

Children and Young People's Home Use of ICT for Educational Purposes: The Impact on Attainment at Key Stages 1-4

Professor Gill Valentine (University of Leeds), Dr Jackie Marsh, Professor Charles Pattie (both University of Sheffield) and BMRB

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Executive Summary

This report summarises the findings of a research project undertaken to understand the links between children's educational uses of Information and Communication Technologies (ICT) at home and their performance and attainment at school. It is based on research conducted in the summer term, 2004, in 12 schools in England. This study aimed to:

- investigate the types and amount of home use of ICT by children and young people at Key Stages 1-4;
- establish the relationship between the types and amount of home use of ICT and children and young people's attainment at school;
- identify the drivers for home use of ICT by pupils and what motivates pupils to choose (or not choose) to use ICT;
- establish the significance of digital divide issues in the relationship between home use of ICT and attainment.

The research involved three stages:

- A self completion questionnaire survey of children and young people in years 6, 9 and 11 about their use of ICT, outside of school, across all curriculum subjects and for non-subject specific educational purposes. Questionnaires were sent home via primary schools for parents of year 2 children to complete.
- On the basis of this national survey, 111 children and their parents/carers (from diverse social backgrounds and with diverse patterns of ICT use), as well as both primary and secondary teachers, were recruited to take part in qualitative interviews. In addition to the interviews, a log of computer-related activities was kept by 62 year 6, 9 and 11 pupils. 23 year 2 pupils kept logs over the period of one week
- Analysis of the statistical relationship between children's use of ICT out of school and their attainment in national tests and GCSEs.

Summary of Key Findings

Access

There were very high levels of home computer ownership across all year groups (89%). These figures suggest a moderate rise in levels of access compared to previous research conducted between 1999 and 2000¹, and a narrowing of the gap in home computer ownership between different year groups. The cost of a home computer remains the main barrier to access.

Pupils from social groups AB² and year 11 pupils had more independent access to, and exclusive use of, computers within the home than pupils in

¹ Although these studies are not directly comparable with this research because they are based on slightly different methodologies and sampling frames, nonetheless they provide a broad basis against which to assess current trends.

² Social grade is used as a household-based proxy measure of social class. This classification is based on the normal occupation of the chief income earner in the household, which is categorised into AB (professional, managerial and technical), C1 (skilled non-manual), C2 (skilled manual), D (partly skilled and unskilled) and E (dependent on state and

other year and social groups because they were more likely to have a computer in their bedrooms. This reflects the proliferation of technology in middle class households and parents' concerns to support the educational needs of older children. Children in year 2 had least independent access to a home computer.

Relatives' homes were the only important location beyond the school and the home where year 2 children accessed ICT. This pattern may be a product of after school childcare arrangements.

Libraries and Internet cafes did not act as substitutes for lack of access to ICT at home, because it was children who had access to a computer at home who were also the pupils who accessed ICT most often in other locations out of school. Thus, home use of ICT appeared to exacerbate, rather than reduce, digital divides. The implication of this is a need for initiatives to encourage those children who do not have access to ICT at home or have limited access, to use technology out of lessons within the school and to develop their confidence to take advantage of provision of ICT in other out of school venues.

Patterns of ICT use

The majority of children in years 6, 9 and 11 reported using a computer at home for school work for 1 to 2 hours per week although patterns of use also varied with season and the stage of the school year. Use of home ICT for educational purposes intensified with age with 14% of year 11 pupils reporting that they use it for 10 hours or more per week. Use of computers in libraries and outside of lesson time in a lunch-time or after-school computer clubs declined with age.

Levels and type of home use of ICT varied according to subject, year group and gender. Some subjects lend themselves to ICT work at home (for example, in English ICT is used for word processing and spelling/grammar checks; in geography, history and science to find information and create presentations for projects/assessment). In contrast, in other subjects children are deterred from using ICT because of the nature of work/teaching in that specific disciplinary area (for example, English settings on word processors deter use for MFL; mathematics homework is commonly set in work books and so cannot be completed on a computer). English was the subject where most use of ICT was made by year 6 and year 9 pupils for school work outside of school; for year 11 pupils ICT pushed in English into second place. There were also other patterns by age group: year 6 pupils were significantly more likely to use ICT for mathematics and science than other year groups; year 9s to use it for geography and history and year 11s to use it for ICT. Children who use a computer everyday or at least once a week in a particular

casual workers). For those unemployed for two months or less, social grade is based on their previous occupation – the longer term unemployed are graded as E. The main advantage of this classification system is that it provides a relatively stable population profile over time and all respondents can be assigned a social grade, unlike occupation-based systems such as the Registrar General's Social Class based on Occupation which excludes the long-term unemployed, arguably one of the most materially and socially disadvantaged population groups.

subject are more likely to use a computer for school work in these subjects at home. Likewise, children who never use a computer at school in particular subjects are also more likely to never use a computer for these subjects at home. This has clear policy implications, in order to develop children's ICT skills and use of computers for educational purposes, schools need to provide good scaffolding in terms of introducing children in the classroom to how technology can be used in specific subjects and to show them how this ICT use can be developed for each subject at home.

Use of ICT for school work outside of lessons intensified with age due to the increasing demands of coursework and exam revision pressures. Concomitantly, children's use of computers for fun declined with age. Year 11 pupils had more independent access to ICT at home. Younger pupils (year 6 and year 9) made more use of exploratory technologies e.g. CD Roms and DVDs, whereas older pupils had a greater emphasis on the use of specific packages to support coursework such as word processing and spreadsheets. These patterns of activities may help teachers in planning the use of ICT in subject specific lessons, both to build on and extend different year groups' current patterns of activity.

Girls were more likely to use home computers for school work than boys (particularly in the subjects they enjoy such as English, history and science), reflecting their more conscientious attitude to education rather than a preference for ICT. The only subject in which boys more likely than girls to use a home computer for school work was ICT – a subject they enjoy. However, boys had access to more items of hardware than girls and were more intensive users of ICT at home than girls for leisure uses, as well as using computers outside of lesson time at a lunch time or after school club more often than girls. This has implications for the gender educational gap as the research also showed that high levels of leisure use of ICT was correlated with a negative impact on educational attainment. There is therefore a need for education policies to re-direct boys' interest in ICT and leisure uses of computers towards use for school work in other subjects. The gendered pattern of ICT use - girls using it for educational purposes and boys for 'fun' - was established as early as year 2.

Parents placed relatively few rules on computer use at home either because they trusted their children to use the hardware and software appropriately or because the technology was located in a family room where they could exercise informal surveillance.

Children in rural LEAs (years 6, 9 and 11) were more likely to *own* a home computer, but those in urban LEAs were more likely to *use* a computer at home every day. However, children from rural LEAs were more likely to use school computers outside of lesson time (every day or at least once a week), in lunch time or after school computer and homework clubs, than children in urban LEAs. This pattern would appear to be related to the different organisation of the school day/transport issues between rural and urban areas.

Home - school links

Home-school links were generally poorly developed. Only 10% of pupils stated that they visited the school's website/intranet frequently, over 50% had never visited it. Many children (and the majority of parents) were not aware their schools had this facility; or had technical difficulties accessing it; or found the site boring/not useful. Rather, schools tended to use the intranet for planning purposes and to facilitate internal communication between staff. The majority of pupils did not email teachers for help with homework. Thus schools need to develop ICT to support home school links and to ensure that information about school Intranets and websites are communicated more effectively to parents and children.

The majority of teachers interviewed did not set homework explicitly to be done on a computer because of their concerns about digital divides in terms of children's access to home-based ICT. Children, however, implicitly absorbed the message that they should use a home computer if they had access to it. As such the digital divide is still there even though teachers did not explicitly set homework using ICT, it was just not acknowledged because pupils were using it out of 'choice' rather than under teachers' direction. These findings suggest that there is a need for schools to acknowledge that a significant proportion of their pupils now use ICT for homework and that as such they need to build on and support this use. In doing so schools must address digital divide issues in terms of pupils' access to ICT out of lessons in school, parents' ability to support home use of ICT and pupils' confidence to use the technology.

Children made very little use of ICT home-school links. However, where school revision websites were used, they were highly motivational and their use could be promoted more widely by teachers. The majority of pupils did not email their teachers for help with school work. However, year 11 pupils' preference for using email and children's general interest in on-line communication suggests that these forms of ICT have the potential to be harnessed by teachers to support children's educational activities out of lessons.

Parents wanted to be able to contact schools via email, to have training and help from schools in relation to supporting their children with school work using ICT and to have more information about which websites they should encourage their children to use. The ability of parents to support their children's use of ICT varied widely according to whether they had developed ICT skills through training courses or using computers in their own occupations. Teachers were only providing guidance about ICT use to parents who were knowledgeable or motivated enough to approach them for help and so were implicitly reproducing divides in pupils' access to home support. There is a need to find ways of reaching 'hard-to-reach' parents. For example, family literacy and learning programmes should include sessions which address how parents can support children's use of ICT for school work.

Teachers have a lack of understanding about what home-school ICT links might involve and are fearful about the potential impact on their time of establishing ICT home-school links, for example having email contact with pupils or parents. None of the teachers interviewed had had training in developing and using home school links. Some also had concerns about

security (in terms of giving out email addresses, child protection issues, spreading computer viruses etc.). There is therefore a need to clarify for teachers what would be involved and to reassure them in terms of their workloads/time management if they are to embrace training opportunities and opportunities to develop home-school links.

Learning and attainment

There was a statistically significant positive association between pupils' home use of ICT for educational purposes and improved attainment in mathematics at years 6 and 9, and a modest but more extensive association with attainment in English and mathematics at year 11. Using a home computer for educational purposes at year 2 did not have a statistically significant positive association with pupil attainment. The majority of parents believed that computers helped their year 2 child to learn useful skills and knowledge, though they could not readily identify what these were beyond things such as learning words or to type more quickly.

Pupils, parents and teachers reported that using ICT raised pupils' confidence and had motivational effects. ICT was motivational because it contributed both to making school work more enjoyable and also to pupils' perceptions of achievement. Specifically, ICT was regarded as making homework less boring because children regarded using computers as: 'cool'; interactive and multi-modal texts were more interesting than books; ICT saved time (e.g. it is easier to write and revise documents on a computer than by hand) and enhanced the presentation of children's work; the Internet was a good source of information (range and depth) and educational materials (such as revision websites); ICT enabled multi-tasking and was perceived by children to improve grades (just under 50% of children thought that using computer improved their marks). The subjects in which pupils (in years 6, 9 and 11) used computers at home for school work at least once a week were also the same subjects in which they believed that using a computer improved their grades and in which they had most home-based electronic resources.

Some parents and teachers identified what they felt to be educational disbenefits of ICT use. These included the perceived enhanced ability to plagiarise by cutting and pasting from the Internet, the possible negative effects on handwriting and the potential for distraction by non-educational uses of ICT.

There was a statistically significant positive association between pupils' use of ICT out of school for leisure purposes and decreases in attainment. This effect was over twice as large an effect as the positive association of using ICT for educational purposes. In other words, it is not access or general use of ICT per se that could raise attainment, but rather how the technology is used that matters. The more time pupils spend playing computer games, the less time they may have available for other tasks, including homework and study. Some children reported pretending to their parents that they were using the home computer for educational purposes when they were actually using it for 'fun'. Thus, pupils need to be made aware of the disbenefits of predominantly leisure uses of ICT and encouraged to adopt a more responsible attitude to home use of ICT for school work.

A minority of parents argued that console games and non-educational computer games have developed particular skills in their children, such as making them think, or developing factual information about specific topics. However, it is hard to identify and measure these 'gains' because they are so embedded in pupils everyday lives.

The main barriers to using ICT for educational purposes out of school lessons included: a lack of explicit instruction to do so by teachers; a lack confidence in how to use the technology; not regarding ICT as applicable to specific subjects; a lack of interest in particular subjects per se; the limitations of home-based ICT (e.g. 97% of children with access to broadband used the Internet compared to two thirds of pupils with dial-up access to Internet); the limitations of ICT available at school out of lesson time (poor specifications, inability to customise school computers, frustrations of website filters etc.); a lack of time to use school based ICT out-of-lessons (because of limited equipment, its location, booking systems); and the limited appeal of school computer clubs. Here, there are clear implications in terms of addressing how schools deliver out of school ICT opportunities for their pupils in ways that make them more attractive for children.

Implications

The educational use of ICT outside of school is positively associated with a modest rise in pupils' attainment in specific subjects, as well as bringing wider benefits including motivational effects, raising the self esteem and confidence of low achievers and enabling those with special needs or high achievers to demonstrate their ability. More importantly, leisure uses of ICT are positively associated with a negative effect on attainment. The implication of this is the need for schools to focus on pupils' patterns of ICT use, in particular, to redirect pupils' predominant interests in using ICT for leisure activities towards educational ends and more generally to extend pupils' educational uses of technology out of the classroom.

The clear relationship identified in this study between subject specific use of ICT in the classroom and subject specific use of ICT for school work outside of lessons highlights the need for good scaffolding in terms of introducing children in the classroom to how technology can be used in specific subjects across the curriculum and showing them how this ICT use can be developed at home for school work in specific subjects.

Teachers however, are generally reluctant to explicitly ask children to use ICT for school work outside of school because of their concerns about digital divides in access to hardware and software. This is problematic because children, whether explicitly or implicitly, pick up the message that they should use ICT at home if they have access to it. As such the digital divide in terms of the opportunity to use ICT (with the potential advantages and attainment gains it may bring) is still there even if teachers do not explicitly set homework using technology. Teachers tend to provide support for parents on an *ad hoc* basis to those motivated or knowledgeable enough to seek advice so implicitly reproducing divides in terms of home support. Rather, schools need to develop initiatives (within school out of school lessons and with libraries and

Internet cafes) to support access to ICT for the minority of pupils who do not have a home computer; to make information about how to support children's home use of ICT available to all parents; and to connect with 'hard-to-reach' parents who may be deterred from taking up ICT training opportunities at their children's school because of their own negative experiences of education.

More generally, home-school ICT links appear to be poorly developed. Teachers have not had training in developing these uses of ICT, therefore do not have extensive understanding of what this might involve and are fearful about the potential impact on their time of home-school ICT links. Further attention to these matters is needed in pre- and in-service teacher education.

1. INTRODUCTION

1.1 Context

Since 1998, when the Government published its plans to develop the National Grid for Learning (NGfL), considerable progress has been made in advancing children's access to Information and Communication Technologies (ICT) within schools. In *Fulfilling the Potential* (DfES 2003) the Government identified ICT and e-learning as having a contribution to make to all aspects of the school reform agenda including: teaching and learning; motivating children and helping to meet individual needs [a policy further emphasised by David Miliband, the Schools Minister, in a speech stressing the Government's commitment to individualised learning³]. At the same time, there has been a rapid growth in the home ownership of computers and access to the Internet, as well as a rise in new spaces where ICT is available, such as Internet cafes. The Government's White Paper *Excellence in Schools* has identified the need to provide parents with information; to give parents a voice; and to encourage parental partnership in schools. ICT offers one potential way for enhancing home-school links and facilitating programmes of family and community education. As a result of such policies and initiatives, there is increased concern about the relationship between children's use of ICT outside the school, especially at home, and their levels of educational attainment.

Previous research (Holloway and Valentine, 2003) including the ImpaCT2 study (DfES, 2003) – comprehensive research carried out between 1999 and 2002, involving 60 schools in England -- has found that home use of ICT provided children with a number of advantages including: the advanced specification of home computers in comparison with those available in schools; the greater speed of home connectivity to the Internet; greater time and freedom to use, and become familiar with, ICT at home than school allows (away from peer pressure); and the motivation to study.

At the same time, research has suggested that access to an Internet connected home computer does not necessarily translate into use by children (Holloway and Valentine, 2003). Parents often restrict children's independent use of ICT because of concerns about their safety on-line; worries about their eyesight/health; or fears about possible damage to expensive hardware or software because of children's lack of ICT competence (Facer, Furlong, Sutherland and Furlong, 2003; Holloway and Valentine, 2001a; Kerawella and Crook, 2002). In some households, ICT use is rationed because of the competing demands of other family members, or is limited by parents' and/or children's technophobia. Who 'owns' a home-computer and where it is located (an individual's bedroom, a 'private' office space or shared 'public' room such as the living room) can also influence how much access an individual child has to a computer and their willingness to use it (Holloway and Valentine, 2003). Likewise, children who do not have access to ICT at home might still have significant access to these technologies out of school by using friends'

³ David Miliband - 08 January 2004 - Personalised Learning: Building A New Relationship With Schools, North of England Education Conference.

computers or visiting libraries and Internet cafes. Computer games are the most commonly cited use of computer technology by children at home. Not surprisingly, there are often tensions between the amount of time that children spend using ICT for recreational compared with educational activities (Livingstone and Bovill, 1999). Previous research (Holloway and Valentine, 2003) suggests that children often tell parents that they need Internet connected computers for school work, yet in practice predominantly use them for recreational activities. As such, there is a need to measure the role of ICT in children's home and social lives in order to understand its relationship to children's educational attainment. There is some evidence to suggest that computer games can have a positive effect on attainment (McFarlane, Sparrowhawk and Heald, 2002).

The evidence for the effect of home use of ICT on educational performance and attainment is very limited. The ImpaCT2 study, conducted in England, showed that use of ICT at home and school varied according to age. At key stage 2, children predominantly used it for playing games and drawing; at key stages 3 and 4 for school work (mainly in English, Science and Mathematics) and games. After analysing the amount of time children spent using the computer for school work: (a) during lesson time; (b) outside lesson time, but within school and (c) outside school, including home use, the study identified that the relationship between ICT use and achievement was not always statistically significant and not evenly spread across all subjects. ImpaCT2 found that:

- At key stage 2 there was a statistically significant association between levels of use of ICT and performance in the national test for English.
- At key stage 3 there was a statistically significant association between levels of use of ICT and performance in the national test for science only.
- At key stage 4 there was a statistically significant association between levels of use of ICT and performance in the national test only for GCSE in design and technology and positive, but not statistically significant associations, for modern foreign languages and geography.

There is a need, therefore, for further consideration of children's home use of ICT for educational purposes.

1.2 Objectives of this study

This report summarises the findings of research undertaken to understand the links between children's educational uses of ICT at home and their performance and attainment in school. It is based on research conducted in the summer term of 2004 in 12 schools in England (see Appendix 1 for details about the range of hardware and software included in the term 'ICT').

Although the primary emphasis of this research was on use at home, the research also considered ICT use in after school/ lunchtime clubs, libraries or other people's homes, particularly for pupils who did not have access in their own home.

The objectives were to:

- Investigate the types and amount of home use of ICT by children and young people at Key Stages 1-4.
- Establish the relationship between the types and amount of home use of ICT and children and young people's performance and attainment at school.
- Identify the drivers for home use of ICT by pupils and what motivates pupils to choose (or not choose) to use ICT.
- Establish the significance of digital divide issues in the relationship between home use of ICT and attainment.

1.3 Methodology

The research involved three stages, briefly outlined below. A more detailed explanation can be found in Appendix 2.

The research was conducted with year 2, 6, 9 and 11 pupils. Table 1 outlines the relationship between age, year group and key stage.

Table 1: Relationship between age, year group and key stage

	Key Stage 1		Key Stage 2				Key Stage 3			Key Stage 4	
Year	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11
Age	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16

Twelve schools in ten different socio-geographical areas in England were selected to take part in the study. Representativeness was achieved by stratifying Local Education Authorities by type (metropolitan etc), region and proportion of Minority Ethnic Population.

The aim was to select 60 pupils per year in each of the participating primary schools and 120 per year in each of the participating secondary schools. This was undertaken by selecting whole class lessons of mixed ability groups (e.g. PHSE, registration class) in which the pupils would complete the questionnaires. Where smaller primary schools were recruited, two schools were recruited per area, and the aim was to select 60 pupils per year in total across the two schools. Table 2 outlines the sample with regard to type of LEA.

Table 2: Questionnaire Sample by type of LEA

LEA type	Number of schools recruited	Pupils selected in year 9	Pupils selected in year 11
SECONDARY			
London	1	126	121
Unitary	1	235	120
Shire (1)	1	120	130
Metro	1	112	125
Shire (2)	1	116	120
TOTALS SECONDARY	5	709	616
PRIMARY		Pupils selected in year 2	Pupils selected in year 6
Shire (1)	1	45	53
Unitary	1	58	59
Metro (1)	2	57	71
Metro (2)	1	64	59
Shire (2)	2	65	57
TOTALS PRIMARY	7	289	299

The sample of schools was selected from the schools who participated in the PIPS and YELLIS systems, run by the Curriculum, Evaluation and Management Centre (CEM) at the University of Durham. This was done in order to obtain a measure of relative progress or value-added. Because of the variation between schools in terms of their catchment areas and the prior socio-cultural experiences and economic backgrounds of pupils, simply using the results of national tests would not allow a fair comparison to be made. The PIPS and YELLIS systems gather baseline information on a number of variables relating to academic attainment, developed ability and attitudes. These are then used to calculate measures of relative progress or value-added. The final raw test scores are thus re-calculated to take into account the pupil's projected score, predicted using the baseline measures.

A self-completion questionnaire survey [see Appendix 3] was then completed by children and young people in years 6, 9 and 11 about their use of ICT across all curriculum subjects and for non-subject specific educational purposes. Questionnaires were sent home via primary schools for parents of year 2 children to complete [see Appendix 4]. Table 3 indicates the response rates for each year group.

Table 3: Questionnaire Response Rates

YEAR	Sampled	Returned	Response Rate
Year 2 (Parents)	286	121	42%
Year 6	299	273	91%
Year 9	721	545	76%
Year 11	616	401	65%
TOTAL	1922	1340	70%

On the basis of this national survey, 111 children and their parents/carers (from diverse social backgrounds and with diverse patterns of ICT use), as well as 11 primary and secondary teachers, were recruited to take part in

qualitative interviews. Table 4 outlines the characteristics of the sample interviewed.

Table 4: Interview sample

	Male	Female
Year Group		
Y2	12	16
Y6	16	12
Y9	18	16
Y11	10	11
	Frequency of computer use	
High ICT users	46	
Medium ICT users	45	
Low ICT users	20	
<i>Total number of children and young people interviewed</i>	111	
<i>Total number of parents interviewed</i>	111	

These interviews examined the drivers for home use of ICT by pupils and what motivates pupils to choose (or not choose) to use ICT; the role of parents, friends or other members of the household in supporting or limiting children's use of technology; home-school links; and children and parents' perceptions of the relationship between children's use of ICT and their attainment in school [for interview schedules, see Appendices 5 - 6]. Interview transcripts were inductively coded to identify patterns and key themes. In this report, comments from the interviews have been used to illustrate particular issues. These extracts were chosen because they represented general views expressed on those topics. Where excerpts from the interviews represent minority viewpoints, this is made clear. In addition to the interviews, a log of computer-related activities was kept by 85 children over the period of one week [see Appendices 7 and 8].

Finally, the statistical relationship between children's use of ICT out of school and their attainment in national tests and GCSEs was analysed. Multiple linear regression was used to assess the influence of ICT-related behaviour on relative performance year on year for school pupils. Relative performance was obtained by comparing each pupil's actual achievement with his or her predicted achievement, derived from 'baseline' scores produced by the Curriculum, Evaluation and Management Centre (CEM) at the University of Durham from tests carried out on the pupils.

2. ACCESS

This section examines patterns in terms of levels of pupils' access to ICT within the household, and their levels of independent access to technology within their own bedrooms.

2.1 Patterns of access to a home computer

Access to ICT at home is growing rapidly, reflecting parents' desire to provide educational opportunities for their children (Turow 1999, Holloway and Valentine 2003). The majority (89%) of children in years 6, 9 and 11, and parents of year 2 children claimed to have access to at least one computer at home (including laptops), with 12% of pupils living in homes with 3 or more items of hardware. This figure represents a moderate rise from 2002 when the Department for Education and Skills' (DfES) survey of young people's (aged 5-18) ICT use recorded that 81% of households had access to a computer or laptop at home (BECTA, 2003)⁴.

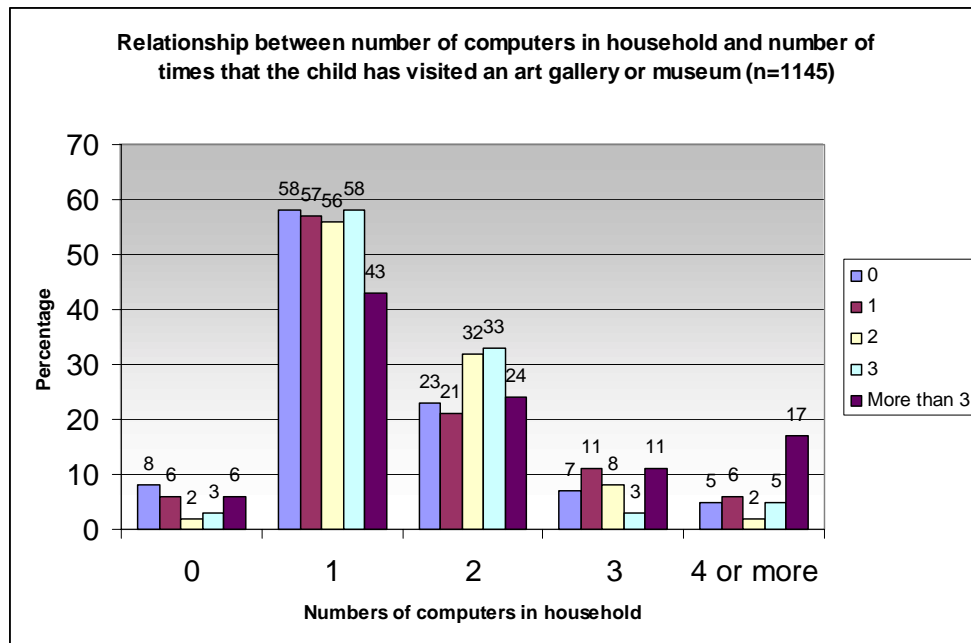
Levels of ICT ownership amongst the households interviewed were generally linked to socio-economic class, mirroring the findings of previous research (BECTA, 2003). The majority of families in social group DE owned only one computer. The majority of families who owned three or more computers were from social group AB (upper/middle class)⁵. There is no relationship between the number of children in a household and the number of computers both overall and by school year. The proliferation of domestic technologies appears to be a result of households upgrading their machines in response to technical advances, or because of parents' employment, allowing older machines to be passed down to children, with the oldest child having priority.

There is a significant relationship between computer ownership and measures of cultural capital. Children with no computers in the household are also less likely to visit an art gallery or museum than children with access to a home computer (Figure 1). This suggests that children who have ICT opportunities at home also have a lot of opportunities to gain information elsewhere. It also indicates that children who have high levels of ICT resources at home may have more parental involvement/support in their learning.

⁴ Although these two surveys are not directly comparable because they are based on different samples, nonetheless the findings indicate a common pattern of ownership.

⁵ A Upper class; B Middle class; C1 Lower middle class; C2 Skilled working class; D Working class; E Subsistence level/ other

Figure 1



The families interviewed who did not own home computers cited cost as the main prohibitive factor. The parents in these families all valued computers as an educational tool for their children, but stated that they could not afford to purchase one. One parent of a seven- and a four-year old reported that, in addition to cost, they had not felt that it was important to buy a computer until the oldest child had moved into key stage 2. In another family, the father's attitude appeared to be the main barrier to the acquisition of a computer, in that he believed that books should be the main educational resource for his children. These findings replicate previous studies which show that income is the key, though not sole, determinant of home computer ownership (Holloway and Valentine 2003).

A number of factors appeared to have contributed to the high levels of computer ownership in the families surveyed. First, many parents stated that they bought computers to support their child's education (Holloway and Valentine, 2003). Second, a large number of parents used computers themselves for leisure and work purposes. Third, some families suggested that they needed the technology to keep in contact with distant relatives. Finally, a number of families regarded computers as an integral part of every day life in the twenty-first century.

There are no significant relationships between the number of computers in the home and the gender of year 2 pupils (although boys were significantly more likely to have access to games consoles than girls). Amongst year 6, 9 and 11 pupils, there is a significant relationship between computer ownership and gender. Girls were significantly more likely to have either no access to a computer, or to have access to only one computer/laptop at home, whereas boys were more likely to have access to two or computers/laptops. This pattern reflects the findings of other studies which suggest that boys tend to be more techno-enthusiasts than girls and to purchase their own ICT

hardware and software for leisure use (Holloway and Valentine 2003). There were no significant differences between white and minority ethnic pupils' levels of access to a computer at home for any year group.

Previous research (DfES, 2003) has shown that access to a home computer increased with each key stage: from 68% at key stage 1 to 87% at key stage 4. The data from this study suggests that this gap has closed – here the figures showed a high level of home computer ownership across all year groups (91% of year 11 pupils have one or more computers at home, compared with 88% of year 9 pupils; 88% of year 6 pupils, and 88% of year 2 pupils). While younger pupils were thus slightly more likely not to have a home computer than older pupils, there was no statistically significant relationship between year group and number of items of technology at home. The implication of this high level of computer ownership is that the digital divide in terms of hardware is now so narrow that schools need to begin to address this so that they can exploit the opportunities ICT offers in relation to homework and for developing home-school links (see section 4). The further implication of this pattern of ownership is that schools also need to address digital divides in terms of pupils' confidence, competence and interest in using the out-of-school ICT resources available to them because these factors are arguably now more significant in terms of shaping pupils' patterns of out of lessons use than access to hardware (see section 3).

2.2 Independent access to a home computer

There was a relationship between year group and where computers are kept. The year 11 pupils surveyed were significantly more likely to have a computer in their bedroom (41%) compared to year 9 (34%) and year 6 (31%) pupils. In other words, year 11 pupils potentially had more access in terms of time and exclusive use of this technology within the household than pupils in other year groups. Year 2 children had the least independent access to a home computer. Only 6% of the parents surveyed reported that there was a computer in their year 2 child's bedroom. Rather, the pattern for the location of home computers in the families of year 2 children was more diverse than that reported by children in years 6-11, with the most important locations for computers being a study/office, then dining room and living room. Likewise, children and young people interviewed from families in social group AB were more likely to have individual access to a computer in their bedroom than those from families in social group DE, who were more likely to have to share a computer, usually located in the living room. This reflects the concern, and ability of, middle class parents to maximise the educational support of children facing GCSE examinations, and more generally the greater trust placed in older children to manage their own ICT use.

While the number of children who had their own web page is strikingly similar across all year groups (year 6 – 15%; year 9 – 15%; and year 11 -14%); year 11 pupils were significantly more likely to have an email address than younger pupils. Again, reflecting the perceived maturity of children to communicate independently in this way.

2.3 Access to other hardware in households

The majority of households surveyed owned at least one games console (just under 90%) and just under 70% of the households had one or more handheld games machines. Levels of ownership of interactive digital television(s) (80%) were also very high. The majority of year 6, 9 and 11 pupils (over 90%) reported that there was at least one mobile phone in the household. Only 4% of year 2 parents stated that their child had a mobile phone.

There was a significant relationship between the number of games consoles, handheld games machines and mobile phones and the number of children in the household. The number of items of hardware increased with the number of siblings in the household. However, this was not true of either computers or interactive televisions. There was no relationship between these items of technology and the number of children in the household. This may be due to the relatively higher costs of these items.

ACCESS: SUMMARY

- **Levels of access to home computers were very high (89%), reflecting parents' support of children's education and their own work/leisure needs.**
- **Access to ICT is still related to socio-economic status. Families in social classes AB were more likely to own 3 or more computers.**
- **Children in social classes AB, and those in year 11, are more likely to have independent access to a computer in their own bedroom. This access potentially allows them to have more time, and exclusive use of, this technology.**
- **Boys are more likely to have access to two or computers/laptops than girls.**

3. PATTERNS OF USE

Use of a technology is not the same as access. Previous studies have shown that some children do not take advantage of the opportunities they have to access ICT at home, and that parental rules can also constrain some children's opportunities to use equipment in the home (Holloway and Valentine, 2003). This section considers parental restrictions on use; general variations in use; educational patterns of use (including subject specific patterns of use); leisure use and variations in patterns of leisure use.

3.1 Parental restrictions on use

Just under three quarters (74%) of the year 2 parents surveyed claimed that they did not have any rules about computer use for their child, and less than a quarter stated that they had a filter system on the computer. The main rules employed by these parents for year 2 children were that they could only use a computer with the permission of their parent(s) or their parents' partner, and that they could only use the computer for a fixed time period.

Of the children surveyed, year 6 pupils (56%) were significantly more likely to report rules on using the computer than year 9 (38%) or year 11 (33%) pupils. This reflects the fact that parents generally begin to trust children to manage their own lives and grant them more independence as they get older. There were no significant variations in rules according to gender, ethnicity (or social class). The most common rules that year 6 pupils reported were expressed in terms of *'I can only use a computer for fun once I have finished my school work'* (38%); and *'I can only use a computer for a fixed period every day'* (14%). Interestingly, these rules did not prevent leisure uses of the computer; only 3% of children surveyed said that they were only allowed to use a home computer for school work. Household rotas were also uncommon, with only 4% of children reporting this restriction on their computer use. Over 90% of children answered 'no' to the question *'I know our computer has an automatic filter system'*. This suggests that lack of knowledge about filters on home computers amongst the young people surveyed was extensive, and raises questions about the extent to which such strategies are effective barriers to risk-taking in the use of the Internet.

In the interviews, some parents explained their relatively low level of supervision of children's computing activities, arguing that they did not have explicit rules about the use of the home computer because they trusted their children to use the hardware and software appropriately. Other parents suggested that rules were not necessary because the computer was located in a shared room (for example, the living room) where they could oversee what their children were doing. When parents did report the use of rules, these were primarily because they were concerned about the amount of time a child spent on the computer (reflecting the need for computers to be shared between users) and concerns about health and safety (e.g. eyesight).

In terms of use of the Internet, some parents also specified that their children were not allowed to give out their name and address on-line and forbade the use of chat rooms. In two instances, parents outlined how they how they looked at the history of sites visited in order to ensure that their children had not accessed inappropriate sites.

In line with other studies (Valentine and Holloway, 2001), some children resisted parental rules, or found ways around them. For example, one year 11 pupil complained about the rules that limited the amount of time he could spend on the Internet, saying, “ *Silly, I don’t see the point in paying for the Internet if I’m not allowed on it.*” He then told the interviewer that he got around this:

I put it back in and go on it and then once everyone goes upstairs I turn the screen off. I just turn the screen off and then they can’t see it, because they can’t see the wire.

(Year 11 boy)

Other children interviewed talked about knowing how to disable the firewalls, or to change the age setting on them. Livingstone, Bober and Helsper (2005) also suggest that parental strategies to reduce on-line risks appear to have little effect. The implication of this is that children may well tell their parents or teachers that they are using ICT for educational purposes when in fact they are spending this time engaged in leisure activities such as computer games or surfing the net for fun.

3.2 Variations in use

Year 2 children appeared to have good exposure to computers. The majority (95%) of parents stated that their year 2 child used a computer at school, while 84% of parents claimed that their child used a computer at home. According to the parents surveyed, almost two thirds (65%) of year 2 pupils used computers frequently (every day or at least once a week) at home, a figure that is comparable with year 6 and year 9 usage levels. Half of all year 2 children spent up to 2 hours per week using computers outside of school; 16% of children spent 3 hours, usage then tailed off rapidly.

The only other important location where year 2 children used a computer is at a relative’s house, with just over a quarter (26%) of the parents stating that their year 2 child used a computer there every day to at least once a month. It is possible to speculate that this pattern may be a product of after school childcare arrangements.

When he visits, when he goes, he goes to my sister’s every day, she picks him up from school for me because I don’t finish work until five. So, he goes there every day and if her children are playing on the computer, then he’ll play on it.

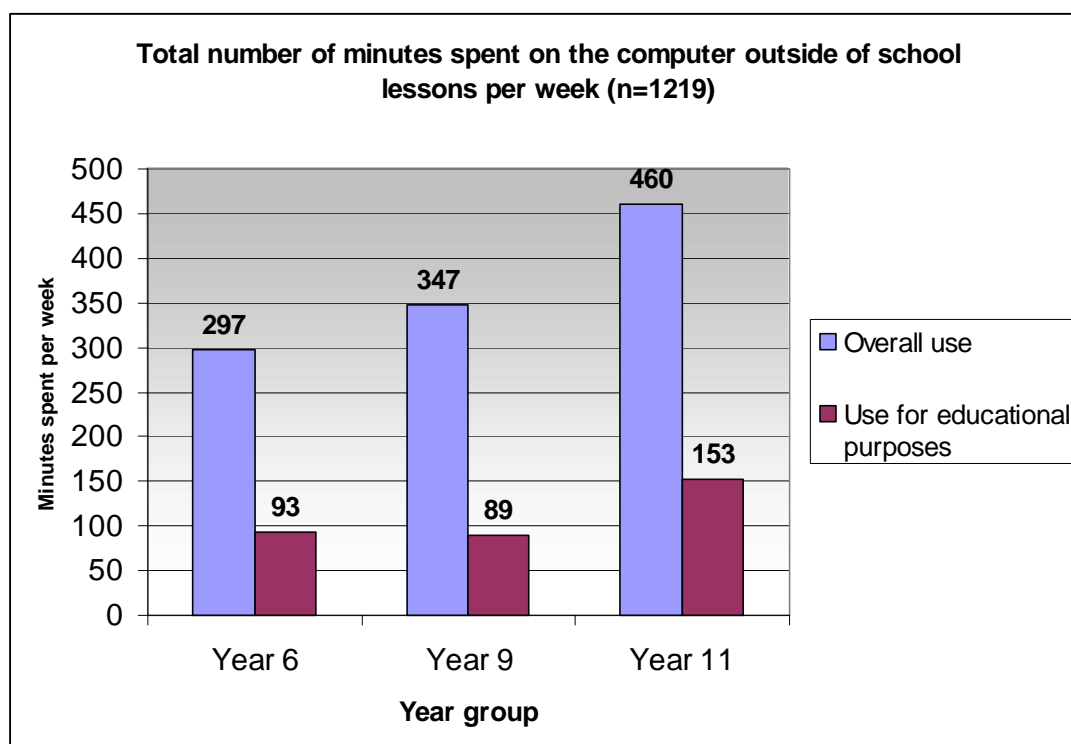
(Mother of year 2 boy)

Year 2 children’s use of computers in other locations, including Internet cafes, parents’ workplace and libraries was negligible. Access to these out-of-school

venues can be expensive, lack flexibility (e.g. due to opening hours), be unwelcoming to young children, or depend on the willingness of a parent to take a child to the appropriate place. Over 70% of year 2 children never used a computer outside of school lessons at a lunch time, after school or in a computer club.

The mean amount of time spent by children using a computer outside of school was between 5 to 7 hours per week (397 to 460 minutes). However, the mean amount of time spent using a computer outside of school for educational purposes was only 1.5 hours per week for year 6 (93 minutes) and year 9 (89 minutes), rising to 2.5 hours per week for year 11 pupils (see Figure 2). This pattern reflects pupils' preference for using computers for leisure activities, while the pattern of increased computer use for educational purposes between years 6/9 and year 11 is a product of the increased pressures older pupils experience as they approach public examinations. Around 14% of year 11 pupils stated that they used a computer outside of school for 10 hours or more.

Figure 2



Older pupils were significantly *less* likely to use a computer in a library than younger pupils. 80% of Year 11 pupils never use a computer in this location compared to 72% of year 9s and 62% of year 6 pupils. This may be related to the fact that Year 11 pupils were more likely to have access to their own computer.

The majority of parents interviewed reported that children and young people used the computer both for school work and pleasure more during the winter months than summer months. During the summer, children and young people were more involved in sport and leisure activities outside of the home. Children and young people also suggested that their out-of-school use of the

computer for school work varied according to the school year. Year 11 pupils were more likely to use revision sites prior to exams, having used the computer for coursework for the rest of the academic year.

Children in years 6, 9 and 11 from African-Caribbean and African backgrounds appeared to be less likely to use a computer than Asian or white pupils⁶. At year 2 there is some evidence that children from minority ethnic groups were more likely than white children to use a computer club at lunchtime (once per week or once per month) than white children⁷. There were gender differences in relation to computer use at years 6, 9 and 11. Boys from all socio-economic backgrounds reported higher use of ICT in the home and were more likely to be described by parents as intensive users:

He would probably spend every waking hour on it messing around, you know, I don't think that he would police himself so I have to be quite strict and I say, 'Right, you've only got an hour/couple of hours', depending on the situation because I don't think he would, quite honestly.

(Mother of year 9 boy)

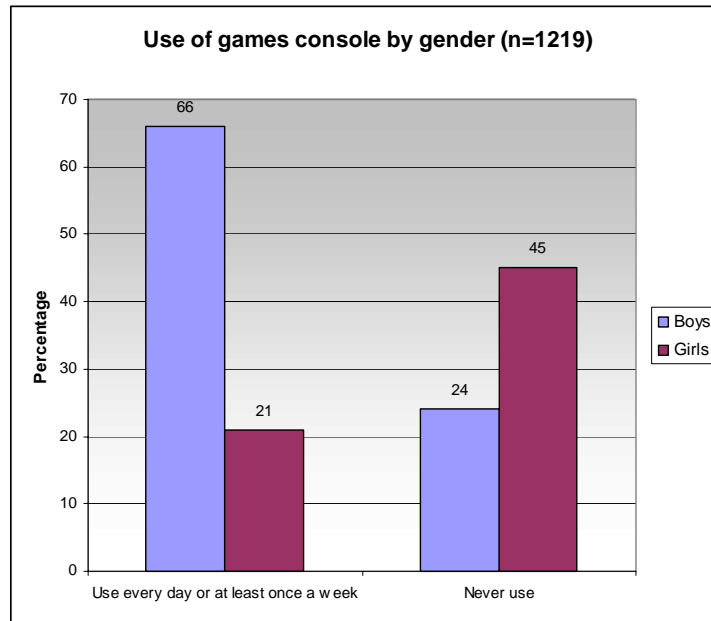
There were also gender patterns in relation to the purposes of ICT use. Boys were more likely to report use of the computer for games (use every day or at least once a week: boys, 61%; girls, 44%) and more boys than girls stated that they use games consoles (use every day or at least once a week: boys, 70%; girls, 32%). This mirrors the findings of numerous other studies that have all suggested that computers are boys' toys – in that boys like using them more than girls (e.g. Reinen and Plomp 1997), have greater confidence in their own ability to use them than girls (e.g. Comber et al., 1997) and that many computer games are designed around boys' interests rather than girls', which perpetuates a masculine computer culture (Holloway et al., 2000).

Unlike the older age groups, within year 2 there was no significant relationship between gender and the frequency with which parents reported that their children used computers at home. Boys were slightly more likely to use a computer every day, otherwise the pattern of usage was strikingly similar. However, there was a clear gender difference in terms of the use of games consoles across all year groups, with boys more likely to be frequent users (every day or at least once a week) than girls; girls were also over twice as likely never to use a games console as boys (see Figure 3).

⁶ The number of respondents from minority ethnic backgrounds is too small for this relationship to achieve statistical significance.

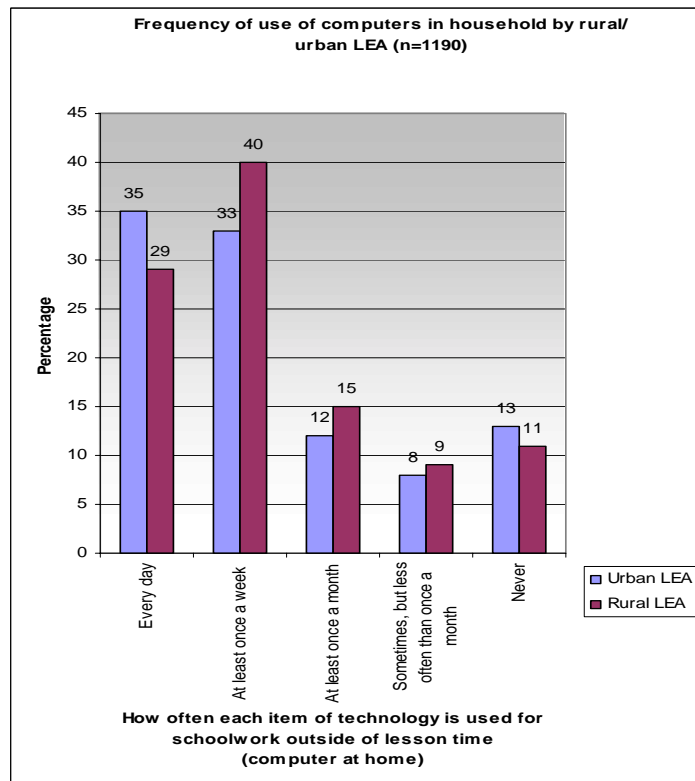
⁷ The number of respondents from minority ethnic backgrounds is too small for this relationship to achieve statistical significance.

Figure 3



There was a significant relationship between the frequency of computer use at home and geographical location (see Figure 4).

Figure 4



Children from urban LEAs in years 6, 9 and 11 reported that they were more likely to use a computer at home every day than those in rural LEAs; but urban children were also more likely never to use a computer at home for school work than rural children. In contrast children from rural LEAs were more likely to use computers outside of lesson time every day or at least once a week (at a lunch time or an after school computer or homework club) than pupils from urban LEAs. This is likely to reflect the fact that rural children may spend more time on the school site during school-time, as there are fewer attractions beyond the school gates to attract them out of school during lunch-time hours than in urban areas. Many of the children may also travel long distances to school, but because of bus times may arrive early for school or have to wait on after school and so may spend time using ICT equipment. The implication of this finding is the need for urban schools to deliver out of school ICT opportunities for their pupils in ways that compete with other out-of-lesson or out-of-school attractions.

While computers were only frequently (every day or at least once a week) used for school work in other locations by a *minority* of pupils, there is a linear relationship between age and how often computers were used for school work at a relatives' house; year 6 pupils were more likely to use a computer in this way every day or at least once a week than year 9 or year 11 pupils (year 6 17%; Year 9 - 9%; Year -11 6%). It is possible to speculate that this may be related to after school childcare arrangements. Year 6 and year 9 pupils were also more likely to use a computer frequently (every day or at least once a week) at a friend's house, and at public libraries, than year 11 pupils.

In terms of the Internet, the majority of the pupils surveyed across all year groups did not use the Internet at home. Although levels of use of the Internet rose slightly with age, this relationship was not significant (36% of year 6 pupils stated they use the Internet compared to 38% of year 9 pupils and 43% of year 11 pupils). Where families owned two or more computers, there was usually one computer which had the most up-to-date software and highest specification and was the only computer in the house with an Internet connection. As a result of competition between family members for this one machine, children and young people's access to the Internet was often limited. These figures are lower than other recent studies. For example, Livingstone, Bober and Helsper's (2005) research found that 75% of UK households surveyed between January and March 2004 had domestic Internet access to the Internet and that 75% of 9-19% olds had used the Internet at home. This disparity can be attributed to the fact that the Livingstone et al., (2005) study asked whether children had used the Internet, whereas this research focused on current patterns of use. The survey used in this study was conducted in the summer term, when children and young people may have been less likely to use the computer in favour of playing outside, or undertaking outdoor pursuits. Where children do use the Internet there is a clear difference in patterns of use evident between those with broadband connections and those without. Of the children living in households with broadband connections, 97% stated that they used the Internet at home. In contrast, of those households that do not have broadband only just under two thirds (63%) of the children stated that they use the Internet at home, just over one third (36%) reported that they do not use Internet at home).

Children's use of Internet cafés was negligible – less than 4 % of children in any age group used it with any form of regularity (defined as: every day/at least once a week or at least once a month). As previous research (Holloway and Valentine, 2003) has indicated, the children who used Internet cafés and computers in libraries were those children who already had home computers. One advantage for these children of using the Internet outside the home was that it enabled them to access sites they were not permitted to do so by parents, as this year 9 girl described.

Interviewer: And what kinds of things do you use the computer for at the library?

Female: Printing things, looking on the Internet. Sometimes, there's, like, mathematics games and English games that help you with your skills for school.

Interviewer: And how is that different from what you do with the computer at home?

Female: Some of their games are linked to the Internet, so I'm not allowed to play games on the Internet, you know, I just do school work at home.

(Year 9 girl)

None of the children interviewed who lived in families which did not own computers used the Internet in locations such as Internet cafes. The implication of this is that children who had opportunities to use computers at home also took advantage of opportunities to gain information elsewhere, so that ICT use at home exacerbated, rather than narrowed, digital divides. There is a need for initiatives to be developed between schools and local Internet cafes in order to support and encourage children who do not have Internet connected home computers to access ICT in these spaces.

3.3 Educational patterns of use

It is difficult to distinguish between year 2 children's leisure and educational uses of ICT. In their ICT diaries, children in year 2 recorded that they used a home computer for the following activities:

'Office' software

- Finding clip art on the web and pasting into a word processing document.
- Writing stories using a word processor.
- Drawing pictures using an art package.
- Producing greeting cards using a CD-ROM.

Educational games

- Playing computer games e.g. arcade spelling games.
- Playing CD-ROM games linked to television and popular cultural interests.

'Non-educational' games

- Playing CD-ROM games linked to television and popular cultural interests.

- Playing simulation computer games.

Websites

- Using web sites to find out about electricity.
- Playing games on websites linked to television and popular cultural interests.
- Playing educational games on Internet e.g. alphabetical order game, spelling games, mathematics games, science quiz, support for writing stories.
- Colouring in a sheet printed off from a website.

CD ROMs/ DVDs

- Watching a DVD on the computer.
- Using encyclopaedia CD-ROMs to find out information.

In their ICT diaries, year 6, 9 and 11 children recorded using a home computer for the following educational activities:

'Office' software

- Using a word processing package to write a business letter.
- Using a word processing package to write up a project in geography.
- Using a word processing package to look through business studies notes for an exam.
- Using a word processing package to write English and history essays.
- Using a spreadsheet to make graphs for mathematics project.
- Using an email program to contact friends about exams.

Educational games

- Playing spelling games to work on spelling.
- Playing mathematics games to practice Mathematic skills.

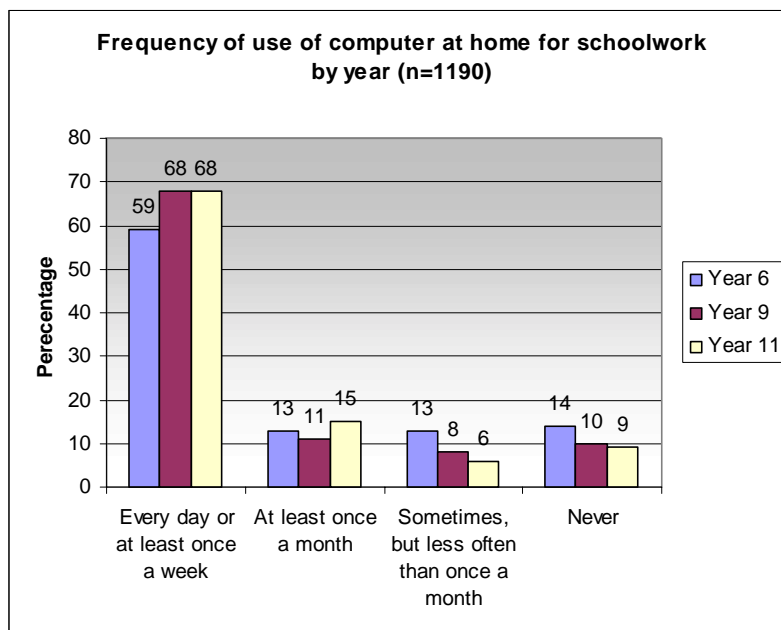
Websites

- Using a revision website to revise for English.
- Using a website to retrieve information for projects e.g. information about the seven wonders of the world/ Inuit communities.

Children surveyed in year 11 (62%) were more likely to use a computer *at school* out-of-lesson time for school work than year 9 (53%) or year 6 (52%) pupils. The pattern is reversed in terms of computer use for fun or hobbies; more year 6 (65%) pupils stated in the survey that they used computers at school out of lesson time in these ways than year 9 (60%) or year 11 (54%) pupils. This pattern of use reflects the increased demands of school work as children move into GCSE coursework requirements.

There was a significant relationship between the amount of *home use* of ICT for school work and year group. ICT use intensified with age, with pupils in years 9 and 11 being more likely to use a computer at home for school work every day or at least once a week than year 6 pupils (see Figure 5) or year 2 pupils.

Figure 5



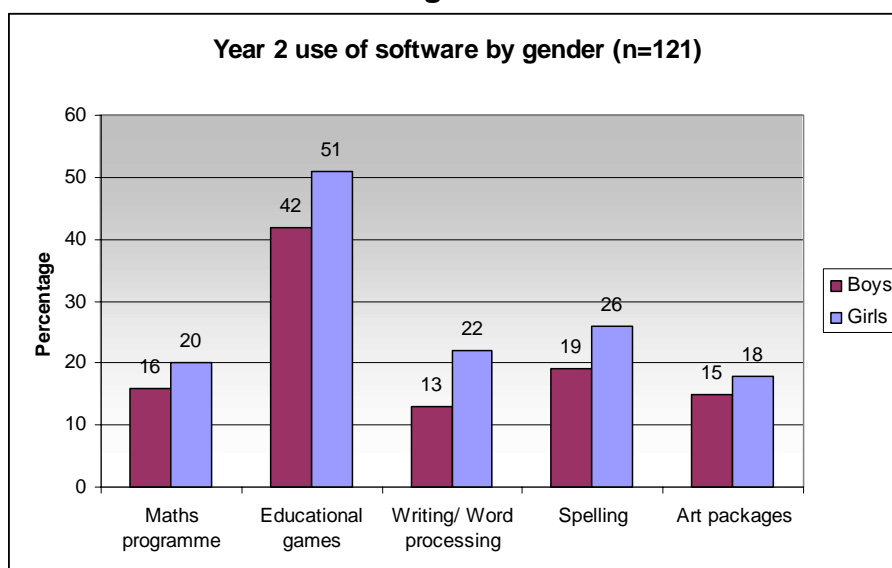
Interestingly, this pattern was reversed in terms of use of computers for school work outside of lesson time in a lunch-time or after-school computer or homework club. Here, year 6 pupils were more likely to use computers in this way every day or at least once a week than year 9 or year 11 pupils (year 6: 28%; year 9: 19% and year 11: 13%). Year 11 pupils were more likely to use computers in this way more casually (at least once a month) than either of the other year groups (year 6 10%; year 9 10% and year 11-18%). There was a gender dimension too, with boys significantly more likely than girls to use a computer outside of lesson time at a lunch time, after school or homework club than girls. The implication of this is the need for schools to make computer clubs more attractive to girls. Previous research (e.g. Holloway et al., 2000) suggests that girls are often reluctant to use computer clubs because they are seen as the domain of techno-enthusiastic boys (see also section 7.2).

Whereas using a computer for school work was largely a solitary activity, in contrast the majority of children across all age groups (70%) used the computer for fun with friends. However, when girls used a computer outside of school, both on their own (70%) or with friends (24%), they were significantly more likely to use it for school work than boys (50% and 15%). This pattern can be understood in terms of girls' more conscientious attitude to school work, rather than any properties of the home computer.

Little is known about children's use of computers across different ethnic groups. A study of adults found that British minority ethnic respondents were more likely to have used a home PC for educational purposes than white informants (Owen et al., 2003). There is some indication that year 2 children from minority ethnic groups were more likely to use a computer for educational purposes than white children in that they were more likely to play mathematics programs and were less likely to play games than white children

(mathematics programs: White pupils -16%; Minority Ethnic pupils - 40%⁸). Year 2 girls were also significantly more likely to use computers for mathematics, educational games and writing/word processing than boys⁹ (Figure 6).

Figure 6



When the parents of year 2 children were asked about what their children liked doing on the computer outside of school, and what they liked doing best, playing games clearly came out as the most popular option, followed by drawing/art packages. The gendered nature of computer game playing clearly took effect at an early stage; the parents of year 2 boys were significantly more likely to state that they liked playing computer games than the parents of year 2 girls (57%, compared to 45% of girls).

However, year 2 children were more likely to report in the interviews that they liked playing games of an educational nature than older children did. Some described the satisfaction that they gained from learning skills by using educational games:

On my computer, I do, I put some music on for my brother because he likes music. I've got his best songs on it. When he's not playing with that, I turn it off and I put maths and I do take-aways, shared and times, two-times table.

(Year 2 girl)

⁸ However, because the numbers of children from minority ethnic backgrounds responding to this question was so low, the small cell sizes mean this relationship cannot be stated with any confidence.

⁹ However, because the numbers of children participating in these activities was so low, the small cell sizes mean this relationship cannot be stated with any confidence.

Interviewer: *OK, so is it an educational kind of game, and why do you like that game?*

Male: *I like it because it helps you learn words quicker and type quicker on the computer, that is what it is all about really, typing quicker.*

(Year 2 boy)

Children did mention use of other forms of ICT for educational purposes, such as CD-ROMs and text messaging. When asked what kinds of things friends contacted each other for, children mentioned clarifying the purposes of tasks, sharing information about good places to go for information, or presentational issues:

Sometimes it's computer questions. Sometimes it's stuff like, if we're doing this homework on the computer, are we allowed to do it in a different font or something, stuff like that.

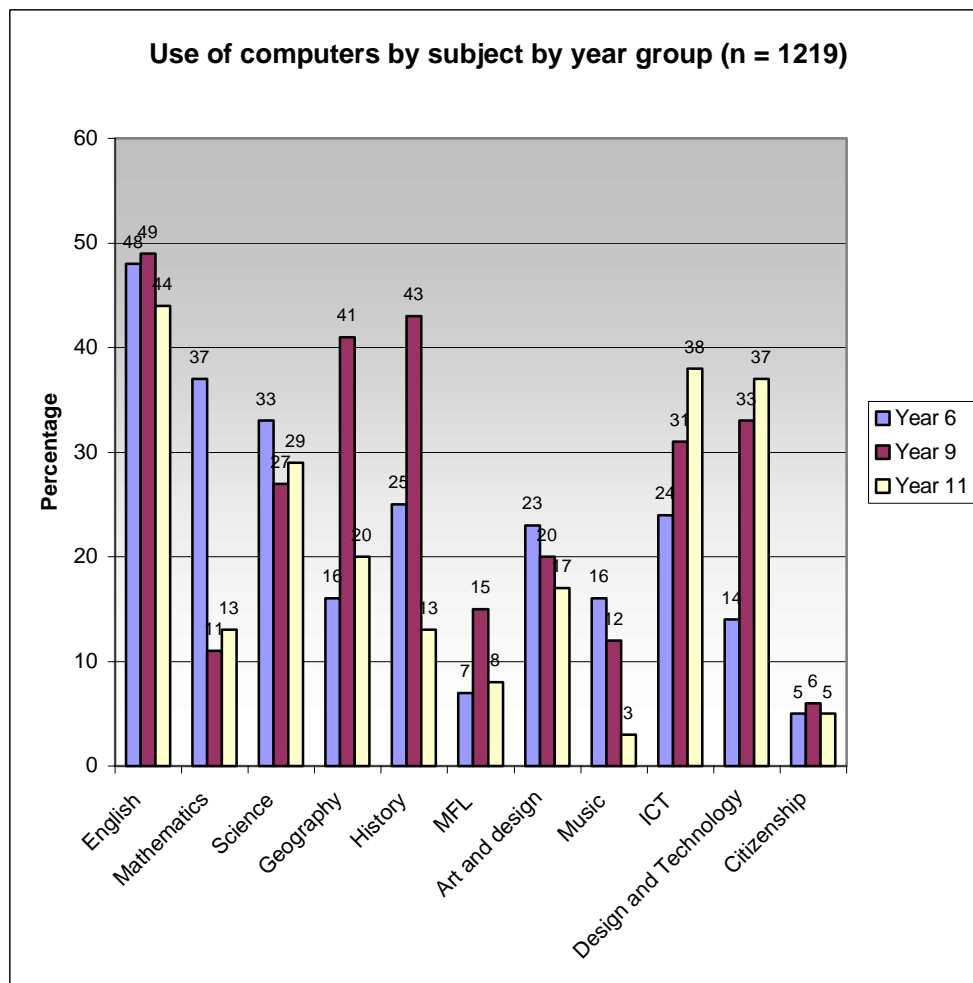
(Year 6 girl)

There was little evidence of the use of communication software for collaborative homework, although given the high level of interests many children demonstrated in online communication, this is an area which could be utilised when setting tasks.

3.4 Subject and year group specific patterns of use

There were clear patterns in terms of the questionnaire responses about how often children of different year groups used computers for school work in each subject outside of school lessons (see Figure 7). English is the subject for which computers were used most often by year 6, 9 and 11 pupils. Year 6 pupils were significantly more likely to use computers frequently outside of school for mathematics (every day or at least once a week) and science than older pupils. Year 9 pupils were significantly more likely to use computers frequently (every day or at least once a week) for geography than either year 6 or year 11 pupils. Both year 9 and year 11 pupils were significantly more likely to use computers for design and technology than year 6 pupils.

Figure 7



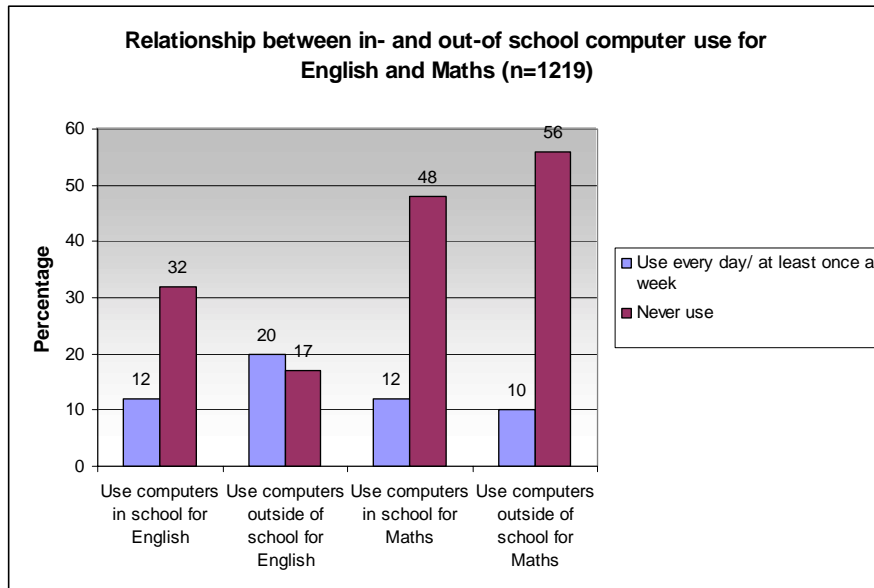
Children’s use of computers outside of lessons for school work in modern foreign languages (MFL) was low (in year 9, where use is highest, less than 7 per cent of pupils did so frequently (every day or at least once a week). Here, year 9 pupils were significantly more likely to be casual users (at least once a month, or sometimes but less than once a month) of computers for school work in MFL than the other year groups. Use of computers for school work in other subjects not specified above outside of school was largely negligible.

When children’s level of ICT use for specific subjects at home was compared with their use of ICT in the same subject at school, a clear pattern emerged. Children who use a computer for English and mathematics at school every day or at least once a week are also more likely to use a computer for these subjects at home every day or once a week. Correspondingly, children who never use a computer at school for English and mathematics are also more likely never to use a computer for school work in these subjects at home (see Figure 8). The same pattern was repeated for other subjects too including: ICT, science, history, and geography. It may be the case that children are not confident using computers for different subjects outside of school if they have not used the technology at school; or that they do not recognise the possibilities of how ICT might be used for subject specific purposes if this has not been demonstrated to them at school. The data could also indicate that

those schools which had devoted more time to the use of ICT within subjects also set more homework using ICT (home-school links are considered further in Section 4). This clear relationship between what children are asked to do at school and what they do at home has important policy implications. In order to develop children's ICT skills and use of computers in specific subjects at home, schools need to model the use of different hardware and software for children in each subject if they are to feel able to use them independently and to integrate more fully ICT into subject specific learning. Schools also need to suggest how this use of ICT in specific subjects could be developed by children at home.

The relationship between subject specific use of ICT within school and out of school identified in this research is particularly significant given that while a series of annual surveys of ICT in schools show that the proportion of secondary schools making substantial use of ICT has increased for all subjects between 2003 and 2004, nonetheless there are still clear subject specific patterns of ICT use within schools (Prior and Hall 2004). The *ICT in Schools Survey for 2003* showed that secondary schools make most use of ICT in the subjects of: ICT (99%) and design and technology (60%), followed by mathematics (41%), science (49%), geography (30%) and English (24%). Other research (Dixon et al., 2004) has identified clear differences between secondary schools in terms of how far ICT is used across the curriculum and variations in the subjects within which it is used. In particular, subject specific use of ICT within individual schools is affected by differences in: location of hardware resources, the reliability of hardware, technical support, the skill and confidence of teachers, and the presence/absence of strategic leadership in relation to ICT within the school (Valentine and Holloway 1999; Dixon et al., 2004). Previous research which provided teachers in case study schools with laptops found that their use of ICT for lesson preparation, communication and presentations in the classroom increased (Somekh et al., 2003). However, while the 2003 ICT in School survey of head teachers and ICT co-ordinators reported that 85% of primary school teachers and 81% of the secondary school teachers are very confident to use ICT (Prior and Hall 2004), other research with teachers themselves has identified lower levels of confidence and more ambivalence about the use of ICT in the classroom (Holloway and Valentine 2003). The *Evaluation of Curriculum On-line* survey of schools found that on average only 16% of secondary school teachers use digital sources in their lesson planning; and that the proportion of teachers using ICT resources in at least half of all lessons is low (14% in secondary schools) (Kitchen and Finch 2004). A third of teachers also reported in this survey that they rarely or never use computer packages or subject specific software in their lessons. The implication of this research therefore is the need to address teachers' ICT skill levels across all subject areas and to develop models of good practice in terms of ICT use in specific subject areas, if teachers are in turn to model use for pupils in lessons across the curriculum.

Figure 8



In this study the Internet was used extensively for particular subjects such as science, geography and history. These are subjects that require specific knowledge about particular topics and it is clear from the interviews that children and young people felt that they could acquire this information quickly and thoroughly through the use of the Internet. However, how effective their strategies for information retrieval were was not clear from the interviews. At times, the searching techniques children and parents described appeared to be rather vague and random. There was little evidence of the pupils being reflective about the process of information retrieval from the web, despite the evidence from Livingstone et al. (2005) that 69% of 9-19 year-olds reported being taught effective use of search engines. This may be due to the fact that, in the present study, children were unable to describe the practices they used, rather than suggesting an inability to use effective strategies. A few pupils did indicate that teachers had sanctions for homework that included plagiarised passages from web texts:

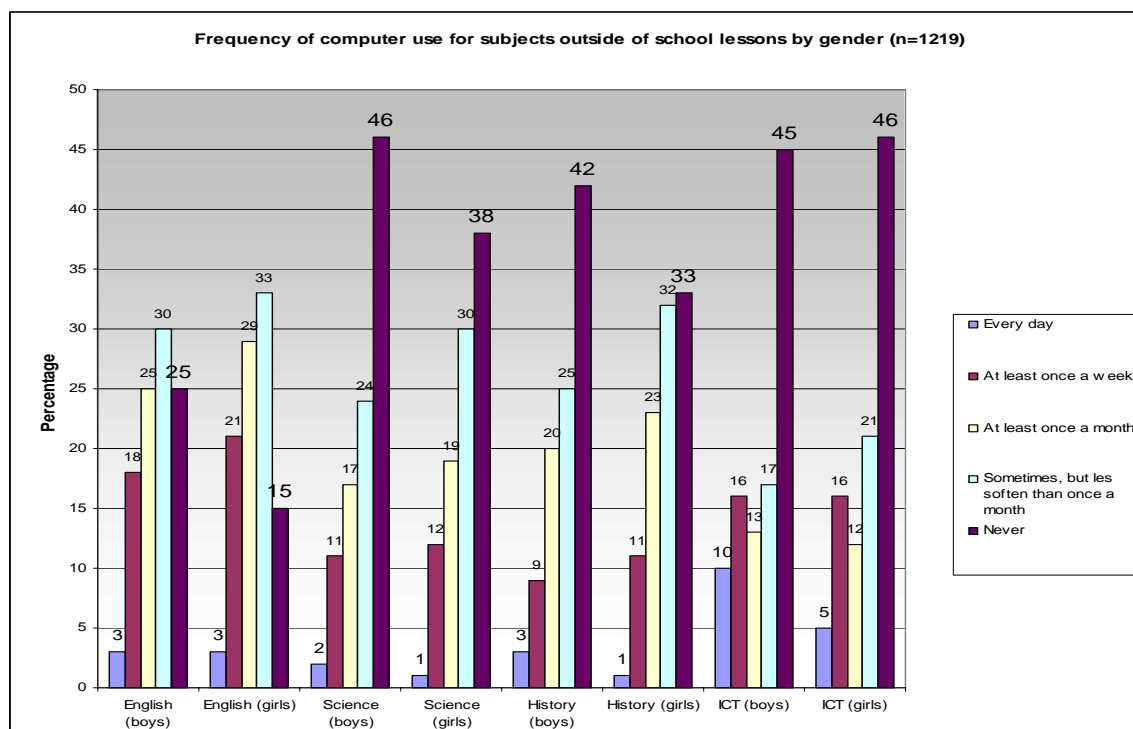
If they can tell that you copied it from the Internet they tell you to do it again or they'll put you in a detention or something.
(Year 11 girl)

In year 11, use of revision web sites was extensive. Online revisions sites are overwhelmingly popular and well used. In some cases, particular revision sites were promoted by schools.

Girls were significantly more likely to use a computer outside of school lessons for school work in English, science, and history than boys. Yet, boys were significantly more likely to use a computer outside of school lessons for school work in ICT than girls (see Figure 9). It appeared that this pattern of use reflected children's gendered preference for particular subjects rather than their attitudes to computer use per se in these subjects. This pattern of use may also be related to the fact that, as the section 3.3 identified above,

girls use computers both on their own, and with friends for school work, more than boys.

Figure 9



Variations in patterns of subject use were also evident in relation to household background and ethnicity. Here, children from households with low levels of cultural capital (in terms of numbers of books in the home and number of visits with parents to galleries and museums) were more likely to never use computers in English, history and science, although this relationship was not significant for other subjects. This may reflect the fact that children from households with high levels of cultural capital may be encouraged to take an interest in these subjects, through, for example, visits to galleries and museums, or having books on these topics in the home. This enthusiasm for these subjects may then translate into use of ICT for these subjects; as section 5.2 highlights, children are more likely to use ICT for subjects they enjoy.

In terms of ethnicity, black children (57%) were more likely *never* to use a computer for Science than white children (38%) or Asian (30%) children. Yet, black pupils were significantly more likely to use a computer everyday or at least once a week for ICT than white pupils (20%) and Asian pupils (28%). It may be that some groups of black pupils tend to underachieve in schools and therefore would be less likely to use a PC for an academic subject like Science, but often get channelled into subjects like ICT in a bid to engage them with school work where they may be more likely to use them (the issue of using ICT to support low achievers is discussed further in section 5.7).

3.4.1 English

This is the subject where, according to the survey, children across all year groups made most use of ICT outside of school lessons. The logs identified the following kinds of ICT use:

- Spelling games.
- Use of word processing software for writing essays, poems, reports, reviews.
- Use of presentation software for presentations on aspects of English coursework.
- CD-ROMs which focused on specific aspects of English e.g. grammar.
- Use of Internet search engines to find information about specific texts or authors.
- Use of desktop publishing software to produce booklets.
- Use of revision websites.
- Use of DVDs to watch film versions of texts

However, the actual pattern of activity between year groups surveyed varied. Year 6 (27%) pupils were significantly more likely to use CD-ROMs and DVDs for English outside of school lessons than year 9 (11%) or year 11 (5%) pupils. Year 9 pupils were significantly more likely to use the Internet to find information for English (40%, compared to year 6 -33% and year 11- 24%); and to create presentations for English (24%, compared to year 6- 20% and year 11-12%) than younger (33%) or older pupils (24). Year 11 pupils (59%) were significantly more likely to use word processing outside of school lessons for English compared with year 9 (47%) and year 6 (24%) pupils.

The use of English revision software and Internet sites is largely comparable across all year groups (around 18-21%). Less than 10% of pupils in all three age groups use email for English outside of school lessons (year 5- 6%, year 9- 8.1% and year 11- 7.8%). The number of pupils in all three key stages creating web pages or using instant messaging is even more negligible (less than 5 per cent).

The accessibility of word processing programs means that most children interviewed were confident at using them and found them helpful for work in English. The use of grammar and spell checks in word processors was also mentioned by some children as an important factor in their choice of ICT for English school work. In addition, a large number of the children interviewed suggested that they did not like handwriting extended pieces of school work and so this was a contributing factor in their choice of ICT for English. Generally, children, young people and parents reported that using the computer for school work was linked to the level of interest pupils had in particular subjects. This area is explored in further depth in section 5.

Although English was the subject most often cited by many children in terms of subject-specific work, it was also the most frequently mentioned subject when children were asked about the most 'boring' piece of school work they had completed using ICT. Children described finding writing long

essays, writing book reviews, undertaking information-retrieval exercises on authors and a range of other English tasks boring and lacking in appeal. In particular, the use of the computer to type up previously hand-written work appeared to be a particularly unpopular activity.

3.4.2 Mathematics

Year 6 pupils were the highest users of ICT for Mathematics outside of school lessons. This reflects the results of the *Evaluation of Curriculum On-line* survey in which 84% of schools surveyed reported that ICT was most important at key stage 2 in mathematics (Kitchen and Finch 2004). Year 6 pupils were significantly more likely to: use CD-ROMs/DVDs for mathematics outside of school lessons (26%) than year 9 (8%) or year 11 (6%) pupils; use mathematics revision software (32%) than year 11 (27%) and year 9 (17%) pupils; and to look for mathematics information on the Net (year 6 -19%, compared with 11% of year 9 and 11% of year 11). Not surprisingly, year 11 pupils used spreadsheets/databases (24%) for mathematics more often than year 6 (17%) and year 9 (10%) pupils; and were significantly more likely to use computers for word processing in mathematics (16%) than year 9 (8%) and year 6 (6%).

The use of email, web pages (less than 4% of pupils use it in these ways across all year groups) and instant messaging (less than 1%) for mathematics was negligible.

There were no significant gender differences in terms of how often girls and boys use computers for mathematics.

Many children and young people and their parents stated that there was little use of ICT for mathematics outside of school because teachers asked them to complete homework for this subject in books or on worksheets.

...from what I've seen, most of her maths homework, they get it on a sheet, they give them those little facts sheets to come and do...
(Mother of year 9 girl)

I don't really use it for maths much, because if, like, you can't really do calculations, sums on it... Well, it's better to do it on paper as well, because you can do workings out and things, and it is probably quicker to write it down.

(Year 9 girl)

3.4.3 Science

The Evaluation of Curriculum On-Line survey found that ICT was perceived ICT as most important for science compared to other subjects at key stages 3 and 4. The most frequent use of ICT for science outside of school lessons was to look for information on the Internet – with a third of all pupils using it in this way. The other main ICT activities for school work in this subject outside

school were: revision software/Internet sites (28%) and word processing (23%).

There were clear patterns in terms of ICT activities in science according to year group. Year 6 (20%) pupils were significantly more likely to use CD-ROMs/DVDs, compared to Year 9 (12%) and Year 11 (8%) pupils; they were also more likely to use computers to create presentations in this subject. In contrast, year 11s' main uses of ICT for science were for word processing (year 11- 36%, compared to year 9 - 20% and year 6 - 8%) and revision software and sites (year 11 - 30%; year 9 - 28.% and year 2 - 24%). They were also more likely to use spreadsheets and databases, although the level of this activity was very low (less than 10%). The one ICT activity where year 9 pupils were the main users was finding information on the Internet (36%, compared to year 6 - 29% and year 11- 28%).

The use of email (less than 4% of pupils use it in these ways across all year groups), instant messaging (less than 3%) and the creation of web pages (less than 1.5%) for science was negligible.

3.4.4 ICT

Not surprisingly, pupils (especially year 11 pupils) make more use of ICT for school work outside of school in the subject of ICT than they do for most other subjects (except English). This was true in terms of the overall amount of use by pupils, and for year 11s also in terms of the range of uses of technology for this subject. For example, there was: higher use of revision software/sites for this subject (year 6- 8.4%; year 9- 13.1% and year 11- 17.7%); greater use of the Internet to find information (year 6- 16%; year 9- 27%; and year 11- 27%); and greater use of word processing (year 9- 23% and year 11- 33%). Pupils also made moderate use of databases (year 6 - 6%; year 9- 2%; year 11- 21%) and computers to create presentations (year 6- 10%; year 9- 23% and year 11- 19%) for ICT.

This was the only subject where email was used to any degree by pupils (year 11- 15%; year 9- 10% and year 6- 4%) and where a reasonable number of pupils were creating web pages (year 9- 12% and year 11- 12%). Although there was slightly more evidence of the use of instant messaging by year 9 pupils and year 11 pupils in ICT than other subjects, this is still at very low levels (year 9-6%; year 11 - 6%).

3.4.5 Geography

Year 9 pupils used ICT for geography outside of school more than pupils in the other year groups. This relationship achieved significance. The most popular use of ICT for geography was to: find information for this subject on the Internet (year 9- 44%; year 6 - 29% and year 11- 18%); and word processing (year 9- 33%; year 11- 21% and year 6 - 5%). A computer was more important for creating presentations in geography than for other subjects. Again, there was a significant relationship with year group, with more year 9 pupils (16%) using it in this way compared with year 6 (9%) and year 11 (4.9%)

pupils. Likewise, more year 9 pupils (16%) used revision sites for geography than year 6 (12%) and year 11 (10%).

Pupils across all key stages made negligible use of web pages (less than 1%); instant messaging (less than 3%) and emails (less than 4%) for geography outside of school.

3.4.6 History

Here, the pattern of use was similar to that for geography. This was both in terms of the significant relationship between use of ICT for history and year group (with year 9 pupils again using ICT more frequently for this subject than the other year groups) and in terms of the nature of ICT activities.

For example, high use was made of the Internet for finding information for history, with year 9 (46%) pupils making more use of ICT in this way than either year 6 (37%) or year 11 (10%) pupils. Year 9 (33%) pupils also used word processing for history more than year 6 (8%) and year 11 (21%) pupils; and used ICT to create history presentations (year 9- 15%) more than year 6 (9%) and year 11 (5%). All these relationships achieved significance.

However, the year group pattern was different in terms of the usage of CD-ROM/DVDs and revision sites. Here there was a linear relationship with age, with year 6 pupils (13%) making more use of CD-ROM/DVDs (year 9 -10%; year 11- 2%) and revision sites (year 6- 16%) than their older peers (year 9 15% and year 11 -11%).

Few pupils across all year groups had created their own web pages (less than 2%); used instant messaging (less than 4%); databases (less than 4%) and emails (less than 4%) for history outside of school.

3.4.7 Modern Foreign Languages (MFL)

There were lower levels of CD-ROM/DVD use for this subject compared to others (less than 7 per cent) across all year groups. However, secondary school pupils make more use of revision software/Internet for MFL than other subjects.

Again it is year 9 pupils who made most use of ICT for MFL. For example, 20% use information on the Internet for MFL compared with only 9% of year 6 pupils and 8% of year 11 pupils. Year 9 pupils were also the most likely to use word processing (year 9- 21%; compared to year 6- 2%; and year 11- 14%) and to create presentations for this subject (year 9- 11%, compared to year 6- 7% and year 11- 4%).

Pupils across all key stages made negligible use of web pages (less than 2%); databases (2%), emails (2%) and instant messaging (less than 3 %); for MFL outside of school.

Some pupils suggested that they avoided using computers for MFL because of the English settings on their word processors:

...I like French, it's just that it's hard, especially if you're on the computer trying to type things out in French, the spell checkers go crazy saying it's all wrong. Trying to put in accents is quite complicated as well.

(Year 11 boy)

3.4.8 Design and Technology

The most significant ICT activities for design and technology outside school lessons were finding information on the Internet and word processing. In each case there was a significant linear relationship with age; the percentage of pupils using ICT in each of these ways for this subject rose between year 6 and year 9, and between year 9 and year 11 (Internet: 11%-24%-26%; word processing: 3%-24%-31%). There were relatively low levels of database use and use of revision sites but again, use increased with age (3%-4%-10%; and 6%-7%-12%).

The relationship between year group and other ICT activities was more complicated. While use of CD-ROM/DVDs fell between year 6 and year 9 but rose between year 9 and year 11 (11%- 6%- 7%), in terms of the use of ICT to create presentations, use rose between year 6 and year 9 but fell between year 9 and year 11 (11%-14%-7%). A negligible number of pupils across all year groups had created their own web pages; levels of instant messaging and email use (under 4%) for design and technology outside of school lessons was also very low.

3.4.9 Summary of educational patterns of use by year group and subject

The patterns with regard to educational use of computers outside of school lessons by age group were, broadly that: (a) older pupils used computers more extensively for school work outside of lessons than younger pupils, probably due to the increasing demands of coursework and use of revision sites; (b) younger pupils made more use of 'exploratory' technologies e.g. CD-Roms/ DVDs, whereas for older pupils, there was a greater emphasis on the use of specific packages to support coursework activities, such as word processing and spreadsheets.

The pattern across a number of the subjects (discussed above) with regard to a peak in use in year 9 was interesting. This may be due to the fact that by year 9, pupils were more likely to have access to computers outside of school than year 2 and year 6 pupils, but were not yet having to do significant amounts of national exam focused coursework or revision, which was the case for many year 11 pupils. As such they had more opportunities to use computers outside of school and were more willing to do so because they were less bound by the constraints of assessments.

Different subjects lent themselves to ICT use in different ways and to different degrees. ICT was useful for word processing and spelling/grammar checks in English and the Internet provided an important source of information for subjects that involved project work such as geography, history and science. However, ICT was not perceived as useful in subjects like mathematics where school work must often be completed in work books, keyboards with English settings also deter use in modern foreign language. Given that out of school use of ICT was strongly related to subject specific patterns of ICT use in the classroom, if ICT is to be used across the curriculum, teachers need to model subject specific uses in the classroom and to address the issues that deter use in specific subjects.

3.5 Leisure uses of ICT

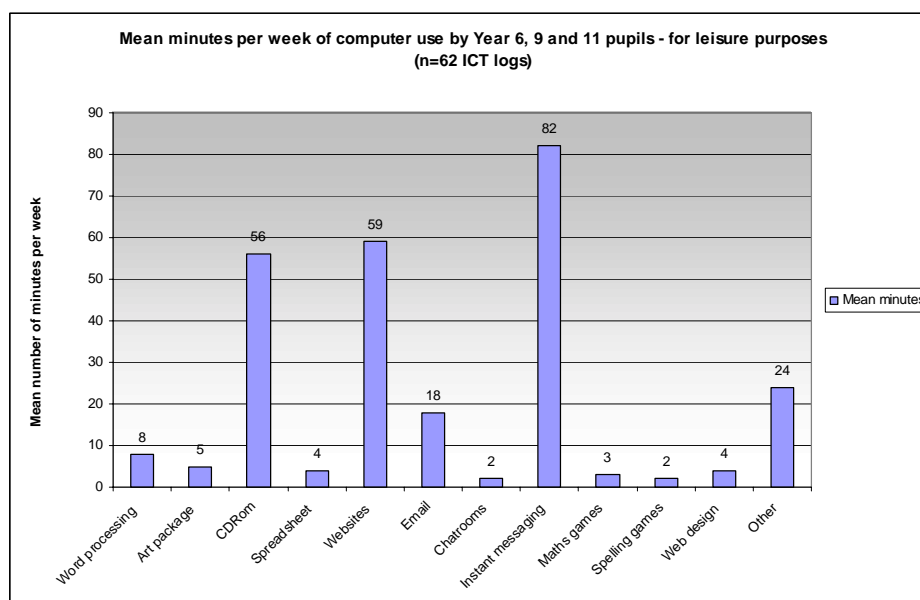
The majority of children and young people interviewed state that they preferred to use ICT for leisure purposes than for school work.

It's better when you're not doing school work, but it's very helpful though, in terms of school work. It's quite interactive, which makes it better [inaudible], but I prefer the pleasure side.

(Year 11 boy)

The amount of time spent on different forms of leisure activities is illustrated in Figure 10.

Figure 10



In the following section of the report, the use of the Internet, computer games, E-communication and creative software will be considered.

3.5.1 Internet

Children across all year groups reported using the Internet for pleasure (year 6- 68%; year 9-74%; and year 11 - 75%). Leisure activities recorded in the ICT logs included the following:

- Surfing web sites related to their popular cultural interests.
- Playing networked, online games.
- Shopping.
- Finding cheats for computer games.
- Using chat rooms.
- Using instant messaging (sometimes with webcams).
- Downloading music.
- Downloading photographs.

Year 2 children primarily used the Internet to play games on sites linked to television and popular cultural interests.

3.5.2 Computer games

As other research (Livingstone and Bovill, 1999) has indicated, computer games are extremely popular with children and young people of all ages, gender and social classes. Children reported in the interviews enjoying games on both games consoles and computers. Their social use of ICT was closely linked with computer games. Both boys and girls reported playing computer games, although use by boys was more widespread across all year groups.

Girls appeared to favour simulation games. These types of games have been reported to develop a range of skills not readily apparent from a cursory examination of the games, such as 'mathematical skills, urban planning, economics and engineering and environmental awareness' (Kirriemuir and McFarlane, 2004 p24). Younger girls, particularly those in Year 6 and Year 9, mentioned a website where users can create a virtual pet and play games with others:

When you can make your own or adopt a [pet], it's kind of like a pet, only they are different. You have got a choice of 50 species and then you play games to get ...points and buy it food and toys and all that stuff. Sometimes you can play games with your friends.
(Year 9 girl)

Girls also liked to spend time on sites which enabled them to create other characters, such as pop stars:

There's this one I've found recently...it's where you make bands and you can give them names, you can write lyrics for the songs and that's quite a fun thing to do. And then what happens is, other people on the Internet can look at your songs and rate how much they like them and then there's charts so you can see if you get to number 1 and stuff.
(Year 6 girl)

The games mentioned by girls, therefore, were often related to creation and co-operation, whereas many of the games mentioned by boys appeared to be more competitive and focused on themes such as war and 'shoot-em-ups':

Well, there's a game called [...]. I move the spaceship about and he just fires it at all the meteors.

(Year 6 boy)

Online games sites were the most frequently accessed websites noted in the ICT logs, more popular than other kinds of sites such as online auctions or sites linked to popular interests such as football and pop stars.

3.5.3 E-communication

Use of email and instant messaging increased with age. Year 11 pupils in particular appeared to be spending large amounts of time chatting online:

Interviewer: *What sort of things do you do...?*

Male: *We just go on [instant messaging software], practically all night...*

Interviewer: *...And who are you chatting to...?*

Male: *Everyone. You can – three hundred people and you can talk to them all at once, so whoever is online...we can talk to them.*

(Year 11 boy)

Little of this chat related to school work. The children interviewed described chatting with peers about what they had done that day, what plans they had for the near future, or common leisure interests such as football and pop music.

3.5.4 Creative software

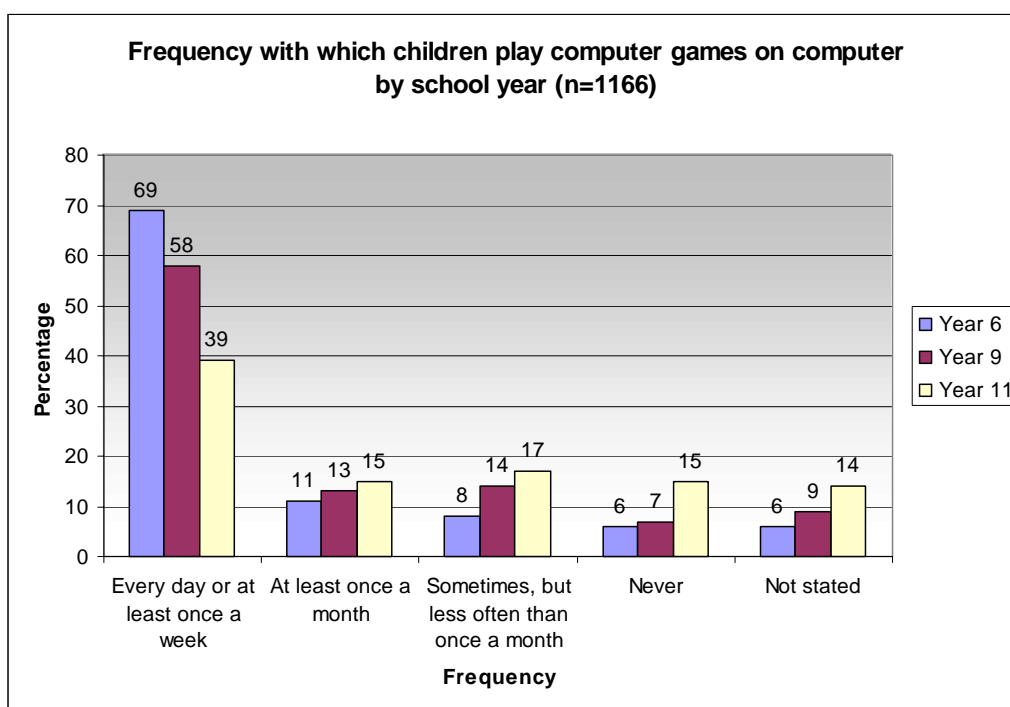
Children and young people used a range of software which enabled them to develop artwork and animations, crop and edit photographs, create music and produce invitations, booklets, websites and diaries. Children in year 2 and girls across all year groups were more likely to use the computer for these kinds of leisure activities. Use of software for creative purposes was likely to decline with age in some areas. For example, using the data from the ICT logs, the mean number of minutes¹⁰ that year 6 pupils used art packages over a week was 9. This decreased to 4 minutes per week for year 9 pupils, down to 1 minute per week for year 11 pupils. Web design, however, peaked at year 9 (7 minutes per week), whilst some year 6 pupils reported undertaking this activity (2 minutes per week). No year 11 pupils reported designing web pages in the ICT logs.

¹⁰ Usage was recorded in hours and minutes in the ICT logs.

3.6 Variations or patterns of leisure use

There is a significant linear relationship between year group and the frequency with which children played computer games on the computer, with 69% of year 6 pupils stating they do so every day or at least once a week, compared to 58% of year 9 pupils and 39% of year 11 pupils (see Figure 11). This pattern is repeated for children's use of games consoles. In other words, children may grow out of their enthusiasm for games (Livingstone and Bovill, 1999), or it may be the case that the pressures of GCSE coursework reduce the time available for non-educational use of ICT.

Figure 11



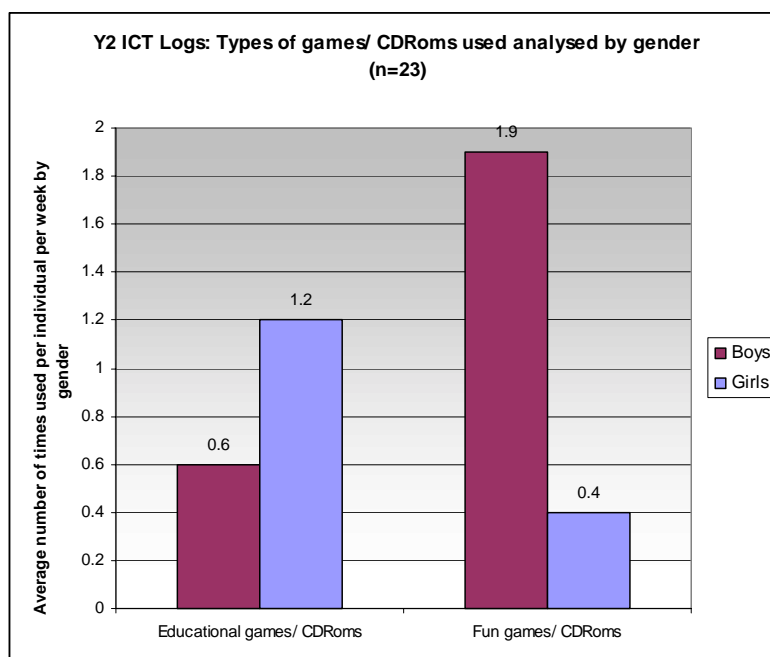
In all year groups, not many pupils used computers frequently (every day/once per week) for personal or story writing, although this was more frequent among year 6 and year 9 pupils than year 11 pupils. About half the number of year 11 pupils (12%) used the computer in this way every day/once a week compared to 23% of year 6 pupils; and the number of pupils who never used the computer in this way doubled from just from over a quarter of year 6 pupils to almost a half of all year 11 pupils. This may reflect the fact that younger pupils are more oriented towards 'story-writing' at school, whereas such activities may be seen as immature by older pupils. Older pupils also have more homework than younger pupils that may involve writing/typing activities and so may come to regard story writing or personal writing as too similar to homework to be enjoyable, particularly given the fact pupils identified typing as the most 'boring' element of possible ICT activities (see 3.4.2).

The pattern in relation to use of the Internet was more complex. The figure for children using the Internet to search for information about sport, pop stars etc. every day was strikingly similar across years 6, 9 and 11 (18-19%) but the number who never used the Internet in this way was significantly higher

among year 2s (55%) and year 6s (25%). The use of chat rooms was minor but the pattern was also similar with around 8% of pupils across all year groups using chat rooms every day, with three quarters of year 2 pupils never using a chat room compared to 54% of year 9 and 50% of year 11 pupils. The only other leisure use of technologies where the linear relationship of use rose rather than diminished with age was for use of email, and downloading files from the Internet. These patterns reflect the fact that younger pupils were significantly more likely to report rules on using the computer than older children (see section 3.1) and that as children become older they also become more aware of, and develop the skills, to download files and use email.

Leisure uses of ICT were clearly gendered. Boys (18%) were significantly more likely to have their own web page than girls (11%); and to play computer games outside of school lessons (40% boys play every day, compared with 13% girls). This pattern was repeated in the logs, which showed that girls were more likely than boys to use overtly educational games/ CD-ROMs, and boys were more likely than girls to use 'fun' games/ CD-ROMs.

Figure 12



While girls were nearly three times more likely (19% v 7%) than boys to say that they liked using the web (in general for school work or leisure), in terms of actual Internet use for leisure, boys were more likely to surf the Internet for fun every day (26% compared to 16% of girls). Girls' use was more infrequent: 17% of girls surf the Internet sometimes, but less often than once a month, compared to 10% of boys. Contrary to previous studies that have suggested chat rooms are the haunt of girls (Mumtaz, 2001), boys were more likely to frequent these spaces every day or at least once a week than girls (22% boys, compared to 15% of girls). This strongly gendered pattern of ICT use for fun has clear policy implications when viewed in relation to gender differences in patterns of boys' versus girls' attainment that are outlined in section 6.

PATTERNS OF USE: SUMMARY

- Digital divides are much clearer in terms of patterns of usage than patterns of access to hardware, in terms of social class, age and gender.
- Children who did not have computers at home did not access the Internet in other out-of-school locations. Children who had computers at home also took advantages of opportunities to use ICT elsewhere, so ICT use at home possibly exacerbated, rather than narrowed, digital divides.
- Children and young people across all year groups reported that they preferred to use ICT for leisure purposes than school work.
- *Out of lessons school use:* Year 11 pupils were more likely to use computers out of lessons at school for school work than other age groups; year 6 pupils were more likely to use them in this context for fun/hobbies. Children in year 2 and year 6 play more overtly educational games than children in other key stages.
- *ICT use at home:* for school work intensified with age; and rural children used the Internet more in this location than urban children.
- *Other locations:* Use of ICT in Internet cafes by all age groups is negligible. Year 6 children were more likely to use computers at a relative's house than other year groups. Use of computers in public libraries declined with age.
- Children and young people reported using ICT for school work outside of school across a range of subjects.
- *Subject specific uses:* English was the subject within which most use of ICT was made for school work outside of school. There are also patterns by age group: Year 6 pupils were significantly more likely to use ICT for mathematics and science than other year groups; year 9s to use it for geography and history and year 11s to use it for ICT. There was also a general peak in use across a number of subjects for year 9. This may be due to the fact that year 9 pupils are more likely to have access to computers outside of school than year 2 and year 6 pupils, but are not yet having to use computers for coursework or revision, which many year 11s are required to do.
- *Leisure uses of ICT at home:* Year 2 children's preferred computer activities were playing games and drawing/art packages; Year 6 pupils played games and wrote personal stories on computers more often than older children and were the highest users of CD-ROMs/DVDs; whereas year 11s word processed, used email or downloaded files more frequently than younger children.
- *Gender:* Boys were significantly more likely to use ICT for leisure than girls. The significance of this pattern becomes more evident in section 6 when viewed in terms of gendered patterns of attainment.

4. HOME - SCHOOL LINKS

In this section, issues relating to the use of ICT to develop home-school links will be considered. In this context, the term 'home-school links' refers to: the setting of homework by teachers; the use of email in communication between teachers, pupils and parents; the use of school websites and intranets to facilitate home-school communication for pupils and parents; and the provision of ICT training for parents by schools (see www.becta.org.uk/homeschoollinks).

Previous research (Somekh et al., 2003) has identified home school links as having the potential to radically extend pupils learning opportunities beyond the school and the school day. Case studies with schools at the vanguard of developing innovative practice indicate that using ICT can transform the role of homework, creating a more integrated pattern of learning between home and school. In particular, pupils in the case studies who had their own laptops benefited from the flexibility this allowed them to work without interruption as they moved between home and school. In some cases, pupils could submit work to teachers and receive electronic comments. Children were also motivated to engage in ICT based tasks at home where they were free from the time constraints of the classroom. Home-school ICT links have particular value for pupils who are unable to attend school on a regular basis. Here, some schools have used video conferencing and other forms of on-line communication to provide teaching for children with irregular patterns of attendance at school because of illness.

The development of school websites also offers potential to change patterns of administrative work in schools, with benefits to both parents and pupils in terms of enabling them to access web-based curriculum materials and other information (for example about achievement or attendance) 24 hours a day, and enabling pupils and parents to contact teachers by email. In addition, such resources can provide schools with the space to display information about themselves (mission statements, staff photographs, newsletters and so on) and to display pupils' work and establish community links (Somekh et al., 2003). However, previous research suggests that e-confident schools – those that have high levels of ICT use across the curriculum – are more than other likely than other schools to make ICT facilities available outside of school hours to pupils, the local community and staff (Prior and Hall 2004).

As the focus of this study was on the use of ICT in school work outside of school, the first section considers how far teachers were involved in the setting of homework using ICT. A number of schools in the study had set up intranets and so the second section explores this issue. The third section moves on to analyse the qualitative differences in children's use of ICT and the home in order to consider how far this impacts on the use of ICT for homework. Finally, communication with parents is a key to the development of good home-school links and so the final section considers data relating to teacher-parent communication.

4.1 Teachers setting homework

Many children and young people reported in the interviews that teachers did not set homework on the computer. Sometimes, they suggested that the reason for this was that homework was given on worksheets or in specific exercise books:

It's only if we choose to. Most of the homework, they give out exercise books and things, where we have to write it in and then give the exercise books back in, so the teacher can mark it. Sometimes our teacher will say, 'If you want to, you can do it on the computer,' and most people do do it on the computer, except if they don't have a computer.

(Year 6 girl)

Parents of year 6, 9 and 11 pupils also made it clear that children mainly used the computer for school work out of choice rather than being instructed to do so by the school:

No. She'll say I need to use the computer for my homework, but I don't think that's because the school have told her, I think that's because she wants to. None of them have ever said that the homework that they've been set is to be done specifically on the computer, no.

(Year 11 girl)

Year 6, 9 and 11 pupils suggested that teachers sometimes gave them the choice of whether to use computers or not, or that there was an implicit expectation that children would use a home computer if they had one. In this sense, pupils were aware of the digital divide and picked up the message, whether explicitly stated by a teacher or not, that they should use a computer where possible and that it may improve their grades (this is explored further in section 5).

...they have said occasionally that you can type it up if you want. Change a few things, add bits in. Just make it look better to get a better mark.

(Year 9 girl)

This may explain why the survey showed that 60% of pupils had been asked to use computers for homework by teachers, yet the interviews with both teachers and children offered little evidence that setting homework using computers was this widespread. This accords with the pattern evident in the data from the *Evaluation of Curriculum Online Follow-up Survey* (Kitchen and Finch, 2004: 27) which suggested that the proportion of 733 secondary school teachers surveyed who had set homework requiring a computer 'very' or 'quite' often was 23%; 56% suggested that they set homework requiring a computer 'occasionally' and 21% 'never'.

Nearly half of those interviewed who mentioned that a teacher had set homework that necessitated using a computer were pupils from two of the

secondary schools. This supports the evidence of other research that there are strong disparities between schools in terms of the extent to which they have embraced ICT and use it both within the school and to develop home-schools links (Valentine and Holloway 1999, Prior and Hall 2004). Just over a third of all of the pupils interviewed who mentioned a teacher had set homework using ICT were year 11 pupils, and the subjects mentioned varied according to their GCSE options, however English, geography, and ICT – three subjects where there were relatively high levels of ICT use made within schools and by pupils for school work out of school – were mentioned most frequently. A few pupils stated that some teachers had encouraged them to use online revision sites.

The number of parents who claimed that their year 2 child had been asked to use a computer at home by a teacher was negligible. However, just over half of those surveyed would like their year 2 child to use this technology more often for school work at home.

Boys reported in the survey that they were more likely to be asked to use a computer for homework by teachers and parents than girls. It is difficult to speculate whether this was because teachers and parents regarded using computers as a masculine activity or whether this reflected a concern with boys' general educational underachievement. However, given the gendered patterns of use described in section 3 and the gendered patterns in children's attitudes to school work/homework described in section 5, there is a clear need for schools to identify ways to harness boys' enthusiasm for leisure uses of ICT more effectively in order to support their education.

4.2 Pupils' use of school web sites

The majority of children surveyed made little use of schools' web sites or intranet outside of school. Just over 12% of pupils stated in the survey that they visited their school's website/intranet frequently (every day or at least once a week); with over half of all (53%) children *never* visiting it. Year 6 pupils made greater use of school websites/intranet in this way than either year 9 or year 11 pupils (year 6- 15.8%; year 9-10.7% and year 11-11.8%: visiting it everyday or once a week). This lack of use of the school web site contrasted strongly with leisure uses of the Internet, with just under 50% of pupils reporting that they visit websites for interest (music, sport, famous people etc) every day/once a week, and only 13% saying they have never used the web in this way.

Indeed, in the interviews a large number of pupils suggested that they were not aware whether their school had an intranet or not. Even where children were aware of it, some said that they had not been able to access it from home because of technical difficulties or because they had misplaced their password or mislaid the instructions. Some pupils circumvented these difficulties:

No, there isn't a way of connecting but [the Internet provider] has the option of accessing your email from anywhere, so I just send an email to myself and log on...at my school, then I just download what I've sent to myself on the school's network.

(Year 11 boy)

A minority of pupils suggested that their lack of use of the site was a response to the 'boring' nature of the site itself or that the information on the school's web site was not appropriate for homework use.

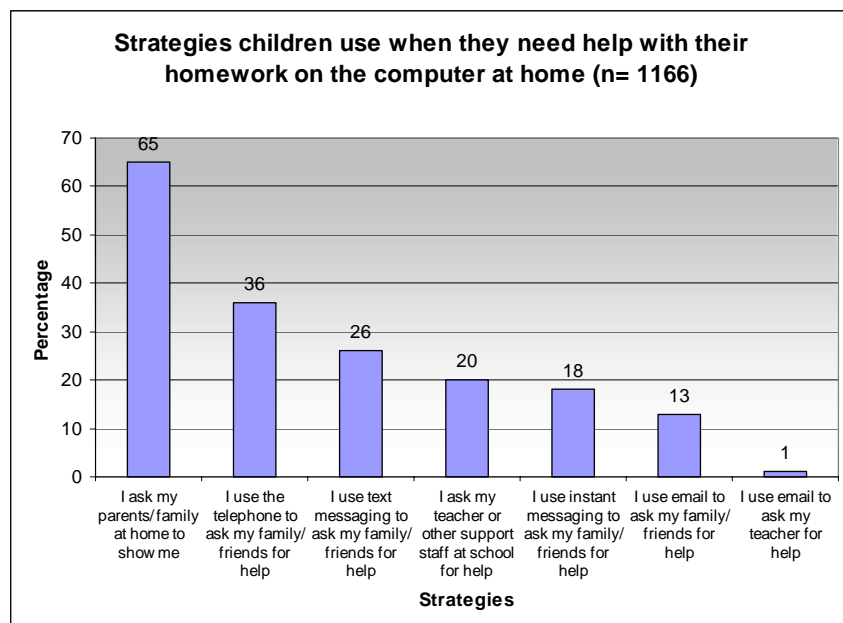
Pupils in one school stated that their school had subscribed to an online revision site, which they had found useful.

I would go on [name], it's this website that the school have paid for and the school pay for us to use it because it's good and it's got everything on there that you need, it's a bit like GCSE [revision site]...they set you up for some things, they set you a time to do it and it comes up with the answers and it tells you what mark you've got and it helps you to know what the examiner knows, what he wants.

(Year 11 boy)

The majority of children surveyed did *not* report emailing teachers to ask for help with their homework (only one or two pupils per year did this,) but the use of the telephone (used by over a third of pupils), text messaging (used by just over a quarter of all pupils) and instant messaging (used by just under a fifth of pupils) to ask friends/family for help appeared to be important in supporting children's homework (see Figure 13). In contrast, email was only used by 13% of pupils to ask for help.

Figure 13



Here, there were significant patterns between the year groups in terms of the technologies that they used to ask for help. There is a clear linear relationship

between year group and use of instant messaging: use rose significantly with age (5% at year 6, compared to 18% at year 9 and 29% at year 11). The picture in relation to telephone and text messaging was more complex, again year 6 pupils (27% and 13%) were significantly less likely to use either of these means of communication than year 9 or year 11 pupils, but the telephone emerged as slightly more important to year 9 pupils (42% and year 11- 31%) and texting as slightly more important to year 11s (year 9 - 29% and 33%). Girls were also significantly more likely to use: email, text messaging, instant messaging and the telephone to get help from friends and family with their homework than boys – although this may have reflected girls' greater willingness to seek help rather than their greater ease with using these forms of communication. There were no patterns according to ethnicity.

4.3 Differences in home/ school uses of ICT

Children and young people reported a range of differences in relation to their experiences of the use of ICT in school and at home. These can be categorised as: time; access; specification; customisation; potential distractions and support.

Many children felt that restrictions on time prevented them from using the computer at school outside of school lessons. At home children can use computers at their own convenience and work at their own pace:

In school at break you are allowed to use it in the library. There are only ten computers in there. So, if someone wanted to book one and ten people have booked, you can't use it in the break and the same at lunch. So if you can't use it, you have to go back after school and it is only open until half four or something...If you have to use a computer and all the computers are booked, then you can't do anything. If you can use one at home, it is easier and you know it is definitely there.

(Year 9 girl)

This accords with the evidence of previous research which suggests that it is not the amount of hardware that schools have that shapes children's use of ICT but rather the extent to which these resources are made available to pupils for independent use outside of lesson time (Valentine and Holloway 1999, Holloway and Valentine 2003). Larger secondary schools (over 1200 pupils) are more likely to offer pupils informal access to ICT than pupils from smaller schools (fewer than 800 pupils) (Kitchen et al., 2004). In many schools computers are confined to IT classrooms or libraries where their use is restricted by booking systems and controlled by members of staff because of concerns about the safety of expensive hardware in the hands of pupils and concerns about children's potential misuse of ICT (e.g. accessing unsuitable material, communicating with strangers on-line, or wasting time on games). For example, a number of pupils in this study complained that schools had filters on the websites which prevented them accessing many sites of interest to them:

The school computers aren't the best ones ever, they're kind of slow. On the school computers, they've filtered all of the games websites and everything like that, so you can't use any of them like that.
(Year 9 boy)

Yet controlled provision undermines both children's ability and willingness to use the technology on site. In contrast, in case study schools where computers are made more freely available around the school for use without adult supervision, and there are multiple computer clubs targeted at different kinds of users (e.g. specialist girls computer clubs), children make more use of on-site provision outside of lesson time (Valentine and Holloway 1999).

As some previous research (Lankshear and Knobel, 2003) has suggested might be the case, children and young people were increasingly finding that the specifications of the machines they used at home were significantly better than those they experienced in school.

Interviewer: *What about the computer that you use at school, how different is it from using one at home?*

Male: *Very much slower at school. Sometimes vandalised a bit and they're not working, sometimes the Internet's not working because there's so many people on the network.*

(Year 11 boy)

For some children, the fact that they were not able to customise the desktop of school computers made them less desirable to work on than home computers:

Interviewer: *Is there any difference between the kind of computer that you use at school, and the kind of computer you use at home?*

Male: *At school, everybody's on the same sort of network, they've all got the same sort of icons up in their thing at school, and also you can't make the backgrounds different colours or change the background, or screensaver or anything.*

Interviewer: *You can't do that at school?*

Male: *No, because they've all got like locks and stuff on it, but at home, you can tamper with all of that, and change all of that...*

(Year 9 boy)

Some children felt that they would rather work on the computer outside of school lessons at home because they were less likely to be distracted by others:

The French site I use at school when we have French lessons on the computer and again it just gets tedious because there is so many people on the network so it gets very slow. The computers at school are a hindrance as opposed to a help because people just play games and use the Internet and e-mail and stuff when they should be doing stuff I mean I am included but if you are in class you haven't got that distraction, the only distraction you have got is mobile phones.

(Year 11 girl)

The issue of support differed across the families according to whether or not parents felt confident to help their child with school work using ICT. More ICT confident parents felt that children and young people received more intensive support at home:

One advantage is, he can have help from me and my husband, should he need it – ask advice about bits and pieces, where he might not get if he was at school...there might not be anyone there to help him, so he could possibly get stuck.

(Mother of Year 9 boy)

However, for parents with limited ICT skills, the opposite was the case:

At the school she can, well, she can learn more on how to use the computer more. She can't learn anything off us because we are learning off her.

(Mother of year 9 girl)

Inevitably, it is professional parents who use ICT in the workplace who are best equipped to support children's home use of ICT for educational purposes (Holloway and Valentine 2001). There are clear implications here in terms of the need for schools to recognise that digital divides in relation to parental skills levels to support home use of ICT are as, if not more (given that 89% of homes in this study have at least one computer), important than divides in terms of access to ICT hardware at home. As such schools need to provide more ICT training and support for parents and the wider community (see below).

4.4 Parents' contact with schools

The majority of parents had not used the school website, nor had they contacted the school using email. Parents generally did not appear to be aware of the use of Intranets which could be accessed away from school. However, there was one secondary school which appeared to have a clear policy and procedure that some parents knew about:

...they are given a code, a letter from school with a code on. They put it in with the name and then every time they use it at home the school know exactly who is using it and what they are looking at as well.

(Mother of year 9 girl)

Nevertheless, this policy had not obviously been understood by all parents. Other parents whose child attended the same school in the same year group as the above interviewee were not aware that their child could access the intranet, outside of school, whereas their child stated that she thought the intranet was just accessed from school:

No, you can't. I don't think you can get onto it, just the school computers in school. They have got their own, like, Internet and then you type in your password and then that goes into the main Internet. So they've got their own, like, with help subjects, like teachers.

(Year 9 girl)

This mirrors the results of a survey of home-school ICT support in all types of school (Parents Information Network, 2000) which found that the support offered to parents is usually reactive in nature and not initiated by the schools themselves (Livingstone and Bober, 2004). It therefore indicates that there may be an issue about ensuring that all children and their parents are clear about school policy with regard to the use of school websites and intranets outside of school.

When parents were aware of the school's website, it was often because they had had a specific purpose for finding the information. For example, one parent had used the school web site to find out about who to contact when her son had transgressed school rules.

The majority of parents stated that they would like to use computers to facilitate their contact with their child's school, through email or the use of an Intranet, if this were to be available¹¹. Many also suggested that they would like some training and help from schools in relation to supporting their children with school work using ICT. Some schools had offered these courses, but parents who worked during the day had not been able to attend.

I think I quite often think I'd like to do more courses to be able to understand computers more so I knew how to look things up for her or knowledge to get and things like that. When she was in junior school, I used to go in and help and they used to give you more sort of advice and things. I think secondary schools they tend to do it all themselves. You don't get that link, parent - teacher link.

(Mother of year 9 girl)

Although this parent identified more positive home-school contact at the primary than the secondary phase, this was not a clear pattern in the interview data. Parents with children in years 2, 6, 9, and 11 all described very diverse experiences of the home-school interface - positive, negative, and indifferent.

Most parents would also have liked to have received information from school about the websites that they should be encouraging their children to use:

¹¹ The Becta web site (<http://www.becta.org.uk/homeschoollinks>) provides examples of how schools can use ICT to involve parents including: email attendance checks and reports on children's progress; electronic message displays in school foyers; joint parents/pupil workshops on computer based learning; accredited computer courses for parents; presentational software displays by pupils for parents; software programme for use by parents of children with special educational needs; a choice of educational CD-ROMs for home use to reinforce what taught is in school; independent information, advice and support lines for parents about the purchase of hardware and software; educational websites specifically for parents and pupils with downloadable worksheets and activities; and details of Parents Online events.

Well, just general guidance on sites to hit that are good quality sites for school work. That's the main thing. Because we don't know where to look apart from looking generally for general project work information. For course work I would have liked, and I did ask the school, for advice on information, French was one of them. And they basically came back and said, 'No, we don't know of anything to hit'. So it could be something out there that we don't know about.

(Mother of year 11 girl)

This study supports the findings from previous research which indicates that home-school support varies widely between schools and has developed in piecemeal and ad hoc ways. A survey of home-school ICT support in all types of schools (Parents' Information Network, 2000) found that the support offered to parents is usually reactive in nature and not initiated by the schools themselves. Only four per cent of primary schools had ICT in their home-school agreement. The Parents Information Network report concluded that the research 'raises a serious issue about the extent to which schools are considering the impact of ICT as a shared resource between home and school'. Schools at the forefront of ICT development say that the lack of an established culture of using ICT school-home links means that even when links are offered (for example, emailed weekly newsletters for parents) the take up is often low or the novelty wears off (Livingstone and Bovill, 1999).

The survey found no relationship between children's school year and whether they were asked to use a computer at home for homework by parents. Just over one third of children in each year group reported that their parents had asked them to use computers in this way (year 6 – 36.5%, year 9 - 37.4% and year 11 - 34.6%). Not all parents are willing participants in introducing and using ICT at home. Family life is complex and varied. ICT may be seen as invading space of home with school demands (Wellington, 2001). There is also a risk that increased home-school links and therefore parents' awareness of, and involvement in, children's home use of ICT may undermine the qualities of home ICT – freedom to experiment and so on - that children value and which motivates them to use it.

4.5 Teachers' views on home/school issues

All of the teachers interviewed valued the use of ICT for school work, but generally felt that setting homework that required use of the computer would disadvantage those pupils that did not have access to ICT outside of school. When teachers did set homework that required use of a computer, they enabled children who did not have access to this technology outside of school to complete the task by extending the timescale for the submission of the piece of work. Generally, however most of the teachers preferred to give children the option of whether to use a computer to complete homework.

Yes. I would give work, as I have done in the past. Give them research work like on a topic on Florence Nightingale and a lot of them wanted to find out about her. Obviously, a lot of them downloaded stuff from the Internet. Whereas the children without a

*computer went to the library and photocopied pages from that. So I have set work where I have not actually said, 'Go on the computer'.
(School 1, Year 2 teacher)*

*At the moment, the policy is that we don't set any tasks which require that the outcome is say word process...we wouldn't ever set one to say, 'You must do this on a word processor', because obviously we're mindful of the fact that some students don't have that access.
(School 4, Secondary ICT Co-ordinator)*

Such approaches however are problematic because children, whether explicitly or implicitly, picked up the message that they should use ICT at home if they had access to it and thus were able to benefit from the advantages that it offered. For example, teachers generally believed that the use of ICT for school work outside of school did have positive effects on children's work. This is primarily because of the range, and apparent depth of information that the Internet enabled children to include in their assessments. One teacher made the point that the use of computers for school work outside of school was particularly beneficial for children in year 11 because it gave them more control over their learning. Another felt that the use of ICT for school work outside of school did have a specific impact on grades (see also section 5). As such the digital divide is still there even though teachers did not explicitly set homework using ICT, it was just not acknowledged because pupils were using it out of 'choice' rather than under teachers' direction.

Teacher: Overall, I think if they have access to IT outside of school and it's used constructively in school, then I think it has a positive effect on their attainment in school, so I suppose what I am saying, the bottom line is yes, it's lack of access outside of school I think diminishes the progress they can make within school.

Interviewer: Do you feel it affects their quality or quantity of work?

Teacher: I think it varies, I think if students get into key stage 4 where there's a lot more course work etc., involved, then the access to IT outside of school can be quite significant because as I say, if you've got access at home, you've got the freedom then to make the decisions about when you work and how you work, where you now are more in control of your learning. Whilst we offer the opportunity at school, it means they've got to do it on our terms, and that doesn't necessarily lend itself to students being as effective as they could be, so I think it's even more significant than it is in the lower school, where it's in the key stage 4, and then 6th form even more so.

(School 4, Deputy Head with responsibility for ICT)

Well, if they're using websites like [name] and some of the resources that I send to them to use, then yeah, it will have an effect on their grade. Often it makes work more stimulating by having say flat animations or that type of thing, or video clips, which is going to help them to understand ...[inaudible]... so I think if used effectively, then it will have a positive impact on their grades.

(School 4, Secondary science teacher)

Likewise, while teachers stated that they do provide guidance to parents on hardware and software, it is clear that this advice was only given to those parents who approached the teachers to seek advice. In this way, some schools are implicitly reproducing educational divides in the home support available to pupils by helping those who already have parental interest and support.

Interviewer: I am wondering if parents have ever asked you about any ICT programmes or packages that they should buy for the... children?

Teacher: Only to do with the SATs test. That is all.

Interviewer: And did you recommend any to them?

Teacher: Yes the ones I have got, the National ones or the [name] they are called.

(School 1, Year 6 teacher)

These findings suggest that there is a need for all schools to acknowledge that a significant proportion of their pupils now use ICT for homework and that as such they need to address digital divide issues. This means developing initiatives to support access to ICT for the minority of pupils (11% in this study) who do not have a home computer and to make information about how to support children's home use of ICT available to all parents rather than on an ad hoc basis to those motivated or knowledgeable enough to seek advice.

One secondary school in the sample was attempting to address the issue of enhancing access to computers for those families that did not have computers at home. However, the teacher made the point that this provision was not reaching all of the target audience. It is commonly the more educated or motivated parents who take up such opportunities. As such schools need to develop ways of drawing in 'hard-to-reach' parents who may be deterred from attending courses at a school because of their own negative educational experiences as children.

Well, again, that shapes to a large extent our philosophy about the school as part of the community, the college is available to pupils and parents at regular intervals, during the day it's open until 4.30/5 o'clock every day for students if they wish to make use of it. We run various courses with parents, for tasters and so forth, to help them support their own children if they're looking at IT, but I'm afraid we don't always get the uptake on the community that we would expect to get, but that's something we're working on in terms of trying to get to the right audience.

(School 4, Deputy Head with responsibility for ICT)

At the same time it is important to recognise that some teachers were not motivated to encourage pupils' use of ICT at home because they did not believe that unless the focus for assessment is ICT-related, completing the work on a computer should not make a difference to pupils' specific grades. Indeed, some teachers were concerned about the potential educational disbenefits of Internet use. For example, the tendency for some children to cut and paste chunks of information from web sites in an unreflective manner was a matter of concern:

It isn't assessed differently because the assessment should have been specified beforehand, and the assessment for the student will be whether it's collecting about a certain amount of data, or given a certain response to a question or what ever, so that's what will be analysed, or that's what will be assessed, the fact that it's been word processed won't count for or against the student, but what it might do is actually give the teacher a road into talking to the student about their use of IT, and that can be sometimes quite interesting, in terms of the amount information you find out about that student in terms of what they like about IT and so forth.

(School 4, Deputy Head with responsibility for ICT)

I think it's a two way this one, I think the one thing about it is that it helps them get their homework done and it's done efficiently, and it can help them access information, but I don't think it works when they just bring you ream after ream of Google, you're doing a topic on something and you know, pages and pages, so I think they need to still be able to use them and be able to select information.

(School 5, Year 6 teacher)

Teachers interviewed in the study generally did not make use of ICT to develop home-school links. In all schools except one, if there was a school intranet, then it was used primarily for planning purposes and for communication between staff. A number of teachers expressed concerns about developing the use of email to communicate with children and parents outside of school, because of the extra demands they perceived that this would place on them:

My personal opinion is once you go home, if people can get in touch with you too easily shall we say then you're making a lot more work than you already have, and I think we all carry a heavy workload as it is without it being added to by somebody getting in touch with you. If you wanted to get in touch with someone by telephone in order to enquire something, that's fair enough but I think you could make too much work for teachers by introducing something like that. It's intrusive on their personal life, out of their own time and it's that work school balance would go out the window.

(School 2, Year 6 teacher)

We've got an email site in school and the head is encouraging us to use it, we have done things across classes where we use it, but I don't out of school like to use email, I think that it really does make you 24/7 in a way, but I know my other colleagues in school say, 'Yeah, it's okay, children can send us work on email and we'll mark it', but I think it's opening up something whereby you're out of working hours really, and if you send a piece of work, you're marking at home, I mean, I could be marking at home at 10 o'clock, I'm not sure if I want to be going down that road really .

(School 5, Year 6 teacher)

As these quotations imply, there is obviously work to be done in terms of clarifying the nature, and implications of, out-of-school use of ICT for homework for teachers. If teachers do not fully understand what is involved and have their fears addressed, they are likely to be reluctant to engage in home-school link initiatives. For example, teachers could not be expected to work extended hours in order to engage in online homework activities. Obviously, time-management would need to be carefully considered so that teachers were given time within school to respond to intranet use and email queries. It also needs to be made clear to teachers that they would not be expected to give out their home e-mail addresses. A few teachers also expressed concerns regarding the use of email and child protection issues in relation to developing the use of the intranet to enable pupils to access it from home. Further barriers to the development of home-school links were also expressed in terms of security worries in relation to computer viruses.

I've got a school account which I use, I'd never give them my home account for obvious reasons...It's something that has worried me I suppose, from doing email with kids, is possibly the perception that the parents might have, all the stuff you read about in the paper, people that feel that, I don't know, you're making contact with their kids while they're at home, that sort of thing... there's always that shadow in the back of your head of, 'What if someone gets your email address, and somebody does this?' You'll often read about people becoming liable for things that happens involving children in schools, and dodgy things on the Internet, and so you sort of worry about that. If you got sent an email from a malicious child, which effectively once you've opened it up not knowing what it is, you're sort of at risk with your job aren't you...?

(School 4, Secondary science teacher)

We do have a school easy link system, which is primarily for staff, which means we can log on and we can check out our use areas from home. The network manager in the school who's obviously in charge of everything that goes onto the computers, he seems a little bit anti getting the kids logged onto it at the moment, because he's worried about security issues within the school, like viruses...

(School 4, Secondary science teacher)

Although teachers had attended a range of INSET courses on the use of ICT, none of them reported having undergone any training about the use of ICT to

develop home-school links. As such the findings of this study echo previous research which has identified the need for teachers to receive more training in how to integrate ICT with subject learning and how to use the technology to develop creative approaches to homework and self-directed projects (Dixon et al., 2004).

HOME-SCHOOL LINKS SUMMARY

- **Home-school links using ICT are generally very limited.**
- **Teachers suggested that they occasionally set homework on the computer, but were deterred from doing so frequently because of digital divide issues. However, there was an implicit recognition amongst children that teachers expected home to use home computers if possible and so did so. Thus the digital divide is use is significant even if it is a product of children's choice rather than teachers' direction and as such needs to be addressed by schools.**
- **Children and young people reported a range of differences between their use of ICT at school and at home that meant they preferred using home computers. These related to: time; specification; customisation; potential distractions and support.**
- **Pupils and parents made little effective use of school web sites and intranet sites, where they were available. These links did not appear to be promoted by most schools.**
- **Year 9 and year 11 pupils were more likely to be asked to use a computer for their homework by teachers, but there is no age-related difference in terms of parents who asked children to use computers for homework.**
- **There are age- related patterns in terms of the way children sought help with homework on the computer. The use of instant messaging increased with age. Year 9 pupils were significantly more likely to use the telephone to gain help and year 11 pupils were more likely than other age groups to use text.**
- **Parents wanted specific advice from schools about educational software and Internet sites. Teachers did provide advice on hardware and software, but only on an ad hoc basis when approached directly by those motivated or knowledgeable enough to seek advice. Schools therefore need to develop ways of providing advice for all parents and engaging those who may be hard-to-reach because of their own negative childhood experiences of education.**
- **If home-school links are to be developed, there is a need to address teachers' misunderstanding about what might be involved and their fears about workload and safety issues.**
- **The use of ICT to promote home-school links needs to be addressed on ICT training courses. It had not been provided on courses teachers in this study had undertaken.**

5. PERCEPTIONS OF HOW ICT CAN CONTRIBUTE TO LEARNING AND ATTAINMENT

The majority of children and young people believed that ICT competence would be important for their futures. They suggested that ICT would be central to their careers, even when they identified future jobs that ostensibly do not involve extensive use of ICT, such as physiotherapy. The majority of parents believed that skills in ICT would be vital for their children's future. Their comments were often linked to the importance that ICT might play in children's future careers. With the exception of one parent, all of the parents interviewed stressed the importance of ICT for their children's education.

The majority (86%) of year 2 parents agreed or strongly agreed that it is important that their child used a computer at school. A similar proportion of parents, 82%, believed that it was also important that their year 2 child used computers at home. The difference between those who strongly agreed that it is important a child uses a computer at school - 47% - and those who strongly agreed that home use is important – 28% -- suggests that parents still perceive school as the most important location for children to use ICT.

Given the importance that children, young people and parents placed on ICT use, this section focuses on the relationship between ICT use and attainment. It begins by looking at the patterns of support children received at home, and then goes on to look at children's attitude to homework, children's perception of ICT and attainment and why they used ICT for school work at home. This section then moves on to examine parents' perceptions of ICT and attainment before considering the actual relationship between children's use of ICT outside of school and their patterns of attainment.

5.1 Support at home

There were subject specific patterns in terms of children's access to books, electronic resources and private lessons. Children received most support in terms of material resources and parental help in the three core subjects of English, science and mathematics. Two parents, from minority ethnic backgrounds, stated in interviews that their year two children attended a private computer class once a week, where they used English, mathematics and science software, because they felt that these classes provided an opportunity for their children to develop literacy and numeracy skills.

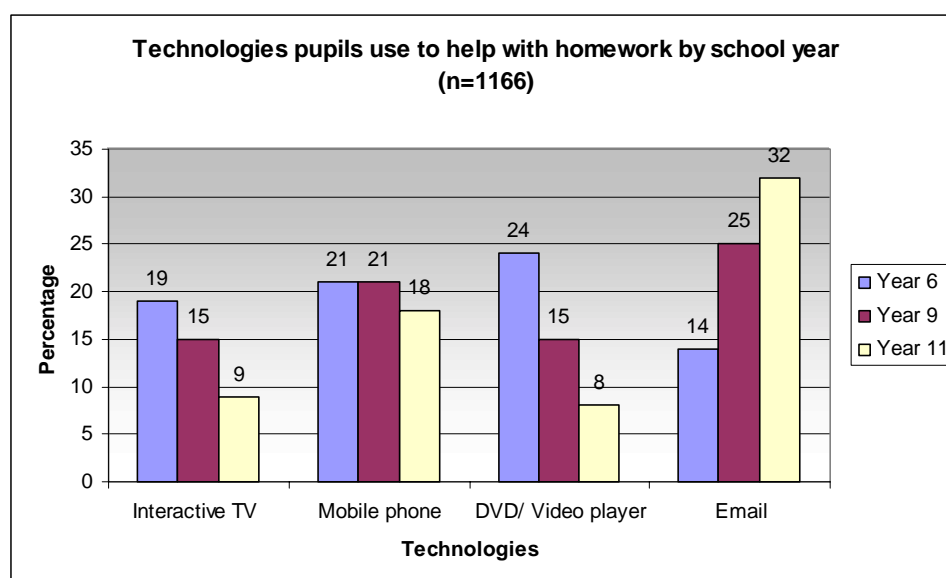
The pattern of access to material resources (books and electronic) was largely consistent across the year groups, although year 6 pupils were significantly more likely to have books, electronic resources, and help from parents in the subjects of English and science (see table 5, below). Year 9 children were more likely to have electronic resources for geography than year 6 and 11 pupils (electronic resources: 10%, year 9 - 13%, year 11 - 4%), and year 11 pupils have more ICT books than year 9 pupils (year 6 - 11%, year 9 - 8%, year 11 - 9%). Girls (34%) were also more likely to have books in English at home than boys (24%).

Table 5: Sources of help with English and science

	Year 6	Year 9	Year 11
ENGLISH			
Books	43%	25%	25%
Electronic resources	22%	16%	8%
Parents	36%	24%	8%
SCIENCE			
Books	42%	24%	29%
Electronic resources	21%	13%	11%
Parents	28%	22%	8%

There were clear patterns (see Figure 14) in terms of the technologies, other than computers, which pupils used to help them with their homework (as opposed to the technologies that they used to ask for help). Year 6 pupils were significantly more likely to use interactive television (19%) or DVD/video players (24%) than year 11 pupils (9% and 8% respectively). These technologies could be used to support homework in various ways. For example, background information on news and current affairs issues can often be obtained through interactive television. DVDs/videos can be used to watch documentaries relating to school work, or contain film versions of texts that are being studied. Year 9 pupils were more likely to visit educational web sites every day or once a week than older pupils. In contrast, the technology (other than computers) that was most commonly used by year 11 pupils to help them with their homework was email (32% compared with 25% of year 9 pupils and 14% of year 6 pupils). Around one fifth of pupils in all year groups use a mobile phone to seek help in this way (year 6-21%; year 9 - 21%; year 11-18%).

Figure 14



Children were far more likely to turn to their parents for help with their homework on the computer than to a teacher (two thirds asked them for help in this way, compared with a fifth who turned to their teachers). This finding may be explained by the fact that children are most likely to complete homework in the home, where parents are accessible. Girls (71 %) in particular were more likely to draw on support in this way from parents and friends than boys (59%). This reflects girls' general conscientiousness about school work and the fact that girls tend to be less confident about their ICT skills than boys. There was a linear relationship between children's age and willingness to ask their parents for help with their homework on a computer at home. The older children were, the less likely they were to turn to parents for help (78% at year 6, compared to 71% at year 9 and 50% at year 11). Parents of year 11 pupils explained that they no longer helped their children as often as they had done previously because either their children had become more independent as they got older, or because they did not know enough about the subjects to help them.

The pattern was more complex in terms of children's attitude to asking teachers for help, with year 9 children less likely (16%) to consult teachers than either younger (22%) or older pupils (24%).

In relation to the use of ICT, most of the parents interviewed said that the help they gave children was to support their use of the Internet to find information:

She would probably do it on her own now. Certainly at the beginning it would tend to be, we'd sit down to do the homework and she'd say, 'I don't know the answer to this'. And there was questions we got about shadows and the sun and I didn't understand it. So we went on to do a search to find out what that would tell us about the science part of it. And she's probably picked up enough now, so instead of coming to me and saying, 'I don't know the answer to this, what will I do?' 'Okay, well let's go and do a search and let's look something up and do it'. She's probably now got on to that thing of, I'll go and do the search, so she's cut out the middle man. I'd say she might do it on her own, but I think she's probably still more likely to come and ask us. I don't know the answer to this, what is it? And if we don't know, then she might go off and do it.

(Mother of year 6 girl)

Many parents generally felt less competent than their children in the use of computers. This disparity in computing skills meant that some parents were not always able to provide support for their children's homework, and would often prefer to help with paper based homework rather than work using a computer, but in most cases it did not appear to have deterred them from trying to assist with use of the computer. This study also echoed the findings of previous research that parents from non-professional backgrounds that do not use computers in their own work, and mothers in particular, (Holloway and Valentine 2001) are less confident about supporting their children's use of home-based ICT.

Interviewer: *If [name] has some homework or if he did have some homework to do and it was on the computer, would that make a difference as to how willing you were to help him with it?*

Mother: *For me, it probably would, actually. If I knew how to do it, it would be fine but, I mean, I don't imagine he would be, given anything at this stage that I didn't know...I mean, I can use it a bit, I'm not completely ignorant, but yeah, I don't know, I just prefer [Laughter]...I'm so old-fashioned, but I just do prefer helping him with things that, you know, to do with books and writing and stuff.*

(Mother of year 2 boy).

The implication of this finding is that schools need to be aware of and tackle differential levels of ICT support available to pupils at home if they are to further develop use of ICT for homework and home-school ICT links (see section 4).

5.2 Children's attitudes to homework

In general, parents described their children as having negative attitudes towards homework, a view supported by children and young people themselves. In the interviews, boys were more likely than girls to adopt a negative approach towards homework, with girls generally having a more positive outlook towards school as a whole, reflecting gendered patterns of educational engagement evident in other research. The reasons given for children's dislike of homework related primarily to their desire not to have to undertake school work at home – a space they believed should be reserved for leisure activities. Children also frequently suggested that they found homework 'boring'.

Mother: He hates homework.

Interviewer: Do you know why that is?

Mother: Because I think he feels school work should be done in school time and not his time at home, that's his away from school time, so he doesn't see why he should have to work then.

(Mother of year 9 boy)

In many cases, children's attitudes towards their homework related directly to their feelings towards particular subjects. Children were much more likely to feel positive towards homework in a subject that they liked. Performance was also important. If children felt they attained well in a subject, they were more likely to say that they did not object to completing homework in that subject.

Interviewer: OK, we were talking about homework now on the computer, what is [child's name]'s attitude to homework. How does he feel about it?

Mother: I think it is typical of all children – 'Why do we have to have it?' Because he is in the top group for most subjects, they do expect a certain standard and he does get a fair bit. But he will do it. He might not do it before it is due in, but he will always do his homework.

Interviewer: *Does his attitude vary between different subjects?*

Mother: *Most definitely. Most definitely.*

Interviewer: *Does he have favourites that he – what would be his favourite?*

Mother: *Anything to do with maths, geography, history, RE.*

Interviewer: *How would he approach homework to do with...?*

Mother: *He would do that quite happily and he wouldn't stall at all, he would do it quite happily, but other subjects not quite so.*

(Mother of year 9 boy)

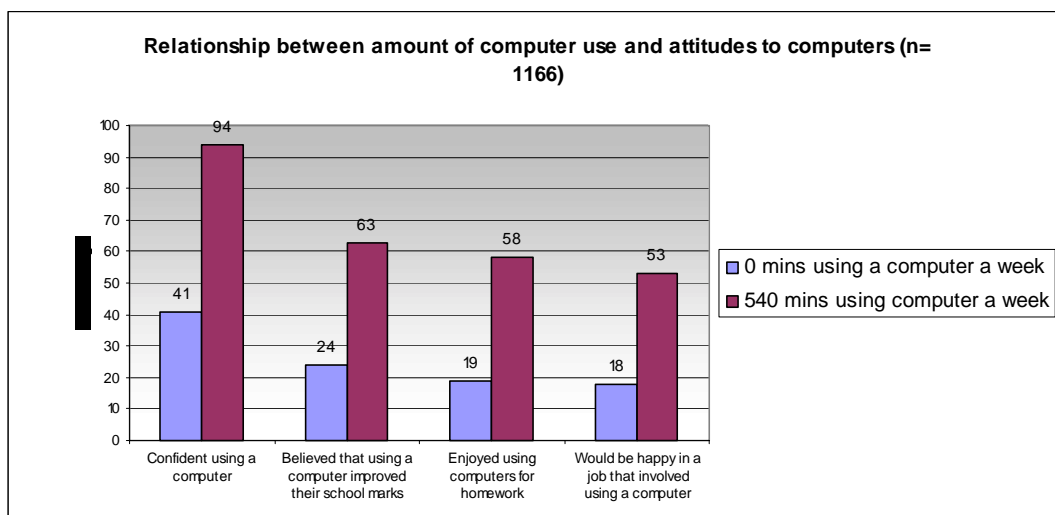
This pattern was also evident with regard to homework completed using the computer. Children were more motivated to use ICT for school work in those subjects that they enjoyed. At the same time, using computers appeared to make homework more enjoyable and intrinsically motivating (particularly for boys), creating a virtuous circle:

..you do presentation and stuff. I had to do one on roller coasters, I had to do one where I had to design my own shop and make a web page for it and stuff so that keeps me interested, it's not boring. It just bores me writing out of books.

(Year 11 boy)

Children who spent more time using a computer outside of school per week were more likely to display positive attitudes towards computers generally (see Figure 15).

Figure 15



This is an important point that relates to the correlation between use of computers in subjects inside and outside of school. Those children who are least likely to use computers outside of school for school work are less than half as confident using a computer than those who use it extensively. It is essential, therefore, that schools provide less confident pupils with a range of opportunities to develop this confidence within school. It would not be useful,

for example, for home-school initiatives to be developed without first ensuring that pupils felt confident enough to take up these opportunities effectively.

Again, it appeared to be boys in particular who liked to complete homework on computers because they found writing tedious or difficult. This has obvious policy implications, given the concern about boys' underachievement in particular subjects.

5.3 Children's perceptions of ICT

The majority of pupils across all year groups expressed enthusiasm for the use of computers. Of the year 2 pupils, 63% rated using computers at school as brilliant, and 21% good (less than 1% rated it as not very good). The response to using a computer out of school was similarly positive, with 59% rating this as brilliant, and 23% good. Similarly, two thirds of year 6, 9 and 11 pupils expressed a positive attitude towards computers. In the interviews children described using computers in terms of interest, excitement, enthusiasm and so on. The 'wow' factor was a strong feature of many of the interviews:

Interviewer. How do you feel about computers?

Male: They're cool. I like them.

Interviewer. In what way? What do you like about them?

Male: They're just cool.

Interviewer. What makes them cool?

Male: How they make them and what they look like and how they can do that.

(Year 6 boy)

Just less than three quarters of the pupils agreed or strongly agreed with the statement '*I am confident at using computers*'. This confidence related to the technical skills required to use the computer, the knowledge of various pieces of software and their ability to use these tools effectively for completing a range of tasks. Some parents reported that they had noticed how the use of ICT had helped their children's general confidence to improve:

I just feel he's been able to go on the Internet, search for what he's looking for and that's given him confidence and he's gone in and maybe typed out a piece of coursework and gone into school quite confident and said, 'This is what I've done, is it right?'

(Mother of Year 11 boy)

A clear gendered response was evident in terms of the strength of the opinions expressed. Boys were more likely to agree strongly (59%) than girls (44%) with this statement about their attitudes to computers and to either agree strongly or disagree more strongly than girls with other statements such as '*using a computer for school work improves my marks*' (boys – strongly agree 21% compared to girls 17%; boys - strongly disagree- 5% compared to girls - 3%) and '*I like using computers for homework*' (boys- strongly agree - 17% compared to girls - 13%; boys - strongly disagree - 14% compared with girls - 7%). It is not possible to tell from the survey however, whether this

difference reflected a difference in the attitude of boys and girls towards ICT or a difference in the confidence of boys and girls to assert their own views. The interviews suggested that girls were more likely than boys to qualify their expressions of confidence:

Interviewer: *Okay. So how would you describe yourself as someone who uses computers, would you say you're good or bad or confident or...?*

Female: *I'm confident.*

Interviewer: *You're confident?*

Female: *Except for music and something like that.*

(Year 6 girl)

There is no relationship between measures of cultural capital (e.g. number of books in the home and frequency of visits to art galleries) and whether children liked using a computer at home. However, pupils whose parents took them to visit art galleries or museums were more likely to agree or strongly agree with the statement that *I enjoy using computers for homework* and that *I like doing school work*.¹¹ This indicates that children who have more opportunities to access information/educational opportunities outside of school are more likely to be motivated by school work. It thus highlights the importance of parental support and the need for schools to address disparities in parents' levels of motivation and ability to provide for and assist their children, as indicated in section 4.

Social capital refers to the social networks that people engage in (Bourdieu, 1986)¹². These networks are closely related to an individual's cultural capital (Bourdieu, 1986, op. cit.) , which is a term used to describe the store of experience and knowledge individuals acquire through such things as their cultural and life histories, their family background and socio-economic status. The comments made by many children suggested that using computers enhanced their cultural capital and was a socially desirable activity which gave them status. In some instances, children reported that low levels of cultural capital in relation to new technologies might lead to reduced social capital. Here, schools might build on the social credibility of ICT to motivate disaffected or underachieving pupils to engage with the technology as a way of drawing them back into the educational system.

Interviewer: *Is it a cool thing to do or is it...?*

Male: *Yes it is a good thing to do. It's like if you haven't got a computer, you're now called, 'You haven't got a computer'.*

Interviewer: *Why's that? What's good about it?*

Male: *It's probably the technology because you're getting video phones out now and all that and then there's computers with...the flat screen [monitors], and so you're kind of, say if you've got [name] which is a very old computer, you'll be laughed at.*

(Year 9 boy)

¹¹ There was no significant relationship between white and ethnic minority groups in relation to attitudinal questions.

Female: Some of the people in my year that don't have a computer, kind of lag behind in the homework because they don't have the time to sit there and write out and research it all from books and things, so they kind of get in trouble for it.

Interviewer: How else do you think it affects ...?

Female: I think it affects them 'cos they can't... when people say, 'There's this cool website' or a, 'Well-cool computer game', they can't really associate with it and talk about it, so if the whole gang of friends are all meeting up on [instant messaging software] they're all going to talk, that person can't do it and they kind of feel left out.

(Year 9 girl)

In terms of ethnicity, there was evidence of some trends. Asian pupils were more likely to agree or strongly agree with the statements that *I enjoy using computer for homework* (white 43%, black 40%, Asian 55%); and *I like doing school work* (white 19%, black 11%, Asian 27%). This may reflect the fact that some groups of Asian pupils demonstrate higher attainment at GSCE level than groups of working-class Black or White pupils (Gillborn and Mirza, 2000). Thus, more intense orientation to school work may also result in more positive attitudes towards school work and homework.

5.4 Children's reasons for using ICT for school work outside of home

As section 4 identified, very little of the school work children and young people completed using ICT outside of school was set by teachers. The vast majority of work completed using ICT was done so out of choice. This included completing homework set by teachers using ICT and doing additional school work using ICT over and above that set as homework. One of the possible reasons for choosing to use ICT for school work outside of school lessons could be related to the trend identified earlier (Section 3), in which greater use of ICT in a subject in school correlated with greater use of ICT in that subject outside of school. Children who used computers in subjects within school could thus become more confident and feel more able to use computers outside of school. However, there were additional factors which motivated use of ICT outside of school lessons that were identified in the interviews. The reasons outlined in the interviews included the fact that ICT is motivating; is multimodal; saves time; enhances presentation; is an alternative to writing by hand; is a good source of information; is interactive; enables multi-tasking; improves grades. Each of these aspects is discussed briefly below.

It was clear throughout the interviews with children, young people and their parents that the use of ICT was highly motivating for pupils. This role of ICT has been identified in much previous research (DfES, 2003a, Passey et al., 2003, Dixon et al., 2004).

Well, I think if I only had the books I would probably not have revised that much because near the end I got bored of looking at the same things over in the book. Whereas then if I had gone onto the computer you could, especially on that CD-ROM you can like play games and it makes learning much funner.

(Year 6 boy)

There is research which suggests that some children prefer to read multi-modal texts (Mackey, 2002). In this study, some children indicated that texts on screen offered a more conducive learning environment for them:

Really helpful. It's like I can't just like read out of a book and revise, I find it really boring. [name] has got pictures, diagrams and it breaks it down into smaller chunks just so you can take it in.

(Year 11 boy)

A large number of children and young people suggested that they preferred to complete their homework on computers because it saved them time. In particular, the ability to revise documents without having to rewrite them was appealing.

Coursework like I said, you don't have to retype out things, you just see the teachers' notes, 'Cut that bit out, add this bit in', reprint it and you've got your second draft of what you need to do...

(Year 11 boy)

Interviewer: *Has the fact that you can do it on a computer changed how you do your homework?*

Male: Yes, it's made actually want to do it because I know it's not going to take, like, 3 hours.

(Year 9 girl)

Many pupils felt that the use of word processing programmes for their school work was beneficial. This aspect of the use of ICT was also frequently mentioned by parents in terms of the reasons why they encouraged its use. The ability to decorate work with clip art and borders was also mentioned by a number of children as a motivating factor. Girls were more likely to cite this factor. A large number of children, in particular boys, suggested that they liked using the computer because they disliked writing. Here, the children's comments are supported by the evidence of previous research with teachers which found that children's presentation and explanation of material was generally better as a result of using ICT (Dixon et al., 2004).

Because when you are writing by hand, your wrist gets really tired and it really hurts you. When you are writing on a computer and it doesn't hurt you, you want to carry on a bit more and a bit more and you don't feel the need to stop.

(Year 9 boy)

As previous research (DfES, 2003; Dixon et al., 2004) has identified, both parents and children regard the Internet as an excellent source of information. This was cited frequently as a reason for using ICT to complete school work.

The interactive nature of CD-ROMs, games and websites was frequently cited as a reason for choosing to complete school work on the computer.

It's like one big encyclopaedia, you can find out anything for your subject, you can even go to the exam board websites and find out the specifications of what you have to do. It's just a great help, it's basically like a library.

(Year 11 boy)

It affects 99%, it's just so much easier because websites you can go on for revision, it has all your topics listed and the [name] one, it's interactive so you can revise that section and do a test on it, then the test comes up and you have a list of what you have to revise.

(Year 11 boy)

A number of children and young people suggested that they liked to use the computer for school work because it enabled them to undertake a number of tasks at once.

I'm not really good at revising, I get bored or distracted and I kind of skip through a few of my ... but because it was our main SATS to choose our GCSEs and things, I used the [name] website just to guide and that was a bit, that was a more fun way of doing it, I could put my music CD in and listen to the media player while I was doing that, and it just made it less boring. I don't know if it affected my results because I haven't got them yet.

(Year 9 girl)

The implications of these findings are that schools need to build on the motivational aspects of ICT in order to engage pupils in education. In particular, ICT might be used to tackle boys' underachievement, and to challenge pupils' perceptions that homework is boring. However, if ICT is to raise pupils' attainment it will also need to support subject specific learning processes rather than just stimulate pupils' engagement with, and presentation of, work (Passey et al., 2003).

5.5 Children's perceptions of ICT and attainment

Just less than half of pupils (49%) either strongly agreed or agreed that using a computer generally (at school and at home) improved their school marks overall. In the interviews, many children and young people suggested that they used ICT for school work because they perceived that it improved their grades. This is important because even if having a home computer does not improve children's academic attainment if children without access to the technology believe it does so it may de-motivate them or become an excuse for lack of effort or failure.

There were no significant relationships between year group and whether children perceived that using a computer affected their grades. There were

clear differences, however, in terms of the subjects where they identified the use of a computer as having a positive effect on their attainment (Table 6).

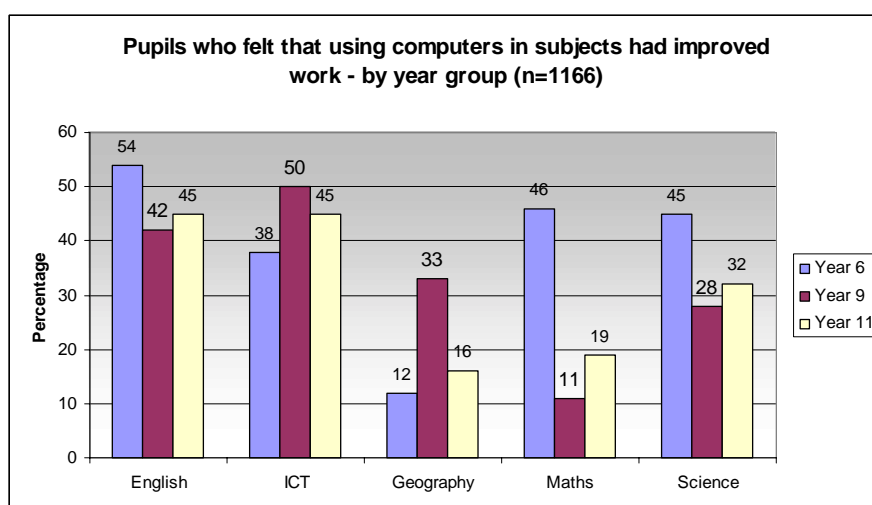
Table 6: Percentage (actual number) of all students (year 6-11) (i) who felt that using a computer outside of school lessons had improved grades in the following subjects (ii) who use the computer at home in this subject at least once a week

<i>Subject</i>	Felt using computer improved grades	Uses computer at home at least once a week
English	46.2% (539)	21.2% (247)
ICT	45.5% (531)	20.8% (242)
Science	33.1% (386)	12.2% (142)
Geography	22.6% (264)	9.8% (114)
Maths	21.2% (247)	10.5% (124)
History	7.3% (85)	10.4% (121)

Here, perhaps not surprisingly, English and ICT, the two subjects in which the highest proportion of pupils said they made most use of ICT for their school work outside of school, were also the two subjects in which the highest proportion of pupils felt that using a computer improved their grades.

Year 9 pupils were significantly more likely to believe that a using computer (in general) in English, ICT and geography had made their work better in these subjects than the other year groups (see Figure 16). The perceived impact on attainment in geography here presumably reflected the fact that at year 9, nearly half of all pupils used the Internet to find information for this subject and it is the subject for which this year group had most electronic resources. Likewise, year 6 pupils were significantly more likely to state that computers made their work better in mathematics and science (see Figure 16), again subjects for which this year group made most use of ICT, and had significantly more books, electronic resources and parental help respectively.

Figure 16



This pattern was broken by year 11 pupils, who claimed that using a computer had made their work better in history, while appearing to actually make little use of ICT for school work outside of school in this subject (History: Year 6 - 7%; Year 9 - 11%; Year 11- 2%).

Girls were more likely to think that using a computer had made their work better in English and boys that it had made their work better in ICT. This is logical, since girls used computers more for school work out of school in English than boys, and boys used them more in ICT. There were no significant gender relationships for any other subjects in terms of whether using a computer made the pupils' work better. In terms of the statement '*Using computers improves my school marks*' boys again had more extreme opinions than girls: they either strongly agreed or strongly disagreed with this statement. This may reflect boys greater self-confidence to express their opinions rather than a greater strength in their perceptions of the technology.

There is some indication that Asian pupils were more likely to believe that using a computer had made their work better in ICT than white or black pupils, which may reflect the fact that some groups of Asian pupils demonstrate higher attainment at GCSE than groups of working class Black or White pupils (Gillborn and Mirza 2000). However, this must be interpreted with caution given to the low numbers of minority ethnic pupils in the sample. The other statements related to attainment '*I enjoy using computers for homework*'; '*Using computers improves my school marks*' and '*I am confident at using computers*' suggest that there was no evidence of any patterns according to ethnicity.

There were also no significant relationships between the number of books that a child had access to at home or the number of visits that they had made to galleries/museums with their parents and whether the child agreed that using a computer improved their marks.

5.6 Parents' perceptions of attainment

Parents of year 6, 9 and 11 pupils believed that, in some cases, the use of ICT outside of school lessons had improved their children's grades for course work, although this was usually speculation rather than based on specific examples:

Interviewer: *So, do you think grades are improved as a result of using the computer outside of school?*

Female: Yes

Interviewer: *How?*

Female: *Just, you have more information. You can put more into it, more diagrams, explanations. And, like, you can use thesaurus if you want to sound better, longer words.*

(Year 9 girl)

Interviewer: *And in terms of her sort of progress at school and her grades and things, does the actual having a computer at home and using the computer, has it made a difference to that?*

Mother: *I think so. I would say without the computer, [name]...has the fortunate ability of having good intellect, certainly with the use of a computer she's A*, because it's actually stimulated, in my opinion anyway, her interest and diverging her interests into other things, and she comes out with some commentary about, you know, 'Did you know that such and such and such and such?' and I went, 'No' 'Well, when I read this and it led me to that...' and then she'll tell me about different things she's drilled down and I think that additional interest or, if you like, stimulation of her thought processes has led her to go from probably an A to an A*.*

(Mother of year 11 girl)

A minority of year 6, 9 and 11 parents, particularly fathers, believed that console games and non-educational computer games had developed particular skills in their children. There is some research evidence (McFarlane, Sparrowhawk and Heald, 2002) to suggest that games literacy can promote a range of skills, knowledge and understanding such as problem-solving skills and communication skills, as well as social development. However, it is difficult to define and identify informal learning, or what are sometimes called 'soft' skills because they are embedded in children's lives and often occur in unintentional and unrecognised ways (Sefton Green 2004).

Yes when they do it on the Internet and play kids from other countries, so they're quite keen on that sort of thing I must admit. Which is, I know a lot of people say, 'Oh they're on it too long', but it does make them think as well, because you know they're taking on someone else, and they're pretty good those two actually.

(Father of year 9 boy)

Interviewer: *What benefit do you think the games have, do you think they do have?*

Father: *I think they do, one of... a while back, this was years ago in my office, and [name] was on a computer there and she was playing a game...and she'd been playing it for hours ... I said, "What have you learnt from it?" And she reeled off all nine planets and in what order they were...*

(Father of year 9 girl)

Despite the fact that year 2 children's pattern of use of ICT was predominantly recreational rather than educational, the majority (84%) of parents agreed with the statement that '*Using a computer helps my child to learn useful things*'. However, the majority of year 2 parents were not able to identify a clear relationship between this learning and their child's educational attainment. Just under half (46%) stated that they had no opinion about whether using a computer had improved their child's school work, and a further 7% disagreed with this statement. In interviews, parents described some potential effects of ICT that are difficult to evaluate in terms of attainment, such as the fact that using computers helped their child to learn new words or to type more quickly. There did appear to be a pattern in terms of ethnicity – parents from minority ethnic groups were more likely to strongly agree that using a computer improved their year 2 child's school work. In particular, minority ethnic parents were more likely to say that playing mathematics games and playing word

games helped their children with their learning than white parents. Parents were also more likely to agree/strongly agree that a year 2 girl was good at using computer than a boy.

Despite parents' generally positive views towards the relationship between ICT use and attainment, there were a number of parents, however, who believed that use of ICT for homework was, in some way, an easy option. Some, echoing the concerns of a minority of teachers (section 4), even categorised ICT use as cheating.

Mainly like his spelling, because he's not very good at spelling, but then because the computer does it all for him, he's not going to learn that he's spelt it wrong, whereas if you spell it wrong and you're told you've spell it wrong, then you correct it, whereas you just type it in and it'll correct it all at the end, so he's not going to actually know what he's spelt wrong, and say with the punctuation, if he puts a wrong thing in and it corrects it, how's he going to know that it was wrong in the first place. So sometimes I think it's a bit of cheating, and it's like the calculators for maths, that's obvious like cheating to me, no they just don't know how to add up properly in their heads these days, but I suppose that's progress for you.

(Mother of year 9 boy)

Interviewer: *Ok, how do you feel about teachers asking her to use the computer at home?*

Mother: *I think it is a bit of a cheat really, because I think they don't, it is like having a spell check, they don't know how to spell the words because the computer does it for them. It is easier for them than it was for us.*

(Mother of year 9 girl)

The implication of this section is that there is a need to build on, and support, parents' generally positive attitudes towards the benefits of ICT (see also section 4). At the same time it is important to address reservations about the use of technology, held by a minority of parents, because otherwise these parents may deter their children from using or undermine their confidence in ICT for educational purposes.

5.7 Teachers' perceptions of attainment

As section 4.5 outlined teachers were divided as to whether ICT raised pupils' attainment. While some argued it did improve grades, others were concerned that it encouraged children to cut and paste material from the Internet and focus on presentation rather than understanding.

However, there was more consensus in relation to the wider impact of ICT on pupils' performance. Both primary and secondary level teachers argued that ICT can raise the self-esteem and confidence of low achievers and enable those with special needs (such as visually impaired and autistic children) to demonstrate their ability. At the same time, they claimed that ICT can extend high achievers by enabling them to work independently. However, one

teacher contradicted this generally positive picture by suggesting that ICT has a negative effect on pupil behaviour, affecting pupils' attention span and making them 'hyper'.

Anybody who feels successful in one area is going to have a raised level of esteem by and large and I think therefore that if you've got students who might struggle with a great deal of their academic courses, if they find an area of IT which allows them to be successful, even if it's a niche part of IT, you know, you might find that they're very, very creative with website design for example...that's got to be good for their development and their confidence, and I think that gives them a strength that they would otherwise not have.

(Secondary School Teacher)

'As far as the high achievers, they can get pushed on a lot further, because we don't have the resources in the classroom they can go out and search for the resources from a wider community. So they can become self-sufficient learners as it were and you can give them a topic area to investigate...and be able to do so very well on the Internet. And again, as far as the lower attainers are concerned, I tend to find websites that are appropriate to them...especially for lower attaining children, when they use a computer, again they don't see themselves as bad at that subject, even if we are doing it with literacy. Somehow they don't consider that they are bad at that subject if they use the computer, so even if I said write about this, pen and paper, 'I can't do it, I can't write', whereas if its is on the computer they would have a go at it.

(Year 6 teacher and ICT co-ordinator)

I mean I've got a Special Needs boy in my class...if he does some say work or some spelling work, then he goes onto the computer to do some reinforcement work...And he's much more keen to do that knowing that he's going to go onto the computer at the end of it...I find it works a lot better having that as a sort of carrot...And we've also got autistic children and visually impaired children, and children who don't hear very well in our school, and they've also got these ways of, you know, demonstrating their ability through the keyboard rather than having to explain it.

(ICT teacher)

These findings are supported by *The ICT in Schools Survey* (Prior and Hall 2004) which found that ICT is regarded by teachers as supporting pupils with special educational needs to access the curriculum. Just under a third (31%) of the secondary schools that responded to the survey also stated that they use ICT to support pupils not able to attend school. Other studies have found that secondary schools have used ICT to help (re)integrate pupils with attitude and behavioural problems and that ICT motivates gifted children because it allows them to be more autonomous learners and carry out more sophisticated research (Passey et al., 2003).

The implication of this is that ICT might provide a means to enable the Government's commitment to personalised learning because these

technologies have the potential to promote individual learning styles and to reflect individuals' needs and motivations.

PERCEPTIONS OF HOW ICT CAN CONTRIBUTE TO LEARNING AND ATTAINMENT - SUMMARY

- **Most parents supported their children to complete homework.**
- **Many parents helped their children to surf Internet sites for information for topic work.**
- **Most parents believed that their children were more competent to use computer than themselves.**
- **Children and young people generally had negative attitudes to homework, but preferred homework that could be completed on a computer.**
- **Reasons for using a computer for school work outside of school lessons included: motivating nature of ICT; it is multimodal; it saves time; it enhances presentation; it is alternative to handwriting; it provides a good information source; it is interactive; it enables multi-tasking; it improves grades.**
- **There were subject specific patterns in terms of pupils' access to books, electronic resources, private lessons and help with homework.**
- **There were age specific patterns in terms of the technologies pupils use to help with their homework.**
- **Children were more likely to ask parents than teachers for help with their homework on the computer, although the willingness to do so declined with age.**
- **Children had a positive attitude towards computers, although boys had a stronger opinion on this than girls.**
- **Children perceived that using a computer had had the biggest positive impact on their marks in English and ICT, the subjects in which they made more use of ICT for school work outside of lessons.**
- **There were age patterns in the subjects in which pupils believed that a using computer had made their work better. These reflected subject specific patterns of ICT usage.**
- **The majority of year 2 parents believed that computers helped their year 2 children to learn useful things, though they could not readily identify what these are.**
- **ICT might provide a means to support personalised learning because these technologies can facilitate individual learning styles and reflect individuals' needs.**

6. PATTERNS OF ATTAINMENT

As section 5 demonstrated, there is a general belief among pupils and teachers, identified in this and previous research, that using ICT can improve pupils learning and attainment. In particular, computers enhance learning by: reducing the repetition of low level tasks (like writing, editing and so on) that are inefficient and can get in the way of the purpose of learning activities (Schacter 1999) so increasing productivity (Kulik 1994); promoting active learning (Berge and Collins 1998); motivating pupils (Sivin-Kachala 1998); tailoring learning to the learner and promoting pupil independence (Newhouse 2002).

Despite the recognition of these general benefits, it is difficult to make a direct connection between use of ICT and learning outcomes because learning is mediated through learning environments, of which ICT is only one element. Nonetheless, some previous studies have suggested that there is a relationship between access to a home computer and attainment. Research at the London School of Economics (LSE) (Schmitt and Wadsworth, 2004) that looked at the link between ownership of a home computer at ages 15 and 17 (taken from the British Household Panel survey 1991-01) and subsequent educational attainment in the principal British school examinations taken at ages 16 (GCSEs) and 18 ('A' levels) found a significant positive association between computer ownership and both the number of GCSEs obtained and the probability of passing five or more GCSEs. Home computer ownership in this LSE study was also associated with a significant increase in the probability of pupils passing at least one 'A' level (conditional on having passed five GCSEs). The ImpaCT2 study of English children aged 5-16 found that pupils who used ICT in both home and school contexts effectively achieved the equivalent of accelerated progress in English and mathematics at key stage 2 and up to half a grade better in some GCSE subjects (DfES 2003). Other studies have identified a general perception among some teachers that ICT has raised attainment and increased individual GCSE performance.

Similar evidence has also been produced in the US. One study found that high school students using educational software at home achieved higher computer literacy test scores than other pupils (Nichols, 1992). A longitudinal study following a group of US pupils from 7th to 12th grade reported that students with home computers attained higher grades in English and mathematics than those pupils without (although they are also likely to be from families with higher education and income) (Rocheleau, 1995).

6.1 The data for this study

This study focused on whether pupils' use of ICT outside of school lessons improved pupils' performance in school and (if it did) by how much. Data on the educational performance of the pupils who participated in this study was obtained from the Curriculum, Evaluation and Management Centre (CEM) at the University of Durham. CEM provides value-added information for schools and colleges in England and Wales that subscribe to it. PIPS (Performance Indicators in Primary Schools) data was used for primary schools and YELLIS

(Year Eleven Information System) data for secondary schools. Both work in the same way, calculating a 'value added' measure of pupil performance, on the basis of tests conducted by CEM on pupils' basic levels of ability prior to national assessments, and subsequent test results. In other words, they show how much better, or worse, a pupil performs in the assessment than the result that might be expected based on average progress from their initial assessment. Since the CEM value added measures are based on pupil performance taking into account (among other things) pupils' social class, the patterns they show indicate, in effect, how pupils are performing when class background is held constant.

The impact of ICT on pupils' attainment was then assessed by means of a statistical method, multivariate regression. Multivariate regression allows researchers to look simultaneously at the effects of several variables (usually termed the independent, or explanatory variables) on a variable they wish to explain (generally termed the dependent variable). The method estimates a linear equation (sometimes referred to as a model) which identifies not only whether each independent variable has an influence on the dependent, but also how large that effect is. The size of effects is indicated by the regression coefficient for each variable. The direction of the coefficient (whether it is positive or negative) also carries information about the nature of the relationship between the independent and the dependent variable. A significant, positive, coefficient indicates that as individuals' scores on an independent variable get larger, so too will their scores on the dependent variable. A significant, negative coefficient, on the other hand, indicates that as scores on an independent variable increase, scores on the dependent variable will decrease. The great advantage of multiple regression as a method is that it allows not only the simultaneous estimation of the effects of a variety of factors, but that it also identifies how each individual independent variable affects the dependent variables, holding constant the effects of all other independent variables in the equation. This means it is possible to state what the effect of each independent variable would be if everything else were the same; in other words, it is the nearest thing to a controlled experiment using survey data.

For this study, a series of equations were estimated for each school year in the survey, with PIPS and YELLIS scores as the dependent variables. The independent variables mostly measure access to and use of ICT resources, primarily outside of school. In addition to measures of ICT use, the independent, or explanatory, variables included controls for pupil gender, and for what we term the cultural capital invested in the pupils' home environments: how many books, roughly, they have access to at home; and how often in the preceding year they have visited a museum or gallery. Recent work in political sociology, for instance, shows that literacy and access to information are major determinants of citizen involvement (Milner, 2002). In part, these variables give an obvious and direct measure of the scale of educational resources available to pupils in their home environments. Inevitably, also, these measures do correlate with parents' social class and education. By and large, pupils growing up in the homes of middle class graduates are more likely to have access to high levels of cultural capital than are pupils growing up in poorer, less well-educated households. For year 6, 9 and 11 pupils, attitudinal measures were also included gauging whether pupils enjoy using

computers and whether they enjoy school work. These latter measures give an indication of general predispositions towards both education and ICT.

6.2 Measures of ICT use

Clearly, the surveys contain a great many possible measures of ICT use. However, it is impractical to employ all of them in every equation. Not only is this computationally inefficient (though not in itself difficult with modern computer power) but, more importantly, it is statistically questionable, as many of the independent measures are likely to be strongly correlated with each other. So, for instance, if measures for height and age were included in a school-wide study, it is very likely that it would be including two measures of much the same thing, since (other things being equal) older pupils will, on average, be taller than younger pupils. This problem, termed collinearity, is highly undesirable, as it can lead to serious problems in interpretation. Important variables might be overlooked entirely; coefficients might be the wrong size and/or direction. Test results can prove very misleading if collinearity among the independent variables is not properly taken account of. The choice of independent variables for the regression equations in this study has, therefore, been guided by three principles:

First, independent variables have been chosen for which there is some theoretical rationale there are reasons for expecting all the variables analysed to have an effect, whether beneficial or adverse, on school performance. The variables employed are:

- *Cultural capital* (number of books in the household; number of trips to a gallery or museum): the more cultural capital a household possesses, the better pupils should be expected to perform at school. Cultural capital is employed here primarily as a control measure: including it in the analysis the effect of ICT use on attainment to be estimated net of cultural capital. The model, in effect, shows what impact ICT use would have if all pupils came from households endowed with identical cultural capital.
- *Gender*: recent research suggests that girls now out-perform boys in the classroom. As with the cultural capital measure above, gender acts here as a control variable, so measures of the impact of ICT use reflect what should be seen if there were no underlying gender differences in attainment.
- *Availability of ICT outside of school*, measured by the number of computers available in the child's household. The greater the availability of computers, the greater the opportunity to use them. The expectation therefore is that children with access to computers at home should be at an advantage over children with no access, and so should perform better.
- *The child's actual use of computers outside of school*: this is measured in terms of the amount of computer use outside of school lessons for homework on a home PC, or a computer in a relative's house. Pupils were asked in the survey whether they used a computer in this way more than 2 hours a day; daily, but for 2 hours or less; every 2 or three days; about once a week; at least once a month; less than once a month; or never. Other things being equal,

if ICT use is related to improved performance, there should be greater improvements in results among those who use ICT regularly outside of the classroom than among those who use it infrequently.

- *Education versus leisure uses of ICT*: if ICT does have an impact on performance, an important issue is whether particular sorts of computer use are more valuable than others, or whether it is general exposure to ICT which makes the difference. One way of thinking about this is whether there is a difference between those who use ICT recreationally (to play games etc.) and those who use it for educational purposes. Respondents to the survey were asked whether or not they used a computer outside of school for school work or for recreation. In addition, they were asked whether or not they made use of educational software or on-line educational resources at home; and they were asked how often they made use of educational Internet sites. Finally, the survey asked how much time was spent playing computer games at home. Other things being equal, the expectation is that the more pupils made use of ICT at home for educational purposes, the better their school performance should be.
- It is harder to predict, *a priori*, what the likely outcome of other forms of ICT use might be on educational performance. One argument, outlined in the literature review, is that all exposure to ICT, of whatever sort, can have positive benefits. If this is the case, the more pupils report using ICT for fun, and the more time they spend playing computer games, the better their school performance should be. However, an alternative view leads to very different conclusions: it could be that entertainment-related uses of ICT, by taking up time which would otherwise be spent studying, are actually detrimental to pupils' results. If this is true, then those who spend more time playing games on computers should perform less well than those who spend less time doing so, other things being equal.
- Finally, pupils' general orientations towards both computers and school were controlled for. Respondents were asked whether or not they agreed with two statements: that they did not like using computers; and that they liked doing school work. Other things being equal, we would expect those who are positively motivated to do better than those who are not. Controlling for these motivational items is important, as it allows us to take into account the extent to which pupils enjoy what they are doing in education, and feel comfortable in using ICT (even if that comfort is not necessarily related to actual aptitude). As with the earlier control measures, the inclusion of these variables in the analysis allows the identification of what impact ICT use would have on attainment if all pupils were equally motivated towards education, and equally confident in the use of computers.

Second, the measures chosen were, as far as possible, common across both the survey of year 6, 9 and 11 pupils, and the survey completed by year 2 parents. This produces a standardised regression model which allows for direct comparisons. Third, variables were eliminated that raise serious

collinearity problems: in every case, there is another variable in the surviving equation which measures a similar dimension.

6.3 Main findings from Multivariate Regression

Previous work, discussed earlier, suggests that ICT use does have a beneficial impact upon pupil attainment (Rocheleau, 1995; DfES 2003; Schmitt and Wadsworth, 2004). What is striking about the results of this research, however, is how little impact ICT use seems to have on pupil performance. Among year 2 pupils, none of the ICT measures employed in the regression equations prove to be statistically significant¹³ (table 7).

Table 7: Year 2: regression models

	SATS value added	
	Reading	Maths
Constant	-1.12	-10.55
N of books in household	-0.54	0.25
N visits to art galleries	-0.16	1.13*
Child's gender (female)	1.13	1.12
How often child uses computer at home	0.44	-0.12
How often child uses computer at relatives	0.46	1.10
Use of computer for school work outside school	-1.88	-1.04
Use of computer for word processing	0.27	
How often child uses computer for literacy	0.23	
How often uses Internet educational site		0.05
How often uses maths programme on computer		0.15
How often uses computer for maths activities		0.03
R ²	0.05	0.11

This suggests that ICT use at home by year 2 pupils has little discernible 'extra' impact upon their school performance over and above what might be predicted on general grounds.

This finding is surprising, given previous research findings. However, the answer may lie in part in the relatively large amount of home ICT use among year 2 pupils, as reported by parents in their responses to our survey. Almost all year 2 parents reported their child made some educational use of a computer at home, so absence of exposure to ICT cannot be a factor here. That said, just under half reported just one ICT-based educational activity being carried out at home.

Also, the frequency of home use of computers for education was relatively low among year 2 pupils compared to older children. Year 2 pupils were not daily computer users on the whole: only 12% of parents reported that their child used a computer at home every day. However, a further 54% said their child used a computer at least once a week, so around two-thirds of all Y2 pupils

¹³ in all the regression tables, statistically significant results are indicated with an asterisk

seemed to be making some educational use of ICT at home on at least a weekly basis. This proportion was very similar to the home usage of ICT among our other year groups: 58% of year 6 pupils, and 68% each of year 9s and year 11s also used home computers for educational purposes at least once a week. However, the older pupils were much more frequent ICT users than younger children. Whereas only 12% of year 2s used home computers every day, this rose to 27% of year 6 pupils, 33% of year 9s and 34% of year 11s – almost a threefold increase from year 2 to year 11. It may be that the (relative) infrequency of use among year 2s pupils was an inhibiting factor

Year 2 pupils' home use of ICT for educational purposes was dominated, hardly surprisingly perhaps, by educational games. Around 45% parents reported their child used an educational computer game. Around 33% of parents reported the use of ICT materials at home aimed specifically at literacy skills – including spelling, writing and word-processing. Only 15% mentioned numeracy skills, however. Given national concerns about children's numeracy, there is a clear implication in terms of the need for primary schools to encourage and advise parents to purchase appropriate educational games to develop children's numeracy skills.

As explained above, the analyses for subsequent year groups relied on information supplied by pupils themselves, necessitating a caveat in drawing direct comparisons between the year 2 and other results. Furthermore, here the analysis concentrated on the core subject areas of English, mathematics and science because these subjects were common across all three age groups, and were taken by almost all pupils.

These caveats notwithstanding, however, in general, ICT use outside of school had only limited effects on the performance of pupils in other years too. Few coefficients were significant, and they tended to be clustered in mathematics. Among year 6 and year 9 pupils, for instance, the only significant ICT coefficient occurs in the mathematics equation and is for the use of computers outside of school for school work (tables 8 and 9).

Table 8: Year 6: regression models

	SATS value added		
	Maths	English	Science
Constant	12.55	-0.80	6.90
N of books in household	-0.22	-0.79	-0.90
N visits to art galleries	0.05	-0.48	0.40
Child's gender (female)	-2.53	6.08**	-0.66
N of computers in household	-0.01	-0.77	-1.20
How often child uses computer at home	-0.18	-0.27	-0.04
How often child uses computer at relatives	-1.18	-0.84	-0.60
Use of computer for school work outside school	6.00**	1.90	0.62
Use of computer for fun outside school	-1.57	-2.34	-1.15
Use educational software/CD ROM/DVD at home	-1.16	0.34	1.60
Use revision software/Internet revision at home	-3.47	2.45	-1.22
How often uses Internet educational site	-0.01	0.77	0.67
How often uses spreadsheet at home for lessons	-0.74	2.14	-1.42
How often play computer games	-0.21	1.17	0.29
Agree/disagree: I do not like using computers	0.80	0.17	0.76
Agree/disagree: I like doing school work	-1.48*	0.06	-0.85
R ²	0.11	0.24	0.07

Table 9: Year 9: regression models

	YELLIS value added		
	Maths	English	Science
Constant	-0.17	-0.12	0.21
N of books in household	0.02	-0.06	0.02
N visits to art galleries	-0.10*	-0.02	-0.10*
Child's gender (female)	-0.07	0.07	-0.19
N of computers in household	0.04	0.09	0.08
How often child uses computer at home	-0.03	0.00	0.04
How often child uses computer at relatives	-0.10	0.04	-0.01
Use of computer for school work outside school	0.30*	0.04	0.14
Use of computer for fun outside school	0.15	0.15	0.31
Use educational software/CD ROM/DVD at home	0.01	-0.23	-0.15
Use revision software/Internet revision at home	-0.10	0.09	-0.14
How often uses Internet educational site	0.02	-0.05	0.07
How often uses spreadsheet at home for lessons	-0.03	-0.09	-0.05
How often play computer games	0.12	-0.02	0.04
Agree/disagree: I do not like using computers	-0.03	-0.04	0.01
Agree/disagree: I like doing school work	0.11*	-0.02	-0.04
R ²	0.06	0.05	0.06

In both cases, the coefficient is positive and significant, indicating that those pupils who used computers for school work outside of school achieved better 'value added' in their mathematics assessments than pupils who did not use computers outside school for school work. In other words, computer-based school work conducted outside of school was positively associated with year 6 and 9 pupils' improved performance in mathematics, over and above what might be expected of them, given their initial performance and abilities. However, the size of the effects is limited. For example, the coefficient of 0.30 for Year 9 pupils who used a computer for school work outside of school suggests that the improvement in their YELLIS value added score is only 0.30 of a standard deviation from the average improvement for all pupils (the standard deviation is a measure of the spread of data around the mean: the larger the standard deviation, other things being equal, the fewer people are close to the overall average, and the more who score much higher or much lower than average). To put that in perspective, standard statistical theory indicates that around 68% of all individuals will be within 1 standard deviation of the mean. So a move of just 0.3 of a standard deviation will mean only a small improvement in the relative ranking a pupil might have otherwise achieved.

Part of the reason for the relatively small size of the effect is the ubiquity of home computer use. Around 63% of year 6 pupils, and 66% of year 9s, reported using a computer for school work outside of school. Under these circumstances, it would be unlikely for all pupils using a computer at home to

experience large improvements in their performances. Some will, but others will not, and hence the average, overall effect will be somewhat muted.

Strikingly, however, more pupils in years 6 and 9 reported using ICT outside of lessons for English than for mathematics or science: 44% of year 6 pupils, and 77% of year 9s said they never used a computer for mathematics work outside of the classroom, compared to 27% each year who never used a computer outside of the classroom for English, and 49% of Y6 and 44% of Y9 pupils who never did so for science lessons.

The major uses of ICT also varied according to subject area. In English, a third of year 6, and 40% of year 9 pupils searched for information on the Internet, and a quarter and 45% respectively made use of word processing facilities. In mathematics, meanwhile, the major uses included Internet revision aids (used by 30% of year 6 and 17% of year 9 pupils for mathematics homework – but also used by (for instance) 30% and 27% respectively of pupils for English work. Spreadsheets were employed by 17% of Y6 pupils for mathematics work, compared to just 10% of Y9 pupils.

This may reflect a greater emphasis as pupils move through school on mathematical theory rather than on arithmetic procedure: considerable sophistication is possible in Mathematics with little more than a pencil and paper for tools.

Slightly more extensive ICT effects are found among year 11 pupils, whose YELLIS value added scores for mathematics and English correlate with how often they visited Internet educational websites, and how often they played computer games at home (table 10). In both equations, the relevant coefficients are positive and significant. Year 11 pupils who used the Internet for educational reasons outside of school have better YELLIS value added scores for mathematics and English than do pupils who did not use the Internet in this way. The difference between an Internet user's YELLIS score and that of a non-Internet user is equivalent to a standard deviation of 0.38 (for mathematics) or of 0.29 (for English). As noted above, this does represent an improvement, but only a modest one.

Table 10: Year 11: regression models

	YELLIS value added		
	Maths	English	Science
Constant	-1.47	-2.21	-0.94
N of books in household	0.00	0.09**	0.05
N visits to art galleries	0.02	0.15**	0.08
Child's gender (female)	0.04	0.44**	0.00
N of computers in household	0.12	0.01	0.04
How often child uses computer at home	0.10	0.01	0.01
How often child uses computer at relatives	0.04	-0.02	0.01
Use of computer for school work outside school	0.13	0.18	0.19
Use of computer for fun outside school	0.06	-0.04	-0.09
Use educational software/CD ROM/DVD at home	-0.03	0.22	0.14
Use revision software/Internet revision at home	0.08	0.04	0.17
How often uses Internet educational site	0.38**	0.29*	0.09
How often uses spreadsheet at home for lessons	-0.03	-0.17	-0.02
How often play computer games	0.09*	0.14**	0.05
Agree/disagree: I do not like using computers	0.07	0.09	0.02
Agree/disagree: I like doing school work	0.01	0.00	0.02
R ²	0.08	0.25	0.07

The second ICT-related factor which had an impact on the mathematics and English scores of year 11 pupils is the extent to which they played computer games outside of school. Again, the relevant coefficients were positive and significant. The variable measuring the intensity of computer gaming was structured so that increasing scores indicated less use. So, for instance, a score of 1 indicated an individual who reported playing computer games every day; a score of 2 indicated someone who played computer games at least once a week, but not every day; and so on. The highest possible score was 5, indicating an individual who reported never playing computer games. The positive coefficients show, therefore that the less time individuals spent on computer games, the better their YELLIS value added scores in mathematics and English. This almost certainly reflects, not ICT use as such, but time. In a finite world, one use of time crowds out another. The more pupils spent time playing computer games, the less time they may have had available for other tasks, including homework and study. Indeed, the evidence of previous research is that children prefer using ICT for leisure than educational purposes and often tell their parents that they are using the computer for school work when in fact they are actually using it for fun (Holloway and Valentine 2003). If the argument advanced here regarding time as a resource is correct, then other activities which take time away from studying, such as watching TV, should have a similar deleterious effect on performance. Some interesting work in a different field shows the potential. In his path-breaking analysis of the decline of social capital in the USA, Robert Putnam (2000) showed that, regardless of age or level of education, the more TV Americans watched, the less active they became in their communities – largely because

participation requires time, and TV viewing fills that time with a different activity. The same, *mutatis mutandis*, is almost certainly true here for children's leisure use of ICT and their educational performance.

What is more, these time-related effects were relatively sizeable, particularly for English. Multiplying the coefficient for computer games in the year 11 English equation by 5 (the score for those who report never playing computer games) shows how significant are these effects. This gives a result of 0.70, almost three-quarters of a standard deviation on the YELLIS value-added score for English. This is over twice as large an effect as the positive effects correlated with using ICT for educational purposes, identified above.

Overall, then, home use of ICT seems to be correlated with modest improvements in pupil attainment, primarily in mathematics. However, especially among year 11 pupils, home ICT use for playing computer games is correlated with more sizeable decreases in levels of attainment. This pattern suggests two policy implications. First, given that section 3 identified that there is a clear relationship between subject specific use of ICT in the classroom and pupil's use of ICT in that subject out of school, if schools are to support and develop improvements in pupil attainment through ICT use out of school they actually need to model, and expand, use of ICT in lessons. Second, and more importantly because of its larger impact, schools need to develop strategies to re-direct pupils' (particularly boys') predominant use of ICT out of school for fun/games towards more educational activities.

ATTAINMENT - SUMMARY

- **Using a computer for educational purposes outside of school lessons at year 2 was not positively associated with improved school performance.**
- **Year 2 children spend double the amount of time using ICT educational materials aimed at developing literacy skills compared to the amount of time they spend using ICT resources aimed at advancing numeracy.**
- **Using a computer for school work out of school was positively associated with a small improvement in children's attainment in mathematics at years 6 and 9.**
- **Using a computer for school work out of school was positively associated with a modest, but more extensive, effect in mathematics and English at year 11.**
- **Using a computer out of school for leisure activities was positively associated with sizeable decreases in attainment. The more time pupils spend playing computer games, the less time they may have available for other tasks, including homework and study.**
- **These attainment patterns suggest clear policy implications in terms of the need to develop children's out of school use of ICT for educational purposes, while re-directing their predominant use of ICT for leisure activities towards school work.**
- **Re-directing children's leisure uses of ICT towards educational use may have a significant impact on pupils' levels of attainment.**

7. PATTERNS IN RELATION TO AGE AND GENDER

Throughout the report, we have identified the ways in which gender and age impacted on issues relating to access, patterns of use, home-school links and learning and attainment. In this section, we will provide an overview of the key patterns which emerged.

7.1 Patterns in relation to age

Table 11 identifies the key patterns of ICT use in relation to specific year group activity, and table 12 summarises the overall patterns in relation to trends with age (i.e. as pupils get older).

Table 11: Patterns in relation to each year group

Year 2	Year 6
<ul style="list-style-type: none"> • The majority (88%) of Y2 pupils had one or more computers at home • The majority (95%) of parents stated that their Y2 child used a computer at school and 84% claimed that their child used a computer at home. • Y2 had least independent access to a home computer. • 26% of Y2 children used a computer at a relative's house between everyday to at least once a month. • Over 70% of Y2 children never used a computer outside of school lessons at lunchtime, after school computer club. • Y2 children were more likely to report playing games of an educational nature than older children. • Y2 children from minority ethnic groups were less likely to use a computer for fun than white children. They were also more likely to play mathematics programs and were less likely to play educational games than white children. The amount of time they spent using CD-ROMs and art packages was very 	<ul style="list-style-type: none"> • The majority (88%) of Y6 pupils have one or more computers at home. • 31% of Y6 pupils had a computer in their bedroom • Y6 pupils were significantly more likely to report rules on using the computer than Y9 and Y11 pupils. • Y6 pupils were more likely to use a computer everyday or at least once a week at a friend's house, and at public libraries than Y11 pupils. • Y6 pupils were more likely to use computers for fun, hobbies <i>and</i> for school work at school out of lesson time and computer or homework clubs than Y9 or Y11 pupils. • Y6 pupils spend more time playing computer games than Y9 and Y11 pupils. • Maths: Y6 pupils were the highest users of ICT for Maths outside school lessons. • Y6 pupils were more likely to use CD-ROMs and DVDs for English and Maths outside of school lessons than Y9 and Y11 pupils. • Science: Y6 pupils were significantly more likely to use

<p>similar to white children.</p> <ul style="list-style-type: none"> • Y2 children used the Internet to play games on sites linked to television and popular cultural interests. • The majority of parents believed that computers helped their Y2 child to learn useful skills and knowledge. • ICT used at home by Y2 pupils had little discernible 'extra' impact upon their school performance over and above what might be predicted on general grounds. 	<p>CD-ROMs/DVDs and computers to create presentations for this subject.</p> <ul style="list-style-type: none"> • History: Y6 pupils made more use of CD-ROMs and DVDs and revision sites than other year groups. • Y6 pupils' made greater use of the school website/intranet compared to Y9 and Y11 • Y6 pupils were significantly more likely to have books, electronic resources, and help from parents in the subjects of English and Maths. • Y6 pupils were significantly more likely to use ICT for mathematics and science than other year groups. • Y6 pupils more likely to state computers made their work better in mathematics and science. • Computer based school work conducted outside of school did improve Y6 pupils' performance in Maths given their previous performances and abilities.
Year 9	Year 11
<ul style="list-style-type: none"> • The majority (88%) of Y9 pupils have one or more computers at home. • A third of Y9 pupils had a computer in their bedroom • Y9 pupils were significantly more likely to use computers for design and technology than Y6 pupils. • English: Y9 pupils were significantly more likely to use the Internet to find information for English and to create presentations for English than other years. • Science: Y9 were more likely to use the Internet to find information for this subject than other year groups. 	<ul style="list-style-type: none"> • The majority (91%) of Y11 pupils have one or more computers at home. • Y11 pupils had more independent access to, and exclusive use of, computers within the home than pupils in other year and social groups because they were more likely to have a computer in their bedrooms. • Y11 pupils were significantly more likely to have an email address than younger pupils • Y11 pupils are less likely to use a computer in a library than younger pupils. • Y11 pupils were more likely to use a computer at home for

<ul style="list-style-type: none"> • Geography: Y9 pupils used ICT for Geography outside of school more than pupils in other year groups. The Internet and word processing were the most popular uses of ICT for this subject. • History: Y9 pupils use ICT for this subject more frequently than other Year groups. • MFL: Y9 made the most use of ICT for MFL through the use of the Internet, word processing and to create presentations • Y9 pupils were more likely to have electronic resources for Geography. • Y9 pupils were more likely to visit educational websites to help with their homework everyday or once a week. • Y9 pupils are less likely to ask teachers for help with their homework than other year groups. • Y9 pupils were significantly more likely to believe that using a computer in English, ICT and Geography made their work better in these subjects than the other year groups. • Computer based school work conducted outside of school did improve Y9 pupils' performance in Maths given their previous performances and abilities. 	<p>school work everyday or at least once a week than Y9 or Y6 pupils.</p> <ul style="list-style-type: none"> • Y11 pupils were more likely to use revision sites prior to exams, having used the computer for coursework for the rest of the year. • Y11 pupils' use of revision websites was extensive. • Y11 pupils were most likely to use email to help with homework. • Y11 children were less likely to ask their parents for help with their homework. • English: Y11 were significantly more likely to use word processing outside of school lessons for English. • Maths: Y11 pupils used spreadsheets and databases. • Science: Y11 more likely to use ICT for word processing, revision software and sites and spreadsheets and databases • Time spent using a computer for school work in Y11 was correlated with an improvement in attainment scores in English. However, time spent using a computer for playing computer games was correlated with a negative impact on performance.
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Table 12: General patterns in relation to age

- Older pupils were more likely to have independent access to use a home computer.
- Older children were more likely to have an email address than younger pupils.
- Older children were less likely to have rules on using the computer.
- Use of ICT in a relatives' home declined with age.
- Use of a computer outside of school increased with age.
- Use of a computer at school out-of-lesson time and at home for school work increased with age.
- Use of computers in libraries outside school declined with age.
- Older pupils were less likely to use computers outside of lesson time in a lunch-time or after-school club.
- Older children were more likely to use ICT for school work and younger children were more likely to use a home computer for fun or hobbies.
- Younger children were more likely to use CD ROMs and DVDs for school subjects.
- Use of email and instant messaging increased with age.
- Younger pupils made greater use of their school's website and intranet.
- Older children were less likely to ask their parents for help with homework, and most likely to use email for help.

These patterns have a number of implications. Not surprisingly, out of school use of ICT for school work increased with age because of growing examination pressures. However, use of computers in libraries and school computer and homework clubs declined with age and use of Internet cafes by all age groups was negligible. This suggests that there is a need for schools to address why older pupils do not take advantage of on-site, out of lesson opportunities, and to develop initiatives to encourage older pupils to take up opportunities to use ICT in a wider range of spaces (e.g. Internet cafes).

There were clear patterns in terms of the dominant use of ICT in each year group – in year 2 and 6 it was the use of CD Roms/DVD; at year 9 use of Internet to search for information; and at year 11 word processing, spreadsheets/databases and revision sites. These patterns of activities may help teachers in planning the use of ICT in subject specific lessons, both to build on and extend different year groups' current patterns of activity.

The survey showed that year 11 pupils were the group least likely to ask their parents for help with school work (because their parents did not have the level of knowledge to help them and because of a growing desire for independence from their families) or to use the school intranet, yet they were also the group more likely to need help outside of school because of examination pressures and the intensity of coursework. Rather, year 11 pupils stated that they were more likely to use email for help than younger pupils (and were also the age group more likely to have an email address). This pattern suggests that schools need to develop the use of home-school links, such as the intranet and email contact between pupils and teachers, to specifically support year 11 pupils' school work outside of lessons. Provision of out-of-lessons support for

pupils in this way might also enable schools to address some the disparities in parents' ability to support their children's use of ICT at home (see section 5).

7.2 Patterns in relation to gender

Previous research has indicated that boys use computers more than girls because of their interest in computer games. Several studies have shown that girls lag behind boys in terms of use of ICT and computer literacy at school, and that girls often perceive school computers as belonging to boys (Schofield, 1997; Holloway, Valentine and Bingham, 2000). However, a recent Gallup survey of 13-17 year olds in the US found similar numbers of boys and girls using a computer each day at home and equal levels of confidence in their skills, which has led to speculation that home use may narrow the computer literacy gender gap. In this study, there were a number of key differences between boys' and girls' use of the computer outside of school lessons for school work.

Table 13: Gender differences

Girls	Boys
<ul style="list-style-type: none"> • Girls were significantly more likely to have access to only one item of hardware at home. • Girls reported lower use of ICT in the home. • Girls less likely to report the use of the computer for games. • Fewer girls than boys stated that they use games consoles. • More girls than boys stated that they liked playing simulation games. • For all subjects except ICT, girls were significantly more likely to use computers than boys. • Girls were more likely than boys to use overtly educational games/ CD-ROMs. • Girls' use of the Internet was more infrequent than boys'. • Girls were less likely to frequent chatrooms every day or at least once a week than boys. • Girls were more likely to draw on support for use of computers from parents and friends than boys. • Girls were significantly more likely than girls to use a computer outside of lesson time at a lunch time, after school or homework club than girls. • Girls were less likely to respond strongly to statements which suggested they held high opinions of their self-efficacy in their use of computers. 	<ul style="list-style-type: none"> • Boys were more likely to have access to two or more items of hardware at home. • Boys reported higher use of ICT in the home. • Boys were more likely to report use of the computer for games. • More boys than girls stated that they use games consoles. • More boys than girls reported playing 'shoot-em-up' games. • In ICT, boys were significantly more likely to use a computer outside of school lessons for school work than girls. • Boys were more likely than girls to use 'fun' games/ CD-ROMs. • Boys were more likely to surf the Internet for fun every day. • Boys were more likely to frequent chatrooms every day or at least once a week than girls. • Boys were less likely to draw on support for use of computers from parents and friends than girls. • Boys were significantly more likely than girls to use a computer outside of lesson time at a lunch time, after school or homework club than girls. • Boys were more likely to respond strongly to statements which suggested they held high opinions of their self-efficacy in their use of computers.

The implications of these gender patterns are twofold. First, although girls made good use of home ICT for educational purposes, there is a need for schools to address the reasons why they were less frequent users of computers out of lesson time at school than boys, and had lower reported levels of self-efficacy at using ICT than boys. Previous research suggests that girls are often intimidated from attending computer clubs because they are seen as the preserve of boys. Girls lack confidence in their own ICT skills and therefore can fear their ability to hold their own with boys in a computer club; and because using computers in a computer club is regarded by their peers as a masculine and 'nerdy' activity can be anxious that using computers in this way will spoil their social identities (Holloway et al., 2000). Here, having

particular computers designated for girls' use only, or girls-only computer clubs can remove the social stigma for girls of being seen to use ICT at school.

Second, there is a need to harness boys' enthusiasm for computer games, and 'fun' ICT activities and re-direct this towards educational activities. Here, again, school computer clubs and out-of-lesson ICT activities have a potential role to play.

8. CONCLUSIONS

8.1 The nature and extent of home use of ICT for educational purposes

The majority of pupils (89%) now have access to home based ICT. However, libraries/Internet cafes are not a substitute for lack of access to hardware at home because children who use technology at home are also the group who use it most frequently in other locations. The implication of this is a need for initiatives to encourage those children who do not have access to ICT at home or have limited access, to use technology out of lessons within the school and to develop their confidence to take advantage of provision of ICT in other out of school venues such as libraries and Internet cafes.

The majority of children in years 6, 9 and 11 reported using a computer at home for school work for 1 to 2 hours per week. Use of home ICT for educational purposes intensified with age with 14% of year 11 pupils reporting that they use it for 10 hours or more per week.

- **How do pupils use ICT at home to support their learning?**
By enabling them to find new sources of information; enhancing the presentation of their work; providing more opportunities for revision/consolidation of learning; saving time on mundane tasks such as editing; and increasing their motivation.
- **How do the level and types of home use of ICT vary?**
 - *Subject:* some subjects lend themselves to ICT work at home (for example, in English ICT is used for word processing and spelling/grammar checks; in geography, history and science to find information and create presentations for projects/assessment). In contrast, in other subjects children are deterred from using ICT because of the nature of work/teaching in that specific disciplinary area (for example, English settings on word processors deter use for MFL; mathematics homework is commonly set in work books and so cannot be completed on a computer). English was the subject where most use of ICT was made by year 6 and year 9 pupils for school work outside of school; for year 11 pupils ICT pushed in English into second place. There were also patterns by age group: year 6 pupils were significantly more likely to use ICT for mathematics and science than other year groups; year 9 pupils to use it for geography and history and year 11 pupils to use it for ICT. Children who use a computer everyday or at least once a week in a particular subject are more likely to use a computer for school work in these subjects at home. Likewise, children who never use a computer at school in particular subjects are also more likely to never use a computer for these subjects at home. This has clear policy implications, in order to develop children's ICT skills and use of computers for educational purposes, schools need to provide good scaffolding in terms of introducing children in the classroom to how technology can be used in

specific subjects and to show them how this ICT use can be developed for each subject at home.

- *Year group:* Use of ICT for school work outside of lessons intensified with age due to the increasingly demands of coursework and exam revision pressures. Year 11 pupils also had more independent access to ICT at home. Younger pupils (year 6 and year 9) made more use of exploratory technologies e.g. CD Roms and DVDs, whereas older pupils had a greater emphasis on the use of specific packages to support coursework such as word processing and spreadsheets. These patterns of activities may help teachers in planning the use of ICT in subject specific lessons, both to build on and extend different year groups' current patterns of activity.
- *Gender:* Girls were more likely to use home computers for school work (particularly in the subjects they enjoy such as English, history and science), reflecting their more conscientious attitude to education rather than a preference for ICT. The only subject in which boys were more likely than girls to use a home computer for school work was ICT – a subject they enjoy. However, boys had access to more hardware than girls and were more intensive users of ICT at home than girls for leisure uses. This has implications for the gender educational gap, as the research also showed that high levels of leisure use of ICT was positively associated with a negative impact on educational attainment. There is, therefore, a need for education policies to re-direct boys' interest in ICT and leisure uses of computers towards use for school work in other subjects. The gendered pattern of ICT use - girls using it for educational purposes and boys for 'fun' - was established as early as year 2.

8.2 The impact of home use of ICT for educational purposes

- **How does home use of ICT for educational purposes affect pupils' attainment?**

It was positively associated with a small improvement in children's attainment in mathematics at years 6 and 9, and a modest but more extensive effect on attainment in English and mathematics at year 11. Parents and teachers also reported that using ICT improved children's motivation and confidence. This suggests that there is a need to address pupils' differential patterns of use of ICT at home for educational purposes. Using a home computer for educational purposes at year 2 produced little discernible impacts on pupil attainment. However, parents of year 2 children did describe less measurable outcomes such as children learning words or to type more quickly.

- **Why does ICT increase pupil motivation/understanding?**

Pupils preferred to do homework in subjects that they enjoyed and in subjects that they were successful in. ICT contributed both to making

school work more enjoyable and also to pupils' perceptions of achievement, thus it was motivational. Specifically, ICT was regarded as making homework less boring because children regarded using computers as: 'cool'; interactive and multimodal texts were more interesting than books; ICT saved time (e.g. it is easier to write and revise documents on a computer than by hand) and enhanced the presentation of children's work; the Internet was a good source of information (range and depth) and educational materials (such as revision websites); ICT enabled multi-tasking and was perceived by children to improve grades.

8.3 The nature and effects of home use of ICT for leisure purposes

- **How does using ICT out of school for leisure purposes affect pupil attainment?**

It was positively associated with sizeable decreases in attainment. This effect was over twice as large an effect as the positive effect of using ICT for educational purposes identified above. In other words, it is not access or general use of ICT per se that will raise attainment, but rather how the technology is used that matters. The implication of this is that re-directing children's leisure uses of ICT towards educational purposes must be a priority.

- **Is there a relationship between pupils use of ICT at home for leisure purposes and their use of ICT for education?**

The more time pupils spend playing computer games, the less time they may have available for other tasks, including homework and study. Some children reported pretending to their parents that they were using the home computer for educational purposes when they were actually using it for 'fun'. Thus, pupils need to be made aware of the disbenefits of leisure uses of ICT and encouraged to adopt a more responsible attitude to home use of ICT for school work.

- **Does using ICT for leisure purposes have some benefits?**

A minority of parents argued that console games and non-educational computer games have developed particular skills in their children, such as making them think, or developing factual information about specific topics. However, it is hard to identify and measure these 'gains' because they are so embedded in pupils' everyday lives.

8.4 Why pupils do or do not use ICT at home for educational purposes

- **What are the drivers of ICT use for educational purposes out of school lessons?**

Pupils had positive orientations to technology because of its motivational qualities described above (e.g. made work more enjoyable, improved grades and so on) rather than because they were instructed

to use ICT in this way by teachers or parents. The subjects in which pupils (in years 6, 9 and 11) used computers at home for school work at least once a week were also the same subjects in which they believed that using a computer improved their grades and in which they had most home-based electronic resources.

- **What are the barriers to using ICT for educational purposes out of school lessons?**

These include: a lack of explicit instruction to do so by teachers; a lack confidence in how to use the technology; not regarding ICT as applicable to specific subjects; a lack of interest in particular subjects per se; the limitations of home-based ICT (e.g. 97% of children with access to broadband used the Internet compared to two thirds of pupils with dial-up access to the Internet); the limitations of ICT available at school out of lesson time (poor specifications, inability to customise school computers, frustrations of website filters and so on) a lack of time to use school based ICT out-of-lessons (because of limited equipment, its location, booking systems); and the limited appeal of school computer clubs. Here, there are clear implications in terms of addressing how schools deliver out of school ICT opportunities for their pupils in ways that make them more attractive for children.

8.5 Use of ICT to support home-school links

- **To what extent are schools using ICT to support the development of home-school links?**

Home school links (e.g. use of school intranet/websites; email links between home and school; advice and support from schools regarding appropriate hardware, software and web sites for children to use at home) were generally poorly developed. Children were often not aware whether their school had an intranet or not; were unable to access it because they had misplaced the instructions or passwords; or found the sites dull and not useful. Schools need to develop ICT to support home school links and to ensure that information about school intranets and websites are communicated more effectively to parents and children.

- **Do teachers set homework that requires use of a computer outside of school?**

The high level of computer ownership (89% in this study) suggests that the digital divide in terms of hardware is now so narrow that schools need to be developing children's home use of ICT for school work and redirecting their leisure uses towards educational purposes. Teachers were reluctant to do so because of concerns about digital divides between those pupils who have access to home based ICT and those that do not. Such approaches, however, are problematic because children, whether explicitly or implicitly, picked up the message that they should use ICT at home if they had access to it and thus were able to benefit from the advantages that it offered. As such, the digital divide is still there even though teachers did not explicitly set homework using ICT, it was just not acknowledged because pupils were using it

out of 'choice' rather than under teachers' direction. These findings suggest that there is a need for schools to acknowledge that a significant proportion of their pupils now use ICT for homework and that as such they need to develop its use and in doing so address digital divide issues. This means developing initiatives to support access to ICT for the minority of pupils (11% in this study) who do not have a home computer and to make information about how to support children's home use of ICT available to all parents rather than on an ad hoc basis to those motivated or knowledgeable enough to seek advice from teachers. It also means providing a range of opportunities in school for less ICT-confident pupils to develop their skills because children who are least likely to use computers outside of school for school work are less than half as confident at using a computer than those pupils who use computers outside of school extensively. Initiatives might include: extending the opening hours for computer and homework clubs; providing different types of computer clubs to support different types of user (e.g. girls clubs etc.); planning the location of ICT equipment around school sites to maximise pupils' out-of-lesson access; developing links with local libraries and Internet cafes to encourage children without home based ICT to take advantages of these opportunities to use the technology outside of school. There is also a need to develop models of good practice in terms of ICT use in subject specific areas, if teachers are in turn to model use for pupils in lessons across the curriculum. These proposals all have implications for resourcing and staffing.

- **Do teachers want to establish stronger ICT-based home-school links or are they resistant to the idea?**

Teachers interviewed in the study generally had a lack of understanding about what this might involve and were fearful about the potential impact on their time of establishing ICT home-school links, for example email contact with pupils or parents. None of the teachers interviewed had had training in developing and using home school links. Some also had concerns about security (in terms of giving out email addresses, child protection issues, spreading computer viruses and so on). There is therefore a need to clarify for teachers what would be involved and to reassure them in terms of their workloads/time management if they are to embrace training opportunities and opportunities to develop home-school links. Further attention to these matters is also needed in pre- and in-service teacher education.

- **Do pupils currently make use of school ICT services at home?**

Children made very little use of ICT home-school links. However, where school revision websites were used, they were highly motivational and their use could be promoted more widely by teachers. The majority of pupils did not email their teachers for help with school work. However, year 11 pupils' preference for using email and children's general interest in on-line communication suggests that these forms of ICT have the potential to be harnessed by teachers to support children's educational activities out of lessons.

- **Do parents currently make use of ICT based home-school links?**
Parents wanted: an email link with schools; help from schools in supporting children with school work using ICT and more information about what websites they should encourage their children to use. This is important because pupils were more likely to turn to their parents for help with using a computer for homework than a teacher; yet the ability of parents to help their children in this way varied widely according to whether they had developed ICT skills through training courses or using computers in their own occupations. Some parents were not confident or able to provide support for children's homework on a computer. Teachers were only providing guidance about ICT use to parents who approached them for help. In addition, pupils who had low levels of home support were also more likely to never use computers in some subjects (English, history and science). Schools therefore need to address, rather than implicitly reproduce, divides in home support and parents' ICT competencies (which is closely related to, but does not map directly on to class). However, when they did so by providing IT classes for parents after school, it was commonly those parents who already supported their children that attended. There is a need, therefore, to find ways of reaching 'hard-to-reach' parents. For example, family literacy and learning programmes should include sessions which address how parents can support children's use of ICT for school work.

8.6 Summary of implications

The educational use of ICT outside of school is positively associated with a modest effect on pupils' attainment in specific subjects, as well as being identified as bringing wider benefits including motivational effects, raising the self esteem and confidence of low achievers and enabling those with special needs or high achievers to demonstrate their ability. More importantly, leisure uses of ICT are positively associated with a negative effect on attainment. The implication of this is the need for schools to focus on pupils' patterns of ICT use, in particular, to redirect pupils' predominant interests in using ICT for leisure activities towards educational ends and more generally to extend pupils' educational uses of technology outside of the classroom.

The clear relationship identified in this study between subject specific use of ICT in the classroom and subject specific use of ICT for school work outside of lessons highlights the need for good scaffolding in terms of introducing children in the classroom to how technology can be used in specific subjects across the curriculum and showing them how this ICT use can be developed at home for school work.

Teachers in the study, however, were generally reluctant to explicitly ask children to use ICT for school work outside of school because of their concerns about digital divides in access to hardware and software. This is problematic because children, whether explicitly or implicitly, pick up the message that they should use ICT at home if they have access to it. As such, the digital divide in terms of the opportunity to use ICT (with the potential advantages and attainment gains it may bring) is still there even if teachers do not explicitly set homework using technology, it is just not acknowledged.

Teachers tend to provide support for parents on an ad hoc basis to those motivated or knowledgeable enough to seek advice so implicitly reproducing divides in terms of home support. Rather, schools need to develop initiatives (within school out of school lessons and with libraries and Internet cafes) to support access to ICT for the minority of pupils who do not have a home computer; to make information about how to support children's home use of ICT available to all parents; and to connect with 'hard-to-reach' parents who may be deterred from taking up ICT training opportunities at their children's school because of their own negative experiences of education.

More generally, home-school ICT links are poorly developed. Teachers in the study had not had training in developing home-school links, had limited understanding of what this might involve and were generally fearful about the potential impact on their time of using ICT in this way. Further attention to these matters is needed in pre- and in-service teacher education.

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