms of what activities they carry out within each item of software they use, and the verbal interactions that occur around the computer. However, the focus of this research was to determine what children use computers for and to monitor whether the opportunity for interaction occurs, not the nature of the interaction. It was therefore decided that commercial software, installed on every child's home computer, that logged all computer activity, in real time, would yield the type of data required about computer use, and would be be a more objective and reliable method than using diaries. For each active application, this software recorded the date, the window caption and the duration of use. It was also important to record who was using the computer at any given time (which this software did not do). Another piece of software was written that presented every user with a customised window, at start up. This contained the names of their family members (e.g. "Mum" or "Jack"), plus an option entitled "family" which could be selected by a visiting relative, plus "friend" which referred to any visiting, non-family member. Each user was then required to check a box next to their name. Both of these programmes stored their data records on the child's hard drive, making it possible for the researcher to download it onto a floppy disk. Precise details of this software, logging periods and analysis of the data are in chapter 6.

4.3.2.3 Investigating the availability of software in the local town

This research is primarily concerned with exploring the context of children's computer use. It was therefore important to establish whether the participants lived in an area that provided the opportunity for the purchasing of all types of computer software. Limited access would have a bearing on the potential of the home computer to support a wide range of potential activities. It was decided that a observational survey would be carried out, in the local town centre, to determine the number of outlets for computer software and the types of software available. This survey could be carried out on any day of the week, at any time of day and would be representative of the types of software available within the town on any given day.

The survey was carried out on a Saturday as this was most convenient for the researcher. A tour was made of the central shopping area in the town together with a small retail park within a few minutes walking distance of the town centre. The shops visited were newsagents, a dedicated games software shop, shops with audiovisual/software sections within them, and electrical retailers. A list was made, on paper, of the types of software that were available, some of their titles, and of the approximate number of titles on the shelves.

4.3.2.4 Investigating children's use of novel educational software

Previous research that has studied children's home computer use has established that they prefer to use entertainment games rather than software that has been developed specifically to support their school work. Although computers are used successfully for formal and informal education in many contexts, e.g. museums (Hawkey 2002), cyber cafes and libraries, it appears as though they are not popular for this purpose at home. Therefore this research set out to shed some light on why this was the case. As discussed previously in chapter 1, parents and advertisers are investing heavily in these products. Is there a discrepancy between parents' and children's perceptions of ideal computer use?

The aims of this part of the research were to track the long-term fate of newly acquired educational software titles and to ascertain parents' and children's responses to them. Once the naturalistic, 30 day computer monitoring had been completed, the families were then given 6 novel educational software titles each. They were invited to make use of them freely, as they wished. The distribution of novel software was designed to simulate a period, such as Christmas or birthdays, when new products might enter the home. Each child received 6 titles which, as far as possible, represented several of the educational genres found in UK shops and homes. Specific titles were requested by the researcher, and donated by software companies (see chapter 8 for full details) in return for feedback on research findings. The logging programmes were left running on the home computers, which tracked the fate of the novel software over several weeks.

Questions regarding the families' perceptions of these titles, both upon receipt of them, and after a few weeks of use, were asked in two of the interviews. These interviews were planned to coincide with the distribution of this software and the questions were designed to gather information that would clarify patterns of use (see chapter 7 for full details of the interview schedules).

4.4 Summary

This chapter has presented the rationale behind methodologies used in this thesis. The various methods chosen were adopted as a means of gathering the most reliable and richest data possible. They facilitated the collection of computer logging data that would be suitable for fine grained quantitative analysis of usage patterns, as well as enabling the collection of discursive data from teachers, pupils, children and parents at home. This would give the researcher first hand experience of the different homes. It would also provide an insight into the ecologies of children's encounters with computers in both the classroom and the home and shed light on the situated nature of their experiences. Problems did arise with putting some of these methodologies into practice, and these will be discussed in future chapters. The next chapter will be the first that considers the findings from this study. It will present data gathered from primary schools.

Chapter 5

The ecology of computer use in primary schools

5.1 Introduction: what does it mean to take an ecological perspective?

The term "ecology" is borrowed from the field of biological sciences. A simple definition is that it is the relationship of a plant or animal to its environment. For example, a plant has a relationship with hours of sunshine, amount of rainfall and local soil conditions. Every living organism occupies its own niche within the local ecology; it interacts with the environment in a specific way. An animal may eat leaves and live in a tree. These are two elements of its niche. If a new species is introduced into a pre-existing environment, both the animal and the environment may adapt and form a relationship with each other. The same principles apply to human, man-made, cultural environments. As discussed in chapter 2, the activities of humans are enmeshed within their cultural worlds, or contexts. It is therefore important that we study humans not as isolated and independent, but as actors-with-artefacts-in-settings. Their interaction with the physical environment is mediated by the cultural tools that constitute it, so that activity is situated. In this chapter the focus is on children-with-computers-in-schools. This chapter will investigate classroom computer use from an ecological perspective. On this occasion, neither the child, nor the computer, nor the school will be studied in isolation as they are all enmeshed with each other. It is the whole system which is the unit of analysis.

If this is so, then we need to characterise cultural context in a way that allows systematic investigation. The notion of concentric circles of context, as referred to in chapter 2, (Bronfenbrenner 1979, Cole 1996) will be adopted and used to characterise classroom context. Bronfenbrenner is the most vigorous advocate of an ecological approach and his book laid the foundations for this conceptualisation of cultural context in psychology. This model will be used because it is a useful tool to systematise classroom cultural context. On entry to a classroom a researcher is faced with the task of systematising a plethora of different activities and contextual features so this model is useful in that it separates the scene into manageable units to investigate, without losing sight of how they are mutually constitutive. It gives precedence to neither the child nor the context, but rather insists that we analyse them as an embedded whole. It aids the generation of research and interview questions as well as their analysis. It will also enable a systematic comparison of the classroom and the home.

In this case, the concentric layers surround a core i.e. the child-computer user. The nested levels of cultural practices then broaden out into practices at interpersonal, community (i.e. classroom) and institutional (e.g. school and governmental) levels (see figure 5.1).

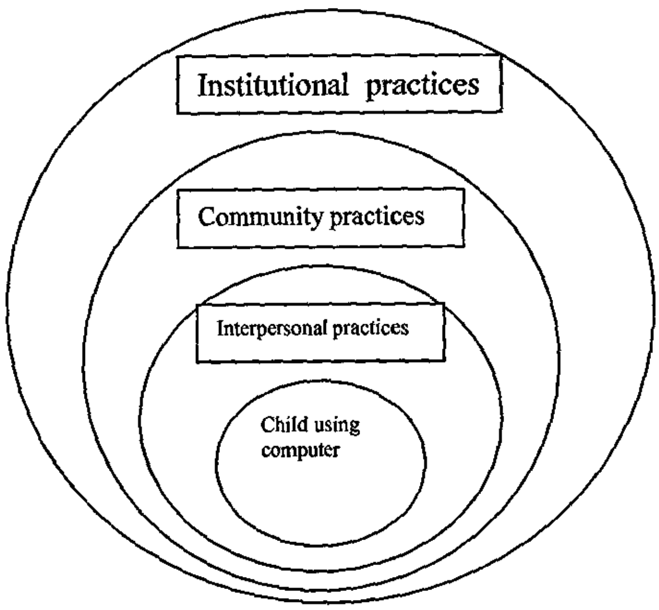


Figure 5.1: Concentric circles of classroom context

If we consider the child at the computer first, it is important to acknowledge that the computer is a platform for a variety of potential activities. However, in reality (e.g. in the classroom) this is rarely the case. The availability of software has a strong influencing effect on the activity that the child carries out. For this reason, the software resources found in the classrooms will be discussed first.

The next level is interpersonal practices. Whilst using the computer, the child will be engaged in conversation with both peers and teachers. The aim of the current research is to explore whether opportunities for interpersonal communication occurrs. The importance of children being given the opportunity to collaborate at the computer, and the ways in which this facilitates the construction of shared knowledge and understanding, has been demonstrated in various studies (e.g. Wegerif and Mercer 1996). Time restraints mean, unfortunately, that actual conversational data will not, on this occasion, be gathered. What is of interest here is to ascertain whether the *opportunity* for collaboration exists in primary classrooms.

Interpersonal practices are, in turn, mediated by community practices. These also impact upon how the child will use the computer, through classroom procedures such as teachers' methods of access control, and where the classroom computer is located. The overarching layer in this model is that of institutional practices. These include those associated with the national curriculum, the effects of which percolate down through all the layers, bearing upon the practices in all of them.

This approach to studying children and classroom computers is not one that is commonly adopted in the psychological literature. As mentioned previously, there is a dearth of studies that have carried out research in the classroom from such a perspective. However, one exception is the book Computers and Classroom Culture by Schofield (1995). She argues that " although the ways in which computers are utilised are undoubtedly influenced by the ongoing context into which they are introduced, it is also reasonable to expect that their use will in turn influence that context..." (p4). This author recognises that the study of computers in the classroom must take the whole ecological setting as the unit of analysis. However, in her study Schofield focuses on the level of classroom community, without referring to higher levels of institutional organisation. Schofield's (ibid.) research aims were two-fold. Firstly, to investigate how the school's social context constitutes computer use. Secondly to investigate how having a computer in a classroom works to shape the school's social context.

Schofield (1995) studied daily, ongoing, uninterrupted, naturalistic computer use in a secondary school in the U.S.A. In one class, where there was one computer per child, she describes how an intelligent tutoring system had been installed. Schofield reports that the presence of these computers and their software had remediated the classroom's social dynamics. For example, compared to a traditional lesson, the teacher no longer stood at the front of the class and was no longer the main source of help. This teacher had become less of an authority figure and more of a facilitator, as the children turned to the computer system for help. Learning became less didactic and more teacher-facilitated. Compared to a standard lesson, the teacher also gave more individualised help, and gave it to the less able pupils. As a result, the children enjoyed their lesson more, they expressed increased motivation and put in more effort than in a traditional lesson. Their fear and embarrassment at asking questions was diminished, as they felt that the computer did not judge them personally. In this class, the social dynamics of this community were changed dramatically by the introduction of this variety of computer-based learning.

In addition to classroom use, the school also ran a lunch time computer club for gifted students. Schofield (1995) found that most members of this club were white males who were frequently considered, by other pupils, to be "nerds" or "computer freaks". The computer room evolved into a place where these boys could socialise, eat their lunch and play computer games. These boys had hitherto existed on the fringe of school life, but the provision of computers brought them together and remediated their social lives during school hours.

So computers in this school had remediated the social context in more than one way. In the above examples, they had changed the teaching practices in the classroom and had provided the opportunity for a lunch club. These two separate social environments are very different. In this case, the computer occupied more than one niche in this school: the classroom and the lunch club. It played its part in constituting the social ecology of either setting.

Schofield's (1995) study argues for a theoretical perspective that gives precedence to the context of computer use. However, it concentrates on the *immediate*, classroom context to the detriment of other broader, surrounding settings, such as those of interpersonal and institutional practices, as described above. She does not investigate the nature of interpersonal interactions by the children and does not explore how the institutional setting works to mediate how the children use the computers. However, the study sets a useful precedent for this thesis.

Barnard (1999) also carried out a study to examine how the use of educational technology could remediate teachers' classroom practice. She videoed six teachers, in higher education classrooms, who were using educational technology as part of their biology lessons. These videos were played back to the teachers and they were asked to provide a commentary on what was happening and what they were pleased or displeased about. She used Brown and McIntyre's (1993) framework for describing their observations of classroom practices. These researchers argue that teachers are continuously evaluating their own, ongoing classroom practices, in terms of two main short-term goals: Normal Desirable States of Pupil Activity (NDS) and Progress. Teachers are also concerned with a number of Conditions, any of which could impact upon NDS and Progress. These were issues such as how demanding the lesson content was, the material resources available, the length of the lesson, student characteristics and their own state of mind. These goals and their conditions represent features of the local classroom context that, Barnard argues, are remediated by the presence of educational technology.

Barnard's (1999) findings are interesting in that they are an illustration of how teachers' goals can change with the introduction of educational technology to the classroom. She studied two different circumstances of technology use. One in which it was used at a peripheral level, i.e. to support other classrom activities, and the second in which it formed the central, or pivotal classroom activity. She found that when technology was being used at a peripheral level, teachers were concerned with their own perceptions of what an acceptable NDS was. Three were happy that the students achieved appropriate levels of NDS, as supported by the technology, and one was unhappy. Teachers in these lessons also focussed on student characteristics as the main condition affecting whether Progress and NDS were acceptable. In contrast to this, in classrooms where educational technology played a pivotal role, teachers were less likely to be concerned with their own NDS goals and more concerned with Progress. They also identified time and material conditions as those affecting their subgoals. The more central the role of technology in a lesson, then the more likely teachers are to forego their own NDS goals because Progress is more important. The presence of technology has effectively remediated teachers' perceptions about the relative importance of NDS and Progress and the likely Conditions that will affect them. This study is quite focussed on teachers and their perceptions of appropriate goals. The research in the current thesis will take a broader perspective and investigate other features of the classroom context.

This chapter will present findings from a broader perspective, thus affording a more comprehensive picture of children's experiences with classroom computers. It should be borne in mind that the central focus of this thesis is an exploration of children and computers in the home. However, since the main theme of the home investigation is the domestic ecology of home computers as tools for learning, it is pertinent to examine also the other important environment (the classroom) where this type of use takes place. The smaller study of classrooms, presented in this chapter, is intended to be less detailed than that carried out in the family homes, but will serve as a useful reference point from which to make comparisons. This will shed light on the main differences between the home and school environments and, in doing so, will go some way towards exploring the differing ecologies that give rise to different types of computer use in each setting. In the next section of this chapter, the methodology for the study of computing practices in a sample of UK primary classrooms will be discussed. This will be followed, in later sections, by the study's findings.

5.2 Methodology

The findings presented in this chapter were gathered from a study carried out in primary schools and in their classrooms. A rationale for the methodology used is presented in chapter 4. What follows is a more detailed description of the participants, tools, procedure and conditions.

5.2.1 Participants

A total of 76 pupils (38 boys and 38 girls) from year 2 (mean age 7 years and 5 months), year 4 (mean age 9 years and 4 months) and year 6 (mean age 11 years and 5 months) was randomly and blindly selected from the class registers of five infant/primary schools in Loughborough (see table 4.1). These schools were selected as their pupils were representative of the diverse ethnicity of the local population. The schools drew their pupils from both working and middle class families who were either white or Asian. Selection of participants was by the following method. A list of arbitrary numbers was compiled and the children at the corresponding positions on the class registers were picked for inclusion in the study. Fifty percent of those picked were girls and fifty per cent boys (if the child selected was a boy when another girl was required then more numbers were arbitrarily selected until one of them matched the position of a girl on the register). The age range chosen was broad enough to represent a wide range of classroom experiences and was also the same as the children who participated in the home study.

The Head Teachers of all the schools, with the exception of school E (see table 4.1), were satisfied that the interviews could be carried out with only their permission. At school E, permission was sought from the children's parents. There was a 55 % positive response rate to the letters that this Head Teacher sent to parents. Hence fewer children from this school were interviewed. None of the children participated in both the school and home studies.

In addition to these children, all of their teachers (N=25), with the exception of short term temporary teachers, were also included in a questionnaire study.

5.2.2 Tools

The school pupils were interviewed using a semi-structured interview schedule (see appendix 3). Questions were chosen in order to shed light on the following themes: type and frequency of school computer use (questions 1-5), whether and how work produced using the computer is shared or incorporated into ongoing classroom activity (Qu.6), the social context of computer use, ie sharing, arguing and teacher supervision (Qu.7-10), the child's views on issues important in deciding where to position the classroom computer (qu.11) and questions to determine home computer ownership (Qu.12-14).

The teachers had very limited free time and it was felt that interviews would be too intrusive into their working day. Instead, they were asked to complete a short questionnaire (appendix 4). The items were designed to elicit information about a) the software that they had used in their class in the current academic year (qu.1), b) the approximate percentages of total computer time allocated to each computer based activity (qu.2), c) the type of lasting products that were produced using the classroom computer, and their fate (qu.3), d) how computers were incorporated into lesson plans and how access to the classroom computer was organised (qu.4), e) teacher's level of ICT confidence (qu.5), and finally f) the type of ICT related questions that children commonly ask (qu.6).

5.2.3 Procedure and conditions

The children were taken individually to a convenient undisturbed area in the school (e.g. the library). They were asked whether they would help the interviewer to find out about how computers were used in their class. Only one child declined and so was replaced with another. All children gave verbal permission for the discussions to be audiotaped. Where possible, children were interviewed whilst sitting at a computer. Replies that involved listing software or computer activities were typed onto the screen by the researcher. When this was not possible, the replies were written down by the researcher on paper. This made the interview more relaxed by focusing on the typing/writing task rather than on the interview itself. It also gave the children the opportunity to look back at these lists to aid their memory and help answer future questions. For example, they could use the list to recall that they had done word processing and then answer specific questions, such as whether this was alone or with a friend.

In order to free the researcher for field work, the audiotaped interviews were transcribed by a member of university staff, which took approximately two months (part-time). They were then analysed with the assistance of qualitative analysis software called Atlas. Each interview question was specific and designed to address a single issue. This shaped the code applied to each reply (e.g. "software used"). As a consequence, all relevant replies to the same question were coded under an identical code. This was a lenghthy process and took about one month. Where replies answered more than one question they were given an additional code, as appropriate. The codes allowed navigation to specific parts of the text, which were content analysed. The was done by counting and categorising children's replies. For example, a table was made, using pen and paper, of all the types of "uses" that the children specified, and the number of children that reported each "use". Percentages were then calculated e.g. X% of children said they had used the computer for word processing. Extracts of the interviews were selected as being representative of coherent forms of response to the theme being discussed. This was done by listening to all the replies once again and selecting the reply that best represented all that had been allocated a particular code. The whole interview analysis took approximately 6 months.

In addition to the children's interviews, all the teachers (N= 25 excluding temporary teachers) of the classes involved were asked to complete a questionnaire in their lunch break. Some teachers had other commitments and were asked to complete it in their own time and post it back to the researcher. Fifteen completed questionnaires were returned. Questionnaire replies were coded and subject to the appropriate statistical summaries (i.e. calculating percentages). Some teachers and IT co-ordinators were also informally asked questions as they arose during the visits to the schools.

What follows are the findings from this classroom-based study. They have been organised under the main headings discussed in the introduction to this chapter. Firstly, software resources are discussed in order to characterise the child-computer "core". This will be followed by consideration of more social-cultural issues, organised under the three concentric layers. Institutional practices are considered first as these have an overarching effect on the other two layers. This will be followed by community practices and interpersonal practices respectively.

5.3 Software resources: functionality of the computer tool

The first feature of classroom context to be considered is central to how the child makes use of the classroom computer: software resources. Lists were made of all the software found installed on the classroom computers and in this section the software is categorised and distribution patterns are discussed.

As mentioned above, the classroom computer has no single functionality: it has many potential uses as schools have a degree of choice over the software that they purchase. This is reflected in the wide variety of software found in these classrooms. Across the 5 schools, there was a multitude of different titles. It was necessary to organise them into genres in order to make analysis manageable. Seven different categories of software emerged, based upon the type of activity that each supported: (1) Reference (searchable hypermedia archive), (2) drill and practice (curricular question and answer cycles), (3) educational game (reasoning problems embedded in a narrative), (4) electronic book (page-turning frame for illustrated text), (5) internet resources (e.g. web browsers) (6) generic, creative tools (e.g. text, image and number processors), (7) control technology (e.g. programming tools for controlling floor robots). All of these genres are supportive of educational activity and the type of software found in the classroom was indicative of the type of computer use that had been sanctioned by the national curriculum (see 5.4. for more details of national curriculum guidelines). The distribution of software across each genre will be considered next.

Internet provision across the schools was variable. Although all the schools had internet access, in some it was available only on a small number of machines. This was due to lack of funds and lack of suitably powerful computers. Across the 5 schools, the majority (42.6%) of software owned was that supporting creative activity. For example, Talking First Word (talking word processor), Minisheet (a simple spreadsheet) and Colour Magic (graphics). This suggests that there was a consensus between schools about the type of activity that they wanted particularly to promote i.e. active child involvement in producing an end product. This type of activity was valued more than using the computer to practice skills such as number work. The next most popular genre was reference software (27%), such as Children's Dictionary or the History of the World. This was consistent with the computer being used as an information resource and, in this case, being used to facilitate the writing of class projects.

These popular software genres were followed next in popularity by educational games (17.6%) such as The Logical Journey of the Zoombinis. Educational games typically did not produce any lasting product and were used mainly to practice pre-existing skills. Their use was not generally incorporated into the main class lesson (see 5.5.1). Only 15% of the software was electronic books, such as Stig of the Dump and The Fish Who Could Wish, suggesting that, with only one computer per class, electronic books were not an efficient use of a limited resource when paper copies were available. Next was control technology (4.9%) such as Superlogo, and finally a very few drill and practice titles (0.6%) such as SATs Mental Arithmetic.

Discussions with teachers and IT co-ordinators revealed that there were only 2 main routes to acquiring this software. Either it was supplied with the hardware as a package (the most common route), in which case the individual teacher had little part to play in the decision making, or it was bought separately by the school. Each school had an IT co-ordinator, who was a teacher who took on this additional role. Levels of expertise amongst them was varied and some were still undergoing training, whereas some were themselves training other teachers. Levels of expertise therefore varied so that advice on what software to buy was patchy. Purchasing was also obviously constrained by institutional financial considerations.

This section has considered the software resources available in the classroom which, in turn, work to shape the functionality of the computer. The next section moves on to describe the institutional practices that constitute the institutional "layer". Issues such as the role of the national curriculum, and teachers' ICT competence as mediating classroom computer practices, will be discussed.

5.4 Institutional practices

One of the most pervasive institutional instruments that shaped classroom practice was the National Curriculum. This was first introduced by the government in 1988 and has since been revised several times. The most recent version came into effect in September 2000 (DfEE 2000a). The national curriculum was introduced in order to raise educational standards and to ensure that each child had a statutory entitlement to learning. It determines the content of what will be taught, and also sets out how learning will be assessed. Every school has a statutory requirement to teach the subjects that it specifies for each age group. For children of the 7-11 age group in the current study, this means they must be taught english, mathematics, science, design and technology, ICT, history, geography, art and design, music and physical education.

With regard to stipulating the content of what will be taught, the national curriculum breaks down each subject into specific aims. In the case of ICT, there are 4 aims. The first is that children use ICT to facilitate "finding things out". The second aim is "developing ideas and making things happen". "Exchanging and sharing information" is the third aim. The final aim is "reviewing, modifying and evaluating work as it progresses".

The National Curriculum also sets out how learning will be assessed. Children aged 7, 11 and 14 sit Standard Assessment Tests in english and mathematics at 7 years old and in these subjects, plus science, at 11 and 14 years old. ICT as a subject in its own right is not tested, but there are still attainment targets that children should meet. These attainment targets are more specific than the general aims described above and hence have more influence over actual classroom practice. For example, eleven year old children are expected to be able to "collect, find and interrogate" information. The national curriculum also suggests the activities which could be involved in meeting them. Schools have no statutory requirement to follow these suggestions, but most of them do. The suggestions for this target mean that children should be able to save and retrieve files, and search the internet and CD-ROMs. Another attainment target is that children must be able to "combine different forms of information" which has been interpreted to involve being able to manage at least 2 files at the same time, and to cut and paste from one to the other. They also should be able to use ICT to "present information". This has been understood to mean the ability to word process, make posters and use desk top publishing. They must also know how to use email to exchange information, and spreadsheets to manipulate data. ICT is unique in that it exists as a subject in its own right as well as there being a statutory requirement to incorporate it into all other subject areas, except for physical education. This means, for example, that a CD-ROM can be used to search for historical facts in a history lesson, or a spreadsheet used in relation to mathematics. The ICT national curriculum is therefore quite prescriptive and has a pervasive effect on classroom practices, so that teachers are often left with few options regarding use.

In the current study, each school generated their own "scheme of work" (policy) about how to incorporate ICT into the classroom, based upon the guidelines in the national curriculum. This involved laying down broad aims or even planning weekly tasks for the whole year across all subject areas. The presence of the National Curriculum meant that no subject could be given priority. This meant that it effectively governed the amount of time a teacher could spend on ICT. Lessons were of only a certain length and the use of computers only fitted into a particular slot in particular lessons. Therefore, the curriculum essentially had a strong role in regulating the development of school policy, and hence the tasks that the child carried out using the computer, as well as how frequently they did them.

The existence of a National Curriculum suggests that the provision of computer hardware and software should be consistent throughout England. In fact this is not the case. Due to different levels of funding, and different local priorities at both regional and school levels, there are both between-region and within-region differences. Some schools have more computers than others and some have more modern machines than others (DfEE 2000b). For example, one of the schools visited in this study used Acorn format computers, others used PCs, and in another classroom there was an old (rarely used) BBC computer alongside a PC. There was therefore a lot of variation in the extent to which this technology could be utilised to fulfill curriculum requirements. This has meant that it is currently not possible to have national standards on the amount of ICT use and experience a child must have in any given period.

Another institutional feature, that has a bearing on how computers are used in individual classrooms, is teachers' ICT competence. These skills varied a lot between teachers. The computer was a comparatively recent addition to the classroom and ICT has only very recently become a statutory part of teacher training. Longer serving teachers have all had to be trained, and, again, funding is limited so that many teachers felt that this had not been adequate. This inevitably also affected how effectively computers were used in the classroom, as teachers were often lacking the necessary skills to support a wide range of uses. Teacher's questionnaire replies in the current study indicated that only 14% were confident in using computers, 65% were fairly confident and 21% were lacking in confidence. A common reply was that teachers were confident using familiar software but lack the technical expertise to troubleshoot when there were problems. One teacher wrote that "*I'm quite confident using the software but not very confident about sorting out problems*", while another acknowledged that "*some children are able to offer suggestions when I get stuck!*".

It is apparent that the national curriculum has a major role in shaping both what the children do on the computer, and how frequently they do it. These institutional factors define cultural force, the effects of which percolate down to mediate the practices of both teachers and children. It is quite prescriptive and often teachers are left with a feeling of very little autonomy in relation to their classroom practices. Its presence led many teachers to attend courses to improve their ICT skills and many felt that there was still room for improvement. The next section of this chapter will move on to explore features of the next "layer" of cultural context; community practices, and how they shape children's experience.

5.5 Community practices

Community practices are issues that involved all members of the class, both teacher and pupils, in jointly contributing to current practice. Teachers and pupils had a common purpose and there were decisions to be made about designing the shared environment to achieve particular goals. These decisions bear upon the children's experience of using ICT. Firstly, issues surrounding the location of the computer in the classroom will be explored. Following this, the community practices of arranging access, managing hands-on computer usage, the display of children's work on the walls, and computer-related rules will be considered.

5.5.1 Location of the computer in community space

This section will discuss the provision and location of computer hardware in primary school classrooms. Central government funding for the provision of computers in UK primary schools has increased over the last few years, from a reported £49 million in 1998 to £123 million in 2000 (DfEE 2000b). This has meant that there are now more computers per school, and hence per pupil. In 1998 there were a mean of 13.3 computers per school (1 per 17.6 pupils), which grew to a mean of 17.8 computers per school (1 per 12.6 pupils) in 2000. In the present study, most computers were found located in classrooms. There were no computer "labs" as commonly found in secondary schools, probably due to the lack of a room that could be designated as such. Of the 25 classes, 22 had a computer in the room, 2 had access to one in an adjoining corridor and 1 had access in a separate room (the school library). Twenty two of the classes had access to one computer, whilst the remaining three of the classrooms had access to 2 computers. All schools had 2-3 "spare" machines on trolleys, or stored away in cupboards, which were shared. Overall, these schools had more pupils per computer than the national average: approximately one computer per 25-30 children. Limited resources, common across all the schools, led to teachers devising methods of strict access control, which will be considered in more detail in the next section.

The location of the computers was important in that it mediated the children's experience of using them. A child sitting at a computer in a quiet library would have a different experience to a child located in a busy classroom. To elicit views about the location of their computers and how it mediated their experiences, children were asked whether they thought that their classroom computer was in an appropriate place. Fifty three per cent thought that it was in the right place and the other 47% would have liked to see it moved. The children were asked to explain their reasons behind these decisions. They were mainly concerned with the physical environment (i.e. space and noise) and the social environment (i.e. proximity to the teacher and to friends). Concerns about physical space centred on the lack of it in the typical classroom, so that computer trolleys or desks were often squeezed in. Children said that this often meant that they *"get a bit squished up"* or that *"you can't get the chair in"*. Concerns about noise mainly centred on that from a neighbouring class (some schools were open-plan) and the advantage of having the computer in the library: *"its out of the way of everybody else, so it's not quite as noisy, so you can concentrate"*. But having the computer separate from the classroom also had its drawbacks. Those children who were concerned about the social environment in which the computer was located expressed the advantages of having others in the proximity for help e.g. *" If you're stuck and you're, like, with a friend and they don't know what to do, nobody can see you if you're in the library. So I prefer it in the classroom, cos you can get more help there really, cos you've got adults around you, and children"*.

Children were concerned about the physical and social context of classroom computer use but could not agree about a single ideal position, there being both advantages and disadvantages to it being either inside or outside the classroom. These advantages and disadvantages seem to be coloured by how they affect children's performance through such concerns as distraction or getting teacher help. This is continuous with the classroom being a performance-oriented environment where success was valued, and poor performance was judged as being less than satisfactory. The replies that these children gave have provided an insight into how the location of school computers can work to mediate their social and physical experience as users.

5.5.2 Access to computers in the classroom community

Organisation of physical access to the classroom computer was a community issue, as it involved the whole class, teacher and pupils, in coming to a shared understanding of how each child was assured of having their turn at this limited resource. Access in these schools was not free and unregulated. High pupil:computer ratios, together with time restraints, meant that each child had limited access, i.e. there were only certain planned times in certain lessons. Children's replies in the interviews indicated that they used them at most once a week, and at least once a month. One child said she could not recall ever using it in the current academic year (several months). Replies varied from *" a lot, and lunch times too"* to *"I've only ever used it twice in year six[last four months]"*. Discussion with teachers suggested that too few computers and not enough time were the main barriers to frequent computer use.

There was little interschool consistency in access arrangements, reflecting the fact that there were no national guidelines on the amount of use each child should have per week. As a consequence there was variety both between and within schools in the amount of hands-on time the individual child got. The most common access arrangement was to have a tick sheet where each child ticked off their name once the weekly computer activity was complete. This systematising of access, and recording of incidences of use was unique to use of the computer. Other tasks were not monitored so closely. It is difficult to tell why the computer had this type of priority assigned to it but it may be because the political climate was one in which new funds were being distributed to schools for the provision of new machines, and access to them was encouraged and highly valued, so that fruitful and equitable use had to be carefully recorded.

Occasionally a child may have got extra time, within a lesson, when they had written a piece of work that the teacher wanted word processed so that it could be pinned on the wall. Access during lesson times was closely regulated and organised by the teacher so that the children reported that arguments over who used the computer were rare.

Some children were keen on additional access, so casual use was also encouraged in the schools. This eagerness to enter the classroom during leisure time was unique to using the computer, which is indicative of just how powerfully engaging this technology can be. Most teachers allowed access at break and lunch times, where admittance was managed either on a rota or with permission from the teacher. One teacher issued badges to the children allowing them access at lunch times. This free time was usually used by a small minority of especially keen children. This was the only time, in school, where there were no curriculum restraints and children could choose the computer activity of their choice. For the majority of time this was the playing of educational games. In one school there were also 3 Apple computers in the main lobby which had only typing tuition software installed on them. These were freely accessible to any child during lunch and break times.

Access arrangements in lesson time inevitably meant that the child/children using the computer during a lesson had to physically move away from their desk, to the computer trolley. Did this mean that their computer activity disengaged them from the ongoing classroom activity? On the contrary, it appeared that classroom computer activity was not isolated and did not disengage the users from the enterprises of the rest of the class. Instead it was embedded in ongoing lessons. Children using the computer were an integral part of class activity, even where the computer was not situated in the immediate classroom environment. This is consistent with teachers' ambitions to ensure that all lessons reflect a corporate endeavour towards the formation of classroom-wide "common knowledge" (Edwards and Mercer 1987) by ensuring that all children reach a joint understanding of the aims and outcomes of the lesson. This meant that children had a good sense of how their computer activity was related to work in progress. Most teachers reported that they had a short class session each week, where the whole class gathered around the computer and were introduced to a new programme or to that week's task. A small minority of teachers said that they teach the skill to a class 'expert' and ask them to disseminate it to the rest of the class. The weekly task could be related to an ongoing class topic such as the Romans, or related to a literacy hour activity, such as reading an electronic book, or could be learning an ICT skill such as how to save a file. As a consequence, most computer based activity was integrated into the ongoing weekly plan and only one teacher described computer use in his classroom as "*ad hoc*".

5.5.3 Computer uses in the classroom community

This section will look at teachers' and children's responses to the questions about what they used their classroom computers for. Teachers' questionnaire responses indicated that the most frequently used type of software, across all the classrooms, was generic creative tools. This was consistent with the fact that the majority of software owned fell into this genre. Its use was listed by 93% of the teachers, and all listed that they had used more than one creative title. Fifty three per cent of teachers listed reference software, and one third said that they had used electronic books. Educational games, control technology and internet/email were listed by 27% of the teachers. No teacher listed drill and practice software. This pattern of use maps onto classroom software ownership patterns as described in section 5.3 .

Another questionnaire item asked teachers to apportion approximate percentages of total computer time that was dedicated to each item of software listed. They reported that most classroom computer time was dedicated to word processing: mean 41% of time in year 2, 47.5% in year 4 and 40% in year 6, with a mixture of software from the other above categories in the remaining time. It appears as though, irrespective of the large range of software that teachers had available, the government driven concern to improve literacy and numeracy had a pervasive effect on the use of word processors.

The proportionately high use of word processing was also reported by the children. One said "*we get asked a lot to type what we've wrote down for a story*". In the current interviews, pupils were asked to recall all applications that they had ever had experience of using in the current academic year, irrespective of frequency of use. The most commonly experienced activities were word processing (83% of pupils), educational games (62%) and reference CD-ROMs (56%). Forty four per cent of children recalled having used art packages and 17% mentioned internet and email. Use of databases and spreadsheets were experienced by 15% of these children. Thirty one per cent of children reported using drill and practice software which did not tally with the teacher's responses. It is likely that the children reported their use of these titles in break and lunch times whereas the teachers reported lesson-time usage. Also, only fifteen out of the twenty five teachers responded so it could be that it was children in the other classes that reported that they used drill and practice software.

The school's policy of integrating computer-based work into the curriculum can also have effects on how software is actually used. This was made apparent in teachers' responses to one of the items in their questionnaire which asked them to list the software that they had used in the current academic year. There was a difference in the number of titles used by different teachers across different schools. For example, one teacher from year 2 listed 24 titles and another, in a different school, listed only 3 titles. In fact, all the teachers in this school listed only a few titles. This inter or intra-school inconsistency indicates how school policy, alongside curriculum requirements, contributes to classroom computer use.

5.5.4 Community display of children's work

A community practice that was very visible in the classrooms was the display of children's work on the walls. This is a well established practice in primary schools but it also responds to the demands of the national curriculum. These stipulate that children must be taught how to "exchange" and "share" information. In addition to this display and sharing of work within the school, items were also produced that were shared in other ways both within the school, as well as with the children's families. The type of computer generated display products that both teachers and pupils mentioned were labels designed for drawers and cupboards, Easter cards destined for home, newsletters for the school library, calendars, stories to take home, word processed titles for wall displays, lines of a play printed out for memorising, and material for a class assembly. Pupils reported that another computer generated product, i.e. scores achieved within educational games, were not shared but were usually lost when the session was over. The children claimed that their teachers did not know how well they had done on such games, which is consistent with the likelihood that this software was mainly used in lunch and break times.

The wall displays effectively fed back computer generated products into the classroom community that had generated them, making work visible to peers and visiting parents. They also reinforced the fact that the schools were productive, working environments. In addition, they acted as a reward system; as, sometimes, winning a place on the wall was perceived as a signal of achievement. The children were therefore surrounded by a visual environment that foregrounded and valued pedagogic practices and the accomplishment of creative activity. The community practice of displaying work constituted part of the classroom ecology and mediated children's experience of computers by displaying the best poems and the best pictures. This helped children to understand what was expected of them: the displays featured work that was a model of good practice (Daniels 1989, Jones and Villarino 1994).

5.5.5 Community rules governing computer use

Surprisingly, there were very few explicit rules related to policing behaviour of the children at the computer. Use of the computer was deeply embedded in the community ecology such that separate rules governing computer related behaviour were not needed. The general rule cited by the children was that there should be no "*messing around*". This was needed because the computer was located on the periphery, and occasionally outside, the classroom making it impossible for the teacher to be in attendance at all times. This rule prevented abuse of the machine and subversion of the teacher's instructions to use a specific item of software. Other rules were implicit and encorporated into those governing good classroom practice and behaviour e.g. not taking another child's turn and not abusing the keyboard. This reminds us of the systemic nature of classroom computer use.

5.6. Interpersonal practices: interactions around the technology

The next "layer" of classroom culture to be investigated is that of interpersonal practices. These are the opportunities for child-child and child-teacher interactions that children engage in whilst using the computer. Access to computers was arranged so that, on the majority of occasions, children were rarely alone. This meant that their experience was collaborative most of the time. They were asked how they felt about this arrangement and their responses are discussed below. Children using the classroom computer also had limited interpersonal contact with their teachers, which is the topic of the second part of this section.

5.6.1 Peer collaboration at the computer

Teachers' questionnaire responses indicated that there was no standard way to manage computer access in any given class. It was usually arranged to fit in with the prevailing circumstances. The most common arrangement was on a shared basis, ranging from pairs up to groups of 6, and occasionally, for individuals. This meant that the experience was not tutorial in nature, but more likely to be collaboration with a peer partner or a group of peers. Sixty five per cent of children said that they had had the experience of working both alone and with at least one other person at the computer, 20% with only a partner or a group, 11% reported only ever having been alone and 4% said they had only ever worked with a teacher or classroom assistant.

When asked which they preferred, 57% of children said that they preferred working with a partner or group. Reasons for this included the sharing and comparing of ideas, using each other for help with problems or as a friendly competitor when playing games, enjoying the company, being involved in something 'good' like sharing, being able to share the blame for mistakes, and getting work done more quickly. For example, one child said that he preferred to share with someone *"cos you can share your thoughts with them, and you wouldn't be lonely and if you didn't know what to do the person next to you might know what to do"*. Yet 43% of children did state that they preferred to work alone. A commonly cited advantage was *"cos you get more done, ...if someone else helps you then they will, they distract you. You try and get on but they're telling you all the words when you know how to do it yourself, so I like doing it by myself"*. Pupils offered other reasons for preferring to be alone which included the prevention of copying, more autonomy over the end product, the prevention of arguments or accidents such as deletions of work, less interruption, less peer criticism, a reduction in the stress associated with working with someone more able than yourself, as well as a reduction in noise. These reasons are indicative of how children's perceptions of collaboration are embedded in institutional concerns such as the production of good work. These findings suggest that classroom computer use is generally collaborative in nature but also that this arrangement is not always popular with the children.

5.6.2 Child-teacher communication at the computer

Computer access arrangements dictated that not all the children in the classroom would be engaged in using the computer at the same time. This meant that the teacher was responsible for supervising two ongoing activities: class activity and computer activity. Consequently, the teacher's attention to the pupils at the computer was transient. Children said that when they needed help they had to attract the teacher's attention. This was done by raising their hands, queuing at the teacher's desk or calling out. This meant that although the child's activity was linked into that of the broader classroom, they were quite socially isolated. They had little opportunity to discuss questions with their teacher and often had to rely on their partner for help and advice. The environment was therefore more collaborative than teacher facilitated.

5.7 Discussion

This chapter has been concerned with taking a cultural approach to studying children's computer use at school. As discussed in chapter 2, this involves noticing that cognition is situated in, and distributed throughout socio-cultural context. This approach therefore gives precedence to the study of the ecology that mediates practice. This chapter has adopted Bronfenbrenner's (1979) characterisation of ecology, as consisting of a core activity embedded within co-constitutive "layers" of practices. These layers should not be perceived as being separate, but instead as being constitutive of the whole setting, and of each other. In this case, the child computer user, in the classroom, characterises the core, whilst being embedded within interpersonal, community and institutional practices. These practices are mediated by both primary artefacts (e.g. software) and secondary artefacts (e.g. community rules and the national curriculum), and it is within the setting that these artifacts constitute, that the child's cognition is situated.

The observations discussed in this chapter demonstrate that the adoption of Bronfenbrenner's (1979) model is appropriate. Practices constituting each "layer", and their interactions, have been found in the classroom. For example, the overarching and pervasive effects of the national curriculum were found to be acting on the practices in each layer. Working inwards, the national curriculum mediates institutional practices in that it defines school policy and timetabling of ICT. The number of lessons in which computers are used is closely regulated by the national curriculum laying down the type of computer experiences that the children should have. This impacts on teachers' classroom practices in that it prescribes what they have a statutory requirement to teach. Community practices are also mediated by it, such as the presence of access arrangements that regulate each child's exposure to the computer. Eventually the influences of the national curriculum percolate down to each individual child using a computer. What they do, how frequently they do it and who they do it with, are all determined by this powerful cultural artefact. This chapter has given an indication of how children's experience of classroom computers is contextually embedded.

As mentioned previously, computers are constructed by different people and different organisations to be different types of tool. For example, the same basic machine will be used differently by an accountant, a teacher or a graphic designer. It is the software tools that users buy that begin to shape how each individual machine, in each separate context, will be used. In the case of primary schools, consistent with the institutional agenda, only educational software was purchased. This defined the machine in various ways. For example, as a creative tool for story writing or drawing pictures, for data management in the use of spreadsheets, or for practising mathematical problems in the form of educational games.

Children's replies in the interviews indicated that they used computers infrequently, from once a week to once a month or less. This supports previous British work in this area (e.g. Mumtaz 2001, Süss 2001, Williams, Coles, Wilson, Richardson and Tuson 2000). Discussions with teachers suggested that too few computers and not enough time were the main barriers to frequent computer use. These reasons were also cited by teachers in a survey conducted in the U.S., together with problems with finding good software, with accessing the internet, with concerns about what the children would access on the internet, and with lack of training and support (U.S. Department of Education 2000). These findings suggest that there are currently several barriers preventing children using their computer more regularly.

Another questionnaire item asked teachers to apportion approximate percentages of total computer time that was dedicated to each item of software listed. They reported that most classroom computer time was dedicated to word processing This supports the findings of other studies carried out in the UK, USA and Europe (e.g. DfEE 2000b, Drenoyianni and Selwood 1998, Livingstone and Bovill 1999, Selwyn and Bullon 2000, Süss 2001, U.S. Department of Education 2000, Williams et al 2000). Children in the current study, and others (e.g. Williams et al 2000) confirm this finding. It appears as though, irrespective of the large range of software that teachers had available, the government driven, national concern to improve literacy, had a pervasive effect on classroom computer use.

Another possible reason for the prevalence of word processing is the institutional need for assessment-based learning. In spite of a broad variety of software being available in these classrooms, teachers and children reported that a lot of computer activity was product oriented: e.g. word processing, graphics, spreadsheets, graphs, projects, posters that can all be printed out. These practices are, once again, embedded in the institutional agenda that requires teachers to demonstrate that their pupils are attaining a standard. Traditionally, this means that they need a product to assess and mark. Other activities, such as playing a maths game or practising grammar, which do not produce a lasting product, are typically not carried out regularly on the computer. Indeed, these pupils reported that educational games were only used by teachers to fill in gaps in their lessons when other work was complete, or were used by pupils in break and lunch times. Teachers also reported that they were usually unaware of a child's performance on these games (they do not produce printable score sheets). In this way, the institutional agenda is having a direct impact on children's computing practices and the time and place that they are carried out.

Teachers also said that their lack of technical expertise and familiarity with the content of other CD-ROMs could also pose a barrier to the use of various software. This finding supports Drenoyianni et al (1998) who found that technical problems were experienced by, and caused problems for 83.7% of their sample of UK teachers. Support and expertise in schools was patchy, in spite of government initiatives to provide training, and is clearly an area that needs further consideration.

This study also found that classroom computer use was collaborative, between pairs or small groups of children, which supports other studies (e.g. Crook 1994, Littleton and Light 1999). Teachers had to supervise the rest of the class as well, which meant that they were relatively disengaged from the children using the computers. This gives rise to concerns about the teachers' level of awareness regarding those children's performance. Activities that produced a lasting product, such as a printed story, that teachers could collect and mark would be preferable in these circumstances. Other activities, such as reading an electronic book or typing data into a spreadsheet would be less amenable to teacher scrutiny. This disengagement also suggests that children's computer experiences were not, on the whole, closely scaffolded (Wood, Bruner and Ross 1976). Perhaps the provision of more classroom assistants could remedy this, although financing this could be problematic.

The findings in this chapter have successfully demonstrated how children's classroom computing practices were embedded in local ecology. The classroom computer had a niche that was constituted by features of the context in which it was found. The three, nested, concentric levels used to characterise this context are a useful model to illustrate how they were mutually constitutive and, as such, created a situated system of computer use. As stated earlier, the main aim of this thesis is to examine the ecology of children's home computing. The classroom based findings discussed in this chapter will serve as a reference point against which to compare practices found there. The next two chapters will consider the findings from the study carried out in family homes. They too will be organised around Bronfenbrenner's (1979) model, as introduced in this chapter. This will facilitate a systematic comparison between the two different contexts.

Chapter 6

Quantifying children's home computer use

6.1 Introduction

Now that the general picture has been painted off the resources that are available to children in primary schools, the uses they make of them and the local ecology that shapes that use, the substantive issue of children's home computer use is addressed. The current chapter will be concerned with documenting fine grained, temporal patterns of children's home computer use, together with investigating the variety of computing activities that they engage in. Contrasts across age and gender will also be made. Specifically, the following questions will be addressed: How is computer use patterned across sessions, time of the day, days of the week and term/vacation times? What genres of software do children use? Are there age and gender differences in amount and type of use?

Previous studies have addressed some of these questions through the use of various indirect methods. They have utilised interviews (e.g. Downes 1999 and Downes and Reddacliffe 1996), diaries (e.g. Downes 1999, Facer, Furlong and Furlong 2000, Livingstone and Bovill 1999, Sutherland,) and questionnaires (e.g. Beentjes, Koolstra, Marseille and van der Voort 2001, Comber, Colley, Hargreaves and Dorn 1997, Downes 1999, Roe 1998, Sutherland et al 2000). These methodologies have produced valuable findings but they are not problem free. Interviews and questionnaires are not real-time data collection methodologies. Some are reliant upon parents being acutely aware of their children's computing activities. They call upon both parents and children to give accurate, retrospective and decontextualised accounts/responses of activities. Diary studies are more concerned with the collection of real-time data but problems may arise in assessing the reliability of entries, particularly where young children are involved. The data produced from using these methods is necessarily coarse grained.

The present study sought to overcome these problems by installing real-time computer logging software onto the hard drives of the family computers. No input was required from individual family members; the data produced was computer-generated, fine grained and objective. Therefore, an aim of the current research was to extend research carried out in the past and thereby make an important contribution to the building of a comprehensive picture of children's home computer use.

Previous research in this area has generated three main themes of interest. Firstly it has been concerned with exploring temporal patterns of children's computer use, for example, how long they spend using the computer per week. In carrying out this investigation, previous researchers have also found that computer use can differ across the variables of age and gender. The current research will develop these three themes (temporal patterns, age and gender). The fine grained data collected in the current study will afford a more full exploration of gender related and age related temporal patterns. For example, computer use across the days of the week, usage patterns within the average day, and examination of individual sessions. It will also afford greater insights into how these activities are distributed across different genres of software. Before embarking upon a description of the method and findings of the current study, previous research will be reviewed. This review is organised by the above three themes: temporal patterns of use, gender and age.

6.1.1 Patterns of children's computer use

There is a dearth of studies that have reported quantitative data regarding children's patterns of computer use. This data is difficult to collect and studies that have done so have relied on diaries, interviews and questionnaires. Perhaps the most comprehensive research was that carried out by Livingstone et al (1999). They report on the findings gathered from 334 nine to sixteen year olds who were asked to keep diaries of their media use throughout several days. Livingstone et al found that the children used their computer, on average, 3.3 times a week. Sixty four per cent of the children used the computer for games and 36% used the computer for non-games. They spent a mean of 45 minutes per day playing computer games and a mean of 29 minutes per day on non-games. On weekdays, computer games were used by very few children in the time before school but by more children in time after school. A different pattern emerged at weekends, when children played them at all times of the day, with a peak in the afternoon.

These British children used the computer more than the European average. Beentjes et al (2001) report that the European average is 30 minutes per day on games, 15 minutes per day on non-games and 5 minutes per day using the internet. With regards to sessions of use, Livingstone et al (1999) found that 55% of children are "low users" (short amounts of occasional use) whereas only 9% were "heavy users", suggesting that parental and media concerns about excessive use is applicable to a minority of children only. Interestingly, they also found that parents more commonly associate "addiction" with excessive television viewing than with excessive computer game use, and that some parents view excessive book reading as a source of concern. This confirms that "addiction" to various forms of screen and print media is an issue of concern to parents. The data generated in the current study will afford further analysis of the degree to which it was present in children using home computers.

Studies that report the types of computing activities that children engage in, were discussed in detail in chapter 3. These studies were based upon interview, diary and questionnaire methods and found a huge variety of activities, with games predominating (e.g. Downes 1999, Downes et al 1996, Giacquinta, Bauer and Levin 1993, Livingstone et al 1999, Sutherland et al 2000). With regard to how use of the home computer fits around children's other leisure activities, studies report that it is relatively popular. Livingstone et al (1999) asked children what they would do if they had the choice of anything that they wanted. The most highly rated activity was to go to the cinema. Using the PC for non-games/homework ranked 4th (out of 19 alternatives), and playing computer games ranked 7th. They conclude that this is an indication of this medium's attractiveness to children.

6.1.2 Gender differences in children's home computing

Research into children's use of various types of electronic media has found consistent differences between boys and girls. Roe (1998) carried out a longitudinal, questionnaire-based study in Belgium which led him to conclude that "boys and girls increasingly inhabit different media worlds" (p23). His study of 9-11 year olds found gender differences in the use of television, the video cassette recorder and computer games. Boys reported using these forms of electronic media significantly more than girls. Moreover, their types of use were also different. For example, boys preferred to watch sport, films and science and technology programmes on television whereas girls preferred children's programmes, music programmes, quizzes, chat shows and soaps. He also found differences in computer game use. Boys reported playing them more than girls did and expressed a preference for car racing, sport, fighting games, simulations and role playing, whereas girls preferred puzzles. Many other UK and European studies support these findings that there are consistent differences between boys and girls, with boys more likely to spend longer using the computer than girls, and boys spending longer times playing games than girls do (e.g. Comber et al 1997, Furlong, Furlong, Facer and Sutherland 2000, Livingstone et al 1999, Roe and Muijs 1998).

6.1.3 Age differences in children's home computing

There are few studies that have investigated age differences in children's computing practices. Those that exist are less conclusive than those concerned with gender. Some research has found that computer use, for games and other purposes, increases with age to a peak in late adolescence, after which there is a slow decline (Beentjes et al 1997, Beentjes et al 2001). These authors argue that contributing factors to this pattern are boys' increasing games use until the age of 13 years, and an increase in the use of the computer for homework by older children. These findings broadly support Livingstone et al (1999). Conversely, Comber et al (1997) found a decrease in games use with increasing age and Roe (1998) found no change at all.

However, what has to be borne in mind whilst attempting to interpret this data is that the electronic media environment is volatile. The pace of change can be rapid. The introduction of new hardware e.g. faster processors, joysticks and key pads remediate the way in which the technology is used. Games may become more enjoyable for some children with the introduction of new software and new means of control. Moreover, some children may, in recent years, be using games consoles for playing most of their games. It is likely that the above studies, carried out in different countries and in a period of rapid technological change, are inconclusive because of these reasons. These age-related studies, and the age-related findings of the current research, therefore have to be interpreted with caution.

This introductory section has provided an overview of three main themes of research concerning children's quantitative use of computers. The next section will now discuss the methods used in the current study.

6.2 Methodology

A full account of the rationale behind the methodology used in this thesis was given in chapter 4. What follows, is a discussion of the sampling and recruitment of the families involved as well as an explanation of the computer logging activities that gave rise to the quantitative findings covered in this chapter. Further details of methods, to gather data not discussed in this chapter, will be given in the relevant subsequent chapters which discuss other findings.

6.2.1 Participants

Approximately 500 recruitment letters (see appendix 6) were sent home with all the pupils in years 2, 4 and 6 in 5 infant/primary schools. These were the same 5 schools as discussed in chapter 5. The letter invited families to take part in the study and stated that they should own a PC, running Windows 95 or above (other machines would not support the software used to log computer activities). Some of these families would probably have owned a Macintosh computer (Banbury 2000) thus making them ineligible for the study. Sixty two families replied to the letters. It was ascertained from the interviews with the random sample of school children (chapter 5) that 65% of pupils had access to a home computer and that 55% of these were boys and 45% were girls. The response to the home study recruitment letter was therefore approximately 20-25% of the PC-owning families.

Twelve families were randomly selected from the positive replies from each of years 2 and 4. There were only 12 responses from families with children in year 6 so they were all included in the study. Gender distribution of the focal children within these families reflected what was found in the random school sample i.e. 6 boys and 6 girls from each year. Therefore a total of 36 families were recruited. Parents were contacted by telephone and more specific details of the study were given. This was followed up with a letter with the same details in writing (see appendix 7). Those families that were not selected were sent a letter (appendix 8) thanking them for their interest and advising them that they may be included at a later date if another family dropped out. When the selected families were first visited, they were asked to sign a joint agreement form, giving their permission for the research to be carried out in their home (appendix 9).

Early in the recruitment stage, 3 of the families with 11 year old boys dropped out, mainly due to their being unable to find the required time. They could not be replaced because there were no possible replacements in the sample of volunteers. Following the first of the home visits another 7 families had to be replaced, predominantly due to technical problems with their computers that were not realised until they had been visited (see table 6.1 for details of reasons).

Age	Reasons	Replaced?
11 yrs	Research too time consuming and concerned about privacy	no
11 yrs	Research too time consuming-expected only one home visit	no
11 yrs	Windows 3.1*	no
9 yrs	Windows 3.1*	yes
9 yrs	Windows 3.1* on one computer and full hard drive** on second one.	yes
9 yrs	Worried about privacy	yes
9 yrs	Computer faulty and unable to play any given educational software. Withdrawn at second interview.	no
7 yrs	Various technical problems	yes
7 yrs	Moved house-no contact made	yes
7 yrs	No reason given	yes

* windows 3.1 would not run the logging software.

** hard drive space was necessary in order to install logging software and use the educational software provided by the study

Table 6.1: Reasons for loss or replacement of participant families

Once the study was underway, only one family had to withdraw due to technical problems with their computer (although they provided some usable data), otherwise the remaining families stayed for the duration of the study. So in total there were 33 families involved, 12 with a 7-year old child (mean age 11 yrs 4 mos), 12 with a 9 year old child (mean age 9yrs 3 mos) and 9 with an 11-year old child (mean age 7 yrs 4 mos). See appendix 10 for demographic details of these 33 families.

All children, except one, had at least one sibling at home. Two of the mothers and one of the fathers were single parents. Families were predominantly white, but there was one Asian family and one of mixed white/afro-caribbean background. In order to determine how representative of the various levels of socio-economic status this sample was, parents were asked to give details of their occupations. The classification of British social strata changed in 2001; the former "social class", based on occupation, was replaced with the National Statistics Socio-economic Classification (NS-SEC) (2001). The classification is still occupation-based but includes details of employer status, such as whether self employed or whether a supervisor, and the number of employees in the workplace. Details of occupations were gathered from the participant families but workplace details were not. This classification system is new and had not been used in surveys of the UK population until the national census in 2001, the findings of which have not yet been published. It is therefore not practical to use this system to assess the representativeness of the participants in the present study. The previous system, which was used to gather details of socio-economic status in the General Household Survey (2000) will therefore be used here. Table 6.2 (overleaf) depicts the various levels of socio economic status (SES), the percentage of the UK population falling into each category in 2000 and the percentage of this study's participants falling into each category.

Examination of this table suggests that the sample is usefully representative of the computer-owning population. This is consistent with the fact that computer ownership is related to social economic status, with families at higher levels more likely to own one than families at lower levels. Mintel (2000) states that "computer ownership rises up through the socio-economic groups and is heavily biased towards [the top]". In the current sample of computer owning families, there are more middle class than working class families which is consistent with Mintel's national survey data.

SES	% UK population	% participants
Professional	5	18.3
Employers and managers	16	9.2
Intermediate and junior non-manual	35	48.5
Skilled manual and own account non-professional	20	15
Semi-skilled manual and personal service	18	6
Unskilled manual	6	0
Not possible to categorise (student)	-	3

Table 6.2: Population and participant social economic status (SES categories and % of UK population reported by General Household Survey 2000).

6.2.2 Computer monitoring: tools and procedure

The aim was to record accurately, in real time, all instances of home computer use. In order to do this, two programmes were used. One was specially written for this study, requiring each separate user, or combination of users, to check a box next to their name, thus recording which family member was using the computer (hitherto referred to as the log-in software, see figure 6.1 for a screen-shot). The window of names was customised for each family and appeared on starting up the computer. It was also accessible via a short-cut on the desktop so that a change of user/s could be logged without restarting the computer (see appendix 11 for a sample printout of the output from this process).

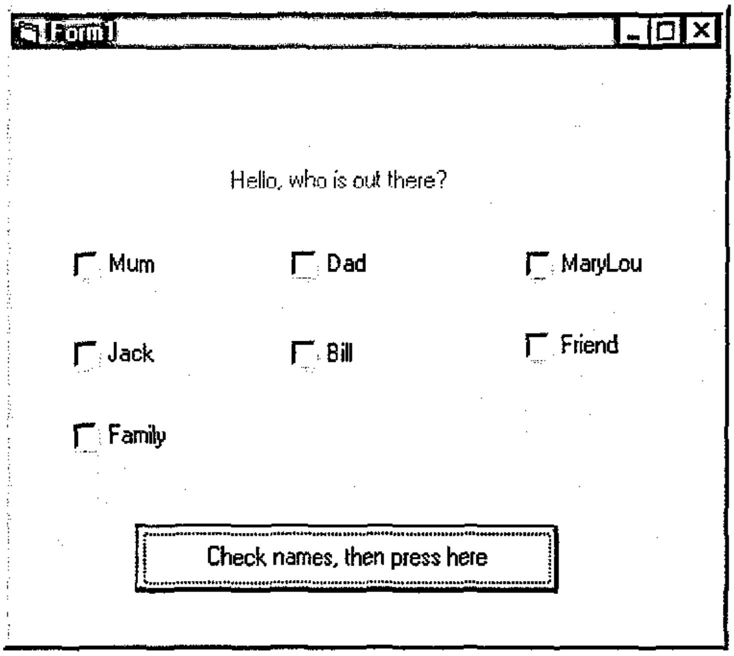


Figure 6.1: Screen shot of log-in window

The other programme installed was available commercially and was called WinWhatWhere. This recorded the window caption of each application running, the start and stop times for that window and the date. These two programmes were left in place for a mean of 30 days (range 14-61 days). The length of this period depended upon each family's availability for home visits and the logistics of visiting all the homes. Due to the fact that there was one researcher and 33 families to visit, each family's computer logging started and finished on a different date. It was impossible to visit all the homes on a single day so appointments were made to suit the families. The aim was to start the logging of all families' computers during term time and to finish it a few weeks later, in the school vacation. This would enable data to be gathered from both term and vacation periods.

The software was successfully installed on all of the computers except for one. Unfortunately, a computer belonging to the family of one 7 year old girl had technical problems and the log-in software would not run. She agreed to keep a diary of her computer use. This proved too difficult for her and she provided no usable computer monitoring data. However, her family were keen to stay in the study and could provide interview data (see chapter 7), so they continued for the full period. Hence, the computer monitoring data from 32 families (instead of the full 33) is presented in this chapter.

Both term and vacation logging was achieved in 23 of the families but not in the remaining 9. There were two main reasons for this: either i) the family went away on holiday, or ii) the family was a late replacement for another that had left the study. Table 6.3 gives details of the computer logging period for each family. During this installation visit, the specifications of the family's computers were also noted to ensure that they were compatible with running the logging software.

In order promptly to alert the researcher to any technical, computer problems, the families were also given access to a telephone help line, managed by a computer expert. This was available to them on one afternoon per week and they were free to ask for help and advice concerning any home computer problem that arose throughout the whole study period. The help line was used only once and the families seemed to prefer to contact the researcher directly. Problems, such as computers crashing, were remedied with an additional home visit to the specific family.

1999	14/6	21/6	28/6	5/7	12/7	19/7	26/7	2/8	9/8	16/8	24/8
	T	T	T	V	V	V	V	V	V	V	V
1	x	x	x	x	x	x	x	x	x	x	x
2		x	x	x	x	x	x	x			
3	x	x	x	x	x	x	x	x			
4		x	x	x	x	x	x	x	x	x	
5			x	x	x	x	x	x			
6	x	x	x	x	x	x	x	x	x	x	x
7	x	x	x	x	x	x	x				
8		x	x	x	x	x	x				
9		x	x	x	x	x	x	x			
10		x	x	x	x	x	x	x	x		
11	x	x	x	x	x	x	x	x	x		
12		x	x	x	x	x	x				
13	x	x	x	x	x						
14		x	x	x	x	x	x	x	x	x	x
15		x	x	x	x	x	x				
16		x	x	x	x	x	x	x			
17		x	x	x	x	x	x	x			
18		x	x	x	x	x	x	x			
19		x	x	x	x	x	x	x	x		
20		x	x	x	x	x	x	x	x		
21		x	x	x	x	x	x				
22			x	x	x	x	x	x			
23	x	x	x	x	x	x	x				
24				x	x	x	x	x	x	x	
25						x	x	x	x		
26				x	x	x	x	x	x	x	
27				x	x	x	x	x	x		
28						x	x	x	x		
29				x	x	x	x	x	x		
30						x	x	x	x		
31					x	x	x	x	x		
32							x	x	x	x	

Table 6.3: Home computer logging periods (shaded families are those with only vacation time logging, T=term time and V= school vacation time)

6.2.3 Data analysis

The two programmes that were installed onto the family computers stored their data on the hard drive. This was downloaded, by the researcher, onto a floppy disk at the end of the monitoring period. The two programmes produced 2 separate types of file: records of computer use (see appendix 12 for a sample) and records of the user/s identities (see appendix 11 for a sample). The analysis of each is described next.

The monitoring period was relatively short, so these files were not very extensive. It was therefore possible to analyse them manually. First, a list was made of the date and times when the child had logged on as the user or as one of the users. A note was also made of whether the child was alone or whether use was shared, and who the other user/s were. Next, the corresponding date and time were found in the WinWhatWhere data file and the active application's name, as well as its duration of use, was noted. Hence a list was generated of user/s, application and duration. The appropriate statistical summaries of this data were carried out using Excel spreadsheets and SPSS, to produce the quantitative data discussed in this chapter.

6.2.4 Systematising software resources

During the first home visit, parents were asked to allow the researcher access to all of the CD-ROMs that they owned, so that a list could be made for each family. They were then asked to describe the contents of each item. It was necessary to systematise the software into categories so that quantitative analysis could be carried out. The software found in the homes could be organised into seven categories (see appendix 13 for examples of software titles allocated to each category): (1) reference (searchable hypermedia archive), (2) drill and practice (curricular question and answer cycles), (3) educational game (reasoning problems embedded in a narrative), (4) electronic book (page-turning frame for illustrated text), (5) internet resources (e.g. web browsers) (6) generic, creative tools (e.g. text, image and number processors), (7) entertainment games. These categories are similar to those found in the classroom, with the exception of entertainment games. They were different to educational games in that they did not set out to support the national curriculum and class-based learning. The products' packaging made no educational claims. This category was also defined by the fact that these products were not found in the classroom e.g. a car racing game or a fantasy war game. This does not mean that children learned nothing by playing entertainment games, just that what was learned (e.g. improved hand-eye co-ordination or planning skills) was not central to classroom based education. It was recognised that a very few products were difficult to categorise, such as an electronic book that contained games as well as a story In this case the predominant activity, envisaged by the manufacturers, was the reading of the book, and this was the basis of its categorisation as an electronic book rather than an entertainment game.

Section 6.2 has been concerned with describing the methodologies used in the current study. The next section will now discuss the findings.

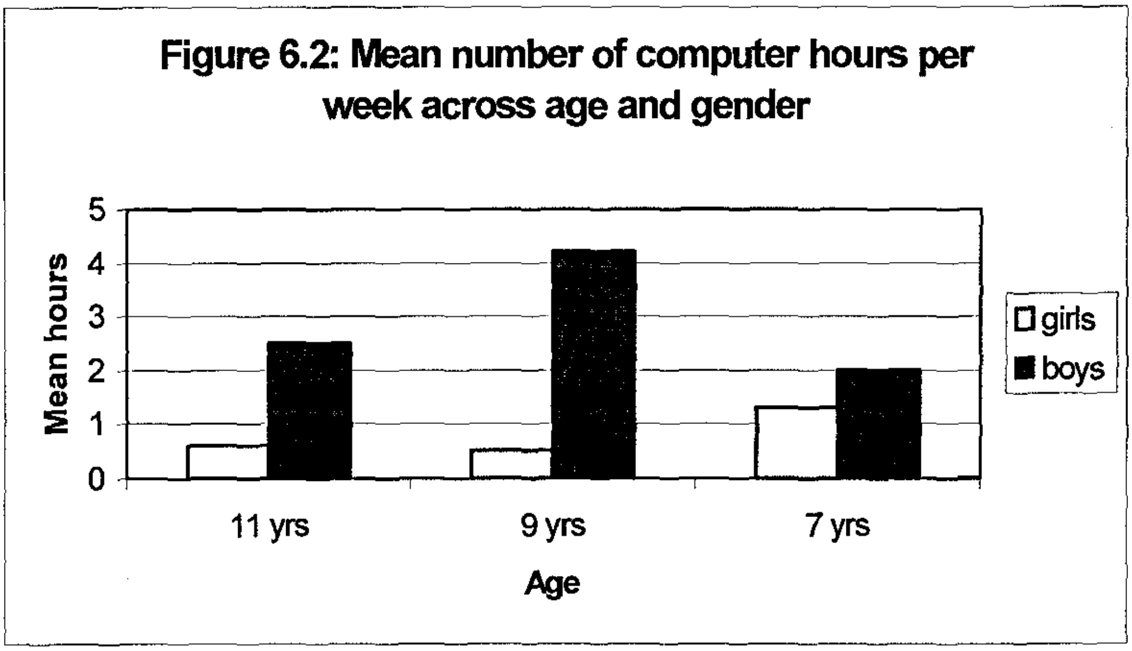
6.3 Results: Children's computer usage in the home

This section will discuss the data gathered from the computer logging software. The main aim of this part of the study was to determine patterns of computer use, compared to those in school. This section is organised into 4 subsections: section 6.3.1 describes how much time children spend on their computers across gender and age groups. Individual computer sessions are discussed in 6.3.2. A description of the genres of software found in these homes is carried out in 6.3.3 while 6.3.4 looks at how mean weekly computer use is distributed across these genres. Patterns of weekly and daily computer use across term/vacation times and weekdays/weekends are considered in 6.3.5.

6.3.1 Average weekly computer usage across age and gender

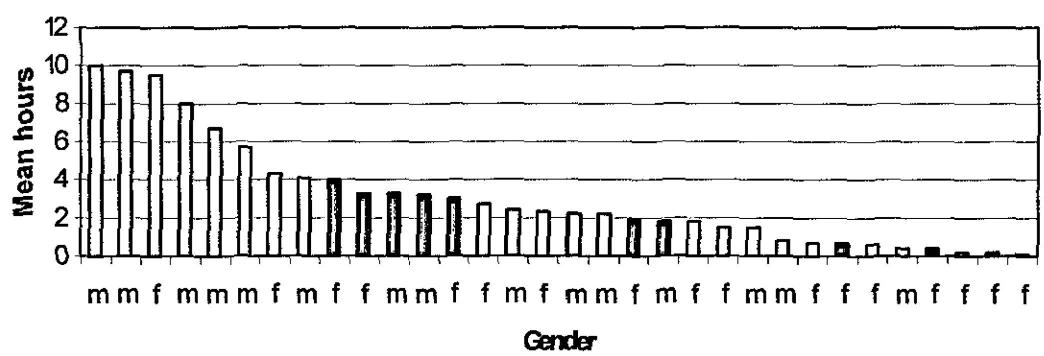
Previous research, as discussed in the introduction to this chapter, has found differences in computer use between genders and age groups. It was therefore appropriate to investigate whether the current study could support this.

Examination of figure 6.2 suggests that there is a difference in the mean number of hours spent using the computer, per week, between boys and girls in the current study. Across all activities, boys used the computer for a mean of 3.8 hours per week and girls 1.7 hours per week: on average, boys spent twice as much time using their computer as girls (mean daily use, across genders, is 24 minutes).



In order to ascertain whether there was a significant effect of gender and age on computer use a 2-way ANOVA was carried out. There was a significant main effect of gender ($F(5,31) = 11.3$ $p<0.05$) and no significant main effect of age ($F(5,31) = 0.8$). There was no significant interaction between age and gender ($F(5,31) = 2.5$). This confirms that boys used the computer significantly more than girls, but that there was no significant difference in mean weekly use between age groups. Figure 6.3 is a bar chart of mean computer hours per week for each child, indicating visually how age and gender come together in terms of time. It illustrates that mean weekly hours are fairly evenly distributed across age groups. However, there is a small cluster of females at the lower end and males at the higher end, elaborating the finding that there is a statistical difference in mean hours per week between genders.

Figure 6.3: Mean number of computer hours per week for each individual child, across age and gender, in descending order

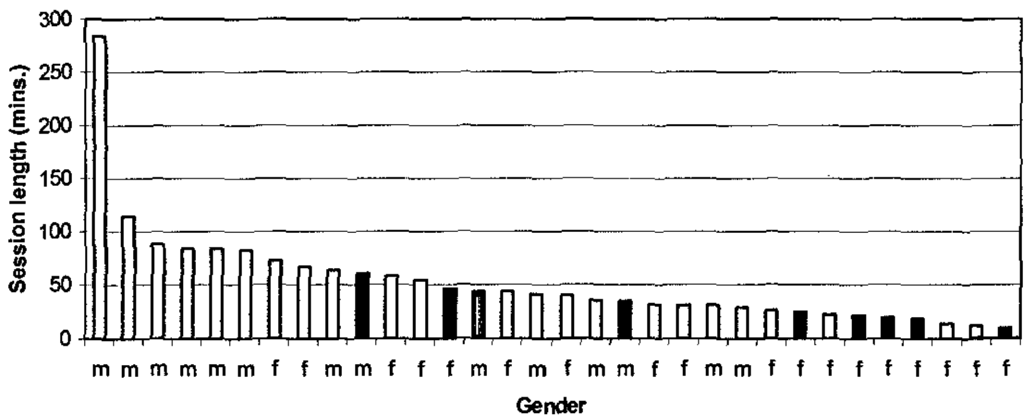


Key for figure 6.3: ■ = 11 yrs ☐ = 9 yrs ☐ = 7 yrs.

6.3.2 Sessions of computer use: session lengths and number of sessions per week

The above calculation of mean computer use as "hours per week" is rather a crude measure. Hence, this section will discuss findings from a finer grained analysis, in terms of individual sessions of use. A session was defined as a period of use, separated from others by a change of day, or a change in time of day. The sessions were usually clearly defined but occasionally they were less so. It was decided that a time lapse of more than 10 minutes of inactivity would mark the end of a session and the beginning of a new one. However, the children usually either used the computer only once in a day or their sessions were clearly marked by a gap longer than 10 minutes. Where several applications were used consecutively, with no discontinuity in logged time, this was considered to constitute a single session. The average session length was 52.3 minutes (SD 49, range 2 minutes to 7 hours). Figure 6.4 illustrates how the large range in session length is mainly attributable to one child. This was a boy who used his computer for long periods every time he logged on. His mean session length was 4.7 hours and sessions were particularly long in the school vacation. In contrast to this, the shortest session was a girl using Paint for two minutes. This child often spent very short periods of time at the computer, her mean session length was 12.5 minutes. This pattern is the complete opposite to the boy mentioned above, who sat at the computer for several hours at a time. The large range in mean session lengths per child, suggesting significant inter-individual difference, is illustrated in figure 6.4.

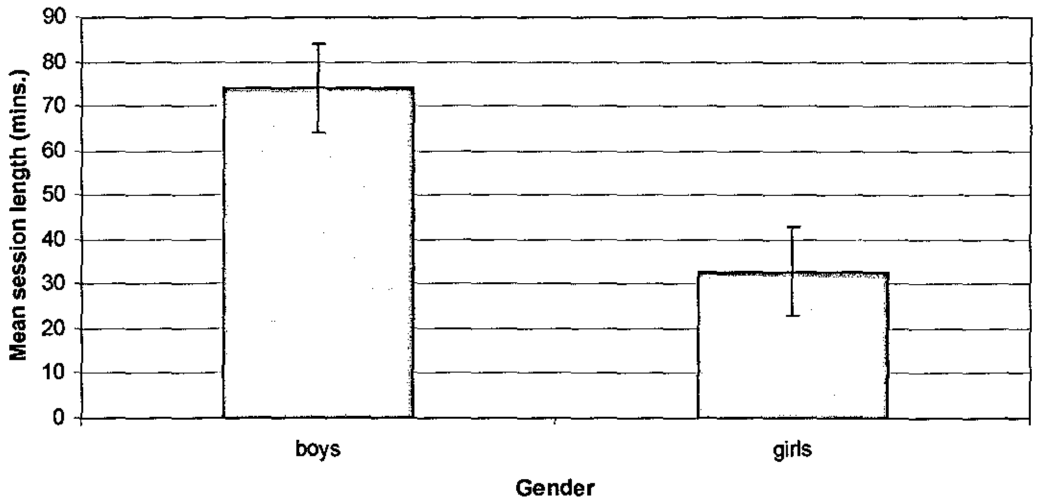
Figure 6.4: Mean session length per child in descending order



Key for figure 6.4: ■ = 11 yrs □ = 9 yrs □ = 7 yrs.

Figure 6.4 shows how the boys are clustered around the longer session lengths, with the girls at the shorter lengths. The three age groups are relatively evenly spread throughout the range. The difference in boys' and girls' mean session lengths is more clearly visible in figure 6.5.

Figure 6.5: Mean session length for boys and girls



A 2-way ANOVA was performed on mean session length across age and gender. There was a significant main effect of gender ($F(1,27) = 4.3$ $p<0.05$) and no significant main effect of age ($F(1,27) = 1$). There was also no significant interaction between age and gender ($F(1,27)=1.9$). This indicates that the boys spent significantly longer per session at all ages. There was also no significant difference in the number of applications used per session across boys and girls ($F(2,29) = 0.3$), suggesting that although boys' session lengths were longer, they used the same number of applications as the girls.

Boys used the computer, on average, 2.5 times a week (SD 0.8 range 1.3-4.4) and girls used it, on average, 2.4 times a week (SD 1.2 range 0.5-4.5). A 2-way ANOVA was carried out on mean number of times that the computer was used per week across age and gender. There was no significant main effect of gender ($F(1,27) = 0.08$) or age ($F(1,27) = 1.3$) and no significant interaction between age and gender ($F(1,27) = 1.7$). This, together with the above finding that boys' session lengths were significantly longer than those of girls, and that boys use the computer overall for significantly longer per week than girls, suggests that **the main difference between boys and girls is that when at the computer, boys used it for longer**. This leads to the question of how this time was distributed across different genres of software. Do boys and girls do different things? The next two sections of this chapter will investigate this further. Section 6.3.3 will begin by addressing the different genres of software found in the homes and 6.3.4 will discuss how these resources were used by the children that had access to them.

6.3.3 Software resources found at home

On average, 20 CD-ROM titles were owned by the families (range 2 – 66). The mean percentage of these that were broadly educational CD-ROMs (i.e. in categories 1-4 and 6 on page 82) was 61.7% (see table 6.4).

Genre	**% of total CD-ROM ownership**
Entertainment game	38.3
Reference	30.7
Educational game	14
Creative tool	9.7
Drill and practice	5.5
Electronic book	1.8

Table 6.4: Distribution of owned CD-ROMs across genres

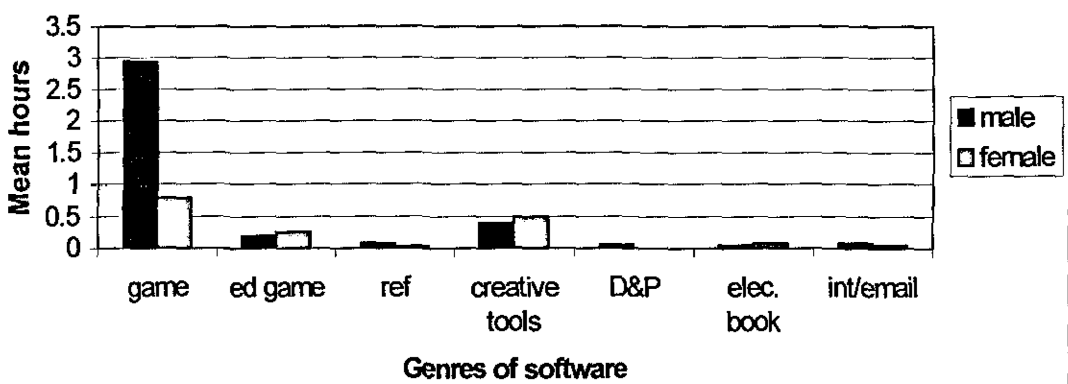
Table 6.4 shows how families owned more entertainment game CD-ROMs than any other category. This was followed by reference software. Electronic books were the least popular category accounting for less than 2% of ownership. In addition to these CD-ROMs, all families had installed the standard suite of Microsoft Office or Lotus generic tools. Forty two per cent had internet access at the beginning of the study and this percentage had risen to over 50% by the end. The next section will consider how the children made use of these various genres of software.

6.3.4 Use of different genres of software per week

The logging data indicated that, on average, each child used their home computer for a total of 2.7 hours a week (SD=2.4, range 0.1-8.3 hours). How was this spread across different genres of software? Figure 6.6 is a histogram of the mean number of hours spent on each genre of software per week across males and females. The activity on which children spent most time (1.7 hours) per week, on average, was playing games (range 0-7.7 hours). This activity accounted for an average of 66% of total computer time across all children. Internet use was comparatively low, but it is recognised that this study was carried out before access was widespread. It has since increased (statistics.gov.uk 2000).

As the above range suggests, there was a wide variation in average weekly time spent playing entertainment games between children. The child with the highest average weekly time (7.7 hours) spent on games was a 9 year old boy; playing games accounted for 96.6% of his computer time. The remaining time was spent on the internet (2.5%) and using creative tools (0.9%). On the other hand, there were 3 children, all girls, who played no entertainment games at all. The domestic ecology associated with such use will be discussed in detail in the next chapter.

Figure 6.6: Mean number of hours spent using the computer per week, across genres of software, for males and females



Surprisingly, the number of game titles owned by the families was only weakly and non-significantly ($r = 0.3$) correlated with time actually occupied in these games. Also, there was no significant correlation ($r=0.3$) between the number of games that the families owned and the mean number of games that the children used per week. This indicates that children were not using a broad variety of games and that their use could have been "faddish" where a particular game was popular, and used a lot over several days, until the child changed to another title.

Moving on from the use of entertainment games, generic creative tools represented the next most commonly used category, although these only accounted for an average of 0.4 hours per week (14% of total time). Educational games occupied only 0.3 hours and use of the internet/email 0.08 hours (although it is important to remember that the number of UK homes with internet access has increased since 1999, when this study was carried out (National Statistics 2000)). Drill and practice software, reference CD-ROMs and electronic books were all used on average 0.06 hours (3.6 minutes) per week. Although the majority (64%) of CD-ROMs owned were broadly educational in nature (see table 6.4), this is not reflected in their actual usage. Overall, use of software that could be categorised as being broadly educational (drill and practice, electronic books, reference, internet, educational games, creative tools) was much less than the use of entertainment games.

This sub-section has been concerned with investigating mean computer usage per week. However, it is possible that there may be a difference in usage on weekdays and weekends, as school commitments vary across these times. Moreover, children may also use their computers differently over term and vacation times. These possibilities will be explored next.

6.3.5 Patterns of computer use and their relationship to school commitments.

It was expected that, due to school and homework commitments, children would use their computer less in term time than in vacation time. Figure 6.7 depicts the mean number of minutes of computer use across weekday/weekend for both term and vacation time. This data is from only 23 of the families, due to the problems in accessing the others, as described in section 6.2.2.

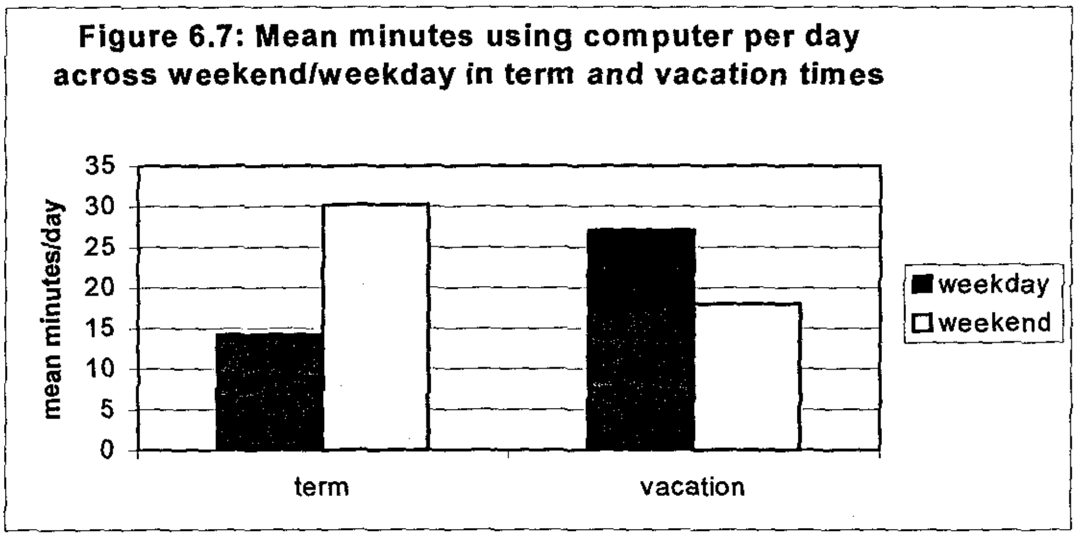
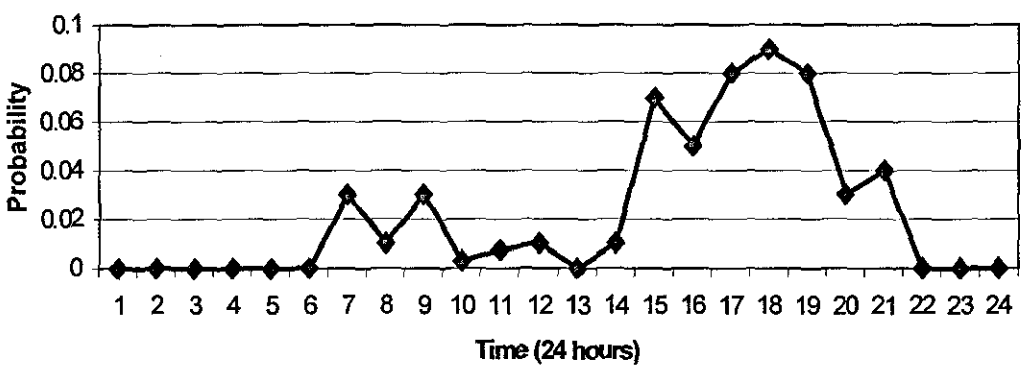


Figure 6.7 suggests that children used the computer for approximately the same amount of total time in term and vacation periods. A within-subjects two-way ANOVA was carried out on time of the week x time of the year. There was no significant main effect of time of the week (F(1,20))=0.4) suggesting that in both term and vacation time there was no difference between weekday/weekend use. There was also no significant main effect of time of the year (F(1,20) =2.5), suggesting that children use their computers for about the same amount of time in vacation and term periods. A significant interaction was found between day of the week and time of the year ($F(1,20) = 6.8$ $p<0.05$) which indicates that the weekend/weekday pattern of term time reversed during vacations; in term time children used their computers more, on average, at weekends and during vacation time they used it more during the week. It is likely that children used their computers most at weekends during term time because they had school/homework commitments during the week, whereas in vacation time they used their computers more during the week, leaving weekends free for other leisure activities.

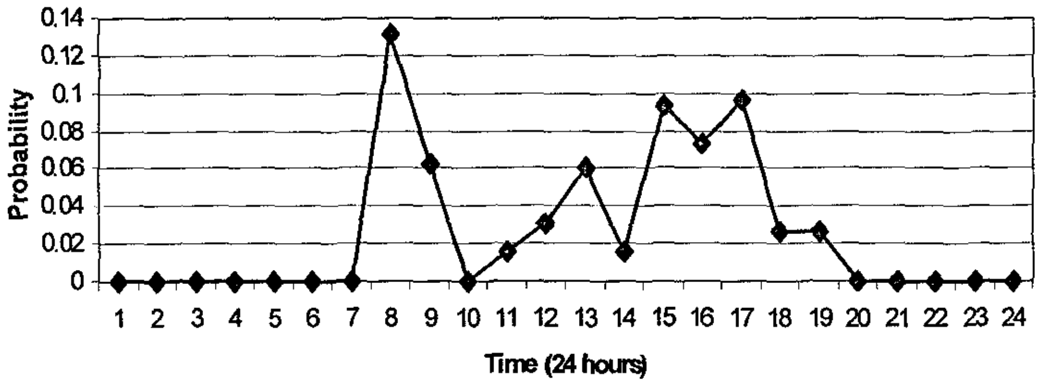
It was also possible to investigate how school commitments shaped computer activity on a daily basis. First, term time will be considered. The mean probability that the children *begun* a computer session in each of 24 hourly intervals (e.g. between 11am and 11.59am) was calculated and plotted on two graphs, one for weekdays and the other for weekends. Examination of these graphs reveals interesting differences in computer use, shaped by school commitments. Figure 6.8 plots the probability of a child starting a computer session during a term-time week day.

Figure 6.8: Probability that children started a computer session on a term-time week day



During term-time week days, there was a small probability that the computer was accessed before school, between 0600 and 0900. This diminishes to a negligible amount during school hours, presumably by sick children kept at home. The probability of a child accessing a computer rises rapidly after school hours to a peak at 1800 and then falls and diminishes at 2200, possibly when they go to bed. However, during term time weekends (figure 6.9), another pattern emerged. There was a relatively high probability that the computer was accessed in the morning, with a peak at 0800. In fact the probability was higher at this time than it was on a weekday or term time evening. This peak diminishes around mid-morning (10.00) and rises again after lunch to peak again at 1800. It then tails off into the evening.

Figure 6.9: Probability that children started a computer session on a term-time weekend



A different picture emerges during <u>vacation</u> weekdays and weekends. Children have no school commitments during this time so their use across weekdays and weekends is similar (figures 6.10 and 6.11).

Figure 6.10: Probability that children started a computer session on a vacation weekday

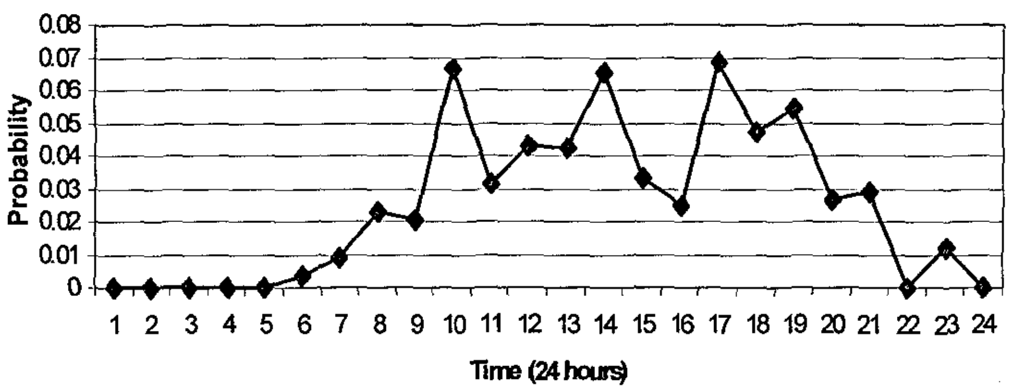
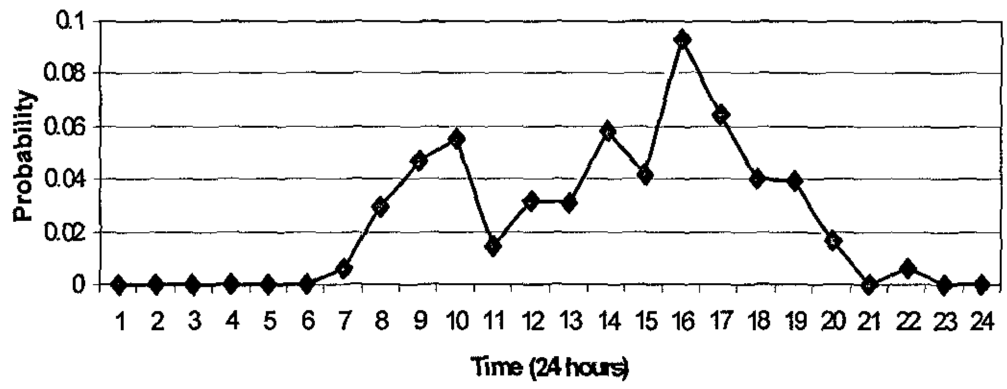


Figure 6.11: Probability that children started a computer session on a vacation weekend



The main feature of vacation time was that access was spread across the whole day, without a "gap" for school. Vacation time computing commenced at 0600 and continued all day, tailing off in the late evening. Vacation weekday and vacation weekend use was similar in that there were three main peaks of use at 10am, 1400 and 16/1700.

6.4 Discussion

This discussion will be organised around the three main themes identified in the introduction to this chapter: temporal patterns of use, gender and age. The data presented in this chapter raises many questions about the situated nature of the children's computing activities e.g. what are the defining features of the domestic ecology that mediate the patterns of computer use reported here? These questions cannot be answered here, but chapter seven considers them in detail.

6.4.1 Patterns of use

This study has found that families owned a variety of computer software prior to the intervention of this research. Nearly two thirds of this was broadly educational in nature, such as graphics packages, encyclopedias and educational games. In spite of this, the real-time computer logging data provided evidence that the most popular activity, accounting for nearly two thirds of computer time, was the playing of entertainment games. This applied to both boys and girls, but boys spent twice as much time using their computers compared to girls. These findings support previous research in this area (e.g. Comber et al 1997, Furlong et al 2000, Livingstone et al 1999, Roe 1998, Roe et al 1998).

Overall, use of software that could be categorised as being broadly educational (drill and practice, electronic books, reference, internet, educational games, creative tools) was much less than the use of entertainment games, which supports other studies that have investigated educational use of home computers (e.g. Giaquinta et al 1993, Kafai and Sutton 1999). These genres of software do not appear to be tempting and, when considering why this is the case, it is easy to conclude that it is just the product design that fails to engage children. The present thesis argues that this is not the only factor. It also asks, how do events at the interpersonal and community levels in the home shape such patterns? These events may also have a bearing on the use of these products and will be explored in detail in the next chapter.

However, the computer logging data, together with observations made during the home visits, have provided a window on the variety of creative uses that children made of their computers, in conjunction with spending time playing entertainment games. For example, they drew pictures, made cards, made slide shows and created music. This minimal use of the computer as a creative tool serves to be an example of its potential, with the appropriate software, to inspire children to engage in activities other than games. The challenge to parents is to make this a viable alternative. These computer generated products will be discussed in more detail in the following chapter where family celebration of such achievements will be explored.

An interesting finding of this study has been the large range of session lengths engaged in by children, which again is a reminder that it was the local ecology of use, rather than the affordances of the individual machines, that constituted children's activities. Both the media as well as parents have been concerned about "computer addiction", yet there is no evidence to suggest that it was a problem. There was only one child whose session lengths were unusually long, and even he could not be labelled as a computer "addict" (e.g. Fisher 1994) or a "heavy user" (e.g. Roe et al 1998) or a "hacker" (Turkle 1984) as the number of times he accessed his computer per week was low. In order to begin to understand an issue such as why this boy engaged in long session lengths, it is necessary to explore the local ecology of use. This will be done in great detail, across all the families, in the next chapter.

Alternatively, under-use was identified in some children, particularly girls. These children used their computers sporadically and for short periods of time. It is clear that for these children the computer did not hold the same attraction as it did for others. In the household of one of these girls, the computer was frequently left switched on all day, with a screen saver running, so it would have been easy for this child to wander over to it and use it for a few minutes without having to turn it on and off. She often quickly dipped into the computer, and out again. Despite having 16 CD-ROM's to choose from, she mainly used Paint, played a quick game of solitaire or went on the internet, all of which required no CD-ROM. These two extreme examples demonstrate how, across these houses, very different patterns of use had developed. This may have been mediated by the local ecologies, but the children's individual differences, in terms of interest in computers and their capabilities, should also be borne in mind.

Another feature of children's daily lives, that serves to mediate computer use, is their varying commitment to school across term-time/vacation and week day/weekend. This study has demonstrated how school plays a decisive role in determining the time of day that children are free to pursue computing activities. This finding supports what was reported by Livingstone et al (1999) although their data concerned daily patterns of game playing only. The presence of meal time lulls and post-meal surges in the probability that children accessed their computers, is also a reminder of how the domestic regime mediates access as well. Once again, this topic will be explored in more detail in chapter seven, when parents' responses to questions about such issues will be considered.

The type and patterns of computer use found in the homes was very different to that found in the classroom. In schools, both teachers and pupils reported that word processing was the most frequent activity whereas, at home, entertainment games predominated. This contrast reflects important contextual differences between the two settings. In chapter 5, the overarching influence of the national curriculum on classroom community practice was discussed. This shaped both why the computer was bought, and how it was eventually used. This institutional dimension was absent in the homes, which meant that children had more choice over what software they used. They found entertainment games more attractive than any type of educationally oriented activity. Indeed this reflected what took place when children were left to choose what software they used in their free time at school; they chose educational games over and above other educationally oriented genres of software. It seems that games, whether for entertainment or education, are the software of choice for children both at home and at school.

The frequency of computer use also differed between home and school. As discussed in chapter 5, access to the single classroom computer was restricted due to factors such as class size and lesson timetables. These restraints were not present in the homes, so children used their computers more often and for longer periods of time than when they were at school. However, one of the important differences between home and school is that school access arrangements, through the use of strict rotas and turn-taking, eliminate the gender differences found at home. This has the effect of ensuring that girls and boys have equal access and demonstrates how school is an important environment where girls gain further computing experience (Süss 2001).

6.4.2 Gender: summary of findings and a discussion of possible explanations.

This study has found that boys used their computers twice as much as girls. This finding supports other research in this area (e.g. Beentjes et al 1997, Comber et al 1997, Roe 1998). The current study has also found that, although boys and girls access their computer, on average, the same number of times per week, and use the same number of applications per session, boy's computer session lengths are significantly longer than those of girls. This extra use was mainly constituted by entertainment games.

There are a variety of arguments about why such gender differences in games use exist. The strongest argument is that computer games are designed predominantly by males and contain features that appeal predominantly to males (Subrahmanyam and Greenfield 1999). Many computer games are competitive, contain male characters, are violent, have strict rules and encourage the player to achieve supremacy. They are also more likely to fall within the genres of sport, fighting, adventure and cars/aircraft, which are more attractive to boys than to girls (Garitaonandia, Juaristi and Oleaga 2001). Unlike boys, girls report that they do not like violent games (Greenfield 1996). They also prefer games which involve real world problem solving, are more concerned with real rather than fantasy characters, have strong female lead characters and give a sense of completion (Koch 1994). Swanson (1995) has found that boys also prefer speed and fast action. Girls find this activity stressful (Cooper, Hall and Huff 1990) and prefer games surrounding the social aspects of the characters. In another study, Gorriz and Medina (2000) report that girls prefer collaboration to competition, they are not concerned with completing stages, they prefer complex social interactions, value a standard of graphics and prefer puzzle solving games. In a study of 100 computer games, Swanson (1995) found that 92% did not include any female roles. Of the remaining 8% of games that included female roles, 6% had them cast as "damsels in distress". This supports other studies (e.g. Kinder 1996, Provenzo 1991) and suggests that the vast majority of computer games on sale appeal mainly to boys, with only a few titles, e.g. Barbie Fashion Designer or Little Mermaid, designed to appeal to girls.

These findings are reinforced by another study where children were given the opportunity to design their own games (Kafai 1996). This found that boys were more likely to design adventure games in fantasy spaces with fantasy characters. The feedback in boys' games was more likely to be through the killing of the player if they made the wrong move. On the other hand, girls were more likely to design games set in a well known location such as a fairground, with more "real" characters and the feedback was less likely to be violent. These game design elements, that are so appealing to boys, are likely to not only initially attract them to using the computer, but also to sustain their use once it has started. They enjoy the activity so they are more likely to carry it out for long periods. This is in addition to other intrinsically motivating qualities that the games contain, such as challenge and overcoming stages to reach the next highest level. The players can fulfill their need to win and succeed. They want to satisfy their curiosity about "what happens next", want to improve upon previous scores and want to get better at playing the game (Crawford 1982, Malone 1981a, 1981b). All these features promote longer sessions of play. These findings, in relation to the current study, confirm the fact that overall, the computer was equally attractive to boys and girls in terms of the number of times they used it per week. It is the activities that the machines afford that play an important role in determining gender differences. The gendered nature of games software, being more attractive to boys than to girls, had a definitive role in lengthening boy's computer sessions as compared to those of girls.

6.4.3 The role of age in shaping children's computer use.

This study has found no significant age effects. This finding indicates that entertainment games are equally attractive to 7, 9 and 11 year olds and that resistance to academic home computing starts at an early age and is maintained in 11 year olds. It suggests that if this is to be reversed, efforts have to be applied to the homes of very young children. It is interesting that receiving more homework at secondary school may increase the amount of word processing carried out on home computers (e.g. Harris 1999). It is clear that this is a channel, from home to school, that could be optimised to improve home-school relations. This point will be discussed in more detail in chapter 7, when findings from interview data will be drawn upon.

6.5 Summary

This chapter has used fine-grained, real time computer logging data to explore how children used their home computers. The gender differences found in previous studies have been supported and elaborated. A large amount of variation has also been found between individual children and it has been argued that in order to understand this more comprehensively, the local ecology of the family homes need to be explored in more detail.

The next chapter will consider the findings of detailed interviews with parents and children and will shed light on the complex environments that mediate the way in which children use computers at home. This chapter has also found that there are major differences between how computers are used at school and how they are used at home. The next chapter takes this home-school comparison further. This will enable more detailed comparisons between the contexts of home and school and will hopefully shed more light on why the use of educational computer resources, at home, is so minimal.

Chapter 7

The ecology of computer use in the home

7.1 Introduction

Children's computing experiences are contextually situated and are hence located in particular settings. They are mediated by broader social practices. This chapter elaborates the quantitative findings discussed in chapter 6, in that it describes how children's home computing is mediated by the immediate domestic context, as well as by broader institutional structures, in this case the child's school. Parents and children were interviewed on three occasions, spread over several months. These home visits also allowed the researcher to get first hand experience of the local ecology of each home. Examination of data collected in the family homes will afford an understanding of how children's home computing is embedded in local ecology. These findings are compared with those found in the classroom (chapter 5), and should demonstrate the situated nature of practice across these two settings. This will also develop a particular view on the nature of learning. It will stress that learning is a form of cultural practice and that learners learn because settings are created for them to do so. In this case, the provision of a computer, whether at home or at school, is not sufficient, by itself, to ensure that learning occurs. Teachers and parents concerned to impart learning are faced with the task of creating an appropriate context within which the computer is used.

Some of the previous research into children and their use of home computers has been ethnographic and the research in this thesis continues this approach. Where the present research differs from much that has gone before is that the observations of computing practices will be integrated into a cultural psychological framework. To do this the adoption of Brofenbrenner's (1979) concentric circles model will be used to structure and organise a description of the domestic setting. This chapter will, in turn, consider the mediational roles of a) domestic interpersonal practices, b) domestic community practices and, at a broader level c) the role of external institutions. This aids clarity of presentation, but at the same time it is important to acknowledge the systemic nature of family life. None of the practices described in the following sections stand alone. They are all enmeshed with each other in one large and interacting system of activity. For example, community practices such as arguments over the computer are, to some extent, shaped by the family's perceptions of how useful a tool it is, which, in turn, are mediated by the uses that children are known to make of computers in school. Software purchasing decisions, which take place at a family level can be coloured by parent's attitudes about learning in the home, which can be influenced by the school. In reality, these practices are all interlinked.

There are various previous studies that have researched children's home computing practices which could fall into one of the three "layers" of practice identified above (i.e. interpersonal, community and institutional practices). These will now be considered in turn where the layers will be defined and previous studies in each area will be considered.

7.1.1 Interpersonal practices

Interpersonal practices constitute the innermost layer of the concentric circles model. They are, in this case, defined as the presence of other people in the child's immediate social environment i.e. whether or not the child shares their computer session with anyone else.

Interpersonal communication, between a child and a more capable peer or an adult, is an important concept of learning in cultural psychology. It stems from Vygotsky's (1978) writings about the "zone of proximal development" which he defines as the difference between a child's actual and potential developmental levels. In order for development to occur, the opportunity must exist for instruction to be aimed at the zone of proximal development, which "rouses to life" those mental functions that are "in the stage of maturing" (1934 p222). This conceptualisation was built upon by Wood, Bruner and Ross (1976). They argue that the parent (or teacher) actively "scaffolds" the child's experience, providing the framework for their learning and development. In the context of the current thesis, it was therefore important to assess the possibility for parents to take an active part in their children's use of the computer, by sitting with them and guiding them through, or scaffolding, their activities.

In a recent study (Orleans and Laney 2000), where the researchers passively observed children using their computers at home, the authors report that parent-child interactions were not common. The parents mainly intervened to troubleshoot technical problems and provide system-related help. Once the children had proved themselves to be competent users of the technology, parental help was withdrawn. These authors do not report any incidence of parents sitting with their children, and guiding them through software. In another survey study of home computers, where children from nine European countries were asked to indicate "who do you usually play electronic games with?", Pasquier (2001) reports that children predominantly do so alone. Computer game playing is a "more peer than family-oriented activity" (p165). Children are more likely to share the activity with a friend than with family members.

A drawback, concerning the methodology of Orleans et al's (2000) study, is that the researchers were passive observers in the family homes. The presence of a researcher had the potential of altering naturally occurring behaviours. The advantage of the present study was that the use of installed logging software made the process of recording users more objective. Given that these studies employed less direct data gathering methodologies than the current thesis, and that one (Pasquier 2001) focussed solely on game playing, it was therefore interesting to investigate the degree to which opportunities for collaboration occurred in the current study homes. More specifically, questions addressed in this chapter include: does the opportunity arise for parents regularly to scaffold their children whilst using the computer? If not, what barriers prevent it from happening?

7.1.2 Community practices

Community practices constitute the middle layer of the concentric circles model. They are defined as practices generated by the collective, whole family. As such, they are negotiated ways-of-living, reflecting the values that each family group hold. Previous studies that have investigated domestic practices, in relation to children's computer use, were reviewed in chapter 3 (Downes 1998a, 1998b, 1999, Downes and Reddacliff 1996, Kafai and Sutton 1999, Livingstone and Bovill 1999, The Screen Play Project). Their findings could be categorised, and hence were discussed (in chapter 3), in terms of four themes: 1) reasons that families gave for purchasing a computer and how these shaped perceptions of the computer's usefulness, 2) the uses that the children make of the computer, 3) influences from the children's' schools and 4) contextual features, or "discourses" that shape use and access. In the present thesis, the uses that children make of home computers has previously been explored in chapter 6 and school uses have been discussed in chapter 5. This chapter will therefore focus on reasons for purchase and contextual features.

The reasons that parents give for deciding to buy a home computer are <u>not</u> strictly a <u>current</u> community practice. They are retrospective accounts of the considerations that were borne in mind before the computer was purchased. They are agenda setting and, as such, represent ambitions for use before the computer was actually bought. They set the scene for future use, they are negotiated expectations. They will not therefore be considered as constituting part of the "community practices" layer but will instead be discussed separately.

On the other hand, the "contextual features", or "discourses", identified in the above previous studies, are, in terms of the current thesis, community practices that shape day-to-day, ongoing computer use. When considered collectively, across all the studies, these contextual features are concerned with the following two emergent themes:

1) Community practices that mediate <u>access</u> to the computer:

- Arguments about gaining physical access
- Rules concerning turn-taking and session lengths

- The child's immediate social environment i.e. siblings, parents, friends
- The location of the computer

2) Community practices that mediate the type of computing activities undertaken:

- Software purchasing and availability of software in the home
- Parent's policing of software type and content
- Parents willingness/ability to create a learning environment in the home
- Interpersonal practices
- Ongoing/changing perceptions of the computer's usefulness/appropriate use

This study will make further enquiries into the above community practices and will discuss how they exist in relation to interpersonal and institutional practices.

7.1.3 External institutions

The third ecological layer to be considered here is the mediatory role of external institutions. It prioritises the role of the child's school. The school is a powerful cultural institution and the aim here is to identify whether, and how, it impacts on children's home computing practices. Are parents concerned about their children's continuing education at home? If so, what measures do they take, at home, to further it? Does the computer have a role in this?

In her discussion of children's lives at home and at school, Mayall (1994) notes that typically, life at home is more negotiable than life at school. One theme of this thesis is to explore what this means in terms of computer use. To what extent do parents think it fitting to appropriate features of the classroom, such as structured educational activities, into the home? Do they feel comfortable about adopting a tutorial role? Parents' knowledge of school computing activities will also be explored, with a view to shedding light on the extent to which home computing activities are structured to reflect and support those carried out in school. Their views about the appropriateness and acceptability of homework will also be investigated, together with the type of informal learning activities that occur in the home. This will hopefully provide a measure of the degree to which parents and children are willing to use the home as a context for out-of-school learning activities.

7.2 Methodology

The aim of this part of the current study was to gather data, from families, concerning details of their domestic ecologies. It was decided, for the reasons discussed in chapter 4, that interviews would be the method used to gather conversational data from family members. Access to the families' homes also allowed the researcher first hand experience of each site so that observations could be made and notes could be taken about, for example, room layout, computer location and software resources present. Specific details of the interviews will be discussed next.

7.2.1 Family interviews: the tools

As mentioned in chapter 4, the whole study was designed to last almost a year. This involved five home visits and so the interview questions were arranged to be spread over three of them (second, third and fifth) so as to prevent parents and children becoming overwhelmed with questions and to minimise disruption to family life. These three interviews were carried out between August 1999 and February 2000. On these 3 occasions, the child and their parent(s) were interviewed separately by the same interviewer using 3 semistructured interview schedules (appendices 14-16) . Questions for parents were chosen in order to explore the following themes (only those relevant to the present chapter are included):

❖ Interview one considered i) resourcing home computing and ii) computer usage, by exploring the following:

- hardware purchasing decisions (interview 1 section A)

- software purchasing decisions (1C)
- general information about how the computer is used at home (1B)
- parent's knowledge about how children use computers at school(1D)

❖ Interview two considered community practices and the mediational role of the school by exploring:

- parent's knowledge about their children's school work (2A)
- parental attitudes to children having homework (2B)
- how the computer fits into the child's leisure activities (2C)
- whether parents encourage computer use over and above other activities (2D)
- whether or not parents scaffold their child's computer use (2E)
- how the location of the computer was decided upon (2F)
- how access and arguments are managed (2G)
- whether home-made computer products are encorporated into family life (2H)

❖ The schedule for interview three was devised after interviews one and two had been carried out. Topics were designed to investigate issues that had previously arisen but required further, in-depth, investigation. There were two themes:

- further enquiries about joint activity and parental encouragement (3A)
- enquiries about children's internet use (3B)

Questions for the children were necessarily shorter, to maximise levels of interest and concentration, but reflected many of the above themes:

❖ Interview one: resources and uses

- computer uses at home and school (1A)
- software purchasing (1B)

❖ Interview two: community practices

- the social environment of computer use (2B)
- access arrangements and computer-related arguments (2C)
- the location of the computer at home (2D)
- learning at home (2E)
- making computer products (2F)

❖ Interview three was designed to gather details on the use of the novel software titles, discussed in the next chapter.

7.2.2 Family interviews: procedure and conditions

The interviews lasted approximately 20-30 minutes and took place in one of the downstairs rooms of the house. They were all audiotaped. Children and adults were questioned separately but it was not always possible to do so out of earshot of the rest of the family as some houses had only one main room downstairs. Other distractions were kept to a minimum e.g. the television was turned off where possible.

To minimise attrition, update letters were sent to all parents at regular intervals which kept them informed of research progress and reminded them of when to expect another visit etc. (see appendix 17a-e). At the end of the last home visit the families were thanked for their continuing participation. They were also given a very brief summary of some of the findings to date (see appendix 18) and assured that they would receive further results at a later date.

7.2.3 Analysis of interviews

Although there are benefits to transcribing interview data, the advantages of dealing with the interviews in audio-file format (.wav) outweighed the disadvantages. When listening to sound files it was easier to project back to the actual interview situation than it was when reading text. Using audio data meant that access to richer details was available each time they were heard, such as rhythm of speech, inflexion, mood and laughter etc. so that the analysis was carried out based on more intimate knowledge of the situation. It was therefore decided to analyse the interviews in sound format.

To do this, the audiotapes were first digitised, and stored on a hard drive, using a software package, suitable for digitised audio data (which Atlas was not), called Kit. The researcher had to learn how to use this software from reading on-line instructions and through trial and error practice sessions. The interface of this software, and its file management system was quite confusing and made use of it difficult at times. It also took up a lot of hard drive space with both audio files and their respective codes needing to be stored. There were nearly one hundred hours of interview data, digitised in real time, so the digitising process took 100 hours to complete. It was inconvenient as it meant that the computer could not be used, simultaneously, for another activity. This meant that another machine had to be obtained temporarily, and used exclusively for digitising interviews.

Following this, the aim was to become intensely familiar with all of the interviews, so they were listened to, in full, several times. This was particularly time consuming and took approximately 300 hours. In doing so, the researcher thereby became immersed in them all. The next stage was to carry out initial electronic tagging using Kit. There were only a finite number of issues addressed by the interviews, governed by the fact that each family was asked the same set of questions. Answers to the same question were identically tagged for all interviews. For example, all replies to the question "why is your computer located at x?" were tagged with the term "location reasons". This meant that at any stage of the analysis, all replies tagged as "location reasons" could be quickly and reliably accessed. Any replies to other questions, in which location issues arose, were given the additional code of "location reasons" as well as the tag relating to the initial question. Then all responses tagged as "location reasons" were subject to further careful listening, and notes were made on paper as appropriate, in order to ascertain how these replies could be categorised and systematised. In this "location" example, categories of reasons for the computers' positions emerged, such as parents being concerned about "security issues" and about ensuring "equity of use". The tagged replies were then given these additional codes. This was a very lengthy process and took about 3 months.

Where it was important to indicate the percentage of parents that had made a certain type of reply, content analysis was carried out by counting responses. It was also important to select representative replies that could be encorporated into the discussion of findings. This was carried out by listening to all the relevant replies once again, and selecting those that represented the whole and that contained the richest data. No difference was found between the content of replies given by 7,9, and 11 year olds, so it was not necessary to keep track of the age of the source child.

7.3 Results

This section is divided into four main parts. The first presents the findings related to the families' decisions to purchase a computer. This section sits outside the following three sections because it considers parents' retrospective accounts of why they decided to purchase a new home computer and, as such, is a consideration of past decisions and not ongoing practices. This decision set the agenda for future use. The next three sections will be concerned with findings from investigations within the three "layers" of the concentric circle model. The first layer is that of interpersonal practices. The second is community practices. The community practices identified in this section are wide ranging so for ease of presentation they will be divided into features of domestic ecology that mediate a) where to locate the computer, b) access to the computer, and c) use of the computer. The third layer will consider the mediational role of external institutions.

7.3.1 Purchasing a new computer: setting an agenda for future use

This section deals with the reasons that the parents offered for deciding to buy a home computer. As discussed in section 7.1.2, parents gave retrospective accounts that gave details of past decisions rather than present practices. This section is not therefore considered under the heading of "community practices", but is instead treated separately.

However, it must be borne in mind that the reasons that parents gave for purchasing a home computer did play a part in defining the family's own perceptions of what type of activities they envisaged their new computer being used for. This shaped parents' aspirations for use and had a role in mediating how children used their computers. This section is therefore separated only for organisational convenience. The findings should be kept in mind when reading future sections.

The studies reviewed in chapter 3 have found that one of the main reasons that parents give for buying a computer is to support their children's education (e.g. Downes 1998a, Giacquinta, Bauer and Levin 1993, Livingstone and Bovill 1999, Sutherland, Facer, Furlong and Furlong 2000). This role is heavily promoted in both hardware and software advertisements found in computer magazines and newspapers. For example, a whole page advertisement for the PC retailer "Time" appeared in The Sunday Times on 29th August 1999. Large text across the top of the page read "work, learn and play" and underneath this were the words "the best educational family PC deal". Bundled with the hardware were 14 educational software titles and the graphics depicted an excited family gathered around a computer with some educational software on the screen. It appears as though both advertisers and parents envisage that the computer is a useful tool for the child learning within the home. There is also a degree to which these advertisements acknowledge the potential multiple roles of a new computer. It could potentially be used for any, or all, of three possible pursuits: working, learning and playing. There is a sense that these companies portray the transition from one role to another to be effortless.

The present study supports those studies cited above, by finding that the most frequent reason (73% of parents) given for purchasing a computer was to help and support their child's education. Many parents gave more than one example of how they envisaged the home computer supporting their child at school. These responses could be subdivided into i) to help with homework (75% of these parents) (defined as use of reference CD-ROMs, or the internet, or use for word processing), ii) to use educational software (67%) and iii) so that their child's ICT skills did not lag behind others in their class (12%). These responses indicate how parents viewed their potential (i.e. yet to be purchased) home computer's usefulness in terms of school based education. As discussed in chapter 5, the main uses of the classroom computer were for word processing and accessing information. It is therefore apparent that the parents, when thinking about buying a new computer, were keen to import these uses into the home. They predicted that the computer's predominant use would be for seeking out information for project based homework, as well as for word processing and presenting projects: *"I wanted them to do a lot of learning and a lot of encyclopedia stuff, a lot of writing"*. This is an important use as some parents thought that children who did not have access would be left behind and their ICT skills would not develop.

These classroom-based uses (i.e. reference tool and word processor), having been imported into the home, also underwent a form of domestication. Families owned a wide variety of reference software (see appendix 13) that was suitable for homework as well as for more family pursuits. For example, encyclopedias and CD-ROMs about the human body were useful for homework, whereas route finders, garden designers and recipes could be used for leisure pursuits, improving general knowledge, and hobbies. Such titles were not used frequently (see figure 6.6) for either homework or leisure use, suggesting that, at purchase, parents were "buying into the dream" that their computer would be used frequently as an information resource, whereas in reality this did not materialise, and entertainment games predominated.

Parents characteristically gave other reasons for buying a computer as well, such as for a parent's study or work (36%), for playing games (33%), and for the whole family to gain confidence in ICT and keyboard skills (6%). Responses typically contained more than one reason, for example: *"everybody else had got one, we thought it would be useful for the girls and their homework, educational information, the internet and basically because IT skills are a useful thing to have"*, and "*we thought it would be good for the kids, education, and games and [dad] wanted it for work*". This suggests that parents took the informal, out-of-school education of their children seriously and were willing to invest a quite considerable amount of money in this pursuit. This range of responses are comparable to those from previous studies (e.g. Downes 1998a, Giaquinta et al 1993, Livingstone et al 1999, Sutherland et al 2000).

Contrary to the general enthusiasm about buying a new computer, there were only two families where one or both parents were less than willing. They both envisaged that its desired educational role would be overshadowed by the playing of entertainment games, which they did not want to happen. These parents, like those above, wanted their computers to be information/work tools and viewed these uses in a positive and beneficial light. They were afraid that their children would prefer playing computer games and that this was a less wholesome activity. One mother had resisted her husband's and son's enthusiasm to buy a computer, and had *"dug in her heels"* for a long time, because she "*knew*" that her family would spend a long time playing games on it. She viewed this as a *"pointless"* activity. Her husband strongly disagreed and admitted that he was aware that playing games would be the main activity. He claimed that *"I knew that [the children] would play games on it. I don't think you can have a PC and not play games on it, I think that's half of their functionality"*. The mother was concerned about the way in which her computer was eventually used extensively for game playing, which interrupted daily domestic routine. She said, *"I mean its very difficult to get [our son] off there at night, and if he's got homework to do...and the first thing he wants to do in the morning is come down and turn it on...I can't get him off"*. It appears that this mother's predictions were accurate; entertainment games took priority over her son's homework which was, according to her, undesirable. She tried hard to counteract this by purchasing educational software in order to prevent her son from *"spending hours and hours and hours playing games"*, but to no avail.

In the other family, parents had resisted their children's pleas to buy a computer until the mother needed one to help with word processing her course-work essays. They too opposed it because they thought that their children would play lots of games that *"go nowhere"*. Despite their intentions that their computer should be used mainly by the mother for her work, the main eventual usage was playing games. However, a particular game called SimCity, in which the player has to construct a city, with its roads, buildings and people, proved to be surprisingly *"creative"* and to promote a high level of constructive conversation between the children: *"they do yap a lot while they're doing it, which is great"*. In both of the families that had resisted purchasing a computer, the parent's worst fears were realised to various degrees and the computer was used eventually, not as a support for education, but as a games machine. The parents with doubts had good insight into the realities of home computer use and were, arguably, justified in their fears.

So, there were 73% of parents who expressed educational aspirations as a reason for buying a computer. These parents viewed this role as being beneficial and desirable and actively went out and spent a considerable amount of money on the first step towards fulfilling their dream. For the majority of parents, the home computer was conceptualised as being a machine that could facilitate their child's out-of-school education. Those parents that predicted a high amount of entertainment games use, to the detriment of more educational pursuits, demonstrated knowledge of the realities of home computer use, as demonstrated in figure 6.6.

The next section will move on from agenda-setting computer purchasing. It will present the findings from the innermost "layer" of the concentric circle model. It will explore the child's immediate social environment and the opportunities for interpersonal collaboration.

7.3.2 Interpersonal practices

This section draws upon data gathered using the computer-user logging programme described in chapter 6, as well as discussing findings from the interviews. The logging data revealed that children were alone on average 72% of the time that they used their home computer. There was no significant difference in degree of solitary working across the three age groups ($F(2,31) = 0.7$).

Certainly, none of these children seemed to want practical help over basic computer operations. One mother explained "*she can switch it on and everything on her own, she's fine, no problems at all so she has access to it whenever she wants really, no problem*". Where use was shared, this was with a sibling (on average, 12% of total usage time), with a friend (7%), with a parent (4.7%) or with a combination of these people (4.3%). Levels of interpersonal engagement were low, especially with parents. In attempting to investigate why parent-child engagement was minimal, parents were ask to describe any barriers to shared computer use.

Evidently, direct parental involvement was scarce. Parents identified a number of reasons why this was the case. The main reason was that it was resisted by the children themselves. Seventy two per cent of parents said that their child would not like it if they were often there when their children used the computer. Seven of these parents simply explained this by invoking a preference to be independent: " *he says 'I can do it myself...I know what I'm doing!'* ". Two said that they would be unwelcome because they did not have enough knowledge to help the child. One said "*if she's composing a letter or something like that, I'm more likely to be able to help her because that's more the type of thing I know about, some things I can't help her with*", and the other, when asked whether or not she thought it her role to offer assistance, said, "*oh dear, I suppose it could be really, but I don't use it you see, so it would make it very difficult*". One mother said that her child felt that parental attendance when using a single-user game was unnecessary. Another claimed that it always led to arguments: "*there's arguments when we do sit with him, he tells [dad] what to do and [dad] tries to tell him what to do. He doesn't like being told what to do, even though he can't do it, he'd rather sit down and struggle through it rather than ask you for help*". A further 19% of parents said that their child would like continuous company but this was more to show what they could do – rather then to initiate collaboration or tuition: "*he does like it when you can observe what he's doing, he does like to show what he can do*".

In addition, 53% of parents said that their own needs prevented them from joining in. For example, not having enough time (25%): "*we don't always have the time, perhaps we should*", getting impatient at not getting a go (9%): "*I think frustration sets in as well* *because not all of us can...we all want to put try and put our bit in and then they shove us out of the way"*, wanting a <u>break from using a computer</u> after using one all day at work (3%): *"I've been looking at one all day and its not what I want to do when I get in, I don't really want to do it on a Saturday really"*, and finding it <u>boring</u> watching children's games (16%): *"they're not very interesting for adults. Maths sums for a nine year old are boring"*. Another said that *"at the moment the boys are wanting a completely different sort of game that I or [my wife, or daughter] would be interested in. It's the interest that keeps us apart"*. Thirty two percent of parents said that the <u>software that their children used was not conducive</u> to use by more than one user and that most was only suitable for one gender and age: *"if you have different age-group children they're using the computer in such a different way. You can't have them sitting down side by side because they're doing different things, they're playing at different game levels and different educational levels, and boys want to do boys things and girls want to do girls things"*. Another father described the ideal picture of a whole family huddled around a computer as *"nonsense"*. It therefore appears as though there were many barriers to shared use of the computer at home.

Children were asked whether they ever asked their parents for help when they "get stuck". Ninety four per cent said that they first asked their father for help, not their mother, generally because *"she's not that good at the computer"*. One child said *"I read the instructions but I didn't understand what they said so I asked him [dad]"*. It appears as though children were not exclusively alone. Parental interest and attention was often transient (and hence likely to have been poorly registered or unregistered by the log-in software). For example, this child said *"she just happened to be in the room, she had a quick look"*, and another said *"sometimes if they're coming through here [music room], they watch me"* and *"he just stood over my shoulder for a while"*. This was more likely to occur with a new item of software when parents *"wanted to see what it was"*. After the child had mastered it and was capable of using it independently, parental involvement tended to decrease: *"[dad was there] just to show me what to do"* and *"they did [help] when I was first on them, but now I know them, they don't"*. Only one mother recognised the fact that further effort on her behalf may have resulted in her son using some mathematics software more often: "*I bought a little [CD-ROM] set and it had got fractions in. I remember sitting with [him] with that fraction thing and he really enjoyed it, but then, when I thought he'd got the hang of it, that's when my interest went away. I thought "oh, he knows what he's doing now", so when I thought he could do it, that's when I left him. Whereas I should really have sat with him cos he's not used it since, and that was over a year age that he used that*". This conversational data suggests that, for this mother, her own interest level was an important factor in whether or not she sat with her son. Also, her interest level was stimulated by the amount of guidance she could give him in the early stages of his software use. She did not perceive her role as being one of offering continuous guidance about the software's content, but instead saw her role as offering advice over how it worked. For this reason her son, once he knew how it worked, was left on his own and she offered no continuing support of a tutorial nature. It appears as though he needed her support and she acknowledged that, without it, his interest waned. It appears as though many parents were concerned that children should know how to use the software, and would help if asked, but were reluctant (for the various reasons cited above) to commit to long periods of assistance or guidance once the children were able to use the software unaided.

The findings presented in this section suggest that both parents and children actively preferred that the children's computing activity was autonomous. Children resisted adult involvement and, at the same time, adults had numerous reasons why they could not sit with their children. This suggests that opportunities for continuous scaffolded learning were rare. It appears as though parents wanted the computing activity to be self-contained, with no need for external personal intervention. The software itself had to generate enough enthusiasm in the child for them to continue with the activity. It also had to be transparent enough for children to be able to operate it by themselves. Perhaps the computer was perceived, by some parents, to be a replacement teacher. This effectively reduced the opportunity for collaborative discourse and so suggests that children were being denied a potentially rich learning resource. However, it is important to acknowledge that fleeting interactions between parent and children may not have been logged as a change in users, which could mean that short periods of parental help did occur even though prolonged joint sessions were rare.

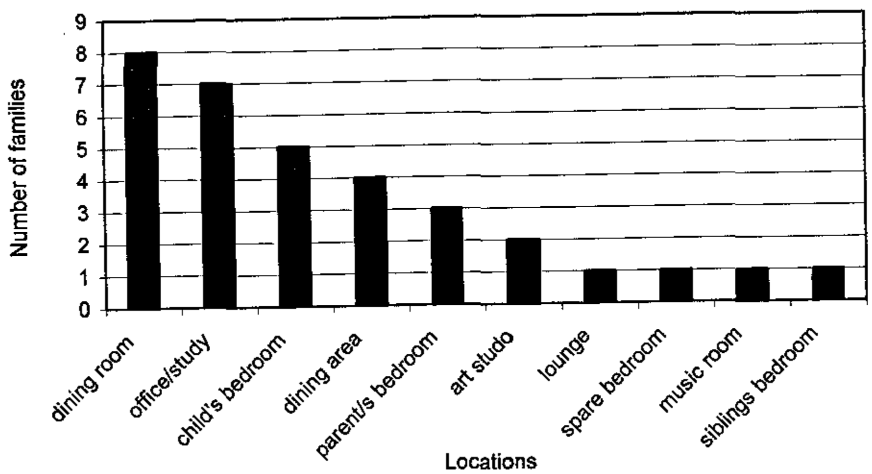
7.3.3 Community practices

The next section of this chapter will discuss community practices i.e. those in the middle "layer" of concentric circles. These are defined as those activities that are jointly negotiated and have become ways of life for the whole family. It is divided into three parts. Section 7.3.3.1 discusses how parents came to the decision of where to locate their computer, section 7.3.3.2 presents findings related to those community practices that mediate children's access to home computers and section 7.3.3.3 addresses community factors that shape how the computer is used.

7.3.3.1 Community practices: locating the computer

When buying a computer, families, at some stage, considered where they were going to put their new machine in their home. A variety of issues arose when discussing this with parents, indicating that this was often a difficult decision that had the potential to remediate both social and physical use of the newly defined space. At home, computers were found in many locations (e.g. lounge, music room, dining room, art studio) (see figure 7.1).

Figure 7.1: Location of Home Computers



In discussing how they had reached the decision of where to put their computer, parents talked about two sets of issues. The first was that characterising the dimension of central-peripheral placement. Families were concerned that their computer should be located in an easily accessible place (make it central) or they wanted it to be less visibly located on the household margins (make it peripheral). Forty four per cent of computers were positioned in a central family room (i.e. one that was physically in the centre of the house e.g. lounge or dining room) and 56% in a room on the periphery (e.g. a study).

The second placement dimension was concerned with the public-private nature of the location. In this case, families were concerned with the social traffic that would be surrounding the user. Forty seven per cent of computers were positioned in a space that protected the privacy of the user (e.g. a bedroom) and 53% per in a more public location such as a dining room or lounge. These dimensions were not completely orthogonal, although private spaces were more likely to be on the household periphery. However, the aim here is to clarify location in terms of reasons more than in terms of rooms. These reasons, that were aligned with the dimensions, were, in various ways, continuous with parents' educational aspirations, as discussed next.

7.3.3.1.1 Location: The central/peripheral dimension.

The notion of "centrality" being important arose in two particular reasons parents used to explain location decisions. First, twelve families said that a central position ensured equity of use: *"I wanted it to be a family computer, so I wanted it somewhere where we could all have access"* and *"so that nobody had particular claims to it. If it was in somebody's bedroom they'd think "oh its my computer". We wanted it to be easily accessible to all of us".* Second, a central location was associated with family visibility. Four families reported that the computer appeared to get more use when it was "downstairs". One father said that *"if the kids are watching something on television and if one of them gets bored they will get up and have a go on the computer, so they probably use it more than if it was somewhere completely removed from everybody else".* This sort of consideration had prompted some families to move computers from an upstairs room to a more central location: *"we've decided that it would be better off down here cos I think it gets more use down here".* All of these reasons behind the location decisions stem from the fact that parents conceptualised their computer as being a useful, beneficial tool and consequently that each family member should be allowed fair access. Denying access, or making it inequitable, would be withholding the opportunity for personal betterment. Each member should be allowed to reap its benefits and "*more use*" should be encouraged.

The concept of "peripherality", as related to location decisions, arose in four different ways. First, it was relevant when considering issues of security. Families were concerned that the computer should be placed where it was inconspicuous to a potential intruder. Often they thought that an upstairs room would be more secure: *"[downstairs] you could see it through the window and people passing would think 'oh there's a computer".* Such statements remind us that the computer is an item of considerable value, either monetarily and/or as an educational tool, that requires protection from potential theft.

Secondly, some families considered that as an object, their computer was not aesthetically pleasing. For this reason they decided not to place it in a central room, but in a less visually intrusive position on the periphery of their homes. When one father was asked why his computer was not in the lounge, he replied that *" if Bang and Olufson designed a computer that was such, like, such a beautiful thing, you could appreciate it as a piece of beauty then, couldn't you. You know, a piece of sculpture or whatever. But you certainly can't with our computer. Gateway, its like a bus isn't it? A number 43 bus in your sitting room".* Yet, interestingly, this father was still willing to have a computer in his home, despite its relatively unattractive appearance. Its potential benefits outweighed this disadvantage. Computers are unique amongst household appliances in that they have not been available in a wide range of colours and shapes that could compliment interior décor. They are usually grey or cream and all look very similar (with the exception of the colourful iMac which was not widely available at the time of this study). There is therefore no option but to accommodate this design. Interestingly, no family had tried to make their machines blend into their surroundings by decorating them.

The third concern related to "peripherality" of position was with the computer's role. Importantly, discussions surrounding this contained the first signs that the computer could be a site of conflict. In spite of their aspirations at purchase, some families did not want a machine that they associated with work or study to be placed in a central location. One parent said that she had decided to place it in a peripheral study room because *"its officey, it's a work piece not a piece of furniture. Dad uses it for work, the kids use it for homework, I don't see it as something that is necessarily fun".* Another said, *"its more a tool. Its not a pure entertainment thing. Anything work related goes out the way down there [study]".* These parents found that there was a conflict between having a useful educational/work tool in the home, and being reminded of work/school, by the presence of the computer in family relaxation or leisure space. On the one hand it's beneficial, but on the other its not *"necessarily fun"*. Serious use for work or study often did not sit comfortably with the rest of family life. It seems that importing a computer for serious use, into leisure space, was problematic for these families. This tension would undoubtedly be apparent to the children who would come to recognise, and become enculturated into conceptualising the computer as being a necessary, but often unwelcome addition to the household.

Fourthly, the computer was placed at the periphery because parents wanted to promote seriousness of use. One father commented that to put it in the lounge would mean it would *"become an everyday object that gets mucked about on"*. He wanted it to be regarded as a *"useful tool to be looked after"* and hence decided to put it at the household periphery - in his bedroom. This father was reluctant to incorporate the computer into the everyday, entertainment activities that were centred around the lounge area of his home. Once again, he had aspirations that it be used for serious use, which was discontinuous with the majority of daily, family life.

7.3.3.1.2 Location: The public/private dimension.

The responses considered here were concerned with the social traffic surrounding the computer. Where the reason for a location decision was expressed in terms of its "public" nature, this was often because of a parental desire to supervise or monitor access. This was important for five families. For example, parents commented: *"it's quite easy to stick your head round"*, or *"we can see what [the children] are doing and if they want help"*. This concern is continuous with the parent's educational agenda where they are keen to assist their children's efforts. Another, related reason for a public position was the corporate nature of the experience, although only one family cited this issue. Here the mother remarked: *"it used to be upstairs in our bedroom but we never got to see each other...now its downstairs we can still sit and talk in the evenings"*. Again, this parent is keen to maintain the normality of family life whilst allowing the computer into her home. By placing the computer in a public space, she, unlike other families, was demonstrating her willingness to incorporate the computer into family time. She can use it and talk to the rest of her family at the same time.

However, some parents said that placing their computer in a public position did have its disadvantages, in that the user was often distracted by parallel activities going on in the same room. This was another area in which conflict arose, this time between the television and the computer. Three families reported that they had decided upon a private location in order to avoid this distraction, both for and by the user/s: *"if it's a noisy computer program like Grand Prix, then you have to turn the computer down or off"*. This potential problem was recognised by 7 other families who decided not to put their computer in the main living area of the house: *"it's not in the lounge because when you're working on it people can still watch the television, and if the children are doing homework they can concentrate"*. In these families, the television, a leisure pursuit, won the right to a public space in the house and the computer was relegated to the periphery. Another mother described how competing noise from the computer and television became troublesome: *"he's got an aeroplane CD thing, his aeroplanes make more noise than the telly, so the telly [volume] goes up then the aeroplanes [volume] goes up then we can't hear anything! If there's something, you know, East Enders, that I want to see, its annoying"*. Limited physical space in this house meant that the family were left with little choice but to put their computer in a public dining area adjoining the lounge, a less than ideal location where competing noise was a problem.

The public/private dimension concerned the social traffic associated with space so another concern raised was that the location created <u>interpersonal tensions</u>. There were 6 families with computers in "owned" public spaces such as a father's office or a mother's art studio. Only two of these families mentioned that this caused problems. One father said that his use of the computer took priority over other family members' use. This sometimes meant asking his children to stop using it: *"if I'm doing something work-related then that takes priority"*. For this father, serious, work related use took priority over the more leisurely pursuits of his children. Another parent felt that the position in her art studio was not ideal, but was a compromise, where she had to "*sacrifice space and privacy*" so that the rest of the family had access to the computer in her space. In this family, the option of a public living space, such as a lounge or dining room, was out of the question and invasive. So, the mother's art studio, an area already reserved for work related activities, was chosen as the most suitable position. The computer was again a source of tension. It was seen as a necessity but was also perceived as an unwelcome invader of space by the mother, a point that the children would have been aware of and that would have mediated their access requests.

All but one of the children had at least one sibling. Where families had decided to locate the computer in children's bedrooms, tension might be expected if siblings had separate rooms. This arrangement was found in four families: the computer was in the bedroom belonging to just one of the children. Consequently, there was potential for sibling argument over access. Yet, in discussing arguments arising from computer use, this particular issue was not raised by any parents or children in the relevant families.

The sociality of location in the sense described here did not appear to influence usage. Comparing families with a computer in public versus private spaces, no significant difference was found in time spent, by children, on any type of activity ($t(30) = 0.2$). This suggests that social traffic did not mediate the amount of activity that was carried out.

Parents also revealed that deciding on a suitable position for their computer was often a compromise. Frequently, the decision involved ruling out the alternatives until only one remained. One parent said, *"we could have put it in the dining room, we could have tried to fit it in here [lounge] or using our bedroom. That did remove some of the privacy from our bedroom. Here [lounge] wasn't really a possibility because of [our young son] and it was disturbing if someone wanted to use the computer and someone else wanted to watch the television, use the telephone, so the dining room seemed really the only other place".* For this family, issues of fitting into family life (retaining bedroom privacy and avoiding distracting television or telephone users) and avoiding distraction for the user were both issues. The eventual decision was unfortunate in that it displaced the once weekly occasion of all the family eating at the dining room table and meant that visitors had to eat in the kitchen, which the family viewed as less than ideal. However, it is an indication of how far families are prepared to go, and of how much disruption they are willing to tolerate, in order to accommodate an item with the potential, perceived benefits of a computer. They were prepared to reconfigure significant aspects of their domestic lives.

7.3.3.1.3 Location: summary of issues

The responses from parents have indicated that the decision concerning where to locate their computer is not straightforward and that there are many issues that get taken into consideration. Very often there is no single, ideal place and the eventual choice can be the result of compromise. Wherever it is eventually located, the physical presence of the computer remediates use of the surrounding space. It not only means that the space is used differently, but also that previous activities can be displaced to another location. The social traffic entering and leaving the space also undergoes change, as the presence of a computer invites various people into the room. Location decisions play their part in shaping children's access to computers as, for example, other users of the space demand their right to access.

What has become apparent is that the majority of parents bought a computer with educational aspirations but that conflict arose when deciding where to place a work-related piece of technology into the predominantly entertainment-oriented domestic sphere. The computer was a valued tool and parents were keen that it should be located where all the family could have equitable access, and some wanted it to be somewhere where the child user could be supervised. This desire that the technology should be in a central location conflicted with other concerns about it interfering into domestic life, particularly with television viewing. Another conflict was between wanting to promote serious use and placing the computer in a quiet place, and concern that the user should not become isolated and divorced from ongoing activities.

The issues that parents had to address were different to those faced by teachers in school. In the classroom environment, many of the above concerns did not arise as teachers had little choice. The institutional setting, with its strong learning objectives, meant that conflicts over use of the space were unlikely to arise as they did in the family homes.

The next section will continue in the vein of presenting findings pertaining to community practices. It will consider how computer access is mediated in the domestic environment.

7.3.3.2 Community practices as mediating access to the home computer

The first type of community practices to be discussed in this section are family, computer-related rules. Formal rules concerning when and how to use the computer were reported frequently. They fell into two main types: a) three "behavioural" concerns which were more focused on regulating the child, and b) three concerns of a more "security" kind which were focused on care of the machine. These will now be discussed in turn.

7.3.3.2.1 Community practices: formal rules for access

Rules regulating the child's behaviour are considered first. These could be split into three different categories, and will be considered in turn.

Children's home computer use was not encorporated into ongoing activity like it was in the classroom. Children's computer use at home was more isolated, and their task generally had no relation to what other members of the family were doing concurrently. Families preferred that the computer did not interrupt domestic life, which made it necessary to generate rules to limit disruption to daily routines. This was in direct contrast to the classroom, where teachers were concerned with incorporating computer use into daily routines. Many of the children, at home, used their computer quite often and for quite long periods of time. The rule that most (48%) families cited was that access should not allow the computer to interfere with other valued aspects of domestic life, and so sessions should be scheduled with respect to these. One mother said *"I did get to the stage when I banned the computer before school, otherwise he was getting up early [to use the computer]and end up being late to school with no breakfast"*. Other families allowed use when other obligations were complete e.g. *"if you've done your music, done your homework then yes you can go on it"* or *"if [my mum] wants help in the kitchen then I help her out, then go on it"*. These comments are stark examples of how the computer was, in a sense, peripheral to family life. It was not fully encorporated into daily activities and took second place to some daily routines that were in place long before its arrival in the home. There was no absolute priority given to using it, probably because the majority of use was not educational.

Fifteen per cent of families mentioned a rule for the setting of time limits on sessions of use. Permitted times ranged from 30 minutes to 2 hours and were sometimes set in the interests of controlling, what parent's perceived to be, compulsive games use: *"the maximum is probably two hours"* and *"there's no going on the computer for longer than mummy and daddy say"*. Although this rule might be set for various other reasons, such as to avoid arguments and ensure all siblings have equable turns: *"they've been quarrelling over it so I gave them half hour turns at a time so it was fair"*. Another parent said: *"it usually starts with "he's not letting me have a go, he's been on it all day!", so [I say] what does all day mean, what are you doing, whose turn is it next? Right, ten minutes then its your half hour up"*. Health concerns were an issue for another family: *"if he is on it for ages we ask him to get off. At 2 hours one starts to worry, we start to worry about their eyesight and radiation"* and having access to a broad range of recreational activities was an issue for another family: *"I don't like him being on it for too long...he's got to have other interests"*.

Only a small number of families (9%) operated a rule sanctioning appropriateness of use. By the time it became necessary to create rules, it had become apparent that the main use would be for playing games. Parents were therefore concerned with policing inappropriate or excessive use. Typically, some games were judged *"mindless"* or *"pointless"* or as containing too much violence, such that access was controlled either by time limits on their use, by parents refusing to buy them, or children having to ask permission first: *"Dungeon Keeper, because I'm under age, I have to ask before I can use it...and my young brother is not allowed to use Nine Month Miracle [about pregnancy and child birth] because its not very nice, it's a bit gruesome for kids"*. One father objected to the shooting games embedded in an electronic book so decided to hide the offending program: *"they only want to play on Treasure Island so we helped them by* *removing it and hiding it. They didn't bother to read the story, all they did was play the various shooting games".* This father was disappointed that an educational piece of software had been designed to include a few games. He wanted his children to use it only for reading the story.

Embarking on a session of use might also have attracted a permission rule simply because parents wanted to monitor recreational activity. Twenty four per cent of families identified a requirement to ask permission for computer use – consistent with those parents' general desire to be aware of how their children were spending time. One child said *"we have to ask before we put it on. As long as we tell someone so that they know we're on it".*

The above subsections were concerned with discussing rules that regulated children's behaviour. However, these were not the only ones cited by parents. They also discussed three rules concerned with more "security" issues such as those designed to ensure that proper care was taken of the equipment and costs were kept to a minimum. These will be discussed next.

Care of the computer was a concern for 30% of families and led to rules over how to be a good user. The computer was regarded as a valuable tool that was to be taken care of and used responsibly. For example, operating rules mentioned by the children included that shut down and start up must be carried out following the correct procedure, that the screen should not be touched, and that no food and drink should be placed nearby. These rules covered general good computing practice, as in the case of keeping drive space free: *"we're not allowed to save stuff on the computer cos its only a very small hard drive".* Sometimes the domestic regime was strongly enforced as for the child who intoned: *"don't mess it up and don't do anything without asking dad if you're not sure of what to do, if anything messes up you have to pay for it".* This child was well aware of the value that her parents bestowed upon their computer and was told that she would have to pay for any repairs herself if her irresponsibility resulted in technical problems.

Twenty four per cent of parents raised the issue of the expense associated with computer use, particularly in relation to use of the internet. Such access was usually managed through time-of-day rules. When this study was carried out, internet use was billed per second. Monthly all-inclusive fees were not in existence, so curtailing excessive use was important for many parents. One child reported: *"I'm only allowed on the internet after 6 o'clock",* as this was when the off-peak rates started. For some families, paper and ink use was an issue: *"I ask before I use the printer and they come and have a look at what I'm printing".* This reminds us that computing expenditure does not stop upon purchase of the computer, but instead is ongoing with software, paper, ink and peripherals all costing extra money.

Twenty four per cent of families cited rules that controlled the privacy of personal files. These could be those belonging to parents: *"my mum's got this bills one [folder] and I'm not allowed to go on that"*. Another child said, *"dad has one file and we mustn't touch that"*. It was always that children were not permitted access to parents' folders, not vice versa. One 7 year old was not allowed to use her brother's games: *"I'm not allowed to go through [my brother's] games cos sometimes I can break them if I don't know what to do"*.

In addition to these formal methods of policing children's access to home computers, informal methods were also found, such as temporary rotas and spontaneous, on the spot arrangements like agreeing on turn lengths. These methods will now be discussed in the next section.

7.3.3.2.2 Community practices: informal rules for access

Access at home was also regulated less formally than by the development of rules. One family used a rota to control access. This was a written list pinned on the wall next to the computer. As it happens, the children subverted this plan with their own version: *"we've made a new one. I'm at church on Tuesday and dance class on Thursday, so my day is Friday, so I'm allowed to say 'I want a go, so get off'. One brother has it on Wednesday* *and [my other brother] is on Monday. At weekends we don't have priority, we just have a time limit".* The development of this computer-access rota, to fit around other family and leisure commitments reminds us of how families were reluctant to change any other routines in order to accommodate the computer. This child did not give up her dance classes so she could have more time on the computer. She was also firm in attaining her turn, telling her siblings to *"get off"* and thereby asserting her right of access to the valuable resource.

Other more improvised methods were also used to govern access, such as the child's age, which might determine priority: *"first we, we go biggest to smallest and then we say like, you've got one hour, you've got one hour, and you've got one hour on it. And then if you're bored, you just let the other person go on."* One child explained how computer use was also embedded in broader daily organisation schedules such as making use of it whilst other family members were out: *"on Saturdays my brother normally has it first because I normally go dancing, so my brother has it first, and then he goes out to do what he wants to do at town in the afternoon, and then I have a go on it".* Organising access through computer desktop structuring was not particularly common. However, two families created personal desktop folders for their child which contained shortcuts to all their applications. This was particularly important for the younger children whose file navigation skills were undeveloped. One father of a seven year old child said that *"I load the software on, basically so they can get to them when they want them, I created a little folder called [child's] games and I put all the shortcuts in there so they know how and where they can get to them".* This father was keen to customise his computer, in order to make it more "child friendly". He wanted his child to be able to use it whenever she wanted.

Some children were quite inventive in devising ways to get around these rules which, all point towards them conceptualising the computer as a tool worth fighting for and worth risking parental admonishment. In the present study, one girl complained that *"my brother would grab me and drag me as far away as he could, then just run upstairs to the computer".* Others recalled opportunities to sneak in and take over: *"she went to the* *lavatory and then I had a few more goes".* Hiding a sibling's CD-ROMs is another way of extending your own turn. One child said that *"I went to look for my CD's and found them under my brother's bed".* Equally devious, a turn on the computer can be drawn out if you *"choose a game that's got levels on it, cos it keeps going".* This resistance to time restrictions is a reminder of how attractive this technology can be to some children.

Rules and more informal means of access regulation were not the only feature of the domestic ecology that mediated children's access to computers in the home. Families were also asked to discuss the occurrence of any arguments that arose surrounding computer use. These occurred mainly between siblings, and the next section will now move on to discuss these and how they mediated children's access to the home computer.

7.3.3.2.3 Community practices: arguments as mediating computer access

Every child with a sibling at home said that they had, at some stage, argued over access to the computer. Solutions were sometimes reached by the children themselves, but some also required parental intervention. When a child was asked what their parents typically did, they replied that a conventional response was, *"you've had enough time, now you can get up and let [someone else] have a go".* The family that were using a rota system also had problems when siblings tried to subvert it, *"we tried a system of an hour each but it goes on to two and a half hours for [my older brothers] and I get fifty minutes".*

These arguments were related to gaining access to the computer. However, they also arose over what the computer was used for when the children were using it together: *"she wants to do a story and I want to play a game. Then we have a bit of an argument over what we do first".* This child stated that she usually *"gets so fed up with arguing that I go and do something else".* One child said that arguments occurred when he asked his older sister for help and she *"takes over"* . A similar problem was recognised by a parent who said problems arose between his two sons when *"one of them knows the game very well and the other is trying to learn it. [One] keeps on saying "you must do this or you must do that", when [the other] wants to do it themselves".*

The above responses suggest that daily life surrounding the computer is often less than harmonious. A single machine per family meant that disputes over access are almost inevitable. Arrangements to avoid this, such as rules and rotas, are often unacceptable to children who sometimes use devious methods to subvert them.

7.3.3.2.4 Summary of findings concerned with community-level mediation of computer access

Section 7.3.3.2 has been concerned with reporting the details of domestic ecology that mediate children's access to home computers. Three main mediational means have been identified here: formal rules, informal measures such as temporary rotas, and the role that arguments have in shaping access. These findings are in line with and elaborate upon previous studies. Downes et al (1996), Pasquier (2001) and Facer, Furlong, Sutherland and Furlong (2000) all report that computer-related rules and arguments are prevalent in the family home. These studies did not report, at length, on the different types of rules identified here.

Computer-related rules, as well as less formal, more spontaneous means of mediating children's computer access, were created by the family community and were usually concerned with parents controlling children. This suggests that if children were left to their own devices, they would (in the view of an adult) spend too long using the computer, use unsuitable software and fail to carry out family activities and chores. This implies that the rules identified in this section are concerned with maintaining the computers rightful status in the home. Pasquier (2001) writes that "talking about media rules is a way of talking about the role and importance media have within the home. It involves moral judgements both about media and about family life, and so it is also a discourse about ideals" (p171). The current findings suggest that parents thought that it was important that a sense of perspective was maintained and that the computer was not allowed to take precedence over other activities. The computer could support activities that were more seductive than the humdrum of daily domestic life so parents were keen that it should not be allowed to overshadow other, arguably more necessary, domestic routines. On some occasions, other activities, such as washing up and getting ready for school, had to take priority. These priorities were clearly illustrated in the previous chapter in figures 6.8-6.11 which depicted the fluctuating probability that children would begin a computer session throughout the day. School commitments, and meal times, had a clear effect on computer access i.e. minimised the likelihood that a child would access their computer.

At the same time, the presence of rules protecting the computer's security, indicate that, although the computer might often be relegated to second place, it was still a valued piece of technology. Rules were put in place that were designed to discourage children from damaging or abusing it. This is a reminder of how the computer became incorporated, or embedded, into the texture of domestic ecology. It had to "fit in" around other features of daily life. Its moral value was frequently changing. For example, it could be a highly regarded source of good entertainment at one time, and quickly could become an unwelcome interruption, or intrusion, at another. Access rules were in place to help overcome this.

The fact that siblings often argued over access also constructed the computer as a valued machine worth fighting over. It became a site of disagreement, a contested object. It is clear that children value this tool and that rules are necessary to control access if discord is to be avoided. The current study builds upon Pasquier (2001) who argues that parents' attempts at controlling children's television viewing are often thwarted by the children. The present study found that children were employing devious methods to get an extra go on the computer, or to lengthen their turn. This is indicative of how the computer was highly valued by children and of how potential, inappropriate, excessive access had to be policed.

The whole of section 7.3.3.2 has been concerned with documenting how the domestic ecology mediates children's <u>access</u> to their home computer. In the next section the ways that family community practices mediate children's computer usage are discussed.

7.3.3.3 Community practices: the mediation of use

This section will explore how the availability of domestic software resources work to shape the uses that children make of their home computers. It will also investigate how parents and children decide which software to buy. In addition to this, consideration is paid to how the children choose which software to use once at the computer, and asks what role parents have in shaping these decisions.

7.3.3.3.1 Mediating use: acquiring software resources

The computer is a multi-purpose machine that has many possibilities for use. When it is brought into the home, certain features of the domestic environment work to shape its functionality. One of the key aspects is that of software resources. At purchase, the computer usually has a selection of software already installed, such as a word processor, a spread sheet and educational/games software chosen by the buyer. It is in the shop that its functionality starts to be defined. Consumers are often asked to make a selection from an attractive array of titles, usually bundled together into genres, such as entertainment games or educational titles. Parents and children, at this stage, make apparent their perceptions of their computer's potential future role. Once it has been brought home, other uses are often realised and new software is purchased. This section will explore how parents decide which software to buy once the computer has been brought home, and will then go on to discuss the type of software found in the homes.

In order to ascertain how accessible and available software was to the families at home, an informal survey was carried out in the shops in the local town centre where all software available on one day was recorded. A well-known newsagent in the central shopping mall stocked many computing magazines and on the particular day surveyed, 9 of them had educational/creative software packaged with them. Such titles included creative software for desktop publishing, music creating and a typing tutor as well as a guide to sharks, an encyclopedia and Dorling Kindersley's The Way Things Work. There was another shop that specialised in computer games, which also had over 150 educational and creative titles on the shelf. These ranged from pre-school to A level in many subject areas. Four other well-known high street shops were visited and all had various titles for sale. This wide range of products and prices suggested that, in this town, children's educational software was widely available. But what issues were important to parents when buying new software?

To explore how purchasing decisions were made, parents were asked to focus on the last item of software that was bought for their child. Twelve parents said that their last purchase was educational software, while 21 parents bought a game. Fourteen of the children said that they had a degree of choice in the purchase, either choosing it themselves or agreeing to a suggestion made by a parent: *"I might ask for one game or another and they choose between the two"*. The remaining 19 children had no role in the decision making (8 because it was a birthday present): *"Lego Technic Turbo Command from my Uncle for my birthday. A surprise"*.

The twelve parents whose last purchase was educational software typically were concerned with the product's degree of appropriateness for school. They discussed this in terms of age suitability, national curriculum compliance, SATs compatibility, or whether it had been endorsed by the school: *"it was ideal for his age group, plus the school curriculum" or "it was in the school book club magazine"*. Parents were heavily reliant on the products' packaging for information about its compatibility with class work. They received very little guidance directly from schools themselves. One father said that more guidance would be welcome: *"if the school said "buy this software, this is what we use in school", I'd go out and buy it, I wouldn't hesitate"*. Useful advice was felt hard to find and parents seemed to struggle to find any basis for making sensible purchasing decisions. A parent, who invested relatively heavily in educational software had started to telephone software companies to seek their advice: *"I ring and say that this is the kind of thing that she likes, can you recommend anything? They've been very good"*. Acting on reviews and opinions was infrequent. One family had read a magazine review, one had taken advice from other parents.

For 75% of these parents, the cost of the item was mentioned – indicating that the purchase had been favoured for its competitive price. One parent said that *"it was on special offer so it was tempting, it was a silly price so it worked out pretty good"*. Direct contact with the item was rare: just one family had advance use of their purchase (at an exhibition). This lack of contact with software prior to purchase differs from other types of educational purchasing e.g. buying books. Books are usually open to full inspection: pages can be sampled and read. On the other hand, there were few opportunities for software to be viewed prior to purchase and parents commonly had to rely on descriptions on the packaging.

The 21 families whose most recent purchase was a game were less concerned with specific content, except one family who were looking for something *"constructive and non-violent"*. For eight of them the main guidance on choice was an expressed preference from their child. Two cited outside personal advice, two had tried the item elsewhere. One family were upgrading an item already owned. Otherwise these purchases were improvised on a fairly whimsical basis: *"I just liked the pictures, I just liked what was on it"*.

With regards to the place of this most recent purchase, a variety of locations were identified: shops dedicated to computer games, hardware shops, a software company representative hosting a home purchase 'party', from a school book-club, PC fairs, from the cover of magazines, from an advert in a newspaper, a supermarket and from a mail order catalogue. This suggests a considerable fragmentation of the outlets for domestic software; the consumer seems not yet clearly oriented to established marketplace niches.

The tendency towards owning more educational software mirrored the dominant motive parents reported for buying the PC itself – to support their children's education. However, in only one of these families had the initial motive been followed through to the extent that they *"have only ever bought educational type games for [the children]"*. Most families expected that their children would converge on game playing and some adopted a policy of purchasing educational software in order to resist, as one parent put it, children *"spending hours and hours and hours playing games"*. Most families had found that their purchasing patterns had changed over time. Initially, educational software predominated, consistent with strong initial aspirations, but this soon gave way to purchasing more entertainment games as parents realised that this was what their children preferred. The purchasing enquiries made in the current research were made at the stage when parents bought mostly entertainment games.

This section has been concerned with investigating how parents decide which software to buy. A broad spectrum of products had been recently purchased, which raises the question of how the children chose which ones to use. Did parents have a role in encouraging children to use any particular type of software? This question will be addressed in the following section.

7.3.3.3.2 Mediating use: activity selection

Children and their parents were asked verbally to describe what they used their home computers for. The following is a selection of responses from children which indicate a wide range of activities: *"games, I play battleships the most, designing things like vases and rockets an' stuff. I look round on the internet sometimes, email my cousins, just look round sometimes, just find out what I can do", "going on painting and sometimes writing, to write about what I've done in the holidays", "I use it for playing games on and sometimes for looking up for school work. Sometimes I'll type stories up on it and look up information on the internet and encyclopedia, the clip art for cards and things", " we mess around, like try to find new ways, load games, load posters [wallpaper], mostly we chat to people, like five at a time, we play games, we do colouring, we've got some CD's what we go on: inventions, encyclopedia 'n' stuff like that for homework", "I use it for playing games and writing stories, maths skill and ten out of ten"*. What becomes apparent is a general reluctance to admit how much time was spent on playing games and how little time was spent on educational pursuits, which hints at an underlying uneasiness or guilt, on behalf of both parents and children, about the fact that aspirations for educational use were not being met. It must also be acknowledged that it may also be a function of the fact that this research was being carried out by a university. Parents may have felt a reluctance to admit that their computers were being used for non-academic pursuits.

However, in spite of the majority of children spending most time playing games, there were also a minority (N=3) whose logging data revealed that they used no games at all. They were all girls. The domestic ecology that gave rise to this was interesting because it was relatively unusual. One child's family intentionally owned no games. This father said, *"we've only ever bought educational type games for [the children], rather than fun games. I've had to delete games [those packaged with windows 98] off the computer to stop me playing with them when I'm trying to work"*. They were the only family that had made this decision and consequently were the only family in which none of its members ever played any games throughout the logging period. Interestingly, this child used the computer least of all. Her average weekly computer use was only 6 minutes, suggesting that restricting her choice to educational software was not a popular decision.

Another child owned only 2 games, her parents said that this was because she was generally not interested in them and preferred academic activities: *"she's not really asked for anything like that [games]. She's got Carmen Sandiago [educational game] on there at the moment, that's the kind of thing she seems to like"*. The third child's teenage brother owned many games, and used them, but she (7 years old) did not have the interest or skill to play them. Whilst explaining why she did not like a particular game, she said, *"I don't like it. You can't control it an' that. When I first played on it, it was all, like, horrible. They had pink people an' that, green gunge that shoots and it was horrible"*. When the child was observed playing this game, which the manufacturers claimed was appropriate for her age, she became very uncomfortable and stressed. She was unable to remember which keys to use to operate features of the game and had a poor understanding of what was required of her. So, one of these three children was prevented from using games by her parents not buying them, and the other two children said that they had little/no interest in playing them.

With the exception of these three children, the average computer usage pattern conflicted with what the parents hoped for when they bought the computers; nearly three quarters expressed aspirations for educational use. The predominant use was for games (see figure 6.6), as was discussed by this father who said that in spite of his initial educational/work aspirations, *"[our teenage daughter] has used it quite a bit for Encarta for her homework, and word processing, we use the internet and email, and the rest of the time is playing games, me included. I guess if one were to cut up the pie, I guess recreation is a lot more than the other usage. When I say recreation, well, games".* When asked what his other daughter, who was involved in the study, used it for, he said, *"Games! Fun games, recreational. I mean she'll play solitaire or rattler race or whatever else is on it. She surfs the net a bit. So primarily it is games".* He manages this by withdrawing his support from them whilst they're playing games: *"a couple of years ago they [sons] spent eight hours preparing a PowerPoint presentation. Every now and they'd interrupt me and I'd help. They'll play about with visual basic, fine, I'll encourage them to use the computer like that as much as they want, but when they want to use games I don't express an interest in which case they don't get much response from me so they'll soon get bored. A lot of games tend to be shoot 'em up, I'm not interested so much".* This father did not deny his children the right to play games but instead withdrew his support, hoping that they would not enjoy them very much and quickly get bored. He was using his potential support as a bargaining tool, promoting it as being attractive. This father's support may have been valued more in this family as the older siblings (not the study child) were the only ones that engaged in a small amount of computer programming and the father's profession was as a programmer.

The above section indicates that most children had a broad range of software to choose from, which raises the question of how they decided which to select for use. Bearing in mind that the most common reason for purchasing a computer was to support the children's education, did this mean that parents played a major role in guiding their children towards educational software? In fact, many parents said that their aspirations that the computer be used for education were difficult to follow through. The following are comments from some of the parents who expressed problems: *"I do encourage them* *but when I'm not around they play games on it", "it's a bit like exercise machines, you have great intentions but the reality's a bit different", "[education] was the idea but that's not gonna happen*", "*you're flogging a dead horse*", the children have "*other things on their minds*" and they "*don't want to learn*", or they "*can't be bothered*". Putting their educational intentions into reality seems to have been a widespread problem for many of the parents and many said that their children actively resisted their efforts.

For most families, this problem appeared to have been discovered quite soon after purchase and was accepted quickly. Every parent, with only one exception, said that beyond suggesting using the computer as an activity when their child was bored, or directing their child to a CD-ROM reference item when they asked a question, they did not encourage any specific educational use of the computer. They generally left it up to their child to decide what activity to choose: "*I think they find their own way, they find their own interests rather than sort of have, have someone pushing them from behind*" and "*we've given them a lot of freedom in choosing. We see education as part of life and growing up, not the be all and end all of life, and they get a lot of education through school. At home, they get a lot of freedom to choose what they do*". In fact, many parents actively resisted dictating what their child should do. To some extent this was associated with doubts about the appropriateness of encouraging educational computer use. So, one parent said that "*I leave it up to her. I think she's too young to be pressurised. School can provide what she wants at the moment*". Another argued "*the kids come home from school, they've been at school the whole day, what they don't want is to come in and for me to say 'now go and spend an hour doing your SATs tests*". These comments are an illustration of parent's lack of awareness about how computers can support their children's learning above and beyond the use of educational CDROMs. The above parent used practicing SATs tests, using a computer, as an example of out-of-school learning. He/she does not acknowledge awareness of how the computer can support other more informal learning, such as the benefits of playing games (chapter 3), for example. These findings also suggest that contrary to their initial aspirations, many parents had changed their views and felt that it was inappropriate to expect their children to carry out computer-based, formal educational activities in their leisure time.

Some parents recognised the problems of drawing children into activities that were not intrinsically engaging and argued that it was the attractiveness and alluring nature of the software, rather their own encouragement to use it, that was important: the software had to *"keep them there", "some of the software is very encouraging in the feedback it gives to the kids, which is why he likes it, its actually interesting. It has to stand on its own merits really and be chosen because it's fun, good feedback, interesting"*. Two of the parents interviewed were particularly insightful in observing that the more formal atmosphere at school made a big difference, but that this was not an atmosphere that children would easily tolerate being imported into the home: *"...they might be more likely to use it [educational software] at school if the teacher says "you are doing this one" We don't do that [at home], if we did then they might not do it".*

This is an important observation. These parents were acutely aware that the home and the school ecologies were very different and argued that the appropriation of a structured environment into the home would not be acceptable to their children. In this case, the child would resist, being unwilling to accept their parent's authority over something that is usually associated with the role of the teacher. This is an important indicator of why it was so hard for parents to encourage use of educational software. They did not feel that it was their role to verbally "*pressurise*" their children into carrying out educational work in their leisure time. It seems that the provision of the hardware and software is where parental input ends. Parent's attitudes towards learning in the home will be explored further in section 7.8.4.

Contrary to this majority view, one set of parents did endeavour to orchestrate a predominant use of educational material: *"we just tell him that he can't have his go if he doesn't do something educational"*. But this was not easy. The child found ways around the ruling: *"he's very crafty though. I set him up and tell him to do his bit, then I tend to leave them alone, and you come back in and he'll have put on whatever he wants and turned the volume down so that we can't hear it. Not only that but he'll load and unload stuff, he'll install it, play it, and take it off"*. This parent introduced a rule that in order to play games, her son must first use something educational for a specified period. This was unacceptable to him and he found ways to disobey her. This is a good example of how unpopular educational software was to children and the problems that some parents faced in trying to encourage its use in the home.

7.3.3.3.3 Summary of community practices that mediate use of the home computer

It is apparent that families owned a wide variety of software resources, from educational games, reference tools and electronic books to the more entertainment oriented games software. These support a broad range of computer uses, although the use of entertainment games was most popular (see also chapter 5). This assortment of uses of the computer supports what has been found in the previous studies that were reviewed in section 3.3.2 (e.g. Downes and Reddacliffe 1996, Giacquinta et al 1993, Livingstone et al 1999, Sutherland et al 2000). The present study has enriched these findings by putting forward a categorisation system for software and carrying out objective computer logging. It has also adopted an ecological orientation to making sense of the relevant activity.

With regard to software purchasing, an interesting difference emerged between decisions concerning buying a new game, and decisions concerned with buying a new educational title. Games purchasing was more casual, the inspiration was more likely to be child initiated, and the child may even have bought it by themselves. On the other hand, educational software purchasing involved a deeper consideration of the contents, by parents. They were concerned that it should support the school curriculum. This is a reminder of the important role that the institution of school has in mediating activities in the home.

However, the infiltration of school values, into the home, was not always readily accepted by children or parents. Some parents reported that attempts to encourage educational software use were actively resisted by their children. Many parents thought that attempts to pressurise their children in out of school hours were inappropriate. This reluctance to suggest activities supports and expands upon Pasquier (2001). She reports that throughout the whole of Europe, the focus of conflict around computers is on controlling amount of use and appropriate times for use, rather than on controlling specific software content. In spite of this difficulty, many parents still bought educational titles for their children, suggesting that the parents' role had evolved into one in which they provided the hardware and software only and did not encourage, or sit with, their children. This is a clear indication of how parental aspirations, held at purchase of the computer, were not met in reality.

This summary hints at the role that the school had in mediating practices in the home. The next section of this chapter will explore this more closely. It will consider how domestic practices are mediated by institutional factors i.e. the outermost layer of the concentric circle model. It will report findings from interviews with the families about their perceptions of the role that their child's school had on family life.

7.3.4 Institutional mediation

Previous sections have discussed the role that some external institutions had on computer purchasing and use e.g. advertising and government promotion of ICT. This section is concerned with investigating how the institution of school mediated the learning culture that existed in the family homes. This was an important part of the cultural context of children's home lives and was directly related to their role as a learner. It also played a part in shaping their uses of the home computer. In order for school to play any role at all, it was necessary that parents should have some knowledge of the activities that took place there. Primary schools have a practice of displaying children's work on the walls (see 5.5.4). To what extent does this display of community products occur at home? Parents were concerned to purchase appropriate educational software, that supported school-based activities, but to what extent were they aware of what their children do on a daily basis in school, both generally, and in relation to the classroom computer? Were parents willing to accept the role of informal educator? More specifically, did they support children with their homework?

7.3.4.1 Institutional mediation: parent's school-related knowledge

As a means to exploring the type of 'education-culture' that existed within these families, parents' general attitudes towards their child's education, as manifested in general commitment to school-activities and awareness of what happens at school, were investigated. Ninety four per cent of parents knew the name of their child's teacher/form teacher. The two parents who did not know were both fathers. All parents said that they regularly attend school-instigated parent-teacher interviews and two parents (both with a dyslexic child) had themselves instigated a meeting to discuss their child's special needs.

All parents had some degree of awareness about the activities that their child was engaged in at school. This ranged from most parents being vaguely aware e.g. " *...she's enjoying her english but I don't know what specifically she's done. Maths is hard but quite enjoyable*", to a few parents with quite detailed awareness e.g. "*history on the Vikings, maths and fractions, adding in the hundreds, point two five equals a quarter, in english just stories*", although no parents knew exactly what was being done in detail on a daily basis. It should be borne in mind that these particular interview questions were asked in the few weeks before the first parent-teacher interviews of the academic year. Most parents said that their knowledge of school activities came from helping with homework e.g. helping to gather information for a project or learning words for a spelling test. These findings suggest that parents' knowledge of what their children did in school was patchy. They appeared to trust what the school was doing to the extent that they felt there was little need to closely monitor their child's activities, except when their child had special need requirements. Is this low level of knowledge reflected in their awareness of the child's computer activities in the classroom?

7.3.4.2 Institutional mediation: parent's understanding of school computer use

Parents were asked whether they knew a) how frequently their child used a computer in school and b) what activities they carried out using it. Bearing in mind that two thirds of parents bought a computer to support their child's education, their level of computer related awareness was surprisingly low. Only 35% of parents had a good idea of how often (i.e. how infrequently) their child used the computer at school, the other 65% either did not know or overestimated the frequency. With regard to parents' knowledge of school computing activities, only 9% had good knowledge (2 of these parents were teachers). One mother, a teacher in her child's school said that her child had done *"word processing, she's been on the net, done graphics and the turtle roamer too"*. Another 59% of parents were more vague, for example: *"I would say two or three things this year, its still very basic, using the keyboard and how to access the computer"*. The remaining 32% had very little or no idea. Responses to a question about whether they were aware of what their child used the computer for in school, varied between *"dunno!"* to *"not really no, no. They have played zoombinis. He did tell me something the other day but I can't remember what it was"*.

Most of the parents relied on scant information from their children, and from the computer-generated, printed out work they brought home. One rather exasperated mother said, *" he doesn't tell me at all. He only reports "games", as for the rest of it he doesn't use anything apparently"*. This low level of awareness indicates that school computer activities were not routinely discussed at parent teacher interviews. This was confirmed by a mother who said, *"I've got no idea [what she uses it for], I don't actually know. When you go up to parents evening you sort of look through maths books and english books, but I don't think I've ever discussed computer work"*. It appears as though parents' aspirations for educational computer use, which existed at purchase, were not followed through effectively. On the whole, knowledge about how the computer could potentially support specific school based activities was poor because parents' were not fully aware of the activities they could be supporting. This raises the question of whether closer ties between the home and the school would be beneficial. One set of parents were particularly disappointed by their child's school's lack of help in advising how they could best make use of their home computer. They said, *"I did ask the school once about software and basically they said they didn't know, especially with [our daughter] being dyslexic we could get the identical software at home and she could come home and do it.*

We haven't had a clear guide in terms of software that would help her". This lack of advice may point to a need for renewed efforts on behalf of schools.

Parents' general lack of awareness about school computing activities was interesting. Their ability to guide their children's educational home computing activities, in relation to what they did in school, was hampered by this lack of knowledge. Another reason for this lack of awareness may be due the children being unable to disengage their computing activities from the broader lesson into which it has been incorporated. These young children may find this difficult to achieve. Is this shortfall in parents' knowledge related to their stance on the degree to which they feel that home learning is important or appropriate? This question will be addressed in the next section.

7.3.4.3 Institutional mediation: parents' views about learning at home

Parents' views about, and attitudes towards, the appropriateness of their children continuing their learning at home are central to the general educational atmosphere that exists within families. With this in mind, they were asked to discuss their opinions on this topic. The nature of the home learning experience, in terms of their child's enjoyment, was one issue that they raised. Seven sets of parents said that it was important that home learning, both with and without the computer, was fun and enjoyable. One parent described how they practised spelling and tables at home: *"if there's a fun way of them doing that at home then I would support that. We tend to play spelling games sometimes in the car or number games at home. It has to be a fun thing that they choose to do and the by-product is that its supporting the work they're doing at school."* With regards to computer-based activity another parent said that *"if you can learn while having fun its always far better."* These responses indicate that dull or monotonous experiences were not favoured by parents or children. They also support the earlier discussion of how parents preferred not to pressurise their children into learning at home. The above quote indicates how important spontaneity and fun were to both parents and children.

Parents said that another important aspect of learning at home was that it was instigated by the child and that parents do not appear to *"ram things down their throats"*. Seven parents said that they were anxious not to appear to be *"hothousing"* their child or pressurising them in any way. One parent said that as a family they had never considered buying educational software *"because I really, really disapprove of things like hothousing children"*, she went on to say that *"I think children have quite enough learning allotted to them in school. I don't think in the end it helps to keep making them do extra work outside school. I'm happy if its something that they do that's very pleasurable to them, I never stop them going and getting serious books out of the library. But that's their choice and their interest and how they want to spend their leisure time. I don't think I'd want to force them. I'm not really in to this thing of hey I want to get my child to be able to do A level when they're thirteen"*. Another parent agreed with this by saying *"we're happy for [our son] to have a balanced life rather than hothousing him in a certain direction"*. One parent, a teacher at her child's school, was particularly concerned that using some types of educational software at home would *"seem a bit too much like bringing school home"*. She felt that some titles *"were a bit too educational for having at home*" and, again, that it would be *"too much like ramming it even more down the children's' throats"*. Another parent was concerned that her son would become disinterested if she forced him to use software that he was not very keen to use: e.g. *"I think if he enjoys it then he'll use it, but I certainly wouldn't sit him there and say "look I've bought you this, you will use it". He'd get frustrated with me, or he'd just get fed up"*.

Four parents mentioned that their child put up resistance to learning at home, which could be a problem to overcome. One said *"They can't be bothered. They go to school, they come in, they're knackered, they do their homework. They have some tea, watch a bit of TV and go to bed"*. Another said *"if you give them a subject and they think that it might even slightly have a relationship to school, to work, [they say] huh? Ooh no!"*. These responses are important in that they reveal how prominent enjoyment and self-initiation is to children learning at home. Parents were reluctant to force their children, or coerce them, into undertaking activities that they would prefer not to do. Again, this suggests that parents were pleased to provide the computer hardware and software, but that this was where their main efforts ended. Did this reluctance apply to policing homework as well?

7.3.4.4 Institutional mediation: parents' interest in, involvement in, and views about homework

Homework is an interesting area to investigate because children (theoretically) have no choice but to carry it out. It is different to other types of learning in the home because it is less voluntary. It can also be used as a measure of parents' general attitudes towards the school agenda, their willingness to support their child in carrying it out and their acceptance of school work being brought into the domestic setting. Were parents' attitudes to homework any different to their views about more voluntary computer activities? All parents were able to indicate a high level of awareness about the content of their children's homework in that they were able to give examples of the type of homework that their child received. Moreover, they all claimed to participate in its completion to varying degrees. One mother discussed how she helped when necessary: *"I'll look over his shoulder, and I'll let him do it, but if I see he's getting into a pickle I'll just sort of explain it*". Parents of the older children, who had, by the time this question was asked, just started secondary school, tended to let their child complete it unaided unless they asked for help. Parents were asked whether they had much input into their children's homework and a typical reply from parents of 11 year old children was, *"no, not really. Sometimes she'll say "oh mum what do you think?" But often she'll just sit and get on with it"*. Parents of younger children were more inclined to be closely involved, as the nature of the work required more parental input, e.g. practising tables, learning spellings or reading a book. Other more solitary activities for the younger children included practising handwriting or completing sums. All but one of the children said that they were glad of their parents' help. The remaining child said "*If I'm stuck and I ask [dad] for help he'll give me an hour's lecture so I rarely ask him"*.

In an attempt to explore whether homework was carried out in close association with the family community, children were asked to describe where they typically sat whilst carrying out their homework. Sixty six percent of all children carried out their homework in a public area of the house i.e. kitchen, dining room or lounge. Only 9% worked in their bedroom and 25% used both bedroom and public area. So most children carried out their homework in a public area where adult help was likely to be easily accessed, and all parents were willing to help. What were parents' views about the appropriateness of home work?

Ninety four per cent of parents agreed that homework was a good idea. For example, one father said that its *"Great, good idea, it gives them an opportunity to work by themselves, away from the school environment. Its about working by yourself and practising researching skills too"*. There were two sets of parents (i.e. the remaining 6%) who disagreed with this general opinion. One father said, *"I'm not wild about it really, I'm not convinced its necessary at all. I think that if they [teachers] can't get through, in the number of hours that they've got, what they've got to get through, then there's something awry somewhere"*. His wife agreed and backed him up by saying *"...if people were at work you wouldn't expect them to bring their work home with them...if they [children] mess about and haven't done what they were asked in the class, then fair enough...but if you've done your best all day then you should come home and muck about"*. The other set of parents agreed with this. The mother said, *"I don't think they should have it. I think they should read lots, but I think homework's pretty tough"*. Again both parents were in agreement. The father said *"it's a bit excessive"*.

It appears as though, in the majority of homes, homework had been accepted and incorporated into family activities. The next section investigates whether the same applies to the classroom practice of displaying children's work on the walls.

7.3.4.5 Display of computer products

Parents and children were asked questions about the destination of any computer generated products. This was of interest because these were cultural products that may be reabsorbed into the community from whence they came. To what extent were these products shared amongst family members? On the whole, there was very little social celebration of computer generated work in the homes, although most children had at some time saved their work to a file. Two homes did not own a printer at the time of the study so production of printed material was not possible. Only three families reported that their child's computer based work was currently on display in the house (in the kitchen, father's office and child's bedroom respectively). But nonetheless the logging data and the interviews reveal that computers were used to make lasting products such as cards (see appendix 19), banners, posters (see appendix 20), invitations, place settings, letters, emails, book marks (appendix 21), pictures for the teacher (see appendix 22), booklets to distribute amongst friends, and signs for bedroom doors (appendices 23a and 23b). One family had used large fonts in a word processor to produce lettering which was then traced onto the bathroom wall, spelling out French words (e.g. salle de bain, chaud) which were then hand painted (see appendix 24 for a photograph). One child used his computer to make slide shows for the family. Game scores were a more transient form of product although one child wrote down scores on paper stuck to the computer's monitor for siblings to challenge. Only one mother reported that she knew her child's score on a maths game, although some children did print off the certificates available in the games once a level had been accomplished.

The list of products in the above paragraph appears extensive, but it hides the fact that actual products, such as those in the appendices, were extremely hard to find (this supports Sefton-Green and Buckingham 1998 who found it hard to find products generated by their study on adolescents' creative uses of the home computer). Generally they were not kept at home for very long, with parents throwing them away after a few days: *"I keep some of them, but sometimes I lose them or they get picked up in a pile and thrown in the bin".*

7.3.4.6 Institutional influences: Summary of findings

It has become apparent that parents' knowledge of the activities that their children were engaged in at school was scant. No parents had a detailed understanding. This also applied to classroom computing activities. This finding is surprising given that one of the reasons that parents gave for purchasing a computer, was to support what their children were doing in school. This suggests that it was not easy for parents to carry out their initial aspirations. Some felt that information and advice from schools was less than satisfactory, making their task very difficult. Parents also discussed how any attempts on their behalf, to encourage use of the computer for academic pursuits were actively resisted by their children.

However, it is encouraging that parents were willing to help their children with homework (the home-school contract requires this). With the exception of two sets of parents, the general attitude towards homework was that it was beneficial and appropriate. All parents contributed in various ways and were concerned that it should be completed. This was in stark contrast to their opinions about the appropriateness of their involvement in less formal means of home learning. It appears as though homework had a certain authority because it was set by the school. Its intrusion into family time was embraced. If schools became more concerned with promoting educational home computer use, then maybe parents would be more willing to encourage it.

7.4 Discussion

This chapter has taken an ecological perspective on children's home computer use. It has described some of the features of domestic ecology that work to constitute children's access to, and use of the computer. When these findings are considered alongside those presented in chapters 5 and 6 it becomes apparent that the ecologies of home and school are very different and that they mediate different computing practices in either setting. The differences in school and home computing practices are a reminder of just how situated they really are. Children's cognition cannot, therefore, be usefully conceptualised as a context-independent function located only within the skulls of individuals. Instead cognition has to be reformulated to capture participation in situated and mediated activity, stretching "beyond the skin" (Wertsch 1991 p27) of the individual. Each child's experience was closely mediated by the context in which they find themselves acting. It is a discussion of the differences between the contexts of home and school that will form the rest of this section. This will shed light on some fundamental differences between the two contexts and will contribute to understanding why children's use of home computers for academic pursuits is so scant (see appendix 25 for a table summarising the main differences between the two contexts).

Ecological differences emerged right from when the computers were first bought. School computer purchasing was carried out with a view to fulfilling curriculum requirements. A computer was bought with the intent that it would be used solely as an educational tool. The institutional setting into which it was placed dictated that there was no alternative. This contrasts strongly with computer purchasing at home.

Families expressed several reasons why they wanted to buy a computer, ranging from education to entertainment, although the most frequently cited reason was to support children with their school/home work. This finding supports the range of responses found in previous studies (e.g. Downes 1998a, Giaquinta et al 1993, Livingstone et al 1999, Sutherland et al 2000). In the present study, three quarters of parents had strong aspirations for educational use of their home computers. At purchase, parents held firm views about what activities they deemed to be appropriate and desirable. Work and education were both considered to be worthy uses of an expensive machine. On the other hand, only a minority of parents embraced the computer's potential role as an entertainment tool, or games machine. In fact this possibility acted as a strong deterrent, against purchase, for some parents.

What is evident in all of these responses is that the majority of parents wanted to buy a machine that would facilitate the importation, into the home, of activities that traditionally took place outside of its walls i.e. work and education. This may be in response to the current government's position on wanting to encourage parental involvement and responsibility in their children's education (e.g. DfES web site). It also may have been encouraged by the fact that they are aware that children are growing up in a technology rich world which gives precedence to technology as a gateway to "information" and that they do not want to deny their children access to such a rich learning resource. Alternatively, advertising may have a role as the computer, and educational software, are often portrayed as being desirable family tools. Also, they may be seeking to justify spending a considerable amount of money on a computer. Whatever the reason, or combination of reasons, parents faced the task of having to blend the external ecology of the classroom into family life. This proved to be problematic and the problems that arose will be considered as this discussion progresses.

Contextual differences between the settings of home and school were also apparent when teachers and parents decided where to locate their computers. Teachers in primary schools had little choice over where to locate their classroom computer. The decision was made at institutional level. With very few exceptions, it was standard practice that each teacher found the space for their own computer within the classroom's boundaries. Sometimes this was less than ideal, with children complaining about, for example, cramped space or interruptions from ongoing classroom activities. Institutional requirements and norms took precedence over physical and social comfort.

Compared to the classroom, parents were open to many more location possibilities within their homes. When discussing location, the issue of encouraging and supporting appropriate computer use arose. Parents were concerned that their aspirations for educational use were supported by a suitable location. For example, they wanted to ensure that such a valuable tool was equally accessible to all the family. They were also eager to place it in a location that would facilitate parental supervision of the child learner. Serious, constructive use was an issue for another family who decided on the bedroom as a location separate from other more playful family activities. Others were prepared to tolerate what they considered to be an ugly machine being brought into their home so that their children's education could be supported. This degree of choice, compared to that in school, meant that parents had to take several factors into consideration.

It also became apparent that bringing a computer into the home was a source of conflict. Many families were torn between wanting the computer in their home on the one hand, and not wanting a work-related tool in family space, on the other. Merging an "officey" computer into "relaxation space" was difficult to accommodate and, in one family, involved the unwelcome remediation/relocation of family meals. Some families were protective of their domestic space and prioritised its use for leisure. This meant that they decided to position their computer in a peripheral location, such as a bedroom, or in a dedicated work space like a study where conflicting use of space would be less likely to arise. Another way in which this conflict arose was when there was no option but to put the computer in the vicinity of the television. On most occasions the television was given priority. There was only one family who had purposefully put their computer in the lounge in order to facilitate interpersonal communication between the computer user and other room users. So, the introduction of a computer into domestic space was not smooth and often involved compromise and conflict.

Another area in which differences between home and school have become apparent is in the computer access arrangements of the two locations. Access to the classroom computer was rigidly controlled, usually by teacher generated rotas. This had the effect of ensuring equitable access to all children, of both genders. In school, children generally obeyed the rota, making it unlikely that there were arguments about turns at the computer. This was unlike the situation at home.

The lack of institutional formality in the domestic context meant that computer access was more spontaneous than in the classroom. A child could potentially access the computer at any time of the day. This was problematic for parents who were concerned with ensuring that computing activities did not interrupt other family pursuits, such as dance classes or household chores. This often motivated them to generate rules that were designed to avoid this problem. In addition to these rules, others were also formulated in an attempt to control frequently occurring access-related arguments. This finding supports previous studies (e.g. Downes 1996, Facer et al 2000). The frequency of arguments, and the necessity for rules, is a reminder of how valuable a tool the home computer was to these children. To some children, access was prized to the extent that they tried to subvert the rules to either gain more access or to lengthen their sessions.

Another feature of the school and home ecologies, that directly mediated the uses that the children were able to make of the computer, was the software that was available. Classroom software directly supported the objectives of the national curriculum and was therefore educational in nature. The institutional setting was a strong mediating factor so there were no entertainment games found in any of the classes. This contrasted strongly with the software available to children at home.

At home there were, on average, more educational titles than entertainment games. This was consistent with parents' aspirations that the computer be used as a support for learning. However, the availability of games at home meant that children had a broader selection to choose from. This difference between classroom and home software is mediated by the two different contexts. School software purchasing was driven by the institutional requirement that it supported education, whereas at home this was less of a concern. At home, the lack of a formal agenda meant that software provision was more flexible. However, this flexibility led to a conflict of interest for some parents. On the one hand, they conceptualised the family home as a place for relaxation and entertainment and bought their children entertainment games, but on the other hand they were also keen to provide their children with educational software. The computer logging statistics presented in figure 6.6 clearly indicate that children perceived their homes as a place for entertainment and not for education i.e. they played games most of the time. This directly conflicted with parents' aspirations at the time of purchasing the computer. Parents tried their best, and provided educational software, but the children chose not to use it. The appropriation of educational practices, from the classroom into the family home, was not easy to achieve.

Children's computer use, in either setting, was also mediated by adult encouragement to use specific genres of software. In the classroom, teachers planned use of specific software as a support for their lessons. They chose it and directed the children towards it so that the children, during lessons, were not given any choice in software selection. At home, the situation was different. Parents reported that they had very little, if any, role in their child's choice of computing activity. They said consistently that encouraging their children to use educational software, outside of school, was inappropriate. Some parents said that they considered any encouragement on their behalf to be "hothousing" or "pressurising" their children. Parents drew a firm line between being a casual, informal educator (e.g. reading bedtime stories, playing number games) and taking on a more formal or forceful role.

At home, children had a more influential role on their parents than they do at school over their teachers (Mayall 1994). Compared to school, adult authority is more open to challenge and was less salient at home. Children have agency at home and are relatively powerless at school. These differences can be used to partly explain why parents found it difficult to coerce their children into academic computing at home. Parents, used to giving their child a voice, and used to negotiation, did not feel comfortable with adopting a less flexible and more authoritarian position more usually reserved for teachers in school.

Family activities were not arranged by a written agenda, instead they were fluid, spontaneous and improvised. This was the acceptable face of family life and is one reason why the imposition of school-related, academic formality was so problematic, and resisted by both parents and children. This was a point recognised by some parents who claimed that the educational environment of the school, and the formal role of the teacher, were more likely to facilitate structured, academic use of a computer than the informal environment of home. Hence, the integration of behaviours usually associated with the classroom (e.g. discipline and structured learning), into the home, was not easy. When parents attempted to do so they were met with resistance from the children and they often felt that they were "flogging a dead horse". They preferred their child's computing activities to be spontaneous and self initiated. It seems that parents perceived their appropriate role to be hardware and software providers, and not to involve policing of its use. How the software was used, was in the hands of their children.

This reluctance to adopt a tutorial role may have been a reason why parents did not regularly sit with their child at the computer. This contrasts with the classroom where children's computer use was likely to be a social experience: shared or collaborative use was the norm. School children were keen to ask the teacher for help and a teacher was always in the vicinity. The teacher's help was structured and goal directed i.e. relevant to the educational task in hand. This was very different to what was found in the family home, where the child user was alone for the majority of the time. This finding supports previous studies (e.g. Orleans and Laney 2000 and Pasquier 2001). Children at home also actively sought an autonomous experience and were reluctant to ask for parental assistance. Parents, too, gave many reasons why they did not regularly sit at the computer with their children. They were available to be consulted but at a casual, generally non-tutorial level. It appears as though opportunities for scaffolding children within their zone of proximal development were limited.

In the light of the above observations, it is also interesting to discuss the findings regarding parents knowledge of their child's activities in school. Most parents knew the name of their child's teacher and all regularly attended parent-teacher interviews. However, they revealed that their child's classroom computing activities were not routinely discussed at these meetings. This, together with children's general reluctance to discuss their daily endeavors at school, meant that parents had scant knowledge of classroom computer use. Parents said that they relied on the completed work that children intermittently brought home (e.g. stories or pictures), and their homework, as indicators of what their children were being taught in their lessons. Only those parents of children with special educational needs mentioned that they had asked the school for more information. It appears that although parents held educational aspirations for use of the computer, they had little insight about exactly how it could be best used to support their child's classroom activities. This is an area of home-school communication that needs to be addressed by schools if parents are to become more effective informal educators.

What has become apparent throughout this chapter is that upon purchasing a computer, most parents held educational aspirations regarding its use, and that these aspirations were not met in reality. The discussion above identifies some of the problems that parents faced when they tried to integrate school-related education into the domestic sphere. The institutional setting in which teachers work was more supportive of them delivering an educational agenda, than the domestic setting is of parents. Teachers' roles are clearly defined, whereas parents have to struggle with balancing multiple possible roles. It has become clear that they do not readily embrace the role of formal educator and that their children do not wish for them to adopt it either.

Cultures of computer use in either setting are situated to such an extent that transfer of activities from one context to the other is very difficult, if not impossible. There appears to be a contradictory message coming from the parents. On the one hand they bought a computer and own more educational CD-ROM's than entertainment games. On the other hand they do not encourage their children to use it. It seems as though they view the computer as the "right" thing to have but do not really know what best to use it for. Some parents expressed the opinion that they think their children "get enough education in school". Parents seem to agree that school provides the time and the place for their children's formal education, and that whilst at home, relaxation and entertainment take priority. However, the picture portrayed in this chapter has not been that educational or creative home computing is non-existent. The differences between home and school are interesting in that some parents recruit the educational agenda into the home to various degrees. However, the overarching message from this chapter has been that just providing the tool and desiring certain forms of computer use are not the necessary precursors for assuring that it will be used as parents wish. Contrary to advertisements that promote the computer as a contextually independent, multi-purpose tool, with users able to swiftly adapt to its different roles, another, more realistic picture of computer use, as being firmly embedded in local ecology, has emerged. It is extremely important that attention is paid to features of the domestic ecology that, together, mediate children's computer access and use if the computer is to be used more effectively as an educational tool.

Chapter 8

Novel educational software in the home

8.1 Introduction

The previous two chapters in this thesis have been concerned with investigating children's undisturbed, naturally occurring, domestic computing practices, and the local and institutional ecologies that mediated them. The research has utilised objective and thorough logging of family computers. This has painted a more reliable and in-depth picture of home computer use than the methodologies used in previous studies. Data collected from interviews and home visits has also demonstrated how children's computer use is contextually embedded. The contrast of classroom and home settings has drawn attention to the issue of how the home computer is used to support children's out-of-school education. One of the central findings so far has been to that, contrary to parent's expectations, children do not routinely use educational CD-ROMs, at home, as a support for the classroom-based learning. Although educational software is more widely available and more attractive than it was in the 1980's, and although parents themselves focus upon provision of this resource as a way of meeting their aspirations, and buy more educational CD-ROMs than they do games (section 6.3.3), children still prefer not to use it.

The overall aim of the research was to investigate how computing practices in the classroom and the home are contextually situated. It has emerged that education is a strong contextualising theme for parents who were keen to provide their children with a tool to support their classroom-based learning. The previous studies in this thesis have taken a snapshot of home computer use; they reported findings from well-settled systems of activity. But how did children's minimal use of educational CD-ROMs evolve, over time, from when such titles first arrived in the home? Were they always rarely used? Can children's interest in educational CD-ROMs be rekindled if they have new titles to use?

One way to answer these questions is to track the fate of educational software use over time. To this end, each child was given six novel titles, representing genres that had spontaneously been bought by the families in the past. This simulated an occasion, such as a birthday or Christmas, when new software could be bought for a child. This methodology allowed its use to be tracked from initial reaction, through early usage, to monitoring how use settled down after a few weeks of exposure. It was also important to establish what the parents and children thought of these new titles and whether or not they were positively received. These responses might shed further light on why educational titles are relatively unpopular.

Sales of educational software have more than doubled since 1995 (Mintel 2000). This is in conjunction with products becoming cheaper, more visible and more widely available. In 1999, children's software took 56% of the home software market (Mintel ibid.). This burgeoning market means that users have a vast range of titles to choose from and, as discussed in chapter 7, a wide range of possible outlets, such as high street shops, computing magazines and software "parties" and the internet. Today, there are tens of thousands of educational software titles available. There are so many that web sites (e.g. evalutech.sreb.org) and organisations (e.g. Parents Information Network) have arisen, and books (e.g. Association for Revision and Curriculum 2000) and magazines (e.g. Children's Software Review) have been published that evaluate educational software and offer advice to parents and teachers on the best products. The current research has indicated that parents often buy this type of software for their children and that households typically own more educational than entertainment titles. Yet they are actually used comparatively little. There have been no studies, to date, that investigate exactly how children and parents make use of new titles, which is what the first part of this chapter will address.

In addition to this, the current chapter will consider how features of software itself may mediate how it is used. Accordingly, parents' and children's opinions of the novel titles were sought in interviews. These are discussed in the second part of this chapter. So, this chapter is concerned with investigating how novel educational software is appropriated into the home in terms of a) its use and b) families' opinions of it.

However, before the current research is considered further, other related research in these two areas will be discussed. Section 8.1.1 will consider previous research into how children make use of educational software and this will be followed, in section 8.1.2, by a discussion of previous studies that have explored the features of educational software that are important to parents and children.

8.1.1 Use of educational software

To date, there has been only one major study into children's use of academic software at home (Giacquinta, Bauer and Levin 1993). This was carried out in the USA in the 1980s, at a time when hardware and software were very different to the present day. These researchers took a snap-shot of computer activities and did not adopt the longitudinal perspective used in the current study. They found that, at that time, in spite of the availability of educational software, use of the home computer for education was minimal. They found that in 51% of homes there was no academic software and hence no academic computing. This is perhaps not surprising considering it was a relatively new product at the time. This finding is in contrast to the situation in current homes, as reported in chapter 6, where all families owned varying quantities of educational software. Giacquinta et al (ibid.) also found that in 30% of homes there was academic software present but an absence of use (making a total of 81% of homes where any type of educational computing was completely absent). In 17% of homes there was software present and it was used sporadically, and in only 1% of homes was there regular and ongoing academic computing. These authors describe the types of academic computing that took place in homes in terms of word processing, programming, typing practise, use of images for school work, drawing, practising tests and composing music.

These findings are very different to those discussed in chapter 6. The type of software owned today is different and all children were engaged in various, albeit usually minimal, levels of broadly educational activity. However, the findings can support Giacquinta et al (ibid.) in their conclusion that educational computing is "not very serious or consistent" (p34). Given that more than fifteen years have passed since Giacquinta et al's study, and that hardware and software have undergone significant change, it is important to investigate present-day uses of educational software. The research considered in the current chapter took an innovative approach by adopting a hitherto unused methodology. It will track how new software is appropriated into the family home over several weeks. This will give a longitudinal perspective.

8.1.2 Parents' and children's opinions of educational software

Giacquinta et al (1993) asked parents to describe why they bought little educational software. Their replies indicated that they held negative opinions regarding its design features. The researchers found that in 1980s America, family knowledge of the available products was minimal. Many parents thought that the software was "unreliable" and came with "poor instructions" for use, which discouraged them from purchasing it. They thought it was "mindless", "basic" and "inadequate". Children often shared this negative view. These authors reported that many children found the software "tedious" or "dumb". Cost was an issue for some parents who considered it not worth the money. Many families also said that they thought educational software was only suitable for children that were having problems with learning and did not perceive it as a useful support for children that were not struggling at school. These points are helpful in determining why parents did not buy much educational software in the 1980s. However, these researchers did not explore opinions about the specific design features that made the software "mindless" or "inadequate". The current study will update these findings in a different national context. It will ask children and parents for their views on software and investigate whether or not these opinions are related to how often the software is used.

More recent research has addressed this issue, although there are still very few studies that have explored the features that children consider to be important. Most magazine or internet software reviews are written by adults and for adults. So children's opinions are rarely made public. However, there are a few studies that do discuss some features that children prefer. Druin, Bederson, Boltman, Miura, Knotts-Callahan and Platt (1999) found that children prefer software that aids easy learning i.e. involves no struggle, that does look down on them as children, and that looks visually attractive. Wilson (1998) found that children like authentic graphics and good quality animation. They also prefer music with a good rhythm and enjoy software that contains a good amount of gaming. They do not like to be frustrated by lack of instructions or by difficult problems.

Tammen and Brock (1997) asked 5-14 year olds to review seven titles. They report that the children's opinions could be defined in terms of six features: Firstly, that the product should provide good educational *and* entertainment value, by being creative, lively, interesting and age appropriate. The second feature was that it should raise their skill levels in a specific, identified area. The third important feature that the children reported was that software must provide a way for them to measure their own progress, such as providing feedback about mistakes and wrong answers. The fourth feature was that the programme must incorporate speed. Programs that ran slowly were regarded as "tedious". Variety was the fifth feature. They reported that software should incorporate various graphics, colours and skill levels. Finally, the interface was important, with a particular emphasis on seamless navigation, a variety of choices and obvious prompts and icons. Not being able to exit or escape easily was a particular frustration that they mentioned. All of these preferred features suggest that the development of software that pleases every child is a very difficult, if not impossible task. They also indicate that children are able to vocalise effectively a wide range of features and that therefore their opinions could be taken into account.

This introduction has identified two areas for further research in this chapter. The findings in chapter six illustrated that educational software was used relatively little, but the point of interest here is to explore how a pattern of usage <u>evolves</u>. Does the use of educational software wax and wane? Does it, at some stage in its domestic life cycle, get put on the shelf and forgotten? The second area of research is parents' and children's opinions of the novel software, representing several different genres. Did they like the software? What were the design features that parents and children considered important? These two strands of research involved different methodologies, which will be discussed next.

8.2 Methodology

The aim of this part of the study was to track, over several weeks, how the same 33 families made use of 6 educational software titles that they had never used before. In addition to this, parents' and children's opinions of these products were also sought by asking them questions in interview sessions. What follows are details of the methodologies used.

8.2.1 Participants

The same 33 families participated in this part of the study. Unfortunately, at this stage, one family with a nine year old child had to withdraw, as their computer had technical problems and would not run any of the 6 titles given to them. Another family, who had never provided any computer logging data because their computer would not run the log-in software, decided to stay in this stage of the study. They would provide useful interview data regarding the 6 titles, even though their actual use of them was not monitored. So at the beginning of this stage of the study there were 31 families potentially providing computer monitoring data and 32 families providing interview data.

8.2.2 Materials: Novel educational software titles

Various educational software companies were approached by mail and asked whether they would be willing to donate any of their titles to the research project, in return for access to the findings. Some companies offered substantial discounts on bulk purchases, but four offered to generously donate their products with no charge. These were Dorling Kindersley, Davidson, Europress and Sherston Software. These companies were amongst the market leaders in the educational field and some of their products were already found in these homes. The intention was to request titles from each of these companies so that the genres found in the families' homes could all be represented. Request lists were posted to them and they responded by donating over 200 titles. Some of the titles requested were not received and in some cases extra ones, not requested, were donated. Table 8.1 gives details of the titles received and the genres that they represented. A short description of each title is in appendix 26.

Genre	**Titles received**
Educational game	Jolly Post Office, I love Spelling, I love Maths, Mad About Science, Pinball Science, Maths Blaster, Castle Explorer, Adding and Subtracting.
Reference	Children's Dictionary, Children's Encyclopedia, My First Incredible Amazing Dictionary, New Way Things Work.
Electronic book	Treasure Island, Rusty Dreamer.
Creative tool	Art Attack.
Drill and practice	SATs Mental Arithmetic.

Table 8.1: Donated software and their appropriate genres.

The aim was to provide each family with 6 titles, representing as broad a range of genres as possible. The quantity of each title received from each donating software company was a factor in shaping actual distribution. For example, there were enough copies of "Maths Blaster" for each child potentially to receive one, whereas only 4 copies of "My First Incredible Amazing Dictionary" were donated. Software was also distributed across the children's age groups depending upon the age range specified on the product. Ideal distribution was not possible in a small minority of families where, for example, the child already owned one of the titles or where the software was not compatible to run on their computer (see table 8.2 for details of the final distribution to each child). These titles were given to the families at the time of the second home visit (ie August/September 1999). It was important that the families used these titles as if they had bought them for themselves and that they felt under no pressure to use them in any particular way. They were therefore advised that the researcher had no specific expectations and were asked to make use of them as they wished.

	Children aged 11					**Children aged 9**						**Children aged 7**				
Title	1	2	3	4	5	1	2	3	4	5	6	1	2	3	4	
Jolly post office													*	*		2
Adding and subtracting													*	*	*	3
SATs mental arithmetic						*	*	*		*	*					5
Children's dictionary	*		*						*		*	*				5
My first dictionary												*		*	*	3
New way things work	*	*						*		*						4
I love spelling		*		*										*	*	4
I love maths			*	*	*			*	*							5
Rusty Dreamer	*	*	*	*	*	*		*	*	*		*	*	*	*	13
Castle explorer		*		*						*	*					4
Art attack		*		*	*			*					*	*		6
Treasure island	*				*	*	*		*							5
Science						*	*		*	*	*	*	*		*	8
Children's encyclopedia			*	*	*	*	*		*			*				7
Maths blaster	*	*	*		*	*	*	*		*	*	*	*		*	12
Pinball science	*		*				*				*					4
																90

Table 8.2: Distribution of novel software titles across children (the reasons behind there being only 15 children are explained in section 8.2.3)

8.2.3 Computer monitoring: procedure and analysis

At the end of the 30-day logging period, which provided the data discussed in chapter 6, the logging software WinWhatWhere was removed from the families' computers because the licence had expired. It was replaced with another logging programme called Snoop. Snoop was freeware available to download from the internet. This recorded the date, the window caption, the time that a window became active and the time that it was inactivated. It did not record the identity of the user/s, so the user log-in software that had been used previously (see section 6.2.2) was left in place. Snoop was tested on several university computers but unfortunately proved to be unreliable on some of the home computers. It failed to operate on 11 of them. It did not log any activities at all. The software was replaced with another product called Omniquad Desktop Surveillance, which was generously donated by the company, but it was decided that it would be inappropriate to use the data that this generated. This was because it was important to have all the data, right from initial distribution of the novel software. The failure of Snoop was regrettable as it meant that the first few weeks of logging how these 11 families made initial use of the 6 new titles was lost. However, Snoop produced reliable data, logging all instances of use, on the remaining 20 computers.

In addition, there were other problems. Two children and one father accidentally deleted their Snoop data files. Another computer crashed and was sent for repair. On return, the hard drive had been reconfigured and all the data lost. In another family, a radiator burst and leaked water into the back of the computer, irreparably damaging the hard disk. Consequently, the logging data gathered from only 15 families can be discussed in this chapter: four 7 year olds (3 girls and 1 boy), six 9 year olds (2 girls and 4 boys) and five 11 year olds (3 girls and 2 boys). The interview data is from all 32 families.

It was not possible to install Snoop on all of the computers in one day as there were too many houses to visit in a single evening. Installation, and hence commencement dates, were therefore arbitrarily staggered to suit the families' availability. Consequently, each family's computer activities were monitored over different windows of opportunity. Each family's starting week was designated as "week one" and coincided with distribution of their novel software. There was a period of 11 weeks where it was logging activities on all of the computers. It is this 11 week window that provided the data analysed in this chapter. At the end of the study, Snoop was not uninstalled from the computers on the same day. However, data collected from any logging beyond the 11 week window was discarded.

Snoop produced large amounts of data which was downloaded from the family computers at each of the home visits. This software produced too much data to be analysed solely by hand. A certain amount of computerised data processing was necessary in order to reduce its vast quantities down to a useable and accessible format. Snoop recorded the start and stop time of every window that was opened. So, for example, a session using Word might generate several lines of data if the user accessed the spell check or the page alignment functions, or worked on more than one Word document within the same session. In this example, the data relevant to the current thesis would be the total session length, so only the first line (start time) and last line (stop time) would be necessary. All the lines in-between would be extraneous to the current need of establishing session length, so could legitimately be deleted. An example of some raw Snoop data is in appendix 27a. The deletion of this extraneous data was carried out manually, in the data base application, Excel. This was time consuming as it required meticulous attention to thousands of lines of data. Small computer programmes were then written to transform and manipulate the Snoop data files further. For example, the start time was subtracted from the stop time to give the duration that an application was being used. Details of the various processing stages are in appendices 27b-d. The final stage was to analyse the data using Excel and SPSS.

8.2.4 Interview procedure and analysis

Family opinions of the novel software were gathered in all three interviews. Some of the previous research in this area (e.g. Wilson 1998), and many of the websites that provide reviews of educational software (e.g. choosingchildrenssoftware.com, school.discovery.com, superkids.com and childrenssoftware.com) have used evaluation tools which generate scores for each title. Other studies (e.g. Druin, Bederson, Boltman, Miura, Knotts-Callahan and Platt 1999, Smith and Keep 1986, Tammen and Brock 1997 and Malone 1981) have asked parents and children to describe their opinions without recourse to any evaluation tool. In the present study, no evaluation tool was used. This was because the aim of this study was to link opinions with a range of usage patterns, so it was inappropriate to categorise potential responses in advance. Parents and children were asked to describe, in their own words, the features that they felt were important and/or un/desirable.

Upon distribution of the software, the families were asked to look at the packaging, and in addition the parents were asked to read the company's promotional catalogue, and to describe what they thought the product's aims and objectives were and how they were achieved. They were also asked what their first impressions were (see appendix 14 for interview schedule).

At the second interview the parents and children were (separately) asked to rank the software in popularity from 1 to 6 and to give reasons for their decisions (see appendix 15 for interview schedule). This elicited details about emerging preferences and opinions once the software had been used for a few weeks.

In the final interview, the children were asked to sit at the computer and actively use each software title with the researcher (see appendix 16 for interview schedule). They were requested to describe the features that they liked and disliked as they appeared on the screen. It is worth noting at this stage that the children found this a particularly difficult task. They found it hard to describe why they thought a product was "OK" or "boring", for example. All of these sessions were audiotaped and analysed using the qualitative analysis software called Kit, as described earlier in section 7.2.3.

8.3 Results

There are two sets of results to be presented. The quantitative findings, generated by Snoop data files, pertaining to how the software was used over time, and the interpersonal circumstances of use, will be discussed next in sections 8.3.1 to 8.3.4. The qualitative findings, of parents' and children's opinions of the software and their views on important design features, as gathered from interviews, will follow in sections 8.3.5 and 8.3.6.

8.3.1 Use of novel software across genres and titles

The mean percentage of total computer time per week that the children spent using the novel software was 21% (range 9-54%). There was no significant difference between boys and girls in the mean percentage of total computer time spent using the novel software per week (t=0.6 df=13).

Girls used the novel software for a mean of 23 minutes per week (SD= 16.3 range= 7.6-51.5). Boys used it for a mean of 18.4 minutes per week (SD= 13.3 range 3.8-33.5). There was no significant difference in mean time per week between boys and girls (t=0.5 df=13). This is probably due to the fact that educational software was equally (un)attractive to boys and girls, unlike entertainment games where a gender difference did exist. However, this mean amount of usage is misleading as there was a systematic decline in usage across the 11 week period, as will be discussed in section 8.3.2.

There was a lot of variation in how much each child used each title. For example, the mean amount of total time that Treasure Island was used, over 11 weeks, was 7.8 hours. However, there was one child who used it excessively and one child that did not use it at all, giving a range of 0-36.8 hours, and a standard deviation of 16.2 hours. This meant that the calculation of a mean was not advisable. Therefore, medians, for individual titles, are presented instead. Figure 8.1 is a histogram of the median amount of hours that each child that owned a title, used it over the 11 week window.

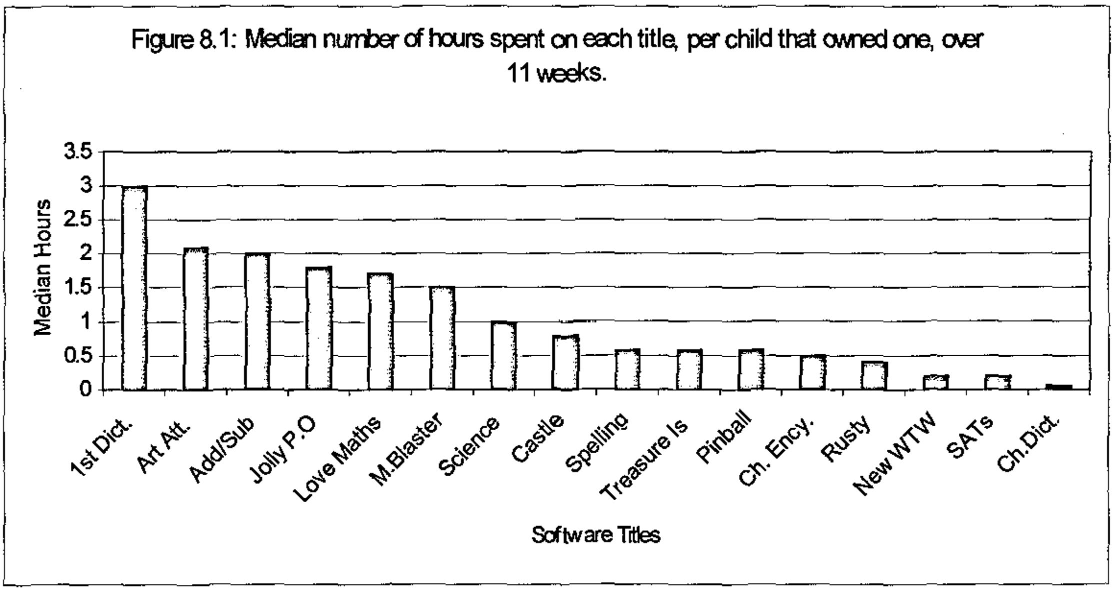
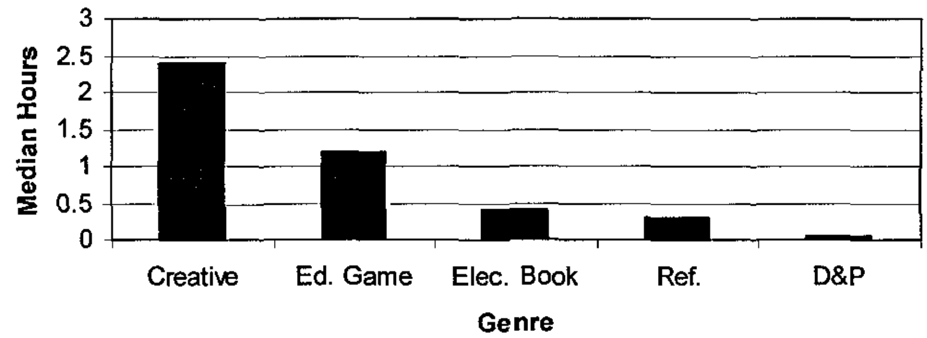


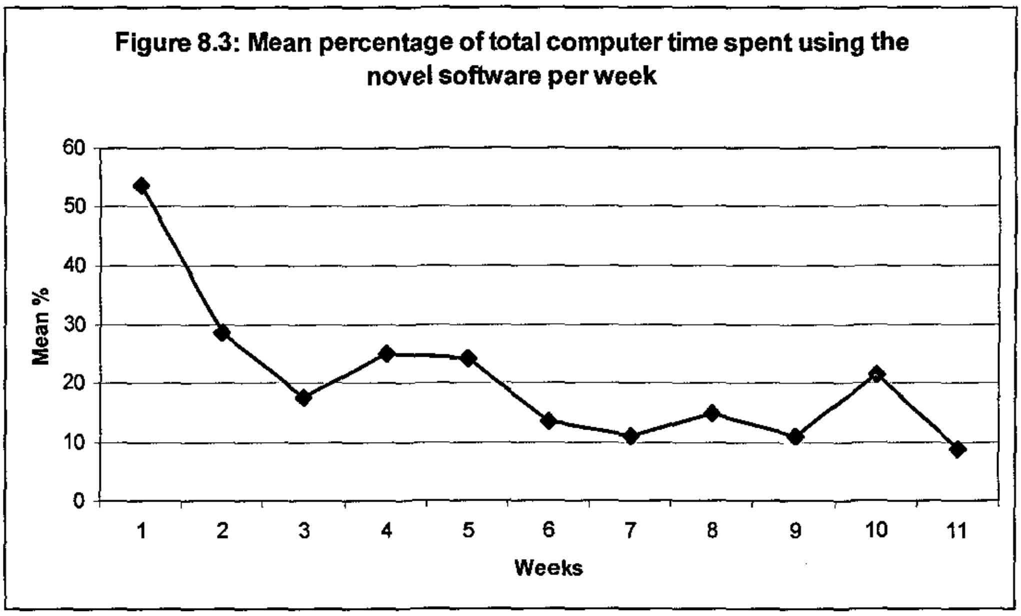
Figure 8.1 is interesting in that the three most popular titles represent three different genres (reference, creative tool and educational game). This suggests that it is not the genre alone that determines popularity. Other reference titles (e.g. New Way Things Work and Children's Dictionary) were relatively unpopular. Other factors might contribute to a title's popularity, such as the engaging nature of the software or the quality of the graphics. This is encouraging as it indicates that software that is not reliant on a games format can be popular with children. If usage is considered across genres, this observation is confirmed (see figure 8.2). Creative tools was the most popular genre. It was not possible to carry out any inferential statistics on this data because there are outliers and removal of the outliers leaves too few participants in some genres.

Figure 8.2: Median number of hours spent on a title within each genre of software, per child that owned one, over 11 weeks.



8.3.2 Fate of novel software over time

The above measures give no indication of the *fate* of this software *over time*. It was therefore interesting to explore the pattern of software use over the whole 11 weeks. Figure 8.3 illustrates how mean weekly usage was highest in the first week following receipt of the software (55% of computer time), which then decreased in week two. Following this, mean weekly usage fluctuated between approximately 10-25% of total time.



There were, however, some titles that were never used at all. Eight of the children chose not to use 1-3 titles each. They did not admit to this in the interviews so it was not possible to ask them why this was the case (the data was analysed when the study was complete). The unused titles were representative of all genres, with the exception of creative tools, again suggesting that the children's lack of enthusiasm was an individual preference, and not genre or title specific.

8.3.3 Characterising patterns of novel software use

The aim in this section is to explore whether or not children's use of the novel software fell into patterns. To achieve this, a table was made in which rows represented each child, and columns represented weeks. Every week in which the child used the novel software was marked with a "1" and every week where they did not use it was marked with a "0" (this does not mean that there was no other computer use in that week). The emerging patterns were scrutinised and organised into the following four types:

Type 1: Novel software not used at all in the first four weeks, followed by sporadic use.

Weeks one to eleven

Child A 0 0 0 0 1 0 0 1 1 1 1

Child B 0 0 0 0 1 1 0 1 0 1 1

Child C 0 0 0 0 0 1 0 1 0 0 0

Type 2: novel software used every week for first 4/5 weeks then sporadically thereafter

Child D 1 1 1 1 0 0 1 1 0 1 1

Child E 1 1 1 1 1 0 1 1 0 0 1

Type 3: novel software used sporadically across the whole logging period

Child F 1 0 1 0 0 0 0 0 1 0 0

Child G 1 1 1 0 0 0 0 0 0 1 0

Child H 1 1 0 1 1 0 1 0 1 0 0

Child J 1 1 0 1 1 0 0 0 0 1 0

Child K 1 0 1 1 0 0 0 0 1 1 0

Child L 1 0 0 1 1 0 0 1 1 1 1

Type 4: novel software used sporadically over the first 6 weeks then not used at all for remaining time

Child M 1 1 0 1 1 1 0 0 0 0 0

Child N 1 1 1 0 1 0 0 0 0 0 0

Child P 1 1 0 0 0 0 0 0 0 0 0

Child Q 1 0 0 0 1 0 0 0 0 0 0

These four different patterns suggest that children's interest and engagement levels fluctuated in various ways to give the overall mean weekly use depicted in figure 8.3.

Some enthusiastically used the titles for the first few weeks and then usage tailed off to either sporadic episodes or to no use at all. Other children left them untouched for four or five weeks then used them sporadically for the rest of the logging period. Others used them sporadically over the whole logging period.

Use of the various titles within each week of use also differed between children. Some children developed clear favourites and used these most of the time, whilst other children spread their usage over all of the titles. Others developed temporary favourites, used them for a few sessions and then changed to another. There was one father that encouraged an unusual pattern of software use in his child. This was one of the children for whom there is no logging data but his verbal accounts suggest that he encouraged his daughter to "finish" each title before going on to the next: *"she goes on them till she saturates them, once it was completed then it was the same questions popping up again and again...the thing repeated itself"*. This father tended to regard each CD-ROM as a teaching package *("its like having a teacher at home")*, to be completed, rather than as a product that could be dipped into every now and then. When he was first given the titles he was curious to know how long each one would take to complete. This was in contrast to the other parents who did not reveal any particular strategy of encouragement or orchestration.

8.3.4 Collaborative use of the novel software

The number of times a novel CD-ROM was accessed by a child was counted. If they used three different CD-ROMs within one session of use this was counted as three CD-ROMs being accessed. In total, the CD-ROMs were accessed 431 times by the children (mean 27 times per child). On 60% of these occasions the child was alone. They spent 21.8% of occasions with sibling/s, 8% with parents/s, 3.7% with a friend and 6.5% with a combination of these (e.g. sibling, parent and friend). The minimal amount of time that parents spent using this software with their children was scattered throughout the 11 week period. It was not concentrated at any particular time e.g. when it was first received.

These figures indicate that parents were, again, spending little time sitting with their children and going through this software with them. It also suggests that parents were not very concerned with investigating the contents of these titles and monitoring their child's progress on them. It also indicates that parents did not recognise that the arrival of new software could facilitate a new opportunity for them to engage with their children. This finding confirms their previous claims that they routinely adopted a non-engagement policy (see chapter 7).

8.3.5 Initial opinions of the novel software

The second part of this results section will now go on to discuss parents' and children's opinions of the novel software, including features they thought were important in making its use an un/enjoyable experience.

8.3.5.1 Initial opinions of educational games

These titles were generally received positively. Both parents and children recognised the genre, for example *"it's a maths game"*. Parents could describe the products' aims and objectives, e.g. *"it gets across the principles of science"*, or *"showing demos of the ways things work, moving objects, whirring buttons"*. These responses suggest that many parents were concerned about what this software could *"get across"* or *"tell"* their children about. Likewise, children recognised this genre in terms of what the products had to *"tell"* them about or *"help"* them with, e.g. *"it helps you with science"*, *"its about forests and animals"*, *"its about when castles were invented"* and *"it tells you how did the houses used to look"*. Frequently used adjectives were, *"fun"*, *"interesting"*, *"exciting"* or *"cool!"*. Both parents and children used language that suggested this software was most useful in its role as a means of transferring information, rather than as an opportunity to explore topics and engage with them in new ways. For example, no parents said that maths, in the form of a game, might help their children to understand its scope and how it can be used in a different context, outside of the classroom.

However, some parents identified how important it is for software companies to get the right balance of fun and education. Two parents expressed concerns about this genre, particularly Maths Blaster. The packaging of this product is extremely bright and the graphics are cartoon-like: green people, monkeys with wings and a space ship control panel. This appealed to all parents except one, who thought it looked *"cheap"*. Small screen shots are also shown, which depict mathematical problems deeply embedded in games. This was worrying to some parents. One said *"I'd just be a bit worried that the maths may get lost in the play, in the games aspect of it"*. These parents appeared to be worried about the relative amounts of gaming and maths in this software. They were concerned that entertainment might take precedence over education. The children did not share this parent's concerns. They liked the game element, one said *"you have to do interesting things, like jumping around, getting things"*.

On the other hand, some parents thought that The New Way Things Work looked *"too hard"*, *"not much fun"*, or *"too serious"*. The graphics on the CD-ROM cover are line drawings and use mute colours. The game element of this product is not strongly emphasised, instead precedence is given to how the product can teach children facts about how mechanised objects work. These parents seemed to be concerned that their children would not enjoy this product as they perceived it to contain too little entertainment.

Parents were predominantly concerned with how much their children would enjoy these educational games. For example, they considered that what the packaging specified about educational content or appropriateness for school was relevant, but this detail seemed to take second place to enjoyment. The fact that their child was interested in the subject, and that they would enjoy using it, was enough. Children, too, were primarily concerned with the enjoyment factor. This is consistent with the previous finding that enjoyment and entertainment were both important when using the computer at home.

8.3.5.2 Initial opinions of reference titles

Parents and children were very familiar with this genre. They were aware of the products' aims, such as this parent who said, *"she puts in whatever word she's looking for, like "ship", and it'll come back with a text and a picture, and it talks"*. The children, again, described this software in terms of what it could *"tell"* them, *"show"* them or *"help"* them with. For example, *"shows you words", "helps you learn about things"* and *"tells you facts about everything"*. A common adjective was that these products were *"useful"*. This frequently used descriptive suggests that using these titles is a means to achieving something else that is external to, and separate from the search activity itself ie a means towards finding something out, rather than a means of entertainment. Very often, children use CD-ROM encyclopedias as a homework resource, such as this child whose parents said, *" [our son] has used them in the past. He's come home with a homework topic and I've sort of said to him, before you go down the library lets get those discs out and have a look through there. We've found a lot of information on them. I think they are an excellent idea"*. CD-ROM reference tools seemed to be appreciated as a useful source of information to help with school related projects and homework. However, some parents said that they felt more comfortable using a book. Fifteen families received an electronic book, and five of these parents said that they would prefer to buy a book rather than a CD-ROM. They thought that books would be easier to use.

8.3.5.3 Initial opinions of electronic books

There were mixed responses to this genre. Rusty Dreamer was received positively by all parents. All, except one, recognised that it was a story with added extras, although they were unsure what the extra activities consisted of: *"I like the idea of that. I think its telling a story, and you have different abilities. And I think they've got added things"*. The packaging proved to be important in forming this opinion as responses to Treasure Island were less positive. Some parents described this product as looking *"cheap and nasty"*, which suggests they were concerned with quality. Another described the graphics as looking too *"cartoony"*. This concern with the aesthetics of the packaging indicates how this can be an important feature in parents' decisions of whether or not to buy software. Other, more positive opinions suggested that the product was *"fun"*, *"enjoyable"* and *"exciting"*.

8.3.5.4 Initial opinions of creative tool (Art Attack)

This product was received very positively by all parents and children e.g. *"ooh aaart attack! Oh, really cool, wow. It looks dead fun as well"*. There was a corresponding, popular children's television programme and magazine, of the same title, that parents and children had been involved with at that time. The parents were able to accurately predict the types of creative activity available within this tool, e.g. *"paint and create"*, and *"a paintbrush on the screen"*. Some children were less realistic and hoped for *"clips of the TV programme"* and the ability to *"scan and put you next to Donald Duck"*. Expectations were high and influenced by the television programme.

8.3.5.5 Initial opinions of drill and practice (SATs Mental Arithmetic)

Distribution of this CD-ROM was not ideal, in that the 11 year old children, for whom this product was designed, had already taken their SATs. It was therefore given to nine year olds instead but their tests were 18 months in the future. However, some of the views about this product are pertinent and worth exploring. All of the parents gave accurate predictions of what this product would be, e.g. *"it gives you timed tests"*. This CD-ROM was distributed to twelve families and aroused strong views about the SATs themselves, as well as the appropriateness of parents pressurising their children to perform well. Five sets of parents said that they strongly disagreed with the tests and would never consider purchasing such a product. One father said that the software was aimed at the *"hothousing parent. This is all where the parent imposes the software onto the child. Everything to attract the anxious parent"*. Another said that they thought revising for these tests was *"cheating"* and that the software was for *"pushy parents. It puts pressure on the children to make them feel they have to score better"*. The remaining parents did not express such views and one thought that it would be *"a useful revision* *tool".* Conversely, the children's views, although comparatively minimal, were quite positive e.g. *"this will definitely come in handy in year six. It just helps you through your SATs tests so you can prepare for them earlier. Mmm, looks good".*

8.3.5.6 Summary

Section 8.3.5 has discussed findings from the first interview regarding parents' and children's initial opinions of the software. These were based upon information and graphics on the packaging and in company catalogues. At this stage they had not actually used it. Their opinions were continuous with the educational aspirations that they had expressed regarding purchase of a computer. Parents were encouraged by the educational content of these titles and were keen that their children should enjoy using them. Overall, parents' responses were positive and optimistic and they expected that their children would use it. Likewise, the children did not express negative views The next section will now explore their opinions of these titles once they had been using them for a few weeks. The findings are drawn from both interviews two and three.

8.3.6 Important features of the used novel software

Section 8.3.5 was concerned with identifying parents' and children's initial opinions of the novel software before they had used it. They were then free to use it as they wished over several weeks. The current section draws upon interview data collected once the families had used the software, and is concerned with exploring their opinions of it in the light of experience. All of the interview discussions regarding their opinions of the novel software were analysed and 5 main themes emerged. It was possible to categorise parents' and children's responses into the following five features:

1. Usability
2. Enjoyment
3. Educational value
4. Age and gender appropriateness
5. Endearing/annoying qualities of the characters

Each will now be considered in turn.

8.3.6.1 Usability

A concern that was common to both parents and children was the lack of availability, and ease of use, of help and instructions. One father had to intervene and help his daughter: *"she said she found the instructions quite difficult. I did the first level myself and even I had to puzzle a bit. How do I get to the instructions?"* Another found Maths Blaster confusing: *"sometimes its not exactly clear where they've got to go. Its not that clear that you've got to climb the step, or how to climb the step. All of a sudden she was hovering, she didn't know where to go or what to do"*. Some children agreed with this and one found that *"it was quite hard to find where to go, and dad had to help me"*. These comments suggest that lack of instructions can lead to feelings of frustration. They also point to the fact that children would prefer their computing experiences to be autonomous. They would like not to have to ask their parents for help. Parents too feel that the software itself should provide enough support for their child so that they did not have to intervene. This is consistent with the findings reported in section 7.9 where this reluctance to collaborate at the computer was discussed.

Another feature regarding usability, that both parents and children discussed, was the need for good keyboard skills in order to use the software effectively. Titles that involved fast game elements were mentioned as being particularly problematic. Some children found Maths Blaster and Pinball Science particularly challenging and stressful, or frustrating, because they were not used to playing loud and fast games which required quick keyboard responses. One father described how his son could not progress because *"his game playing skills aren't good enough to get him up to level two"*. This was echoed by two children who said *"it's not the actual maths that I find hard, it's the actual gamey part of doing it because on the hard level its much more fast"* and *"its quite hard when you have to do the jumping and work out the sums as well"*. This problem became particularly apparent when four of the seven year olds were observed using the software in the third interview. It became clear that they were confused about which keys to use to make the characters move, and they randomly clicked all over the screen hoping to have some effect. This made using the software a difficult and stressful experience, especially as the maths problems were timed, meaning that hesitation was detrimental to their score. These problems suggest that, contrary to popular belief, some children do not have a "natural" ability to master ICT.

The final feature to be considered in this section is one mentioned only by the children. They judged the success of a title based upon whether or not they achieved full completion i.e. finished all the elements and got to the end. A measure of success was the length of time it took to complete a whole programme. The faster the better, e.g. *"this one's really good, I completed it in one day!"*, and *"I like this one, I've already completed it"*. Previous studies suggest that children enjoy a challenge but if it is too difficult they get frustrated. It has to be "doable". This point was supported by one child that said, *"I have only been on this [Mad About Science] a few times. Shall I tell you why? It's because I find it really hard to complete"*. These children's strong ambitions to complete a piece of software as soon as possible may well be a function of the fact that it is in a game format. Their desire to finish it, to reach the end, in this case took precedence over practising the activity. It suggests that design is important in getting the right balance between enjoyment of the activity (i.e. not wanting it to end) and achievement (signalled by getting to the end).

8.3.6.2 Enjoyment

The success of the software was very often measured, by parents and children, in terms of how much the child enjoyed using it. As previously discussed in section 7.3.4.3, parents cited enjoyment as one of the central principles important in any learning that takes place in the home. If the children do not enjoy it then it gets limited use: *"I think they had a little bit of fun on it but it was quickly off and something else was on"*. On the other hand, enjoyment can lead to hours of use: *"she loves Rusty Dreamer, she'll sit there and listen to it all day long if she had the choice"* and *"I couldn't get him off the maths one, he thought it was really good"*. Children supported these findings. If they perceived a product to be unenjoyable and boring, it did not get used: e.g. *"Its boring! Its got boring pictures and I can't get into it, I want to throw it in the bin"*. Finding something scary can make it enjoyable, as this 7 year old child tells of his experience of Rusty Dreamer: *"its good because I feel really scared when that thing pops up...that weird thing...I go ooooh"*. Enjoyment can also disguise the fact that the software is educational: *"when you're playing you forget that you're learning something cos it is really fun"*. This balance between fun and education was also important to a parent who said that being too much like school work can make a title unenjoyable: *"its dull, deadly and awful. Hideous! It's too much like homework"*.

Also related to enjoyment was the child's interest in the main subject area. If the child was not interested they would be less likely to use it. This parent was talking about Mad About Science and said *"if [our child] were that way inclined I'm sure she'd get a lot out of it, but she's not... "*. In a similar vein, another parent said *"he's not a practical person so the Way Things Work hasn't interested him"*. Children agreed with this. One child, who enjoyed history, found Castle Explorer particularly appealing: *"I like this because I like building stuff in olden times, I'd like to go back in time and build a civilisation and fight"*. Another child enjoyed Mad About Science because it was his favourite subject: *"this is my best game actually, I like animals and I like doing science"*. The software's broader relevance to other activities that the child was involved in had relevance to making use of it enjoyable, such as this child who found the Children's Encyclopedia useful: *"I'm reading a book on Anne Frank at the moment and I find that quite interesting so I was looking up about that".*

8.3.6.3 Educational value

Parents also judged the software in terms of its perceived educational value. All were concerned with how much their child could learn from it. This father, for example, was talking about Maths Blaster: *"Its very good, it's a game with a good educational message".* The value of the activity itself was important to another parent who said, *"I think mental arithmetic is important and this encourages it. It gives them a target to reach and rewards it".* Applicability to school work and home work was also an important aspect. This was spoken about mainly in relation to the Children's Encyclopedia, which 86% of parents (who were given one) found disappointing. They said such things as *"Its not got enough information in for her. She'll go to look for a subject she's doing in school, or for her own interest and it was very very basic. It wasn't enough depth of information for her"* and *"I was playing with him the other day trying to find out about Egypt. I found that a bit disappointing because it mentioned it in several places but didn't really tell you a great deal".* This was less of a concern for the children and only one mentioned that he liked a title because it challenged him: *"its fun but it also makes you think, and I think that's good".*

8.3.6.4 Age and gender appropriateness

The software's success also depended on its suitability for the child's age and gender. Treasure Island received a lot of comment from parents of 9 and 11 year olds, with regard to it being too easy. One parent said *"Treasure Island was a bit of a waste of time for someone like [our daughter]. She reads a book anyway. It is very good to encourage children who have difficulty with reading"*, another said *"if you're a competent reader you don't need to wait for it to be read for you. She was on the hardest level and it wasn't really demanding. She just got bored waiting for it".* Quite often it is difficult to get the level right in all elements of the software, as this parent explained: *"we found the* *language too easy, in the actual dictionary, but the games too hard"*. Not only is software too easy at times, but also too hard: *"the I Love Spelling one I thought would be good but I was quite amazed at how hard the spellings do get with the ages. I remember looking at the book [that comes with the software] and thinking 'this is real hard, that can't be for his age', but it is, its says seven to eleven"*. If the software was too difficult it could lead to the child turning it off, as this parent explained whilst talking about Maths Blaster: *"its actually quite difficult on the higher levels. They were getting to the stage when they had to think quite hard, and they gave up"*.

Children were also concerned about age appropriateness. A product's success was often judged, by children, in terms of how easy or hard it was in relation to their age, or what material they had covered at school e.g. *"When it gets on the harder levels it gets really hard and I can't do it. I only know my two times table , my five times table and my six times table. I can't do it. I hate it"*. Maintaining the right level throughout the whole product is often problematic, as this 11 year old describes: *"I think this [dictionary] is too young for me...I tried looking up 'arachnophobia' and it doesn't have it...but the games are hard. It has a 'magical word machine' and somebody my age would think that's silly"*. Once again some of the younger children did not verbalise their problems in this area, but they became apparent from watching them use the software. Several of the seven year olds found the vocabulary in The New Ways Things Work too difficult. One child could not read the word 'buoyancy' and did not know what it meant. Another 11 year old asked what 'scientific exactitude' meant in Pinball Science.

The importance of compatibility with the child's age was made apparent in relation to SATs Mental Arithmetic. This was not distributed amongst children of the appropriate age group and consequently they were concerned about the level of stress that it induced. This response was summed up by one child who said *"it makes you feel like you gotta do it and get the answer. It makes you feel a bit pressurised"*.

The software that emerged as being perceived as the most gender-specific was Rusty Dreamer and The New Way Things Work. One father described how his son never once used Rusty Dreamer because it was a *"sissy game"*. On the other hand, some girls did not like The New Way Things Work because it was *"more for boys"*.

8.3.6.5 Endearing/annoying qualities of the characters

Children cited likability of the characters as a feature affecting their judgement of the software. Some children enjoyed interacting with some of the characters that they liked. For example, one seven year old boy liked the character Sour Puss in Mad About Science: *"I like clicking on Sour Puss, I hope it hurts him, well he tries...he terrorises you. He turns the lights out when you want to do word attack, and he flings words at you!!"*. One of the seven year old girls particularly liked the witch character in The Jolly Post Office and spoke to her whilst using the software. In the following sequence of the game the postman leaves the child in charge of weighing parcels and taking the money for stamps. Both the witch and the wolf are customers that come into the post office:

Animated postman: I have to go out for a while will you look after the parcels?
Child: yeees!
Animated witch: here's a heavy parcel for you.
Child: laughs aloud.
Interviewer: why are you laughing?
Child (imitating the witch's cackling voice): this is a heavy parcel today (laughs).
Child: one two three four. Money!! Thank you!!
(a small mouse then appears on the screen)
Child: Hello little jolly fellow!!
Animated witch: how much will it cost to send this parcel?
(Child then continues i.e. weighs the parcel and takes the money, in silence)
Animated witch: thank you!
Child: thank you. Go on!! Go away!!
(witch then leaves and a wolf comes in)
Child: Hello wicked old wolf!!

This child clearly liked the characters and, as a consequence, enjoyed using the software. On the other hand, not being fond of them could reduce the children's opinion of the software: *"its OK, its just the people that are weird. They just don't look very realistic. It would be better if they looked like someone, or just a bit human".* Other disliked characters were described as *"annoying"* or *"rude".* Parents were less concerned with the characters. Only two raised the topic, but both in relation to Mad About Science: *"it's got a bit of a silly woman on it, I think that's what let that programme down"*, and *"this is the one [character] that makes the rhymes, oh I wanted to throw it at the wall! Awful! Its so important isn't it, her voice was horrible!"*

8.4 Discussion

The main aim of the research reported in this chapter was to take a longitudinal perspective on exploring how new software is appropriated into the home. Children's usage of 6 novel educational software titles was logged, over time. Also, parents' and children's opinions of these titles were explored in an attempt to determine whether this could shed light on why the particular patterns of use emerged. This research has provided useful new insights, as well as supporting previous studies.

The families' responses to the new titles were overwhelmingly positive. Not only were they pleased to receive "free" software, but parents, in particular, were encouraged by how much they thought their children would enjoy it, as well as by its educational nature and how it claimed to support school activities. Both the parents and the children were (apparently) excited and looked forward to using the titles. This response supported parents' previous comments regarding their educational aspirations for their children's computer use.

However, in support of the findings in chapter 6, and of Giacquinta et al (1993), the novel software was actually used relatively little. There was an initial flurry of enthusiasm, marked by relatively high usage, which subsided into a persistently low average level of use over the forthcoming weeks. The four types of engagement patterns that have been identified give some insight into how children differ in terms of their fluctuating interest levels. No significant gender differences were found in the amount of usage. Chapter six discussed how gender differences in computer use were mainly attributable to the finding that boys spend longer playing entertainment games than girls do. The fact that the six novel titles contained no entertainment games probably explains why no gender differences were found in use of the novel titles. However, the degree to which a product encorporated gaming elements into the activity had an effect on its popularity. Software which encorporated elements of games (e.g. Maths Blaster) were more popular than those without (e.g. SATs mental arithmetic). Another important finding is that the creative tool (Art Attack) was also very popular, suggesting that this type of art activity was not viewed, by the children, as being overtly educational in nature. Software that encorporated a degree of entertainment and enjoyment prevailed as the most popular.

With regards to the software's fate over time, most children used most of the titles in the first two weeks. However, following this initial engagement, usage decreased and remained at a low level. It was also interesting to find that some of the titles were never used. This is a compelling reminder of the strong role that children themselves played, at home, in choosing their software activities and of how parents choose not to intervene (see also 7.3.3.3.2). It also demonstrates how important the packaging and the subject matter are to children. The topic covered by the software has to be appealing to the child. Overall, in spite of their parents' aspirations, the children used the software relatively little, and in the case of some titles, not at all. There is the potential for parents to take a more active, participatory role in their children's use of educational software. Their involvement would probably not only increase the amount that it is used, but also reduce attrition after the first two weeks.

However, these children do give an insight into the educational possibilities of this software. They did use it for some of the time. The longer term challenge is to understand why it was more successful for some children and less so for others. Parents' and children's comments collected in the current study contain implicit suggestions about how educational software might be improved, and hence be more attractive. These findings support and elaborate upon previous studies (e.g. Giacquinta et al 1993, Druin et al 1999 and Tammen at al 1999). They can be summarised as follows:

a) Children were concerned with what the software could tell them, show them or help them with. It is therefore important that this need is fulfilled. Information, especially in reference titles, should be comprehensive, at appropriate level/s and relevant to homework projects.

b) The packaging and graphics should be aesthetically pleasing. Children and parents are concerned with quality and getting value for money. Packaging that is too bright or too cartoony may be considered as being cheap or garish.

c) Software should be exciting and entertaining. Boring software is neglected. Excitement can be achieved through interactivity, pace, progress, points, game elements, unexpected activities, humorous, non-patronising characters and attainable goals.

d) Interactivity is preferred. In this study, products containing high levels of interactivity, such as Art Attack and Maths Blaster were relatively successful. In both of these titles, children were required to offer high degrees of input e.g. manipulating characters or drawing pictures.

e) Children avoid software that induces stress or pressure. Stress reduction can be achieved by paying attention to age appropriate keyboard skill requirements, difficulty levels, time limits and games skills.

f) Instructions, navigation and help should be clear and unconfusing.

g) To promote practice of the target activity, over and above the desire to reach the end of the CD-ROM, the activity itself should be intrinsically engaging (see c).

The findings in this chapter also build upon those in chapter 7 in finding that children spent most of their time using this software alone, and only 8% of their computer time was spent with their parents. This lack of parental interest in the new software was surprising given the enthusiastic welcome that it received upon distribution. They were aware that they were going to be interviewed about its contents yet they remained relatively disengaged. Although surprising given the context of the study discussed in this chapter, their response is less so when considered in relation to the findings discussed in chapters 6 and 7. The findings in this chapter confirm those discussed previously: opportunities for scaffolded computer activities only rarely arose and parents gave multiple reasons why this was the case.

The findings in this chapter also suggest ways in which parents could improve their engagement with their children whilst using computers at home. Children cited some problems with using the software but parents and children both discussed the need for adult help in negative terms. A particular problem was with the products' instructions. These are difficult to get right as they have to be accessible to children of various ages. The alternative would be for parents to embrace their potential role as advisors and to use the opportunity to improve their own skills too. In addition to this, they could also use software titles that cover topics not popular with their children, to explore why they are having problems or difficulties with an area. These are both areas that could potentially facilitate more adult-child interaction and scaffolded activity.

The findings in this chapter have built upon those in previous chapters and previous studies. The logging data considered here extends the message that educational software was not comprehensively used. By tracking its fate from arrival through to stable use, educational software's position in the family home has been revealed as being inferior to products concerned with delivering a higher level of entertainment, such as games. As a consequence, parents' aspirations for educational use of the home computer could not be met in reality. These findings also reinforce the message that, similar to purchasing the hardware, provision of new, relevant and interesting educational software is not enough, on its own, to ensure that it will be used. Use of educational software is embedded in local ecology to such an extent that without the appropriate support in place, it is typically an under-used learning resource.

Chapter 9

Discussion

The aims of this chapter are threefold. Firstly, to reflect upon the success of the various methodologies used to gather the data presented in this thesis (section 9.1). Secondly, to identify the main findings that have arisen from the research and to discuss the implications of each (section 9.2). Finally, to conclude by addressing the broader implications of the findings, and pose questions that might be addressed in future research (section 9.3).

9.1 Reflections on methodology

The work for this thesis has been undertaken within a cultural psychological perspective and has been relatively demanding in terms of method. Existing work in this field was reviewed in chapter 3 and the need for new methodologies was discussed. This thesis has used three particular methods that have hitherto not been tried in this field of research: a comparison of the home and school settings of computer use, and computer-based logging of children's home computing activities, and a longitudinal perspective on the fate of novel educational software. This section will consider how successful they have been.

As this research was concerned with investigating two natural settings of computer use, it was important that data gathering could be carried out on-site, in the school and in the family home. Children/pupils and their parents were not displaced from these locations, which had several advantages. Not only did it eradicate the need for them to travel to and from interviews but, more importantly, it meant that they were more relaxed. Moreover, the presence of contextual cues assisted their replies to questions. Another important advantage was that the researcher was given permission to enter these settings and could experience them first-hand. This meant that direct observations could be made of, for example, room/classroom layout and the software that each family/class owned. This was preferable to interviewing the participants at another site and trying to imagine what their classrooms and homes were like. The comparison of these two settings has confirmed the utility of using a cultural psychological approach to children's computing practices.

It was also important to gain access to homes so that family computer use could be recorded. The use of commercially available logging software was innovative and provided objective data without any need for family intervention. However, there were problems which should be borne in mind if this method is to be used in future research. The logging programmes were tested on several university computers and all functioned well. It was assumed that PCs were all similar and that the software would therefore work on all of the family computers. This was found not to be the case with Snoop. In future it would be wise to thoroughly test the software, on site, before the research begins. Potential problems could be rectified at an early stage or, if necessary, participants could be replaced early, thus minimising loss of data. There will always be unavoidable data loss from incidents and accidents such as computers crashing and unintentional deletions by inquisitive participants. The recruitment of extra participants to compensate for this is therefore advisable. However, no participants expressed a wish to leave the study for other reasons once it was underway. It can therefore be concluded that regular contact from the researcher in the form of update letters and a Christmas card, and the provision of a help-line were effective measures in preventing attrition.

Taking a longitudinal perspective on children's use of novel educational software in the home produced new insights. It was particularly useful in revealing the average pattern of use of this software over several weeks, as well as individual children's engagement patterns over time. It was successful in providing evidence for the claim that educational software is used relatively little.

This research, and the methodologies that have been used, have shed light on the different interpretations of the word "education". The parents in this study said that they bought a computer to support their children's education and envisaged that this would be achieved through the use of stand alone educational software such as educational games, reference software and drill and practice titles. It has become apparent that the education they sought to support was mainly formal, curriculum-based, classroom learning. They had little or no knowledge of the potential benefits of playing some entertainment games and some parents actively sought to minimise or ban use of these products as they thought they were frivolous and unimportant. At the same time, they were anxious that their children's educational use of the computer should be fun and that any educational software that they bought should meet this need. This focus on promoting the use of educational software is perhaps unsurprising given that the popular press publishes journalistic articles about the claimed harmful effects of games (e.g. addiction, social isolation and inactivity) and rarely promotes their potential benefits.

However, it is important to recognise that parents' claims that they bought a computer for educational purposes may be a result of them trying to justify spending a relatively large amount of family money on a new computer. It is possible that they felt it inappropriate to admit to a university researcher that they wanted a computer so they could, for example, chat to their friends via email or play on-line games. The children and families involved in this study were recruited through primary schools, and parents were aware that research was also carried out in this location, which may have had some bearing on their declared reasons for buying a computer.

Even though this may have been the case in some families, the majority of the software found in the homes was educational in nature (i.e. claimed to support curriculum requirements or was bought with this aim in mind), suggesting that most parents genuinely wanted to promote its use. This software itself also supported different types of educational experience. For example, most encyclopedias provide factual information for the child to read or listen to. Alternatively, some educational games are more interactive and provide the opportunity to practice existing skills e.g. mathematics. Art packages offer yet another potentially educational experience where the child's creativity is encouraged. This variety of genres suggests that parents were concerned with providing children with the opportunity to access different types of educational experience.

In contrast to this, teachers incorporated the use of ICT into their lesson plans and use of the computer was rarely a stand alone activity. The most commonly used genre of software was creative tools, especially word processors. There was an emphasis on children actively generating material e.g. stories and spreadsheets, rather than on using software to practise skills such as mental addition or spelling. Teachers also recognised how the development of ICT skills, such as use of the keyboard/mouse and the ability and cut and paste, could be incorporated into the production of products such as illustrated texts and pictures. Compared to parents, teachers were perhaps more aware of how these skills could be achieved due to the demands of the National Curriculum. Without such guidelines at home, and without teaching expertise, parents' views on what constituted "educational" use of the computer was different to that of teachers. The various methods used throughout this research have been useful in identifying these differing interpretations of the word "education", through family interviews, teacher questionnaires and logging how computers were being used in either location.

9.2 Main findings

The research in the various settings has given rise to a range of valuable findings which underline the benefits of a study of this kind. This section will consider the main findings from this research.

9.2.1 Gender differences in boys' and girls' home computer use

This research has upheld previous gender-related findings in confirming that boys spend approximately twice as much time using their home computer as do girls. Perhaps, more importantly, it has also made a significant contribution by the finding that girls and boys access the computer the same number of times per week. The difference is that boys, once using it, will use it for twice as long as girls i.e. boys' session lengths are significantly longer than girls'. This contradicts assumptions made previously that girls access their home computers less than boys. Interestingly, there was no apparent gender difference between children using the novel, educational software titles. This could either mean that this software was equally unattractive to boys or girls or that the amount of usage was too small to pick up any difference.

The research also demonstrated that the "extra" use that boys make, over and above that by girls, is mainly constituted by the playing of entertainment games. These games are marketed as being for entertainment and enjoyment and not as specifically supporting national curriculum objectives, as are educational games. It is argued that the high usage of entertainment games by boys is likely to be due to the gendered nature of this type of software. Entertainment games, such as car racing and fantasy adventures, contain characters and characteristics that appeal predominantly to boys. It is encouraging that the novel educational software was used equally by both girls and boys, which suggests its contents are more gender neutral.

This research therefore reveals that there is a lot of potential for the development of entertainment games that appeal to girls. This has been demonstrated by the enormous success of Barbie Fashion Designer and Little Mermaid and The Sims. The success of these titles suggests that there is a demand for software that contains features that appeal to girls and which they find absorbing and enjoyable.

9.2.2 Entertainment games are more popular than educational titles

The finding that entertainment games are much more popular than educational titles is robust as it was demonstrated in the 30 day study of naturalistic, uninterrupted computer use, and in the novel software study. Even with 6 brand new, well-received, market leading, educational titles to choose from, the children still opted for entertainment games. This is a clear indication that educational software is relatively unpopular. Indeed, this raises the question of why children should use educational titles that they do not enjoy when entertainment games are far more attractive. This is a complicated issue because whilst parents want their children to use educational titles, they are, at the same time, unwilling to orchestrate their use. Given that, on the whole, children are left to decide what they want to use the computer for, it is not surprising that they focus on the software that provides the most fun.

This finding also points to the fact that the children in this study perceived their home computers more in terms of relaxation and entertainment, rather than as a support for learning. This suggests that if parents want their children to become computer literate, the best way to encourage this is to provide them with entertainment games. Children need little encouragement to use these titles, whereas educational software typically remains relatively untouched. This may reflect different developmental priorities in that the young children in this research may not actively seek out software to support their classroom activities. Older children, who have more project-based homework, may seek out educational software as a reference source.

This also suggests that parents need to consider redirecting their spending, on software, to titles that their children will find engaging and that they will use spontaneously. Parents' ambitions, at purchase, that the computer will be used as a support for formal education, whilst not totally unrealistic, need to be modified to take account of this finding. Perhaps if parents were made more aware of the learning advantages of playing some entertainment games, they would be more willing to purchase them and to encourage their children to use them.

9.2.3 The tension between leisure and work in the home

The research has also found that the introduction of a computer into homes, with its traditional association with work or study, became a source of conflict. There was a degree of unease about trying to incorporate a work-related machine into domestic leisure space. This unease was manifest in four main ways. Firstly, the children strongly resisted using it as a work tool, secondly, parents resisted pressurising children to use it as such, thirdly, families were often keen to locate the computer somewhere that would keep it separate from family living and relaxation space, and finally some families were concerned that its "officey" aesthetics were inappropriate for a family room.

It is clear that the PC, first developed for office use, has not metamorphosed successfully into a domestic machine. It holds strong work associations and most families are reluctant to allow work to creep into their domestic space. Where it is used for work in the home, it is commonly located in a study space that is usually separate from the communal living rooms. It seems that families want to protect their domestic domain from the world of work and, conversely, protect the relatively expensive equipment from potential damage. When, or if, the home computer becomes smaller or more aesthetically pleasing this situation may change.

9.2.4 The location:use relationship.

In this study, no relationship was found between where the computer is located in the home and the ways in which it is used. It's location has no relationship with either what it is used for, or the social circumstances of the user. Creating a quiet study space does not promote more studious use, and positioning the computer in a room with a high level of social traffic does not mean that the child is more likely to share their session with another family member. Children still prefer games even if the environment is made conducive to study, and parents still resist scaffolding their children's computer use, even though they may be in close proximity. This is another indication of the strength of domestic resistance to using the computer in a tutorial role and of parental resistance to spending time with their children in this situation.

9.2.5 Most children use their home computers alone

The study found that, regardless of location, children do not routinely share their computer sessions with another person. Parents spent very little time accompanying their children over prolonged periods. They verbally reported that some of their interactions with their children were fleeting and too brief to constitute a change of users, and were therefore unregistered on the log in software. This suggests that parents are not overly concerned with closely monitoring their child's home computing activities over long periods. It was found that any attempts, on the behalf of parents, to sit with their child are firmly resisted; children preferring their computing experiences to be autonomous. This probably reflects a lack of parental awareness of the benefits of scaffolding and may also be due to a lack of confidence or computing ability in some parents.

There is scope for improvement in screen and furniture design that could encourage and support more than a single user. Venkatesh (2001) argues that "the PC remains only partially adapted to and integrated to the special needs of families and home-based users...[it] has not been fully domesticated for family usability" (p92). He has designed several new chairs to facilitate shared computer use. These include a "tandem chair" which has a footrest that can double as a seat for a small child. Other innovations, which could be used to avoid sibling arguments, are the "split screen monitor", where two users can use the same computer at the same time, and the "remote access monitor". These portable, handheld monitors allow access to the screen from anywhere in the room, to multiple users. This can also be used by a parent to monitor their child's computer activities from a distance. The current research findings suggest that there is a need for this type of innovative design if scaffolded activity is to be encouraged in the future. This would make shared computer use easier and increase the possibility for parental scaffolding.

9.2.6 The fate of novel educational software

The novel software, that was introduced into the family homes, was initially used enthusiastically but this usage quickly diminished to a relatively low level. Even though this software represented market leading companies, and was enthusiastically and positively received, children made little use of it. Moreover, even though the software was present in homes for nearly 3 months, many parents were unable to discuss its contents as they were not familiar with it. This finding supports the interview responses given by parents that indicated that they have a low level of engagement with their children's computing activities. The logging of users also indicated that parents generally did not sit with their children whilst they were using this software; children spent most of their time using this software alone.

These findings, together with those discussed in 9.1.2, are a clear indication that there is a definite discrepancy between parents' ambitions for the way in which their children use the home computer and their actual usage. The parents in this study appeared to have accepted that the computer was used mainly as a games machine by their children but also maintained a hope that it might be used otherwise, as indicated by the fact that they still bought educational software in the hope that it would be used. It seems as though the parents' main role is in the provision of hardware and software and that they expect the software to be attractive enough to draw their children into using it without any input from themselves. This ideal scenario clearly does not occur. This suggests that if parents consider it important that their children become more engaged with ICT, they would be best advised either to redirect their spending to software that is more intrinsically engaging, or change their practices to offer more encouragement and support.

Those novel titles that included a high degree of game play were most popular, which supports the fact that children preferred their home-based computing activities to be entertainment oriented. Parents also objected to titles that were overtly educational to the detriment of being entertaining, and to those that pressurised their children. With regard to software design, parents and children discussed several features that, they felt, made the software more attractive. In particular, they were concerned that the software should offer both educational value, plus an engaging and enjoyable experience. These findings reinforce the fact that the home computer is perceived as a tool for pleasure and entertainment rather than as a support for formal learning.

9.2.7 The contexts of home and school support different types of computer use

This research has revealed a number of fundamental differences between the contexts of the primary school classroom and the family home. These have a strong role in mediating how computers are accessed and used in either setting. Perhaps the most profound difference is that they have very different institutional agendas. School is firmly a place for education and learning and its institutional infrastructure, especially the national curriculum and the role of its staff, supports this aim. Conversely, at home, there is no formal agenda. Any learning that occurs is, with the exception of homework, informal and is embedded within an entertainment/leisure ethos. When such differences are considered it is not difficult to understand why the use of entertainment games predominates at home; there is not the institutional infrastructure to support more academic use of computers. These fundamental differences suggest that the development of links between home and school, where practices from one context infiltrate the other, would be very difficult to achieve. However, there are a few locations where this has been implemented.

Projects that have been successful in this field, such as Broadclyst Community Primary School (Kuhn 2001), are examples of how successful this can be when the appropriate support is offered. This school rents computers to parents for £5 a week and sets on-line homework. However, such projects differ, in approach, from the research discussed in this thesis in one fundamental way: they are concerned with using the home computer to *carry out school work*, whereas this thesis has been focused on how home computers were used to *supplement school work*. Children in projects such as that cited above are encouraged and supported to use their home computers to carry out work that has been set by the school. Some of the schools that have fostered successful links with their pupils' homes (www.becta.org.uk) heavily rely on the internet and e-mail. For example, they have school web pages with links to educational resources and information about classroom activities. The success of web links, to support classroom activities in the home, is well documented and many of the schools have received awards (www.becta.org.uk). Such projects have gone some way towards making the child's experience of learning more continuous across the two different settings of home and school. They are learners, and are supported as such, in both contexts.

Another option that has been considered is to introduce the use of entertainment games, that include activities that support national curriculum goals, into the classroom (e.g. Becta 2001, McFarlane, Sparrowhawk and Heald 2002). These authors conclude that if maximum educational benefit is to be gained from playing games, there has to be clear, teacher-generated learning objectives, the session has to be structured, and there is further benefit if more than one child uses the game at a time as this promotes collaboration, discussion and verbal reasoning skills. The use of games in the classroom would also have the added benefit of being enjoyable and may improve children's perceptions of classroom computer use.

9.3 Overarching conclusions and future research

There are two overarching conclusions that can be drawn from the current research:

1) The domestic ecology is generally not supportive of 7-11 year old children using computers to support their formal education, hence

2) Educational CD-ROMs currently are not the best way to engage children of this age with computers in the home.

The home and the school settings were found to support different types of activity. The ecology of the classroom meant that the use of educational software was prioritised over and above entertainment games. At home, a different picture was found, where precedence was given to entertainment games. Provision of a home computer and of educational software was not enough, by itself, for reported parental aspirations for educational computer use to be met in reality. Home computer use was embedded in local ecology so that without a context that supported its use as an educational tool, children did not use it to its full potential.

However, this study has also demonstrated that parents still purchase educational software in the hope that it will be used. It seems unwise to dismiss this as misplaced optimism and more constructive to consider how/whether this problem can be remedied. What are the obstacles that might most easily be overcome to remediate this situation if this is regarded a priority? The findings discussed above suggest that parental attitudes and practices have to change if the computer is to be used more effectively as a learning tool in the future. Parents have a potentially pivotal role to play and would need to become more informed and supportive. This study has found that they are relatively ill-informed about how they can support classroom activities and about which software to buy, which suggests that any future plans to use the home computer as a learning resource would need considerable input from teachers and schools. In order to ensure that parents are well informed, the link between homes and schools would need to be strengthened.

The potentials of such a relationship might be explored. Is it possible for schools to advise parents about the advantages of collaborative use of computers and how this can facilitate learning? Would parents be willing to adopt the school practice of celebrating children's achievements publicly? Could parents be made more aware of the benefits of playing games or using the internet for leisure? Future research could also investigate the potential role of the educational CD-ROM as a portable link between the home and school. For example, would it be feasible for schools, with their multiple user licences, to have CD-ROM libraries that parents and children could borrow from?

Another possible intervention, which would require school policy to change, is for teacher and ICT co-ordinators in schools to discuss children's school computing activities in their teacher-parent interviews. This should not be difficult, especially as the computer is used across most curriculum subjects. Parents would then be in a position of knowing what their children use computers for at school and would have more idea about the type of use that could be promoted at home to support curriculum activities.

Another consideration is whether schools could reconsider how to make the best of their computers. They need to make them more attractive to children and so they do not consider them to be "boring". Could some home computing practices be transferred to the classroom? The current research suggests that children would welcome the use of entertainment games, such as SimCity, that support curriculum activities and the development of ICT skills in general. This would require the schools in this study to change their current policy that prevents use of such titles. The use of these titles would give children an engaging context in which to gain experience, as compared with some current classroom practices which are outcome oriented and are perceived as being dull. However, it must be acknowledged that teachers currently have heavy work-loads so implementation would require time and support.

Finally, this thesis has demonstrated the utility of adopting a cultural psychological perspective on children's home computer use. It has demonstrated how practices cannot be conceptualised as occurring in a contextual vacuum. Instead, they are contextually embedded. This means that if parents' aspirations, that they hold when purchasing a new computer, are to be met in reality, attention has to be paid to facilitating an ecology that will be supportive and encouraging of children learning in the home. With improved links between home and school, parents would have a better understanding of what their potential role could be. The domestic ecology could be remediated to be more supportive of children's out-of-school education in the future.

References

Amory A., Naiker K., Vincent J. and Adams C., (1998), *Computer games as a learning resource,* http://www.und.ac.za/und/biology/staff/amory/edmedia98.html

Anderson C.A. and Dill K.E. (2000), Video games and aggressive thoughts, feelings and behavior in the laboratory and in life, *Journal of Personality and Social Psychology,* 78(4), pp 772-790.

Association for Revision and Curriculum (2000), *Only the best 2000-2001: The annual guide to the highest-rated educational software and multimedia.*

Baker L., Sonnenschein S., Serpell R., Fernandez-Fein S. and Scher D. (1994), *Contexts of emergent literacy,* USA: National Reading Research Center.

Barnard J. (1999), Computers in FE biology-a study of how teachers' classroom practice can be affected by different types of software, *Educational Technology and Society,* 2 (4).

Banbury L. (2000), Apple sees UK sales soar, Macworld daily news, http://www.macworld.co.uk/news/top_news_item.cmf?NewsID=1420

Bandura A., Ross D. and Ross S.A. (1963), Imitation of film-mediated aggressive models, *Journal of Personality,* 66, pp3-11.

Barker C. (1997), Television and the reflexive project of the self: soaps, teenage talk and hybrid identities, *British Journal of Sociology,* 48(4), pp 611-628.

Barton D. and Hamilton M. (1998), *Local literacies,* London and New York, Routledge.

Beentjes J.W.J., Koolstra C.M., Marseille N. and van der Voort T.H.A. (1997), *Waar blijft de tijd? De tijdsbesteding van kinderen en jongeren van 3 tot 17 jaar,* Leiden, the

Netherlands: Leiden University. Cited in Beentjes J.W.J., Koolstra C.M., Marseille N. and van der Voort T.H.A. (2001).

Beentjes J.W.J., Koolstra C.M., Marseille N. and van der Voort T.H.A. (2001), Children's use of different media: for how long and why? In S. Livingstone and M. Bovill (eds.), *Children and their changing media environment*, Mahwah, New Jersey: LEA.

Becta (2001), *Computer games in education*, http://www.edgameforum.ngfl.gov.uk (need to register and login to VTC conferencing system to gain access to this paper).

Bereiter, C. (2002), *Education and mind in the knowledge age*, Mahwah N.J. and London: Lawrence Erlbaum.

Berkowitz, L.(1962), *Aggression: a social psychological analysis*, New York: McGraw Hill

Bronfenbrenner U. (1979), *The ecology of human development: experiments by nature and design*, Cambridge, Mass., London: Harvard University Press.

Buckingham D. (1993), Boy's talk: television and the policing of masculinity, in D. Buckingham (ed.), *Reading Audiences*, Manchester and New York: Manchester University Press.

Charlton, T. (2000), TV is not bad for children-official, *Observer*, October 29th.

Children's software review, http://www.childrenssoftwarereview.com

Cole M. (1995), Socio-cultural-historical psychology:some general remarks and a proposal for a new kind of cultural-genetic methodology, in J.V.Wertsch, P. Del Rio and A.Alvarez (eds.), *Sociocultural studies of mind*, Cambridge: Cambridge University Press.

Cole M. (1996), *Cultural psychology*, Harvard University Press, Cambridge.

Comber C., Colley A., Hargreaves D.J. and Dorn L. (1997), The effects of age, gender and computer experience upon computer attitudes, *Educational Research*, 39(2), pp123-133.

Cooper J., Hall J. and Huff C, (1990), Situational stress as a consequence of sex-stereotyped software, *Personality and Social Psychology Bulletin*, 16, pp 419-429.

Crawford C. (1982), The art of computer game design, http://www.geocities.com/SiliconValley/Foothills/3761/Coverpage.html

Crook C. (1994), *Computers and the collaborative experience of learning*, London and New York: Routledge.

Cuban L. (1986), *Teachers and machines*, New York: Teachers College Press.

Cuban L. (2001), *Oversold and underused, computers in the classroom*, Camb. Mass: Harvard University Press.

Daniels H. (1989), Visual displays as tacit relays of the structure of pedagogic practice, *British Journal of Sociology of Education*,10(2), pp123-140.

Department for Education and Employment (1999), *The national curriculum for England: Information and communication technology,* London: The Stationary Office.

DfEE (1997a), *Excellence in Schools*, http://www.dfee.gov.uk/wpaper/mindex.htm

DfEE (1997b), *National grid for learning*, London: HMSO.

DfEE (1998), *The Learning Age*, London: HMSO.

DfEE (2000a), *The national curriculum for England,* http://www.nc.uk.net

DfEE (2000b), *Statistics of education: Survey of information and communications technology in schools, England 2000.*

DfES at http://www.dfes.gov.uk/a-z/HOME_SCHOOL_AGREEMENTS.html

Donnerstein E. and Berkowitz L. (1981), Victim reactions in aggressive erotic films as a factor in violence against women, *Journal of Personality and Social Psychology*, 41, pp 710-724.

Downes T. (1998a), Children's and parent's discourses about computers in the home and school, *proceedings of the 16th Australian computers in education conference*, Adelaide, CEGACT.

Downes T. (1998b), Using the computer at home, in M. Monteith (ed.), *IT for learning enhancement*, Intellect Books.

Downes T. (1999), Playing with computing technologies in the home, *Education and Information Technologies*, 4(1), pp 65-79.

Downes T. and Reddacliff C. (1996), Young children talking about computers in their homes, *proceedings of the 14th Australian Computers in education conference*, Canberra, CEGACT.

Drenoyianni H. and Selwood I.D. (1998), Conceptions or misconceptions? Primary teachers' perceptions and use of computers in the classroom, *Education and Information Technologies,* vol.3, pp87-99.

Druin A., Bederson B., Boltman A., Miura A., Knotts-Callahan D. and Platt M. (1999), Children as our technology design partners, in A. Druin (ed.), *The design of children's technology*, San Francisco: Morgan Kauffman Publishers Inc.

Dunn S. and Ridgeway J. (1991a), Computer use during primary school teaching practice: generic skills to think about, *Journal of Computer Assisted Learning*, 7, 7-17.

Dunn S. and Ridgeway J. (1991b), Naked into the world: IT experiences on a final primary school teaching practice-a second survey, *Journal of Computer Assisted Learning*, 7, 229-240.

Edwards D. and Mercer N. (1987), *Common knowledge: towards the development of understanding in the classroom,* London: Methuen.

Facer K., Furlong J., Sutherland R. and Furlong R. (2000), Home is where the hardware is: young people , the domestic environment and 'access' to new technologies, in I. Hutchby and J. Moran-Ellis (eds.), *Children, technology and culture*, London: Falmer.

Fisher S. (1994), Identifying video game addiction in children and adolescents, *Addictive Behaviors*, 19 (5), pp 545-553.

Funk J.B. and Buchman D.D. (1996), Playing violent video and computer games and adolescent self concept, *Journal of Communication*, 46 (2), pp19-32.

Furlong J., Furlong R., Facer K. and Sutherland R. (2000), The national grid for learning: a curriculum without walls? *Cambridge Journal of Education*, 30 (1), pp 91-110.

Gallimore R. and Goldenberg C. (1993), Activity settings of emergent literacy: home and school factors in children's literacy, in N.M. Forman and C.A. Stone (eds), *Contexts for learning,* Oxford University Press, UK.

Garitaonandia C., Juaristi P. and Oleaga J.A. (2001), Media genres and content preferences, in S. Livingstone and M. Bovill (eds.), *Children and their changing media environment*, Mahwah, New Jersey: LEA.

Gates B. (2001), I have seen the future and it's a PC, *The Sunday Times*, 12th August.

Gauntlett D. (1995), *Moving experiences: understanding television's influences and effects*, London: John Libbey.

Gauntlett D. and Hill A. (1999), *TV Living*, Routledge, London and New York.

General Household Survey (2000), http://www.statistics.gov.uk/lib/index.html

Giacquinta, J.B., Bauer, J.A. and Levin J.E. (1993), *Beyond technology's promise*, Cambridge: Cambridge University Press.

Gibson J.J. (1979), *The ecological approach to visual perception*, New York: Houghton Mifflin.

Gillespie M. (1995), *Television, ethnicity and cultural change*, London and New York: Routledge.

Gorriz C.M. and Medina C. (2000), Engaging girls with computers through software games, *Communications of the ACM*, 43(1), pp 42-49.

Greenfield P. (1996), Video games as cultural artifacts, *Journal of Applied Developmental Psychology*, vol. 15, pp3-12.

Harley T.A. (1995), *The psychology of language*, Hove: Psychology Press.

Harris S. (1999), Secondary school students' use of computers at home, *British Journal of Educational Technology*, 30 (4), pp331-339.

Hawkey R. (2002), http://www.archimuse.com/mw2002/bios/au_75010335.html

Heath S.B. (1983), *Ways with words*, Cambridge, UK: Cambridge University Press.

Hennigan K.M., Del Rosario M.L., Heath L., Cook T.D., Wharton J.D. and Calder B. (1982), Impact of the introduction of television on crime rates in the united states: empirical findings and theoretical implications, *Journal of Personality and Social Psychology*, 42 (3), pp461-477.

Hewson, D. (1984), The little newcomer I learnt to love, *The Times*, April 10th, p19.

Howe M.J. (1983), *Learning from television*, London, Academic Press.

Johnstone B. (1981), Every home should have one, *The Times*, February 28th, p21.

Johnstone B. (1983), Sales of home computers will double to £300m, market survey predicts, *The Times*, August 8th, p16.

Joiner R.W. (1998), The effects of gender on children's software preferences, *Journal of Computer Assisted Learning*, vol.14, pp195-198.

Jones E. and Villarino G. (1994), What goes up on classroom walls- and why? *Young Children*, 42(2), pp38-40.

Kafai Y.B. (1996), Electronic play worlds, in Y. Kafai and M. Resnick (eds.), *Constructionism in practice*, New Jersey: LEA.

Kafai Y.B. (1999), Children as designers, testers and evaluators of educational software, in *The design of children's technology*, A. Druin (ed.), San Francisco: Morgan Kaufmann.

Kafai Y.B. and Sutton S. (1999), Elementary school students' computer and internet use at home: current trends and issues, *Journal of Educational Computing Research*, 21(3), pp345-362.

Kinder M. (1996), Contextualising video game violence: from teenage mutant ninja turtles 1 to mortal kombat 2, in P. M. Greenfield and R.R.Cocking (eds.), *Interacting with video*, Norwood: Ablex Publishing.

Kirsh S.J. (1998), Seeing the world through mortal kombat-coloured glasses. Violent video games and the development of a short-term hostile attribution bias, *Childhood*, 5(2), pp177-184.

Koch M. (1994), No girls allowed, *Technos*, 3(3).

Krotz F. and Hasebrink U. (2001), Who are the new media users? in S. Livingstone and M. Bovill (eds.), *Children and their changing media environment*, Mahwah, New Jersey: LEA.

Kuhn A. (2001), Children leading the way to classroom of the future, *Western Morning News*, 7th April.

Lave, J. (1988), *Cognition in practice: mind, mathematics and culture in everyday life*, Cambridge: Cambridge University Press.

Lesser G.S. (1974), *Children and television: Lessons from Sesame Street*, New York, Random House.

Levy M.R. (1980), Home video recorders: a user survey, *Journal of Communication*, 30, pp23-27.

Lewin C., Scrimshaw P., Harrison C., Somekh B. and McFarlane A. (2000), ImpaCT2 project, Preliminary study 2, Promoting achievement: pupils, teachers and contexts, *http://www.becta.org.uk/research/reports/docs/impact2_prelim2.pdf*

Littleton K. and Light P. (1999), *Learning with computers: analysing productive interactions*, London:Routledge.

Livingstone, S.M. and Bovill M. (1999), *Young people, new media: report of the research project: Children, young people and the changing media environment*, London: London School of Economics and Political Science.

Livingstone S. and Bovill M., (2001), *Families and the internet: An observational study of children and young people's internet use*, http://www.lse.ac.uk/depts/media/people/slivingstone/btreport_familiesinternet.pdf

Livingstone S. (2002), *Young people and new media*, London: Sage Publications.

Lull J. (1990), *Inside family viewing*, London, New York: Routledge.

Malone T.W. (1981a), Toward a theory of intrinsically motivating instruction, *Cognitive Science*, vol. 4, pp333-369.

Malone T.W. (1981b), What makes computer games fun? *Byte*, 6(12), pp258-277.

Mayall B. (1994), Children in action at home and school, in Mayall B. (ed.), *Children's childhoods: observed and experienced*, London, Washington DC: Falmer Press.

McFarlane A., Sparrowhawk A. and Heald Y., (2002), *Report on the educational use of games*, http://www.teem.org.uk/howtouse/resources/teem_gamesined_full.pdf

McNamee S. (1998), Youth, gender and video games: power and control in the home, in T. Skelton and G. Valentine (eds.), *Cool Places*, London and New York: Routledge.

Mintel (2000), *Educational Software*, http://www.lboro.ac.uk/library/info/mintel.html

Mintel (2001), *Computer retailing*, http://www.lboro.ac.uk/library/info/mintel.html

MORI (2001), *Visitors to museums and galleries in the UK*, www.resource.gov.uk/documents/mori3.pdf

Morley D. (1988), Domestic relations: the framework of family viewing in Britain, in *World families watch television*, Lull J. (ed.), California, England, India: Sage.

Mumtaz S. (2001), Children's enjoyment and perception of computer use in the home and the school, *Computers and Education*, 36(4), pp347-362.

National statistics (2000), *Internet Access*, http://www.statistics.gov.uk/pdfdir/inter0100.pdf

National Statistics Socio-economic Classification (2001), http://www.statistics.gov.uk/methods_quality/ns_sec/

Newburger E.C. (2001), Home computers and internet use in the united states: August 2000, U.S. Census Bureau, http://www.census.gov/prod/2001pubs/p23-207.pdf

NGfL (2001), Young people and ICT, becta.org.uk/research/reports/docs/youngict.pdf

Nicolopoulou A. and Cole M. (1993), Generation and transmission of shared knowledge in the culture of collaborative learning: the fifth dimension, its play-world, and its institutional contexts, in E.A.Forman, N. Minick and C.A.Stone (eds.), *Contexts for learning*, UK: Oxford University Press.

Noble G. (1983), Social learning from everyday television, in M.J.A.Howe (ed.), *Learning from television: psychological and educational research*, London: Academic Press.

Okagaki L. and Frensch P.A. (1996), Effects of video game playing on measures of spatial performance: Gender effects in late adolescence, in P.M.Greenfield and R.R.Cocking (eds.), *Interacting with video*, Norwood, Ablex Publishing Corporation.

Orleans M. and Laney M. (2000), Children's computer use in the home: isolation or sociation? *Social Science Computer Review*,18(1), pp56-72.

Papert S.(1980), *Mindstorms: children, computers, and powerful ideas*, New York:Basic Books.

Papert S. (1984), Trying to predict the future, *Popular computing*, October.

Pasquier D. (2001), Media at home: Domestic interactions and regulations, in S. Livingstone and M. Bovill (eds.), *Children and their changing media environment*, Mahwah, New Jersey: LEA.

Provenzo E.F. (1991), *Video kids: making sense of nintendo*, Cambridge: Harvard University Press.

Robertson J. (2002), The ambiguous embrace: twenty years of IT (ICT) in UK primary schools, *British Journal of Educational Technology*, 33 (4), pp 403-409.

Roe K. (1998), Boys will be boys and girls will be girls: Changes in children's media use, *Communications*, 23, pp5-25.

Roe K. and Muijs D. (1998), Children and computer games: A profile of the heavy user, *European Journal of Communication*, 13 (2), pp181-200.

Schofield J.W. (1995), *Computers and classroom culture,* Cambridge:Cambridge University Press.

Schweder R.A. (1990), Cultural psychology-what is it? in J.Stigler, R.A.Schweder and G.Herdt (eds.), *Cultural psychology: essays on comparative human development*, Cambridge: Cambridge University Press.

Sefton-Green J. and Buckingham D. (1998), Digital visions: Children's 'creative' uses of multimedia technologies, in J. Sefton-Green (ed.), *Digital Diversions*, London and Pennsylvania: UCL Press.

Selwyn N. (1998), The effect of using a home computer on students' educational use of IT, *Computers and Education*, 31, pp 211-227.

Selwyn N. and Bullon K. (2000), Primary school children's use of ICT, *British Journal of Educational Technology*, 31 (4), pp321-332.

Silverstone R., Hirsch E. and Morley D. (1992), Computers and the moral economy of the household, in R. Silverstone and E. Hirsch (eds), *Consuming Technologies*, London: Routledge.

Smith D. and Keep R. (1986), Children's opinions of educational software, *Educational Research*, 28(2), pp 83-88.

Statistics.gov.uk (2000), *Internet access*, http://www.statistics.gov.uk/pdfdir/inter0700.pdf

Subrahmanyam K. and Greenfield P.M. (1996), Effects of video game practice on spatial skills in girls and boys, in P.M.Greenfield and R.R.Cocking (eds.), *Interacting with video,* Norwood: Ablex Publishing Corporation.

Subrahmanyam K. and Greenfield P.M. (1999), Computer games for girls: what makes them play?, in J. Cassell and H. Jenkins (eds.), *From barbie to mortal kombat*, Cambridge: MIT Press.

Süss D. (2001), Computers and the internet in school: closing the knowledge gap? In S. Livingstone and M. Bovill (eds.), *Children and their changing media environment,* Mahwah, New Jersey: LEA.

Sutherland R., Facer K., Furlong R. and Furlong J. (2000), A new environment for education? The computer in the home, *Computers and Education*, 34 (3-4), pp 195-212.

Swanson J. (1995), *What's the difference?* http://www.girltech.com/Mentors/MN_research2.html

Tammen J. and Brock L. (1997), CD-ROM multimedia: what do kids really like? *Multimedia Schools*, 4(3), pp54-59.

Teale W.H. (1986), Home background and young children's literacy development, in W.H.Teale and E.Sulzby (eds), *Emergent literacy*, N.J: Ablex Publishing Corporation.

Tobin J. (2000), *Good guys don't wear hats,* New York: Teachers College Press.

Tolmie A. (2000), Examining learning in relation to the contexts of use of ICT, *Journal of Computer Assisted Learning*, 17, pp 235-241.

Tolmie A. and Boyle J. (2000), Factors influencing the success of computer mediated communication (CMC) environments in university teaching: a review and case study, *Computers and Education*, 34, pp 119-140.

Turkle S. (1984), *The second self: computers and the human spirit*, London:Granada.

Turkle S. (1997), *Life on the screen: identity in the age of the Internet*, London:Phoenix.

US Department of Education (2000), *Teachers tools for the 21st century*, National Center for Education Statistics.

Venkatesh A. (2001), The home of the future: an ethnographic study of new information technologies in the home, pp 88-96 in *Advances in consumer research XXV111*, M.Gilly and J. Myers-Levy (eds.), Valdosta, Georgia: Association for Consumer Research.

Venkatesh A., Shih E. and Stolzoff N. (2000), A longitudinal analysis of computing in the home, in A.Sloane and F. van Rijn (eds.), *Home informatics and telematics*, IFIP TC9 WG9.3 International conference on home oriented informatics and telematics (HOIT2000), "IT at home: virtual influences on everyday life", June 28-30, 2000, Wolverhampton, UK.

Vygotsky L. (1978), *Mind in society: the development of higher mental processes*, M.Cole, V. John-Steiner, S.Scribner, E.Souberman (eds.), Cambridge, Mass.: Harvard University Press.

Vygotsky L.S. (1981), The genesis of higher mental functions, in J.V.Wertsch (ed), *The concept of activity in soviet psychology*, New York: Sharpe.

Walkerdine V. (1993), Daddy's gonna buy you a dream to cling to (and mummy's gonna love you as much as she can), in D. Buckingham (ed.), *Reading audiences*, Manchester University Press, Manchester and New York.

Wartofsky M. (1979), *Models*, Dordrecht: Reidel.

Wegerif R. and Mercer N. (1996), Computers and reasoning through talk in the classroom, *Language and Education*, 10 (1), pp 47-64.

Wertsch J.V. (1991), A sociocultural approach to socially shared cognition, in L.Resnick, J. Levine and S. Teasley (eds.), *Perspectives on socially shared cognition*, Washington: American Psychological Association.

Wertsch J.V. (1998), Mediated action, in W. Bechtel and G. Graham (eds.), *A companion to cognitive science*, Oxford: Blackwell.

Wiegman O. and van Shie E.G.M. (1998), Video game playing and its relations with aggressive and prosocial behaviour, *British Journal of Social Psychology*, 37, pp367-378.

Williams D., Coles L., Wilson K., Richardson A. and Tuson J. (2000), Teachers and ICT: current use and future needs, *British Journal of Educational Technology*, 31(4), pp307-320.

Wilson L.J. (1998), Children as software reviewers, *Childhood Education*, 74(4), pp 250-252.

Wood D.J., Bruner J.S. and Ross G. (1976), The role of tutoring in problem solving, *Journal of Child Psychology and Psychiatry*, vol.17, pp 89-100.

Web sites:

http://www.becta.org.uk/teaching/homeschoollinks/
http://www.childrenssoftware.com
http://www.choosingchildrenssoftware.com

http://www.dfes.gov.uk

http://www.evalutech.sreb.org.

http://www.pin.org.uk

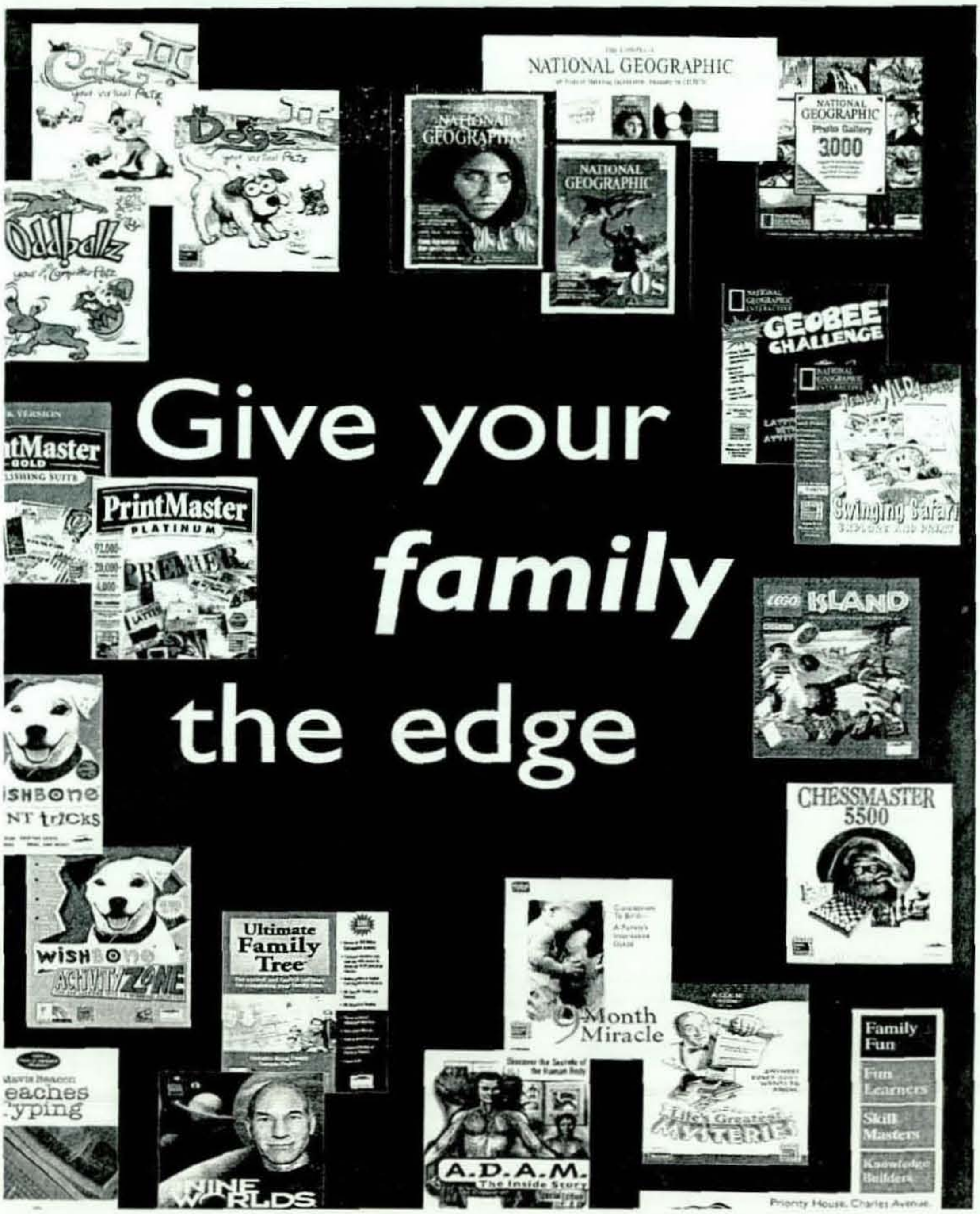
http://www.school.discovery.com

http://www.superkids.com

Appendix 1: Examples of family hardware advertisements

Appendix 2a: Example of family software advertisement

Appendix 2b: Example of family software advertisement



Appendix 3: School children's interview schedule

Preamble: We're going to answer some questions about computers because I want to find out how you use them in school. There's no wrong answers so you can never be wrong. It's not a test and there are no marks. Do you mind if I tape record what we talk about?

Questions to ascertain type and frequency of computer use

1) What have you been doing in your class this morning/afternoon?
2) Do you ever use the computer to do anything?
3) Lets see if we can make a list of all the things that you do on the computer in school (type list on screen or write on paper)?
4) Can you remember when you last used the computer in school?
5) Is this the usual pattern?

Question to determine what is produced by using the computer and the destination of these products

6) When you do all these things on the list what happens to the work or game scores when you've finished?

Questions to determine the social context of computer use

7) Look at the list and tell me whether you did each one with a friend or partner or by yourself
8) Which way do you like it best-with a friend /partner or by yourself, and why?
9) When you were doing these things, how much help did the teacher give you?
10) Are there ever any arguments about who uses the computer at school?

Question to determine the child's views about the physical positioning of the computer

11) Do you think that this is the best place for the computer or would it be better somewhere else-where and why?

Question to determine home computer ownership

12) Do you have a computer at home?
13) For those that do not have a computer at home: do you wish you had one-why? Do you use one in anyone else's house?
14) For those that do have a computer at home: what sort have you got-is it like this one?

Appendix 4: Questionnaire items for teachers.

Questions to ascertain type and relative frequency of software used

1) We are interested in how the computer is being used by children in your class so it would be very helpful if you could take a moment to list all the software that you have used this academic year.

2) You probably spent more time using some software than others so please could you put a rough estimate of the percent of time that has been spent on each (please don't forget software that has been used as a secondary source e.g. like a graphics programme that is used to illustrate a word processed document. Feel free to use the category 'others' to include resources infrequently used).

Question to determine what is produced using the computer and the products' destination

3) Many programmes produce a lasting product such as graphs or stories which can be printed out. Please can you make a list of the kind of things that children produce in this way and describe what happens to them (e.g. filed away or put on the wall).

Question to determine the social aspects of use

3) Please describe how use of the computer is encorporated into your lesson plans and how access to computers is managed.

Question to determine teacher's ICT confidence levels

4) Please could you indicate how confident you feel about dealing with the computer and computer-related problems.

Question to determine the nature of children's ICT enquiries

5) Please could you give examples of the types of ICT related questions that children typically ask you.

Appendix 5: Photographs of classroom wall displays

Appendix 6: Family recruitment letter.

Loughborough University (Department of Human Sciences)

Would your family care to help us discover more about what children like (or dislike) about computers?

If you have a PC at home, you could join in by filling in the slip below and returning it to school in the usual way.

We are working collaboratively with five Loughborough primary schools - trying to learn what children like (or dislike!) about computers. In the long run, we hope to gain clearer ideas about how the home computer might best help young children. NB: no special expertise/enthusiasm is presumed in you or your child! Just an interest in making good use of your computer.

What happens if I fill in the slip?

No obligation follows. One of us will telephone (or visit if you prefer) explaining what the survey is about and answering any questions. If you took part, there would be a few visits (at times that suited) during the year at which one of us would talk about your computer with you and your child (No right answers! No "tests"!) For some agreed period, we would make a simple record of what your computer gets used for.

How would this help my family?

We think you would be helping with a generally useful survey. But you would also receive (to keep) over £100 of educationally-oriented software (e.g. Dorling Kindersley titles). We are interested in what your child thinks of these - but nothing *special* has to be done with them. Finally, you would become eligible to use a computer help-line service (manned at certain times by an expert student) - should you ever be in need of technical advice about your PC.

If you are interested, please tell us your name and telephone number (or address if would prefer more explanation in a visit). Return this slip to school (or ask your child to do so). Again, there is no obligation to help further. If you want more details right now - phone Cindy Kerawalla during the day at the university on 01509 228486.

Your child's first name: ....and surname.................................

Your child's age:............................

Your telephone number: ....

(Optional): Good times to call you ....

(Optional): Address for visit in place of telephone call ....

....

Computers at Home Project: in the event of over-subscription, names will be randomly selected.

Appendix 7: Letter sent to families participating in the home study following the initial phone call

4th June 1999

Dear parent(s),

Thank you very much for your interest in our study about children and home computers. When we spoke on the phone I promised to send further details. I hope this letter explains a little more about the project

We should stress that our interest is very much at the level of "What is happening?" So all our contact with families should have a relaxed and exploratory atmosphere. However, in general, we want to understand how, when, and where the home computer gets used, particularly in relation to the interests of young children. This means you could help in three ways.

First, through some informal conversation with family members about computer use. Second, through allowing us to make a snapshot of how your computer gets used over a period of time (we would install a program that remembers and stores this in the background). Third, through you trying out and commenting on some educationally-oriented home software titles.

The conversations could be carried out during a few short visits - always at mutually convenient times (daytime or evening, weekday or weekend) during the rest of this year and possibly into the new year. No expert or specialist knowledge is expected! The types of things to discuss will be, for example, what your child uses the computer for, when/how often they use it, what your views are concerning using the home computer for education, what software you have purchased and how you made any purchasing choices.

I will come to your home to meet you and to install the computer-use logging program either in the week beginning 14th June or 21st June. This program is unobtrusive and safe (it requires only 3.6 Mb of disc space): it requires no attention from yourselves. It would run in the background for 30 days in the first instance.

As long as you are involved with the project we can provide a modest telephone help line. This would be open at certain times each week and you are welcome to ask our PC expert (called Jim) any questions about your home computer - whether or not they are related to this project. If you are having problems of any kind, he may be a useful guide. However, to help him help you, it would be useful at the introductory visit for me to take a few details of your PC - so that these are to hand should you use the helpline.

Finally, when we do meet, I will invite you to sign a routine consent form. This is merely to ensure that you understand the aims and terms of the project. Of course you are quite free to withdraw at any time - although if this happens very quickly then you may be asked to return the software so that it can be given to another family.

I will be phoning you again some time over the next couple of weeks in order to arrange a convenient time for my first visit. Meanwhile, if you have any further questions please feel free to contact me at the university on 01509 228486. Thanks again for your interest, I look forward to meeting you.

Cindy Kerawalla

Appendix 8: Letter sent to families that had not been selected to take part in the family study

8^{th} June 1999

Dear Parent(s),

Thank you for volunteering to take part in our study about children using computers at home. We had a large response to our request for volunteers and so, reluctantly, we have to disappoint some families in order to keep the final group to a size we can manage.

Unfortunately this time your child was not selected for inclusion - I must stress that the selection was entirely random. However, other families may withdraw and so we would like to keep hold of your contact details in case this happens. Also, we very much hope to expand this line of study and we are in discussion with major software publishers to this end. Again, we would like to keep a record of your interest on file - in case we can discuss your possible involvement in related activities at some time in the future.

Although pleased to attract such a large response, I am very sorry now to be writing to some families with this disappointment. We are very grateful for your interest and we do hope that we can contact you again as the work develops.

Yours faithfully

Cindy Kerawalla

Appendix 9: Joint Agreement form

Computers at Home Project: consent form

Thank you again for helping us with this research. Participation is quite confidential - although we do not expect our research to be embarrassing in any way!

However, signing this piece of paper is a useful formality: it indicates you are willing to take part and that you do know what the research is about in broad terms.

Being properly informed about our general aims is the issue here. Mostly these aims are met by us merely asking questions. In fact beyond agreeing to these conversations the only matter to consider is that you are happy for your PC to host our software. We have thoroughly tested these logging programs on several computers. So we are quite confident your own computer will be safe! Yet a computer running this software *could* develop problems quite coincidentally. So we have to proceed on a basis of mutual trust, and accept that our own work will not be implicated in any problems you might be suffering with your PC at this time. If you do feel your PC is in any way problematic at this time then you should consider whether you want to sign up in case later its tempting to cast the logging software as a *cause* of those problems.

The agreement between us

1) We have seen and understand the description of this research overleaf, and this family is happy to take part in the project

2) We expect the researcher to discuss use of computers within this family. The researcher will be considerate in finding suitable times for such occasional conversations.

3) We expect to receive items of educational software. We shall introduce these to the child(ren) in our family. The researcher will later ask him/her what they think of this material.

4) We permit logging software to be installed on our PC over negotiated periods of time. Specifically, a start-up "who are you" window and a Demo version of the commercial software "WinWhatWhere"

We have read and understand the description of the program WinWhatWhere.

We understand that WinWhatWhere will merely log the starting-up of desktop applications and movements between them. It will *not* log keyboard activity such as might occur in word processors or email windows.

We understand that we are entitled to examine any data log taken away for the project.

We agree that the functioning and security of my computer remains my own responsibility during this period

5) We understand that we have access to a PC helpline at agreed times of the week. This consultant will endeavor to help with any aspect of our PC use - although the decision to follow any advice is entirely our own.

6) We appreciate that we are entitled to withdraw from the study at any time and/or ask to have deleted any records arising from participation. If we need to withdraw in the early stages of the project we understand that we may be asked to return the free educational software in order that it may be used by the family replacing us.

5) I am signing on behalf of the household, all of whom wish to take part in the project.

Participant signature ....

Date ....

In presence of researcher ....

Appendix 9 contd: (reverse side of consent form)

Approximately 50% of families in the UK now own a computer and they are now part of most children's lives. It is therefore important to understand how children make use of them at home so we will be looking at computer use in a sample of families who have children of various ages. The child will be the focus of the study although we will also be interested in parents'/guardians' views. The study will involve the following:

1) A few visits by a researcher to family homes in order to have informal discussions with both the child and the rest of the family. These will be about such things as when and why they use their computer, how they decide which software to buy, and family views about learning at home. These short visits will be spread over several months.

2) A demo version of the software WinWhatWhere and a login window will both be installed onto the family computer/s by the researcher. The login window will record who is using the computer and WinWhatWhere will record which programmes they are using. The content of documents or emails will *not* be recorded. Once these are installed onto your computer by the researcher, you need to do nothing to maintain them.

3) Families will receive a few free educational software programmes shortly after the start of the project. They will be asked general questions about how they use them and what they think about them. These programmes do not need to be given 'special' treatment: the family can use them however they wish and they may keep them.

4) There will be a help line available from the time the new software is distributed. This can be used for queries about existing problems you may have with your PC as well as any queries that arise from use of the new software.

5) Although we don't expect to be an intrusion, we emphasise that we aim to cause as little disruption as possible. All appointments will be made at a time convenient to

you. No expert computer knowledge is presumed and any 'special' usage of the home computer during the study period is not expected.

<u>Contact Details</u>: This research will form part of the doctoral research being carried out by Cindy Kerawalla. She will be carrying out the visits to your home and can be contacted on 01509 228486 or email at L.J.Kerawalla@lboro.ac.uk The research is being managed overall by Dr Charles Crook (01509 223032) and is sponsored by the Department of Human Sciences at Loughborough University. Software companies such as Dorling Kindersley, Europress and Sherston Software are also supporting this study.

Appendix 10: Demographic details of families

Child (gender)	Age at study onset: yrs mos	Siblings (and age)	Parent/s' occupation	SES (estimate)
1 (f)	11 4	Sister (17)	Father: policeman Mother: nurse	3
2 (m)	11 6	Brother (13)	Father: student	N/A
3 (f)	11 5	Brother (15)	Father: quantity surveyor Mother: teacher	3
4 (f)	11 9	Sister (9)	Mother: secretary	3
5 (f)	11 1	Sister (13)	Father: tax inspector Mother: midwife	3
6 (f)	11 2	Brothers (14 and 19)	Father: engineer Mother: personal assistant	3
7 (f)	11 4	Sister (7)	Father: research scientist Mother: housewife	3
8 (m)	11 4	Brother (10)	Father: production line operative Mother: production line operative	5
9 (m)	11 3	Sister (8)	Father: engineer Mother: credit controller	3
10 (f)	9 5	Brother (11)	Father: surgical assistant Mother: clinical nurse practitioner	1
11 (m)	8 10	Brother (5)	Father: power station operator Mother: nurse	3
12 (m)	9 3	Brothers (9,12,14)	Father: management consultant Mother: housewife	3
13 (f)	8 9	Sister (4)	Father: lecturer Mother: administrator	1
14 (m)	9 4	Sister (12)	Father: lecturer Mother: teacher	1
15 (f)	9 9	Sister (19) brother (11)	Father: teacher Mother: receptionist	1
16 (f)	9 7	none	Father: self employed researcher Mother: teacher	4
17 (m)	9 4	Brother (12)	Father: sales director Mother: vicar	2
18 (m)	9 5	Brother (7) Sister (12)	Father: director/researcher Mother: student	3
19 (f)	9 3	Brother (7)	Father: salesman Mother:	3

			pharmaceutical representative	
20 (m)	9 5	Brother (15)	Mother: IT teacher	1
21 (f)	9 0	Brothers (11 14) Sister (6)	Father: salesman Mother: child minder	4
22(f)	7 2	Brother (13)	Father: golf course manager Mother: cook	4
23 (m)	7 6	Sister (3)	Father: CNC operator Mother: canteen assistant/cleaner	5
24 (m)	7 9	Brothers (10,12,14,16) Sister (5)	Father: vet Mother: housewife	1
25 (m)	7 1	Sister (10)	Father: painter and decorator Mother: ancillary worker	4
26 (m)	7 3	Sister (10)	Father: town planner Mother: library assistant/special needs assistant/school lunchtime supervisor	3
27 (f)	7 9	Brothers (11,13)	Father: IT consultant Mother: financial administrator	3
28 (f)	7 4	Brother (15) Sister (13)	Father: oil rig worker Mother: housewife	4
29 (m)	7 3	Sister (2)	Father: retail manager Mother: recruitment agent	3
30 (f)	7 6	Brother (13) Sister (9)	Father: company director Mother: artist	2
31(f)	7 4	Brothers (5,10,14)	Father: shop manager Mother: sales and marketing manager	2
32 (m)	7 7	Brother (6)	Father: school technical and classroom assistant Mother: personal assistant	3
33 (f)	7 3	Sister (2)	Father: paramedic Mother: assistant accountant	3

Appendix 11: Sample printout from log-in software

(Notes: There are 11 data fields: field one is the date, field two is the time and fields 3 to 11 are users. A "1" in any of columns indicates that a user has logged on and "0" indicates that they are inactive. If this were the printout for the default users in the screen shot in chapter 6, Mum would be in the first user column, Dad in the second user column, MaryLou in the third user column, Jack in the fourth user column etc. So, for example, the first line indicates that "MaryLou" and a "friend" logged on together on 07:01:99 at 09:47:06).

```
Date           Time                 Users

07-01-1999,09:47:06, 0, 0, 1, 0, 0, 1, 0, 0, 0
07-01-1999,09:47:13, 0, 0, 0, 0, 1, 0, 0, 0, 0
07-01-1999,09:54:06, 0, 0, 0, 0, 0, 1, 0, 0, 0
07-01-1999,18:59:19, 1, 0, 0, 0, 0, 0, 0, 0, 0
07-01-1999,19:03:10, 0, 1, 0, 0, 0, 0, 0, 0, 0
07-01-1999,21:15:17, 1, 0, 0, 0, 0, 0, 0, 0, 0
07-01-1999,22:13:53, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-01-1999,22:15:39, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-02-1999,07:48:19, 0, 1, 0, 0, 0, 0, 0, 0, 0
07-02-1999,07:50:06, 1, 0, 0, 0, 0, 0, 0, 0, 0
07-02-1999,08:05:09, 0, 1, 0, 0, 0, 0, 0, 0, 0
07-02-1999,16:04:28, 0, 1, 0, 0, 0, 0, 0, 0, 0
07-02-1999,22:43:07, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-02-1999,23:20:20, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-03-1999,08:26:02, 1, 0, 0, 0, 0, 0, 0, 0, 0
07-03-1999,08:45:15, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-03-1999,09:46:22, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-03-1999,13:04:25, 1, 0, 0, 0, 0, 0, 0, 0, 0
07-03-1999,13:05:03, 0, 0, 0, 0, 1, 0, 0, 0, 0
07-03-1999,15:59:21, 1, 0, 0, 0, 0, 0, 0, 0, 0
07-03-1999,19:35:30, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-04-1999,09:21:44, 1, 0, 0, 0, 0, 0, 0, 0, 0
07-04-1999,10:55:33, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-04-1999,11:57:24, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-04-1999,12:33:57, 0, 1, 0, 0, 0, 0, 0, 0, 0
07-04-1999,22:28:38, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-05-1999,23:12:12, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-06-1999,09:12:02, 0, 1, 0, 0, 0, 0, 0, 0, 0
07-06-1999,09:55:25, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-06-1999,18:32:27, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-06-1999,23:24:30, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-07-1999,08:46:58, 0, 1, 0, 0, 0, 0, 0, 0, 0
07-07-1999,23:16:26, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-07-1999,23:25:09, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-08-1999,00:24:54, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-08-1999,08:49:15, 0, 0, 1, 0, 0, 0, 0, 0, 0
07-08-1999,09:20:09, 0, 0, 1, 0, 0, 0, 0, 0, 0
```

Appendix 12: Sample printout from WinWhatWhere

(There are 4 data fields each separated by a comma: date, start time, duration and window caption).

```
  Date      Start time  Duration     Window caption

"7/21/99","21:17:50"," 00:00:05","Project1","C:\PROGRAM FILES\CINDY\PROJECT1.EXE", *
"7/21/99","21:17:55"," 00:00:03","Program Manager","C:\WINDOWS\EXPLORER.EXE","","
"7/21/99","21:17:58"," 00:00:03","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.EXE","C:\PROGRAM FILES\INTERNET
EXPLORER\IEXPLORE.EXE","**
"7/21/99","21:18:01"," 00:00:03","http://www.freeserve.net/ - Microsoft Internet Explorer provided by
Freeserve","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.
"7/21/99","21:18:04"," 00:00:33","Dial-up Connection","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.EXE",""
"7/21/99","21:18:37"," 00:00:06","http://www.freeserve.net/ - Microsoft Internet Explorer provided by
Freeserve","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.EXE",
"7/21/99","21:18:43"," 00:00:21","freeserve Homepage - Microsoft Internet Explorer provided by Freeserve","C:\PROGRAM
FILES\INTERNET EXPLORER\IEXPLORE.EXE","","Vince Aronica","0"
"7/21/99","21:19:04"," 00:00:01","http://www.freeserve.net/ - Microsoft Internet Explorer provided by
Freeserve","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.EXE","",
"7/21/99","21:19:05"," 00:00:01","http://www.beano.co.uk/ - Microsoft Internet Explorer provided by
Freeserve","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.EXE",""
"7/21/99","21:19:06"," 00:02:59","The Beano : Just Great...Since '38! - Microsoft Internet Explorer provided by
Freeserve","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.EXE",""
"7/21/99","21:22:05"," 00:07:37","The Beano - Just Great since '38! - Microsoft Internet Explorer provided by
Freeserve","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.EXE","
"7/21/99","21:29:42"," 00:00:01","http://www.beano.co.uk/xmasquiz/Default.htm - Microsoft Internet Explorer provided by
Freeserve","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.E
"7/21/99","21:29:43"," 00:09:30","The Beano - Just Great since '38! - Microsoft Internet Explorer provided by
Freeserve","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.EXE","",
"7/21/99","21:39:13"," 00:00:10","The Beano : Just Great...Since '38! - Microsoft Internet Explorer provided by
Freeserve","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.EXE","
"7/21/99","21:39:23"," 00:00:09","The Beano - Just Great since '38! - Microsoft Internet Explorer provided by
Freeserve","C:\PROGRAM FILES\INTERNET EXPLORER\IEXPLORE.EXE","","
```

* new user logging on   **start of internet session

Appendix 13: Software categories.

The following is a table containing the seven genres of software found in families' homes, and examples of the software titles that have been categorised under each genre.

Genre	**Software**
Reference	Encyclopaedia of science, world atlas, encyclopedia of nature, oxford encyclopedia, encarta, AA autoroute express, bodyworks, children's dictionary, children's encyclopedia, first amazing world explorer, infopaedia, world of dinosaurs, world atlas, Egypt 1156, space race, world book, grolier encyclopedia, microsoft skill builder, life and works of Beetoven, doctor in the house, recipes, the sea and sealife, the way things work, oxford talking dictionary, encyclopedia of animals and nature, exploring civilisations, space, US atlas, first aid, phone directory, cardiothoracic teaching, seashore life, 9 month miracle, amazing animals, 3D atlas, PC upgrade guide, inland revenue guide, french cuisine, 20th century art, india mystica, world of animals.
Drill and practice	German, GCSE physics/maths/english, junior essentials, simple fractions, talking tables, europress funschool series, berlitz french, typing tutor, science/maths/english for Key Stage 1, PC genius series, SATs tests.
Educational game	Thinkin' things, arthur's teacher trouble, dinosaur hunter, castle explorer, carmen sandiago, maths workshop, zoombinis, crosswords, word hunt, maths blaster, darby the dragon, peter rabbit's number garden, Dr. seuss' ABC, jazzjackrabbit, know your stuff, rayman maths and english, playdays, putt putt, maths workshop, the jolly postman, the jolly postman's party, adiboo.
Electronic book	Bible stories, read with me bible, green eggs and ham, the animals of farthing wood, alice in wonderland, 101 dalmations,

	muzzy at the seaside, payuta the ice god.
Internet/email	Internet explorer, outlook express.
Generic, creative tools	Microsoft publisher, sonic foundry, corel draw/print/photohouse, cakewalk home studio, photogalleries/clipart, photoplus, photoimpact, print artist, lego creator, barbie print and play, storybook weaver, kidiworks, family tree, 3D design centre, disney print studio, hercules print studio, draw plus 3, press works, cards plus, rug rats print studio, cartoon maker, movie maker, paintshop pro, magic artist, will maker, garden designer, music maker.
Entertainment games	Wargasm, atomic bomberman, robot wars, CART precision racing, a bug's life, command and conquer, civilisations, roller coaster tycoon, starcraft, half life, sim city, enemies from space, overkill, roller coaster tycoon, worms, games compendium, battleships, golf, lemmings, checkers, amazing mazes, chess, beetle, grandprix, flintstones, bridge, FIFA 97, championship manager, catz, wallace and grommit, total annihilation, crystal maze, descent, dungeon keeper, cindarella starcastle, egyptian quest, redshift, disney classic games, 300 games, southpark, grand theft auto, titanic journey, space invaders, air assault, hecules action game, barbie, nuclear strike, red line racer, independence day, braveheart, tomb raider, flight simulator, motocross madness, monopoly, solitaire, theme hospital, virtual springfield, age of empires.

Appendix 14: Interview one schedule

Questions for parent/s

This is not a test so there are no right answers-I'm just interested in finding out what you think.

A) The basics:

When did you buy your computer?
Where did you buy your computer?
Did you have one before this?
Have you added anything to your present one-upgraded it-what and why?
Why did you buy it/buy a new one-was your child's education or entertainment part of the reason?
Do you have any problems/regrets about buying it?

B) Assess usage

Can you tell me what your child uses it for?
To what extent do you think your child uses it to supplement their learning at school?

C) Software purchasing

Can you remember what is the last piece of software that you've bought?
How often do you buy new software?
What software have you bought recently for your child?
Can you remember how the decision to buy it was reached?
Who chose it?

Have you ever bought any for your child for a birthday or Christmas present if yes-was it on their request?

Have you ever bought software for later when they're older?
What software have you bought recently for yourselves?
How was the decision to buy it reached?
Who chose it?
Do you ever go to the shops and buy something that you've just seen on the shelf?
Do you ever buy programmes that you've read about/ or seen advertised/ or been told about by friends?

D) Knowledge about computer use at school

Do you know whether your child uses anything like this at school?
Do you know how much time s/he spends on the computer in school in a typical week?

E) Novel CD-ROMs

I'm going to show you the CD-ROMs I'm going to give you. I'm interested in finding out how you interpret the writing on the box and in the catalogue. These have been chosen just because they represent the sort of thing you see in the shops and not because I have any particular views about them.

(for each title) Have a look at this CD-ROM packaging and tell me what it makes you think about the programme and which aspects of it make you think that

And look at these catalogue descriptions about it-can you describe to me what you think it does?

If you saw this on the shelf in the shops would you buy it-reasons?

I'm going to let you have these new ones now. Please don't feel that you have to do anything special with them-if you don't like one and don't want to use it then don't feel that you have to. Pretend you've bought them and you're not in this study-just use them normally.

Questions for child

A) Computer use at home and school

Can you tell me all the things you use the computer for at home?
How often do you use the computer at home?
Can you tell me all the things that you use the computer for at school?

B) Software purchasing

What software have you bought recently/your parents bought for you?
Can you remember how the decision to buy it was reached--who chose it?
Have you ever had any bought for a birthday or Christmas present?
If yes-was it on your request or was it a surprise?
Do you ever go to the shops with your mum/dad and ask them to buy something that you've just seen on the shelf?
Do you ever ask them to buy programmes that you've read about/ or seen advertised/ or been told about by friends?

C) Thoughts about the novel software

We're going to talk about the educational software that you've got-like x y z. Which 2 do you like best/least-why?
Look at this (ie each novel CDROM) and tell me what you think it is and what it does?

Appendix 15: Interview two schedule

Questions for parents

A) To assess parents' knowledge of school

Whose class is your child in now and who's his new teacher?

Do you know what s/he's been doing so far this term?

Does he tell you what s/he does at school?

Do you have to encourage them to tell you?

What opportunity do you get to speak to your child's teachers-how often

Who instigates it

Do you go to all the open days?

B)Homework

Has your child had any homework yet--what has it been?

Where does your child do their homework?

Does this mean that you are often involved in it?

What's your position on children having home work?

C) How the computer fits into other leisure time activities

I'm interested in finding out about your child's leisure activities and how the computer fits into these so can you tell me:

What is his main leisure interest at the moment (prompt reading, drawing, making things)?

Do you think that any of these things are helpful with regards to school?

D) Is computer use encouraged?

Are there any computer based activities that you actively encourage over and above others?

What form does the encouragement take?

Does this encouragement work?

E) Scaffolding/assistance at home

Does your child ever call you over to watch what they're doing--what things?

Does s/he ever call you over for help---what help?

Do you ever find that you have enough time to sit at the computer when s/he's using it?

I'm interested in finding out about this in some detail so can you tell me how this usually comes about, who instigates it?

Do you think s/he likes you to be involved in this way?

F) Location of computer

Your computer is in xx place

Can you tell me why you decided to put it there?

Do you think that having it there in a central/peripheral place in the house has a bearing on you knowing what he's doing?

Do you find yourself popping in and out of the room a lot?

What else goes on in that room?

Is there any other family activity taking part in the computer room whilst your child is using the computer --does it stop when someone is using it or is it simultaneous?

G) Access and arguments

How is access to the computer managed within the home (e.g. rules, ownership, time)?

Are there ever any arguments about turns at the computer-how are these managed?

H) Public display of computer products at home

What type of thing gets saved, printed out or made using the computer?

Whose idea is it to print this out?

What happens to it---is it kept in 'a place'---is it displayed---who is it shown to?

Can I see/have a copy of some of it?

Have you printed out anything from the software I gave you?

Do you manage to keep track of how well your child is doing on his educational games?

I) novel software

If you could only keep one of these titles which one would it be-next-next etc?

Why?

Questions for the child

A) Feelings about novel software

If I pretend that I'm going to take them all away and only leave you one, which one would you keep---then next etc and why?

Do you think that your teacher would use any of them at school?

Did you ever get stuck **(new and old software)** on a bit---what did you do?

B) Social environment of use

Do your parent/s ever come over and watch what you're doing?

Do you like it?

Whose idea was it?

Do you ask your parents for help---doing what?

Do they ever sit with you the whole time you're using the computer?
Whose idea is this?

C) Access and arguments

OK we're going to talk about how you share the computer now
Do you ever have arguments over whose turn it is to use the computer?
How are they resolved?
Can you use it any time you want?
Can you do anything you like on it--is there anything that you're not allowed to use?

D) Position of computer

If your family want to use xxxx room for something else (depends on location, insert something here like ironing, watching the TV, doing office work) do you have to stop using the computer?

Do you ever use headphones-when and why?

E) Learning at home

What about other types of learning at home-what do you do?
What other things do you do in your spare time?

F) Computer products

Do you have any programmes that let you make things e.g. art, cards, cartoons, poems, posters?
What do you do with them?
What kind of things do you save?

Appendix 16: Interview three schedule

Questions for parents

A) Joint activity and encouragement

These interviews have revealed that although the main reason that parents often give for buying a computer is for their child's education, generally parents don't specifically encourage use of the computer for educational software over games--have you any suggestions as to why this is?

Lots of software advertisements show a picture of a child with a parent or a brother or sister---like these ones (show them some) but we've found that this isn't happening in most of the homes I've visited. Do you think that this is what happens in this house? I'm interested in finding out why this is--do you have any ideas?

Do you ever sit with your child doing other computer games like playing a football game or a chess game?

Do you think that your child would like it if you did sit with him?

B) Internet

Does your child use the internet?
What for?
How do you feel about your child using it?
Do you think that you getting the internet has resulted in your child switching from software based activity like games to more net based activity like browsing?
Do you have any concerns about your child using the internet?

C) Assessment of novel software

Have you yourself made any additional effort to look at the software I brought you because you knew I was coming today---why didn't you look at it before?
Did you give your child any encouragement to look at any again?
Would you be happy for your child to use any of these titles in school---why/why not?

How do you think that you can best overcome these problems (do they know about filtering software)?
Do you have any rules?

Questions for the child

For each novel CD-ROM (at the computer)

I want you to help me out here because the companies that gave me this software want to know what children think of it. So I want you to be honest and not to worry about what you say because its not a test or anything like that. We'll look at each one in turn and see what you think of it.
If you could change it so that it was better and so that you'd use it more what would you do?
Is there anything else that I need to tell them?
Are the questions set at the right level for you?

Appendix 17a: First update letter

Computers at Home Study-Update 1

22^{nd} June 1999

Dear parent/s,

About half of our families now have the project software installed on their computers. If you haven't been visited yet-don't worry-we haven't forgotten you!

I'm pleased to let you know that the help line will start running on every Thursday from 7-8pm. This will start next week ie 1^{st} July. The person answering your queries is Jim, who has recently graduated from Loughborough University. His phone number is 01509 265878. He will be available during these times to offer help with any queries you have about your computer.

Meanwhile, if you have any questions about other aspects of the study please don't hesitate to contact me on 01509 228486 or email me at L.J.Kerawalla@lboro.ac.uk

Regards

Cindy Kerawalla

Appendix 17b: Second update letter.

Computers at Home Study-Update 2

16 th July 1999

Dear parent/s,

I'm pleased to say that everything is going very well - nearly all of our families have the logging software installed on their computers. This will log all computer use for 30 days. On some computers it will already have run out and a black window will appear each time you turn the computer on which reminds you that the programme has expired. Please don't be tempted to uninstall it as all the data will be lost.

My second visit to you will involve having a chat with parent/s and child separately to talk about how you decide what software to buy and related issues. I will also bring along your complimentary software as well as down-load the data that has been recorded on your computers. This visit will take slightly longer than the first and will have to be at a time when parent/s are not at work, so I anticipate that it will take me several weeks to reach everybody. Please bear with me - no one has been forgotten!!

In the meantime, if you have any queries about the research (or if you *desperately* want to get rid of that black reminder window) please don't hesitate to contact me at the university on 01509 228486 or by email at L.J.Kerawalla@lboro.ac.uk Also don't forget that the helpline is now running for any computer related queries.

Regards

Cindy Kerawalla

Appendix 17c: Third update letter

Computers at Home Study: Update 3

10th September 1999

Dear parent/s,

All of our families have now received their complimentary software and have had a discussion with me about software purchasing and related issues. Thank you very much to everybody! It has been very interesting and varied finding out about your opinions. Initial results about how often the children use their home computers and what they use them for (gathered from the first set of logging data) have recently been presented at the British Psychological Society's Developmental Section Conference at Nottingham University. Unfortunately I can't let you know any of the findings at the moment as it might prejudice how you use the computer for the rest of the study period, but I will give you a full report at the end of the study.

The next step is to revisit everybody and to find out how the children are getting on with the new software. These visits are planned to start in the week beginning 20th September. This will give everyone a chance to have a go on all the programmes. I would also like to have another discussion with parents, this time about issues surrounding children learning at home. I hope to complete the second visits by the end of October as I am away on holiday in November.

Meanwhile, I hope you are enjoying the software. If you have any software-related problems please contact Jim on the new help line number 01509 880865. Any other queries please contact me on 01509 228486.

Thank you all very much for your continuing participation in the study.

Appendix 17d: Fourth update letter

Computers at Home Study: Update 4

27th October 1999

Dear Parent/s,

Just to let you know that the second interviews are now complete. I plan to make a quick ten or fifteen minute visit to everybody in December to download data from your computers, then carry out the third and final interview in January/February. Once again, a very big **thank you** to everyone for their continuing participation in the study.

Please also note that Jim has found a full time job and so is regrettably unable to run the help-line any longer.

I am away from 29th Oct to 28th Nov. If you have any study-related problems please don't hesitate to contact Charles Crook at the university on 01509 223032. It is particularly important that any actual or possible logging software problems are sorted out quickly so that I don't lose data-so please don't hesitate to call him. Charles has been overseeing my work and is familiar with all aspects of it.

Lastly, if anyone is planning to upgrade their computers for Christmas, I'd be very grateful if you could let me or Charles know beforehand so that I can download the data as I have found that it is very susceptible to being lost during upgrading.

Thanks

Cindy Kerawalla

Appendix 17e: Fifth update letter

Computers at Home Project - Update 5

5/1/2000

Dear Parent/s,

I hope everyone had a pleasant Christmas and enjoyable millennium celebrations. You're in the rare position of taking part in a research project that bridges two centuries!

I plan to start the final interviews in mid January and I expect it will take at least until the end of February to see everybody. This time I'd like to talk about the software that I gave you in more detail. I would like to sit with the children at the computer and go through each CDROM, asking them their opinions of the content. I can only do this effectively if the children have explored all the features of each one, so please ignore all my previous pleas for you to let your child use them as and when they wish. I'd be extremely grateful if you could encourage them to look at all the software if they haven't done so already, even if they find them boring. I'd like both you and them to be familiar enough with it so that you can think about *why* the CDROM is good or bad.

If your computer has broken down or is having any technical problems please let me know when I phone you so that I can make arrangements to access another machine.

Once again, thank you all very much for your continuing participation,

Cindy Kerawalla

Appendix 18: Research summary sent to parents at the end of the study

Once again, thank you very much for taking part in this project. A total of 33 families in Loughborough have been involved. All have talked with us in three interviews, considered six pieces of educational software, and allowed us to record their computer use over a long period.

At this stage we have only analysed interview conversations 1 and 2, and the first 30 days of computer log (last June-August). So we still have a lot of work to do on what you have told us! Moreover, much of what is likely to be of most interest is still to be worked on. However, what follows is a list of some points that have struck us so far:

1) The biggest surprise has been the *range* of perspectives on computer use that we find across the group of families taking part. In some families the computer is an important part of daily life, in others it has a more peripheral role.
2) There is a huge variety in the amount and type of software owned: with very different sorts of expectations from this material.
3) This range is reflected in different attitudes towards the *usefulness* of computers.
4) There has been an interesting range of opinion about the value of learning based at home - and the role of computers in relation to that. Certainly this is a more complex issue than popular political discussion of "homework" would lead us to suppose. Although all parents agree that any *spontaneous* learning interests expressed by children should be supported at home, and that home learning should be "fun". This is a technology that can often divide families (albeit not too seriously!) in terms of its appeal and value.
5) Our logging reveals that, in most families, the computer-based activity that most children spend most time on is games (not including educational games). Some way behind such game-playing in popularity are various kinds of creative play: including word processing stories and poems , making cards and invitations and drawing

pictures etc. Custom-designed educational packages and learning programmes then emerge as rather low on the list of items that easily engage young users.

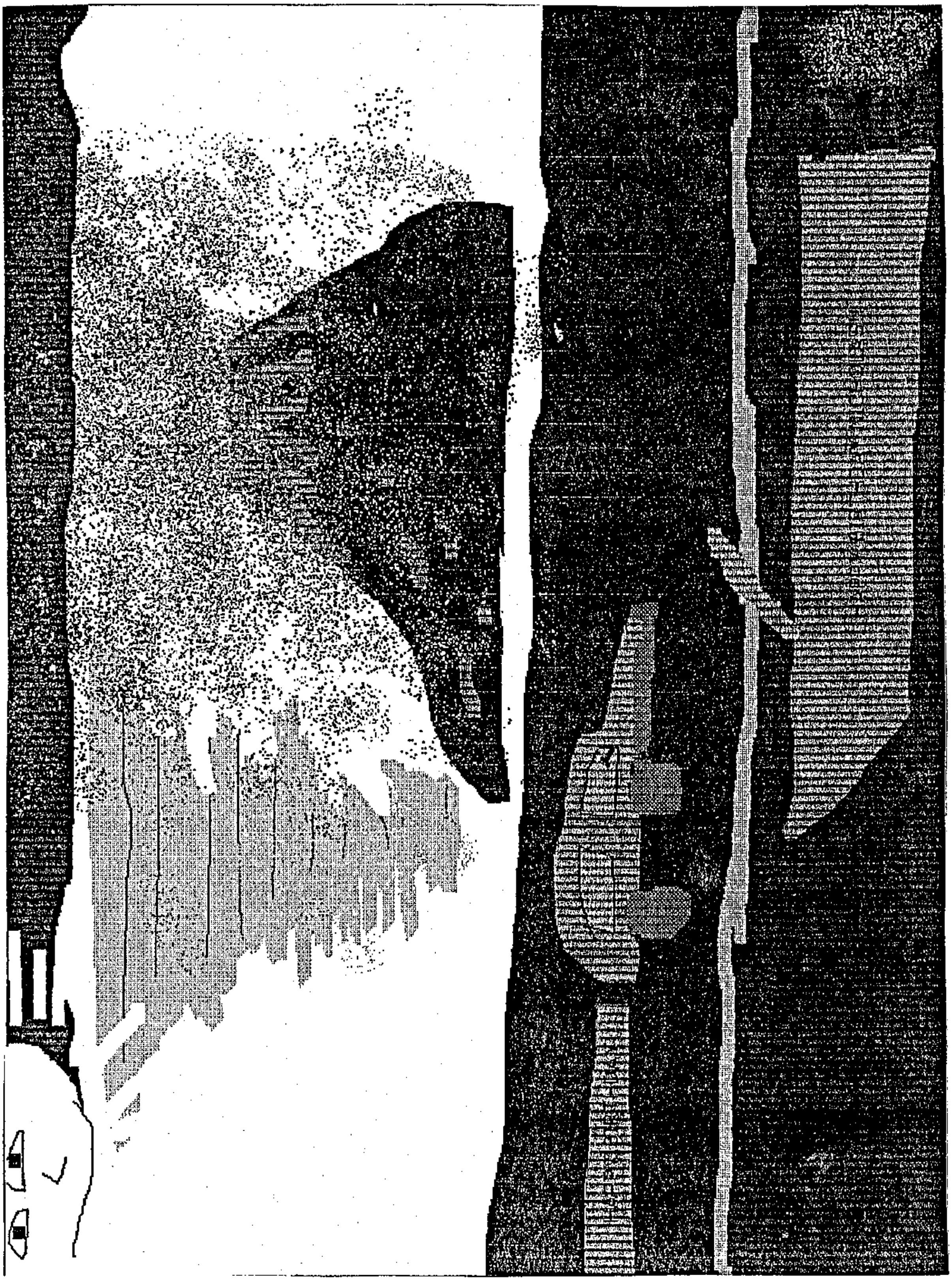
6) Data from the log-in window reveals that most children use the computer *alone* for most of the time. So use at home is very different from the mainly shared use that children experience at school. All parents said that they were available for help if needed, but did not regularly sit with their child at the computer.
7) Computers are found in a variety of locations within the home: their positioning being tied in to how central a role families want the technology to have in daily life. There is a concern in a lot of houses that the computer user (say the young child) is not totally isolated from the rest of family activity - so most computers are firmly downstairs.
8) Most children have, at one time or another, argued with their sibling/s about access to the computer and what it is actually used for. So, like television, it can become a source of routine dispute and, sometimes, tension. Some parents give priority to homework or work related activity.
9) More that 50% of families have the internet but most children seem, as yet, to make rather little use of this resource.

This is a very general overview of our thoughts to date. You'll probably also be interested to know that some of these results have been presented at a conference at Nottingham University last year and more exposure is planned for this year. The media have also presented some (rather distorted!) findings in a computer magazine called Computer Active as well as on the BBC web-site.

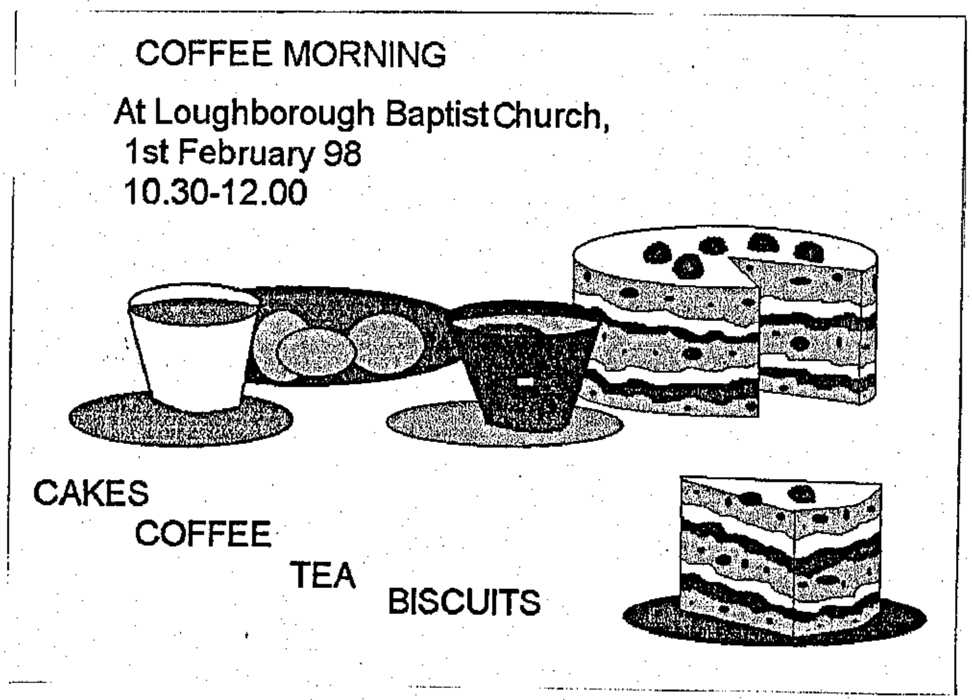
I will of course be keeping in touch with you and sending you further summaries and details of any publicity that the study attracts. Meanwhile if anyone has any queries or suggestions about how it could be made even better, then please don't hesitate to contact Cindy on 01509 228486.

And finally THANK YOU VERY MUCH!!

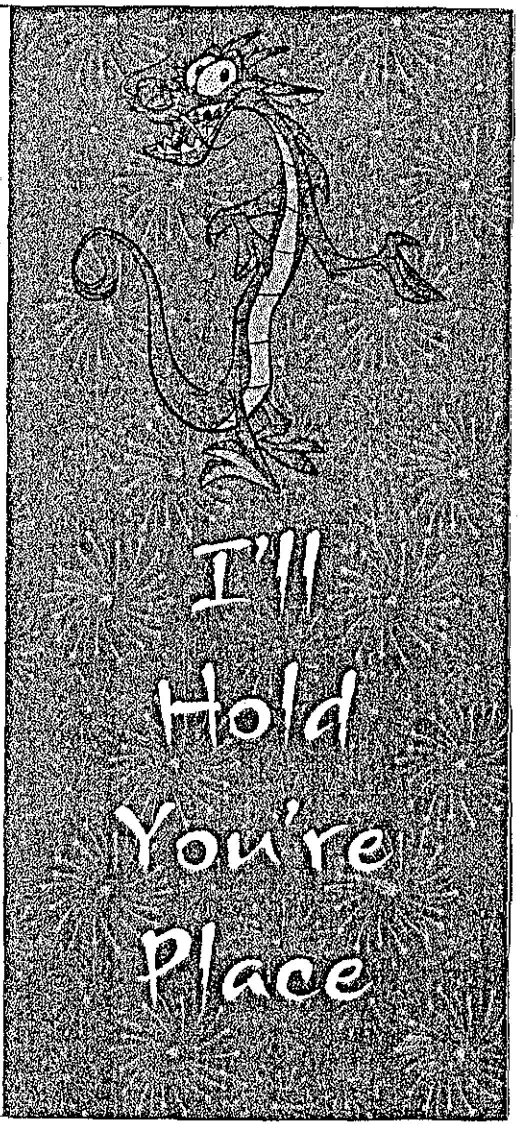
Appendix 19: A birthday card



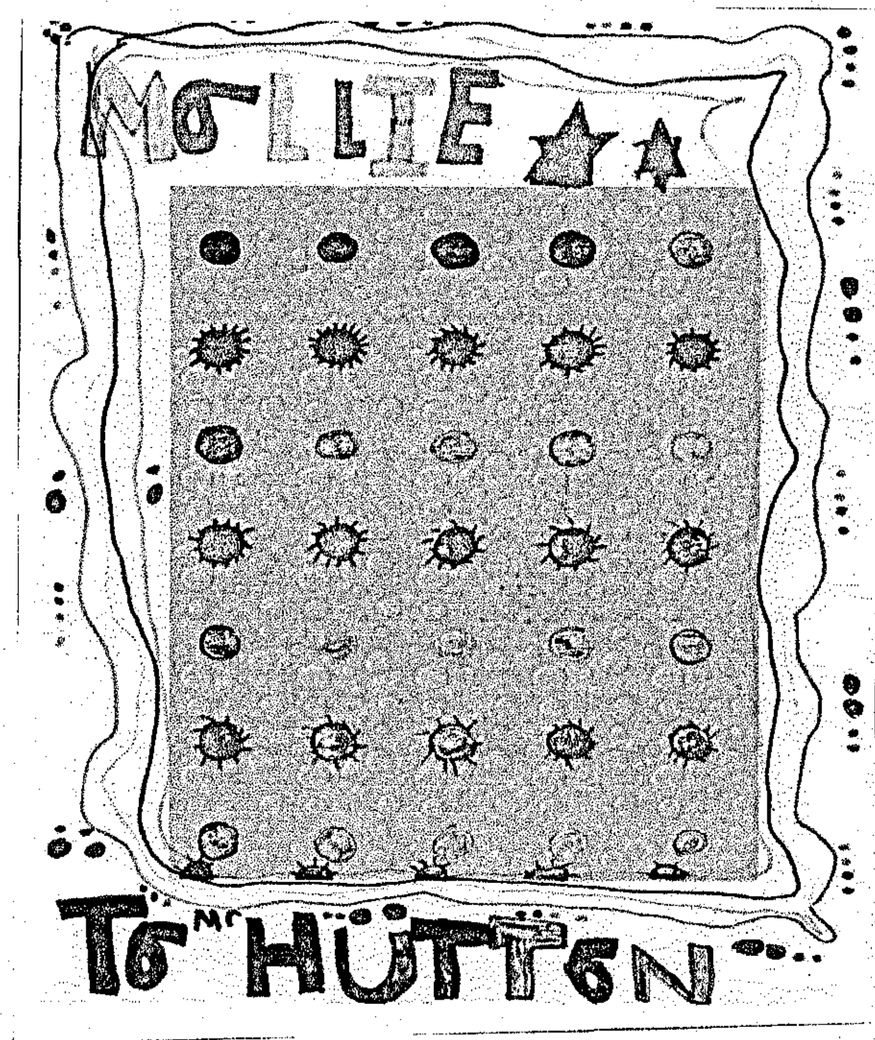
Appendix 20: A poster



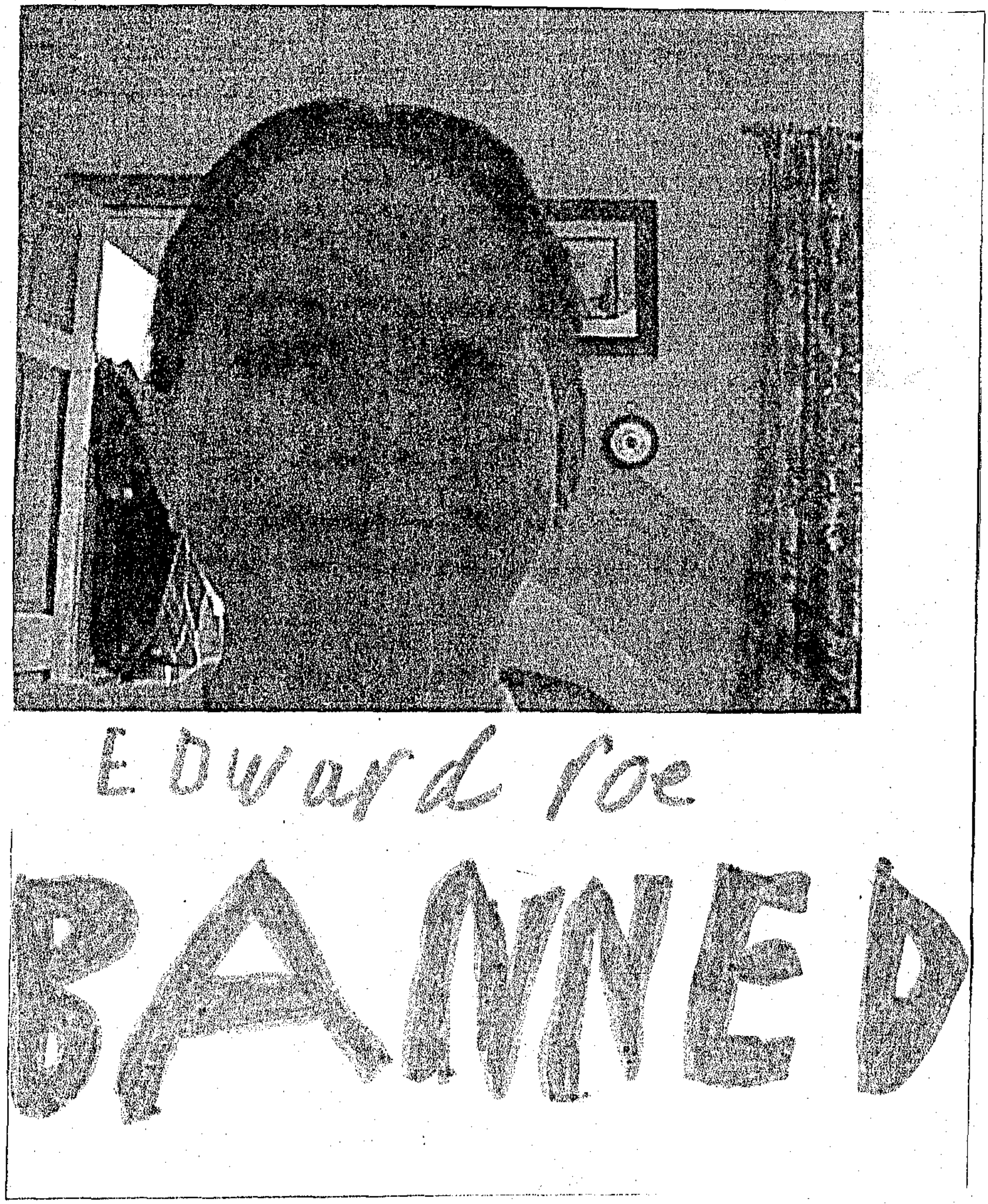
Appendix 21: Bookmarks



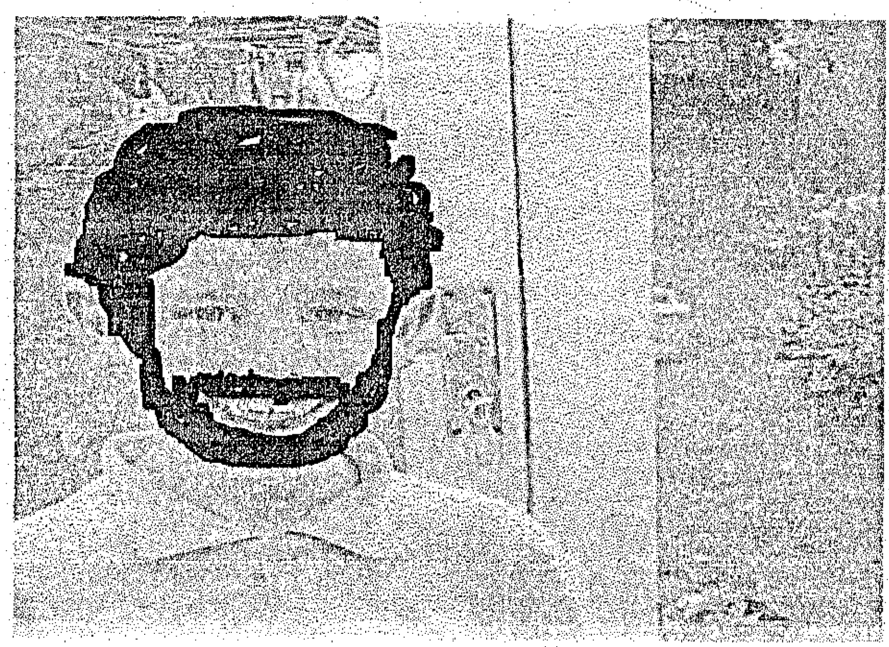
Appendix 22: A picture for the teacher



Appendix 23a: A sign for the bedroom door



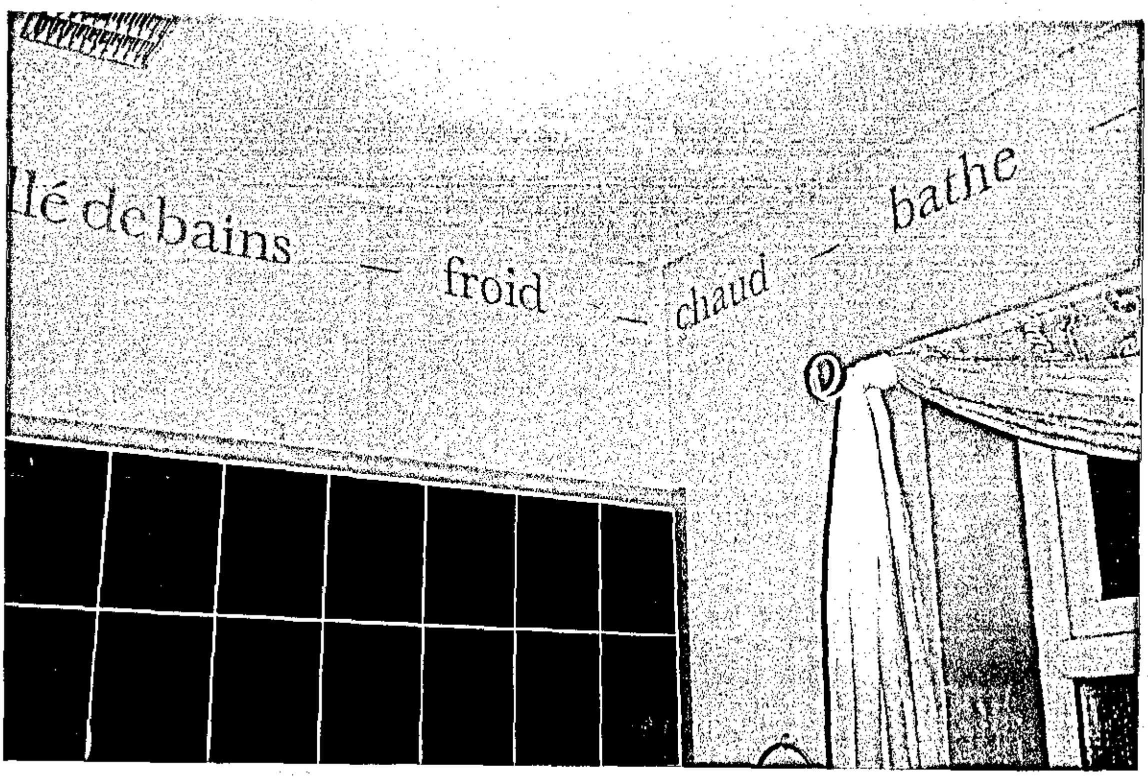
Appendix 23b: A sign for the bedroom door



WANTED!

£50 REWARD FOR CAPTURE

Appendix 24: Bathroom decorated with traced computer fonts



Appendix 25: A summary of the main differences between the contexts of school and home (italicised text emphasises the differences)

Section	**Cultural issue**	**School context**	**Home context**
7.3.1	Acquired to…	Promote learning	Largely promote learning
7.3.3.1	Location	Optimise fair, secure use *Limited* location choices *Learning* takes precedence	Optimise fair, secure use *Broad* location choices *Social, physical and learning* concerns all apply
7.3.1	Resourcing	*Educational* use	Largely *educational* use but also *entertainment*
7.3.3.3.1	Resource supply	*Strategic* purchasing *Limited* software choice	*Serendipitous* *Broad* software choice
7.3.3.2.1 & 7.3.3.2.2	Access rules	*Directed,* fair, *visible, few, rigid*	*Free,* fair, *peripheralised, many, often worked-around*
7.3.3.3.2	Activity content	Teacher *directed*	*Laissez-faire*
7.3.3.2.3	Managing equity	Teacher *rulings*	*Arguments*
7.3.2	Shared action	*Joint* activity with peers	Usually *solitary*
7.3.2	Scaffolding	As *requested* Teacher's presence is *perpetual*	*Resisted* Parent's presence is *transient*
7.3.4	Adult awareness	Teachers *orchestrate*	Parents *oblivious*
7.4	Contextualisation	*Teacher's* agenda *Rigid* timetable *Clearly* defined roles *Educational* agenda	*Child's* agenda *Flexible* timetable *Ambiguous* roles *Family* agenda
7.3.4.5	Products	*Monitored, displayed*	*Invisible*

Appendix 26: Descriptions of the novel software titles

Maths Blaster (ages 9-11 educational game)

This educational game centres around a story where the three characters' (blasternaughts) spaceship crash lands on a strange planet. They are not allowed to leave until they find pieces of the "medallion of prosperity" which, when given to the evil monkey king, will allow them to escape. In order to gain pieces of the medallion, various maths problems, embedded in games, have to be solved. The child can choose between three levels; easy, medium and hard and can also choose the type of maths activity they wish to achieve within a single game e.g. adding fractions. As an example of a game, the child has to build a bridge out of various segments, each allotted the value of a fraction. They have to select the correct pieces to construct the bridge. This takes place in a jungle, with flying monkeys and rhythmic music. Once the bridge is built the character and the monkeys can cross to the next bridge.

I Love Spelling (educational game)

This is an intergalactic spelling gameshow. One or two players can take part and there are three levels of difficulty for each player. There are three games to choose from, which can take place on one of four planets. For example, in the game "word attack", three different versions of the same word fly towards you on the screen and the child has to quickly click on the correct one. There are characters to help if you need it.

Castle Explorer (educational game)

In this educational game the child must assume the identity of either a page or a spy and enter a 14th century castle. As a page you are allowed free access to any part of the castle to explore. As a spy you are sent on a mission which involves exploring different parts of the castle and collecting information and a map of the secret escape tunnel. The castle is depicted in 3D and the child can enter different rooms and meet various real-life, animated characters. There are pop up boxes that explain features of the castle and walls can be dissolved to reveal what is behind them.

Adding and Subtracting (educational game)

There are two characters, white bear and little penguin who live on a large iceberg. The child can choose from four types of maths game or the options of a printshop or painting by numbers game. The instructions are spoken by the two characters and the maths problems are very visual, containing pictures and animations. Upon completion of the games in all four areas the child can complete the supergame. There are also certificates available.

Mad About Science (educational game)

There are 3 different titles in the series: energy and forces, life and matter. Energy and forces will be used in this example. A female character called Mo Mentum invites the child to read a fact sheet e.g. about push and pull forces. Once read there are a series of activities about forces. There are several pictures e.g. a hammer banging a nail or a box opening, and the child has to select which force each activity is utilising. Once this is complete the child then answers several multiple choice questions about this activity and is awarded a star for a correct set of answers. Upon completion of five activities the child is rewarded with a printable certificate and instructions detailing how to carry out an activity at home e.g. building a magnetic car.

The Jolly Post Office (educational game)

The home screen is set behind a post office counter and the child has to click on various hotspots to access the activities. For example there is a game where the child has to weigh parcels and stick on the appropriate stamps, another where broken parcels have to be mended by recognising shapes. In a third game the child has to match pairs of letters. This is carried out to the accompaniment of various catchy tunes and helpful characters.

Pinball Science (educational game)

An inventor has constructed three pinball games, one in a village, one on an island and one on the moon. They have fallen into disrepair and the child has to mend them. They answer science questions related to the component they are trying to win e.g. a spring. If the child does not know the answer to the question they can access the reference files which give descriptions and drawings in which the answer is embedded. On winning each component the child places it in the pinball machine to increase its functions. Once all the components have been obtained the child can play the game. These games are quite difficult but once completed the child is then allowed access to the next location.

I Love Maths (educational game)

Two children called Gretchen and Wilbur, who hate maths, are trying to destroy the world. The child's task is to rebuild it. The homescreen is set inside a time machine where the child clicks on icons to select various activities. They can choose to go to Atlantis, Egypt, Greece or Aztec areas where there are maths questions to solve. For example, Atlantis is set in an Olympic stadium where the child has to answer maths questions to set the athletes free from prison. The other alternatives on the homescreen are "number crunching" exercises. The child selects the maths skill that they want to practice, e.g. addition or decimals, and a series of games test these skills. Points are awarded. There are four levels of difficulty and the option of two players. The child can also select whether they want a time limit for the problems, whether they want the questions read out, and how much animation and chat is included.

SATs Mental Arithmetic (drill and practice)

The child enters their name and date of birth and selects one of two difficulty levels. There is a practice question and then there follows a test. The questions are read out twice and the child has a specified time in which to type in their answer before the next question is read out. At the end of the test the score is displayed on a graph.

Rusty Dreamer (electronic book)

This is a story about a girl called Rusty and her activities and dreams in the countryside. The reader can select from 3 levels of difficulty and within each level there are short and long versions of the chapters. The child can also choose whether or not they want the story to be read out. Each page in split into two: the top half is a picture and the bottom half contains the text. There are a few simple animations on some of the pages. There is also the option of going to a map of the area described in the story. Locations can be clicked on to reveal photographs of the area e.g. the woods or a morris dancing festival. The child's position in the story can be saved and there is also the facility to navigate around the chapters.

Treasure Island (electronic book)

This story of treasure island is read by various Shakespearean actors. Each page contains a cartoon drawing and a portion of text. Some of the pages have animated features. There are also four games e.g. shooting enemy pirates from behind a stockade.

Art Attack (creative tool)

This product is based upon the television programme of the same name. The homescreen is an artist's workbench that children can scroll around to access the three activity areas. There is a paint shop where pictures can be created using a variety of tools, a cartoon creator where animated cartoons can be made, with sound. Finally there is a creative studio where the child can utilise various unusual tools to create pictures e.g. a swinging pendulum that paints patterns.

Children's Encyclopedia (reference)

The home screen provides a choice of several activities to choose from in this product. The child can use the encyclopedia as a reference tool by typing in a search term and receiving information and pictures of the topic. Definitions of various keywords can also be accessed. The encyclopedia can also be used as a more casual browsing tool where various topics can be randomly accessed. There are also various 3D environments to explore e.g. the ocean, a garden, mountains and caves. The child can navigate around these scenes and click on items contained within them. A window then pops up with a question about it that can be researched using the reference files. There is also information about famous historical figures.

Children's Dictionary (reference)

A wizard welcomes the child to his "magical word machine". There are several choices of activity: looking up words and finding details of whether they are a noun or a verb, how many syllables it has, plus a definition. The child can also look at a series of animated pictures that all begin with the same letter e.g. a chest beating gorilla or a spinning globe under the letter "g". The child can also click on a random button where words are selected by the computer and their definitions are given. There is also a choice of three word games (charades, hangman and spelling).

My First Incredible Amazing Dictionary (reference)

The homescreen presents three choices: a dictionary or secondary activities such as a word game. The dictionary gives the child the opportunity to click on a letter of the alphabet and see a list of words, with a corresponding picture, that begin with that letter, or they can type in the word that they want to find. Definitions are provided alongside an animated picture. Stickers and reward stars can be collected as different word definitions are accessed.

The New Way Things Work (reference)

There are a large range of activities in this software. The homescreen offers the child the choice of, for example going to the "digital domain" where they can access information about how digital technology (e.g. digital televisions) work. Line drawings depict the inside of the television and describe what each part does. There are humorous cartoons depicting scientific principles. There is also a quiz where the child can use a reference section to look up the answers. Information is also given about inventors and there is also a time line showing historical inventions.

Appendix 27a: Sample of raw data from a Snoop file as downloaded from the family computer.

There are 5 data fields each separated by a space. This software logs the start and stop times of a window caption and does not calculate the duration.

(#date, ##time, ### family code,*computer logging started ie computer turned on, **start of bootup,***end of bootup, @@start of Microsoft Works, @@@end of Microsoft Works, >>Computer shut down,).

```
19/08/99# 17:53:19## mun### Logging Started*
19/08/99 17:53:23 mun Start: My Computer**
19/08/99 17:53:23 mun Start: Power Meter
19/08/99 17:53:23 mun Start: Norton AntiVirus
19/08/99 17:53:23 mun Start: DDE Server Window
19/08/99 17:53:23 mun Start: OleMainThreadWndName
19/08/99 17:53:23 mun Start: SYSTEM AGENT COM WINDOW
19/08/99 17:53:23 mun Start: MS_WebcheckMonitor
19/08/99 17:53:23 mun Start: OleMainThreadWndName
19/08/99 17:53:23 mun Start: DDE Server Window
19/08/99 17:53:23 mun Start: Snoop
19/08/99 17:53:23 mun Start: OleMainThreadWndName
19/08/99 17:53:23 mun Start: DDE Server Window
19/08/99 17:53:23 mun Start: Instant Access OCR
19/08/99 17:53:23 mun Start: LogiTrayMgrWnd
19/08/99 17:53:23 mun Start: Magellan MSWHEEL
19/08/99 17:53:23 mun Start: Logitech ScrHelp
19/08/99 17:53:23 mun Start: Logitech E/M Executive
19/08/99 17:53:23 mun Start: OleMainThreadWndName
19/08/99 17:53:23 mun Start: Logitech GetMessage Hook
19/08/99 17:53:23 mun Start: Program Manager
19/08/99 17:53:28 mun  Stop: My Computer
19/08/99 17:53:28 mun Start: OLEChannelWnd***
19/08/99 17:53:28 mun Start: My Documents
19/08/99 17:53:43 mun Start: Microsoft Works@@
19/08/99 17:53:43 mun Start: Microsoft Works
19/08/99 17:53:43 mun Start: Microsoft Works
19/08/99 17:53:53 mun  Stop: Microsoft Works
19/08/99 17:53:53 mun Start: Microsoft Works mun [New Microsoft Works
4.0 Database (4)]
19/08/99 17:54:13 mun Start: Insert Field
19/08/99 17:54:33 mun  Stop: Insert Field
19/08/99 17:54:48 mun Start: Format
19/08/99 17:54:53 mun  Stop: Format
19/08/99 17:55:08 mun Start: Format
19/08/99 17:55:43 mun  Stop: Format
19/08/99 17:57:53 mun Start: Spooler Process
19/08/99 18:03:09 mun Start: Microsoft Works
19/08/99 18:03:24 mun  Stop: Microsoft Works@@@
19/08/99 18:04:04 mun  Stop: My Documents
19/08/99 18:04:09 mun Logging Stopped>>
```

Appendix 27b: Sample printout from stage one of Snoop processing.

This is the same data as in appendix 27a which has now undergone stage one processing.

Stage one processing achieved several things: (1)calculated the number of seconds past midnight for each time stamp, which would make it easier to calculate time lengths in the next stage of processing, (2)changed start to >>>, (3) changed stop to --- to make the file less visually demanding in the next manual stage of processing, (4) detected every instance of "logging stopped" "logging started" and inserted a session break as indicated by the long dashed lines below, (5) calculated the day of the week and inserted it into the line at the end of the session so that usage patterns could be extracted later, (6) calculated the session number, (7) calculated the number of days since records began, (8)calculated the total session length minus any screen savers, (9) converted the file into comma separated value (csv.) file to aid future processing.

(*seconds past midnight, **start symbol,*** stop symbol, #=day, ##=date, ###=session length (seconds) minus screen saver activity, ####=session number, #####=number of days elapsed since records began).

```
----------------------------------------------------------------
 64403*,17:53:23,mun,>>>**,My Computer
 64403,17:53:23,mun,>>>,Power Meter
 64403,17:53:23,mun,>>>,Norton AntiVirus
 64403,17:53:23,mun,>>>,SYSTEM AGENT COM WINDOW
 64403,17:53:23,mun,>>>,MS_WebcheckMonitor
 64403,17:53:23,mun,>>>,Instant Access OCR
 64403,17:53:23,mun,>>>,LogiTrayMgrWnd
 64403,17:53:23,mun,>>>,Magellan MSWHEEL
 64403,17:53:23,mun,>>>,Logitech ScrHelp
 64403,17:53:23,mun,>>>,Logitech E/M Executive
 64403,17:53:23,mun,>>>,Logitech GetMessage Hook
 64403,17:53:23,mun,>>>,Program Manager
 64408,17:53:28,mun,---***,My Computer
 64408,17:53:28,mun,>>>,OLEChannelWnd
 64408,17:53:28,mun,>>>,My Documents
 64423,17:53:43,mun,>>>,Microsoft Works
 64433,17:53:53,mun,---,Microsoft Works
 64433,17:53:53,mun,>>>,Microsoft Works,,[New Microsoft Works 4.0 ]
 64453,17:54:13,mun,>>>,Insert Field
 64473,17:54:33,mun,---,Insert Field
 64488,17:54:48,mun,>>>,Format
 64493,17:54:53,mun,---,Format
 64508,17:55:08,mun,>>>,Format
 64543,17:55:43,mun,---,Format
 64673,17:57:53,mun,>>>,Spooler Process
 64989,18:03:09,mun,>>>,Microsoft Works
 65004,18:03:24,mun,---,Microsoft Works
 65044,18:04:04,mun,---,My Documents
,Thu#,08/19/99##, 641###, 13####, 23#####
----------------------------------------------------------------
```

Appendix 27c: Sample printout from stage two of Snoop processing

This is the same data as that in appendix 27a and b.

Processing at the this stage was carried out by hand. All extraneous lines of activity (e.g. bootup) have been manually deleted, with only the start and stop time of the application remaining. This data has also been manually cross-referenced with the user files and the appropriate user code inserted. In this case "c" indicates the study child. * =family code.

```
-----------------------------------------------------------------
64423,17:53:43,mun*,>>>,Microsoft Works ,,c
65004,18:03:24,mun,---,,,c
,Thu,08/19/99,641,13,23,
-----------------------------------------------------------------
```

Appendix 27d: Sample printout from stage three of Snoop processing

A small computer program was written that would identify a) each separate application accessed in 11 weeks (field 2), b) calculate the total number of times an application had been accessed in 11 weeks (field 3) c) add up the total time spent on that application over the 11 week logging period (field 4), d) calculate the percentage of total computer time spent on each application over 11 weeks (field 5). The family identity code is in field one (mun).

For example, Art Attack was accessed 3 times. The total amount of time spent on it was 6498 seconds. This represented 9% of this user's total computer time.

mun,Art Attack , 3, 6498, 9
mun,Internet, 3, 1028, 1
mun,I Love Spelling , 2, 1515, 2
mun,hk, 4, 2105, 3
mun,Rusty Dreamer , 1, 3304, 5
mun,Maths Blaster 9-12 , 3, 10031, 15
mun,Treasunre Island , 1, 47, 0
mun,Microsoft Works, 4, 6954, 10
mun,Children's Encyclopedia , 3, 4277, 6
mun,Microsoft Works , 7, 2411, 4
mun,Scanner , 1, 1138, 2
mun,Disney's mulan Print Studio , 3, 1715, 2
mun,Paint , 1, 5, 0
mun,101 Dalmatians StoryBook , 1, 2819, 4
mun,Disney's Hercules , 1, 317, 0
mun,Disney's Magic Artist , 2, 3636, 5
mun,Microsoft Word , 1, 356, 1
mun,The Land Before Time , 1, 2797, 4
mun,WorldCupFever , 2, 8183, 12
mun,Microsoft Encarta 98 Encyclopedia , 1, 364, 1
mun,Microsoft Photo Editor , 1, 40, 0
mun,Art Attack, 1, 7993, 12

Appendix 27e: Sample printout from stage four of Snoop processing.

Each line of this printout represents one week, starting at week one. The first field is the family code. The second field is the total number of seconds that the child used the computer in that week. The third field is the total number of seconds the child spent using the novel software titles, and the fifth field is the percentage of that week's total computer time spent using the novel software.

For example, in week one, this child spent 20858 seconds using the computer. Of this time, 7590 seconds were spent using the novel software, which represented 36% of his total computer time that week. In week two he did not use the computer at all. In week 7 he used the computer for 4007 seconds but none of this time was spent on using the novel software.

```
br      , 20858, 7590, 36
br      ,,, 0
br      , 4644, 3503, 75
br      , 8103, 6249, 77
br      ,,, 0
br      ,,, 0
br      , 4007,, 0
br      ,,, 0
br      , 4464, 2616, 59
br      , 2641, 2641, 100
br      , 2884,, 0
```