

ImpaCT2

Emerging Findings from the Evaluation of the Impact of Information
and Communications Technologies on Pupil Attainment

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Contents

Introduction	3
ImpaCT2 and the NGfL Programme	3
Evaluating the NGfL Programme	3
What is ImpaCT2?	4
Aims	4
The Research Design	4
Selection of research methods	4
The ImpaCT model of learning	4
Sample and timescale	6
Strand 1	6
<i>Analysis and interpretation of national test data in relation to school rating for ICT</i>	
Strand 2	7
<i>Development and use of innovative research methods to reveal how pupils use ICT out of school</i>	
Innovative methods of data collection	7
Teacher researchers	7
Pupil researchers	7
Link researchers	7
Pupil questionnaires	8
Concept Mapping	8
Special educational needs case studies	10
Strand 3	10
<i>Independent triangulated case studies</i>	
Emerging findings from the ImpaCT2 Study	10
Initial analysis of pupil questionnaires	11
Home use of ICT	11
The use of ICT in English, maths and science lessons	12
The use of ICT in school outside lesson time	12
Initial interpretation of the data gathered	13
Pupils	13
Teachers	13
Curriculum	14
Resources	14
Some specific issues relating to the Internet and safety	15
Further tasks and analysis to be undertaken	15
References	16
Glossary	16
Acknowledgements	16

ImpaCT2

Introduction

ImpaCT2 and the NGfL Programme

The National Grid for Learning (NGfL) is the Government's key initiative to stimulate and support the use of ICT to improve standards, and to encourage new ways of teaching and learning. The NGfL seeks to involve learners, the education and lifelong learning services, industry and local government in a vision focused on three key areas:

- Stimulating the development of high-quality online and offline digital content relevant to the UK education system, and developing an accompanying Internet portal – the NGfL web site (at <http://www.ngfl.gov.uk/index.html>).
- Ensuring that schools and other educational institutions have the means to access and use these resources effectively.
- Providing teachers with appropriate training opportunities so that they are able to incorporate the use of these technologies and resources into their everyday teaching.

Since it was launched in 1998, the NGfL web site has grown to over 362,174 unique indexed documents. Resources for teachers include the VTC (Virtual Teacher Centre) and the Teacher Resource Exchange to which teachers are invited to contribute lesson ideas. The needs of pupils are also addressed, for example in the Grid Club, which provides a safe but stimulating range of activities and information for 7–11-year-olds.

Substantial funding has been made available to schools so that they can take advantage of communications technology and the resources it makes available through the Internet. A programme of professional development for teachers is also under way to help ensure that they are both competent and confident to use ICT. This is funded by the New Opportunities Fund (NOF).

The NGfL programme has links with several initiatives to raise standards in teaching, learning and administration, including Excellence in Cities, Education Action Zones, Technology Colleges and the Information Management Strategy.

Evaluating the NGfL Programme

The NGfL programme underpins the Government's vision for transforming education. Evaluation is being undertaken using a variety of techniques, both qualitative and quantitative, and at both national and local level.

ImpaCT2 is a part of this overall evaluation. It is a major longitudinal study (1999-2002) involving 60 schools in England, and its aims are to:

- identify the impact of networked technologies on the school and out-of-school environment
- determine whether or not this impact affects the educational attainment of pupils aged 8–16 years (at Key Stages 2, 3, and 4)
- provide information that will assist in the formation of national, local and school policies on the deployment of ICT.

To achieve these the ImpaCT2 evaluation will also:

- devise methods of assessing pupils' attainment
- devise a framework for measuring the ICT environment.

Research is being undertaken jointly by teams from the University of Nottingham, the Open University and Manchester Metropolitan University. A full report of the project will be published in 2002, and will be available from Becta, which is managing the evaluation on behalf of the Department for Education and Skills (DfES). The research web site is at <http://www.nottingham.ac.uk/education/research/impact2.html>.

In addition, the School of the Future reports also investigate linkages between ICT and attainment. These reports are available as printed documents from Becta *Primary Schools of the Future – Achieving Today*, *A Report to the DfEE*, and *Secondary Schools of the Future – Achieving Today. A Report to the DfEE*. They are also available on-line at <http://www.becta.org.uk>.

The **NGfL Pathfinders Evaluation** is another important strand of the NGfL evaluation strategy, which centres on ten LEAs identified as following innovative ICT strategies. The evaluation began in 1999. Emerging findings, which will help to inform good practice, are published at <http://www.becta.org.uk/supportproviders/buildingthegrid>.

A range of other products will be published from the NGfL Research Programme over 2002. *Further information on the NGfL programme is available at <http://www.ngfl.gov.uk>; details of projects managed by Becta are available at <http://www.becta.org.uk>.*

What is ImpaCT2?

ImpaCT2 is one of the most comprehensive investigations into the impact of ICT on attainment so far conducted in the UK. This large-scale evaluation study, funded by the DfES and managed by Becta, can be seen in the context of a wider evaluation of the National Grid for Learning (NGfL) Programme. The NGfL underpins the Government's vision for transforming education¹, and for securing economic success². The ImpaCT2 study extends over three years (1999-2002) and its purpose is to make an independent evaluation of the impact of ICT on children's achievement in a representative sample of schools in England.

Aims

ImpaCT2 is a longitudinal study (1999–2002) involving 60 schools in England. Its aims are to:

- identify the impact of networked technologies on the school and out-of-school environment
- determine whether or not this impact affects the educational attainment of pupils aged 8–16 years (at Key Stages 2, 3 and 4)
- provide information that would assist in the formation of national, local and school policies on the deployment of ICT
- devise methods of assessing pupils' attainment
- devise a framework for measuring the ICT environment.

Becta managed the selection and appointment of a consortium of universities to undertake the research. The research design of the ImpaCT2 evaluation study has been informed by two technical seminars involving experts within the research community. The study has gained significant interest within the research community at home and abroad.

The research design

Measuring the impact of ICT on standards of pupil attainment on this scale is unusual but not unprecedented. In 1993 the Department for Education and Science commissioned a study called Impact from King's College London³. This evaluated the effects of ICT on children's achievements in primary and secondary schools and involved 2,300 pupils in some 19 LEAs. This study suggested that for some subjects and age groups, and in certain conditions, pupils in 'High IT' classes (defined in terms of access to computers and appropriate software, together with a curriculum plan that would integrate their use in lessons) could achieve a 5 per cent gain in public examination results.

The ImpaCT2 model of learning

ImpaCT2 is an innovative study because it combines traditional and new research methods on a very large sample of more than 2000 pupils. Before the main study started it was important to identify what was needed and thus two preliminary studies were carried out in 1999. The first of these reviewed the relevant literature, including 102 published studies of ICT and attainment in order to develop and combine appropriate and rigorous methods for measuring attainment. The second study focused on devising new methods of measuring the impact of ICT on the wider learning environment, including homes. This study also considered methods of identifying any additional learning gains that may not be reflected in national tests currently used in schools. These two complementary approaches have continued in the main ImpaCT2 study.

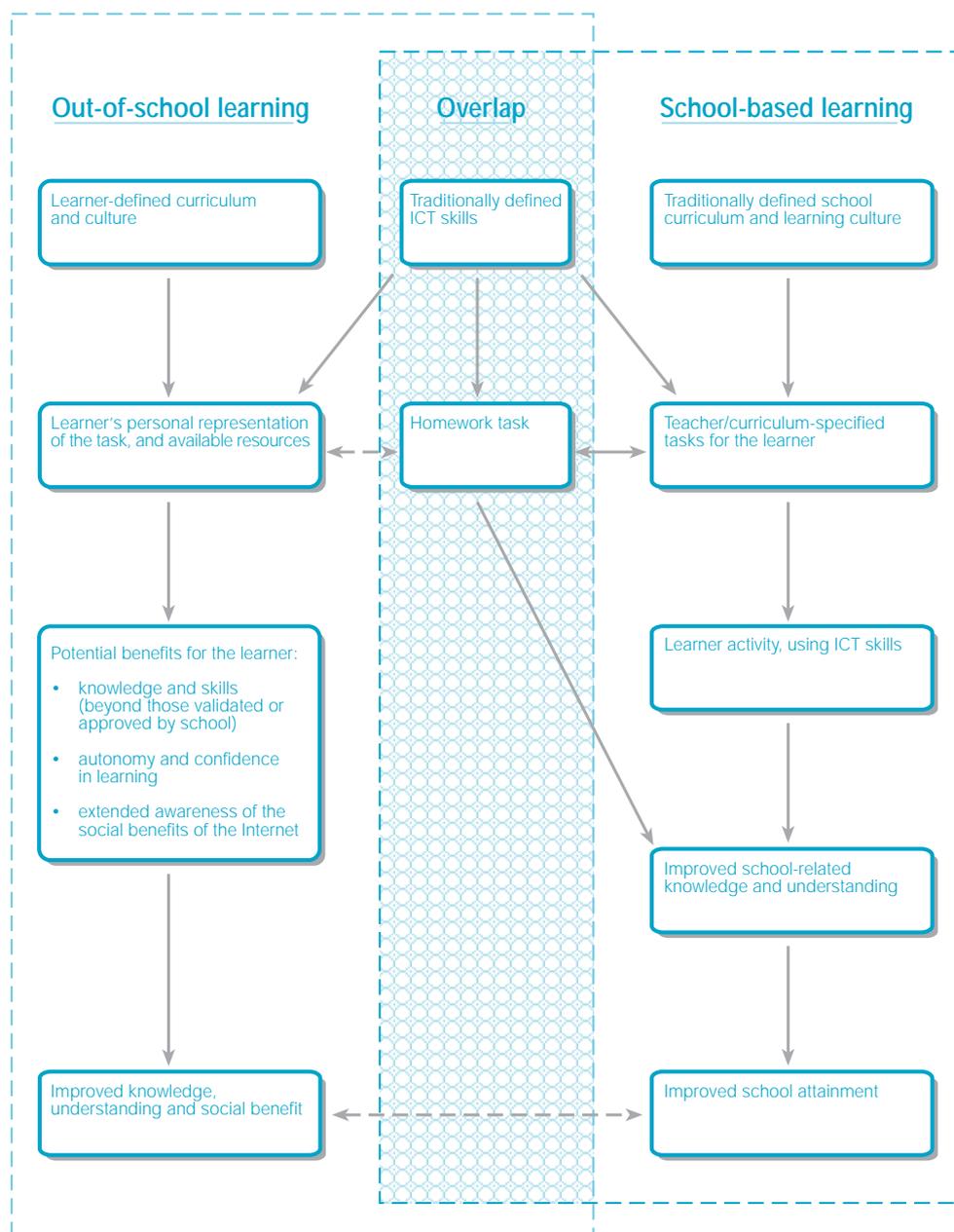
As a result of considering both the traditional and wider learning environment, the researchers developed a new way of representing learning using ICT. Because this model recognises the importance of the wider social context in which learning takes place, it was called the Socially Contextualised Integrated Model of Learning.

¹ As set out in the DfES White Paper 'Schools – Achieving Success', 2001

² As set out in the joint DTI/DfEE White Paper 'Opportunity for all in a World of Change', 2001

³ Watson, D.M., *The Impact Report: an evaluation of the impact of information technology on children's achievement in primary and secondary schools*, Department of Education and King's College London, 1993

The Socially Contextualised Integrated Model of Learning (SCIM-L)



The model places pupils' learning both within the influences of the traditional school-based environment, and in a wider social context. It demonstrates that ICT experience in school is only part of a larger picture of pupils' interaction with networked technologies. Little is known about how learning occurs in this wider context. ImpaCT2 aims to investigate the inter-relationship between these school-based and out of school learning experiences.

The University of Nottingham is leading the research in collaboration with Manchester Metropolitan University, the Open University and the University of Leicester. The preliminary studies and the Interim Report 2001 can be obtained from <http://www.becta.org.uk/impact2>. A final report will be published in Spring 2002.

The sample and timescale

ImpaCT2 is studying the attainment of 2,179 pupils in 60 schools, of which 30 are primary, 25 secondary and 5 are special. Schools were selected to provide a representative sample of pupils from different socio-economic groups, and their geographical spread in England includes urban, suburban and rural areas.

The researchers divided the schools into two groups using information made available by Ofsted. Ofsted identified one group as having a high quality of ICT provision. By contrast, the second group had an average ICT provision. No schools with a low rating for ICT were included because such schools would often be focused on other urgent school improvement measures. The researchers decided that sufficient information could be obtained from a comparison of the 'high' and 'average' schools to indicate the effect of this factor on pupils' attainment.

Researchers have collected additional evidence on the level of ICT provision and usage in the schools in two ways: through visits to schools over a period of 18 months, and through data derived from a pupil questionnaire.

Categorisation of ICT

The 'high' and 'average' categorisation of ICT in schools is consistent with Ofsted's judgement of the following features:

- Adequacy of ICT resources
- Ethos for learning with ICT
- Pupils' attitudes to ICT
- Attainment of ICT skills by pupils
- Quality of ICT teaching

In each of the 60 ImpaCT2 schools, teachers selected 25 pupils from each key stage (KS) as a representative sample of the children in their schools in terms of ability, gender, ethnicity and socio-economic status. Data was collected on 25 pupils from each key stage over a two-year period as follows:

- KS2 (Year 5 in 1999/2000, progressing into Year 6 in 2000/01)
- KS3 (Year 8 in 1999/2000, progressing into Year 9 in 2000/01)
- KS4 (Year 10 in 1999/2000, progressing into Year 11 in 2000/01).

Strand 1

Analysis and interpretation of national test data in relation to school rating for ICT

The research question for this strand of the study has been an examination of how pupils' learning has been enhanced as a result of exposure to ICT. This aspect of ImpaCT2 measures attainment against predictions derived from baseline tests of vocabulary and mathematics administered at the beginning of the key stage. This gives value-added data that can be related to pupils' use of ICT both in school and at home. This data will be further analysed in terms of gender, ethnicity and socio-economic factors, and cross-referenced with data from a suite of parallel research enquiries.

Historical test data for individual pupils has been extrapolated to indicate predicted performance. Actual performance will then be compared with the predicted test results in the light of the impact of a school with high or average ICT ratings. The purpose of this analysis is to measure whether effective use of ICT by a school can enhance pupils' attainment.

ImpaCT2 is making use of baseline data including PIPS (Year 4) and YELLIS (Year 10) scores held by the Curriculum Evaluation and Management (CEM) Centre in the University of Durham. The CEM Centre has provided value-added information for schools and colleges since 1983, and now holds data on a third of the pupils currently in schools in England. End-of-key-stage residual scores for each pupil in the ImpaCT2 schools are being related to their reported use of ICT in core subjects (at KS2 and 3) and in all GCSE courses (at KS4).

Data is being analysed at individual, school and age group level. Separate analyses are being carried out for each curriculum subject, within and across schools. The analysis will contrast schools by ICT usage and will be informed by Ofsted's categorisation of Average (a score of 4 on the 7 point Ofsted scale) and High-ICT school (a score of 1-3 on the 7 point Ofsted scale). It is likely that schools scoring more than 4 would be focused on dramatic improvement across the curriculum and consequently high and average schools provide the best opportunity to study the effects of ICT over a long period.

Strand 2

Development and use of innovative research methods to reveal how pupils use ICT out of school

The two research questions for this strand are 'What are pupils doing with ICT out of school?' and 'What are pupils learning about ICT out of school?'.

ImpaCT2 has developed new methods and research instruments to capture the impact of the wider environment on pupils' learning, to provide information, insights and examples of best practice to help policy makers, teachers, parents and governors decide how improvement can be made most effective.

National tests (GCSEs and end of key stage Standard Attainment Tests) were not devised to capture the holistic picture of how learning takes place, and how use of ICT at school and at home can contribute to pupils' attainment. Consequently it is not surprising that these tests tell us very little about how pupils experience ICT, and are not useful when we try to find answers to these two research questions.

The research design of ImpaCT2 includes new ways of gathering evidence about pupils' use of computers at home and how they perceive and experience networked technologies outside school. It allows the researchers to gather evidence that may not have been forthcoming via conversation between adults and children. This will provide insights on the way learners communicate and handle new information and how they are using ICT as a tool for thinking and constructing knowledge. It will also provide a better understanding of the way in which this learning affects school performance.

The ImpaCT2 research design uses complementary methods to gather and compare data to ensure validity and reliability. For example, by comparing data from the different sources outlined above it is possible to build up a picture that includes pupils' and teachers' interpretations of ICT use in the wider learning. This picture is then moderated with findings from interviews and classroom observations made by Link Researchers from one of the three universities involved.

Innovative methods of data collection

New approaches of obtaining data include:

- teacher researchers
- pupil researchers
- link researchers
- a pupil questionnaire
- a Concept Mapping task.

Teacher Researchers

ImpaCT2 has taken the innovative step of identifying a Teacher Researcher (nominated by their headteacher) in each school, who has been allocated a laptop computer for the duration of the project in order to collaborate with the main research team in data collection. The Teacher Researcher works as a co-researcher with specific responsibility for collecting data from their school and from the representative sample of 25 pupils at each key stage. In addition, they produce a monthly electronic report of interesting practice in ICT at their school, and conduct focus groups with other members of staff. Each school has received funding for supply cover so that the Teacher Researcher can attend ImpaCT2 training days or conferences, and gather the data from their school.

Pupil Researchers

In order to obtain more detailed information on how children are using networked technologies in school and out of school, the Teacher Researchers in each school selected a small group of five Pupil Researchers whose role was to carry out two of four tasks. In each school, all five Pupil Researchers were asked to complete a weekly log of ICT activity at home and school, and selected one of three other tasks. Data gathered by Pupil Researchers can then be triangulated with data gathered by other methods (such as interviews with teachers and statistical data on KS tests) and is therefore verifiable.

The four tasks for Pupil Researchers were as follows:

- Log books – to track pupils' use of ICT during a typical week (all Pupil Researchers carry out this task)
- Special report – a detailed focus on a particular piece of work in which ICT, particularly networked technologies, was used
- Internet questionnaire – to identify when, where and how pupils make use of the Internet
- Interviewing – pupils interview other pupils of their own age to elicit, record and interpret data on the use of ICT, specifically the Internet, mobile phones and electronic games.

Link Researchers

Link Researchers are professional researchers from the three universities contributing to ImpaCT2. Each Link Researcher is responsible for liaising with a cluster of participating schools most local to them, and for supporting both the Teacher Researchers and the Pupil Researchers in those schools. Their role is to guide and train them in the methods to be used in the study. Each Link Researcher makes several visits to each of their schools and interviews teachers, senior managers and pupils. Classroom

observations are carried out along with pupil focus groups to gather first-hand information. Link Researchers stimulate emerging insights from Teacher Researchers by setting specific tasks for monthly reports, then collate and analyse the data collected by the teachers and pupils.

In addition, the Link Researchers have selected six schools, representative of the total sample, for more detailed case studies. This enriches and strengthens the triangulation of data gathered by different methods and from different sources.

Pupil Questionnaires

A pupil questionnaire was used to collect data from each school on computer ownership, access to ICT in school and in the home, and the extent and nature of ICT activity in school.

Teacher Researchers first administered this questionnaire in autumn 1999 to the 25 children in each key stage selected as representative of children in the school as a whole. The same questionnaire was then administered at the end of the key stage in summer 2001 to track the changes over time.

Two versions of the pupil questionnaires were distributed, appropriate for different key stages. The KS4 version was essentially the same as that produced for the younger pupils (KS2 & 3) but instead of having curriculum content focused only on the core subjects of English, maths and science, pupils were given an opportunity to record ICT activity in all of their GCSE subjects.

The questionnaire gathers information about the use of ICT both inside and outside the classroom, including breakfast clubs, lunchtime clubs, after-school clubs and the library. It also quantifies the use of ICT in the home, including computer and Internet activity, and use of mobile phones and games consoles (because many children differentiated between electronic games on a games console and electronic games on a computer). A total of 2179 responses were received to this questionnaire.

Concept Mapping

Psychologists believe that throughout our lives we use tools to help us to think about the world and understand it. We develop mental representations of ideas to help us to function in a complex and ever changing world. Thinking is invisible and hidden from others, so tools such as pictures and language were developed to help us communicate with each other. Verbal and visual communication tools such as drawings and photographs

also help individuals to reflect on a complex idea, and change or adapt this in the light of new information.

Although books are now familiar tools to capture and stimulate our thinking, when they were first invented they revolutionised access to information and also the rate at which people could communicate new ideas and knowledge. ICT is a new tool and, as with all new tools, we do not yet know if the tool itself changes our way of thinking about the world. Both adults and children use ICT to help them think, to analyse complex information, and sometimes to organise and present ideas. In this sense we do not yet understand how ICT – used as a tool for thinking – can change the ways in which children think about the world and construct ideas about it.

Concept Mapping

This research technique is known as Phenomenography. The analysis of the Concept Maps is based on research that suggests that it is possible to identify characteristically different ways in which an object or an experience is discerned. These different ways of experiencing objects significantly affect the way an individual understands the world.

In this instance it is used to identify a small number of qualitatively different ways in which children experience, and think about, networked technologies in their world. The criteria for analysis are derived from detailed scrutiny of the Concept Maps using a procedure called 'constant comparison of data'. This consists of checking each new Concept Map against the criteria that have begun to emerge from analysis of previous Concept Maps and continuously refining/updating the criteria to achieve the best possible 'fit' with the Concept Maps as a whole. The criteria are then used to carry out quantitative analysis of the Concept Maps for correlation with Strand 1 data. Two independent researchers are using an agreed procedure and criteria for reliability to analyse the maps:

1. nodes (each object counted as one)
2. links (links emanating from each node counted and totalled)
3. connectivity (number of links divided by number of nodes)
4. spheres of thinking (purposes of ICT e.g. communication, information, control, music, images)
5. zones of use (locations e.g. home, school, work, hospital, shopping, banking, transport)

The Concept Maps elicited by ImpaCT2 consist of drawings or icons to represent objects, linked together with lines to show connections, rather than being constructed of words in boxes with text links. The Concept Mapping task requires pupils to spend 20 minutes 'drawing' a map of 'Computers in my world'. During the last five minutes of the task, pupils are asked to list the items they have drawn, to help the researchers interpret and analyse the map. In addition, another opportunity to check the validity of these maps is provided by reference to a second task to write about computers for a 'visitor from another world who has never seen one'.

Concept Maps are a valuable method of recording pupils' perceptions of how they experience ICT and networked technologies in the wider environment, including both home and school. Their primary purpose is to help the researchers understand:

- how children learn about ICT (how it works and how to use it well) and
- how they learn with ICT (using it as a tool to understand the world around them).

All 2179 pupils involved in the ImpaCT2 study carried out the Concept Mapping task in June 2000 and repeated it in June 2001 (earlier for 16-year-olds). These maps are in the process of being analysed by two independent researchers and compared with other data emerging from complementary sources and methods used in ImpaCT2. When the data analysis has been completed, the researchers will have information on how children's concept maps develop over one year of schooling and the ways in which an understanding of how computers can be used relates to achievement in school. The Link Researchers interviewed a sample of pupils about their Concept Maps to confirm the reliability of the data communicated by Concept Maps with Pupil Researchers in the ImpaCT2 schools. The accuracy of the interpretation of findings can be further corroborated by reference to the pupil questionnaires. Initial analysis confirms that most pupils (80 per cent) have access to ICT at home. Some pupils get Internet access outside school by going to the home of a friend or to an Internet café, libraries or other community resources. This is consistent with findings from other sources, both within ImpaCT2, and research from other projects that report similar patterns of home usage of ICT.

Perhaps the most exciting potential lies in how Concept Maps might provide information and insights on what children learn through their use of ICT and how new knowledge can be constructed and shared. Concept

Maps have the potential to inform teachers and parents about the most engaging and appropriate learning experiences from the child's perspective. Consequently, ImpaCT2 will provide valuable insights to inform new conceptions of teaching and learning.

Special Educational Needs Case Studies

Each of the five special schools in ImpaCT2 has a unique approach to ICT, which derives from the particular needs of its pupils. There is little commonality between them, but a good deal of interesting practice which merited deeper analysis. The researchers decided that case studies would be the best way to capture and communicate this and five case studies of interesting practice in schools for pupils with very different special educational needs will be compiled during autumn 2001.

Strand 3

Independent Triangulated Case Studies

In addition to the work being conducted in Strands 1 and 2, a further strand of the research involves an independent team of researchers from the University of Leicester.

The team will be carrying out 15 case studies of a representative sample of primary, secondary and special ImpaCT2 schools. These will use new techniques including video diaries, and electronic journals of ICT practice created by pupils and teachers. Case studies will be created in summer and autumn 2001, and will enrich the emerging picture of how pupils are using ICT in the home and in other informal learning environments.

Emerging Findings from the ImpaCT2 Study

The interim findings described here are derived from analysis of quantitative and qualitative data gathered by ImpaCT2 during 1999 and 2000. A richer and more comprehensive picture will emerge when these results can be compared with data on the end-of-key-stage achievement gathered in summer and autumn 2001. Data relating pupils' ICT use at school and at home to end-of-key-stage achievement will not be available until October 2001, but some findings on ICT activity have already emerged.

Data from pupils' logs shows that the majority of pupils spend more time using ICT at home than at school. Initial analysis of 280 pupils' logs indicated that primary school

pupils spent three times longer on ICT at home compared with school. Secondary pupils spent four times longer using ICT at home compared with at school.

A significant finding from monthly reports from Teacher Researchers is that the integration of ICT into subject teaching depends upon teacher confidence and skill and varies widely within a school. Observations of lessons by researchers in ImpaCT2 endorse this view.

In relation to this point, the spatial organisation of computers within the school influences flexibility in teacher and pupil usage. The ideal situation appears to be to have both ICT suites and clusters of computers in the classroom, with dedicated subject-related software with which teachers are both confident and familiar.

The sources of research data

Pupil questionnaires, administered to 2179 pupils by Teacher Researchers

Monthly reports on ICT practice in school and at home, written by Teacher Researchers (acting as co-researchers and supported by a Link Researcher from one of the universities)

Reports of focus groups in ImpaCT2 schools by Teacher Researchers

Concept Maps drawn by 2179 pupils; this task was administered in each school by the Teacher Researcher

Data collected by Pupil Researchers – at each of the key stages, between 10 and 20 Pupil Researchers were chosen by the Teacher Researcher to collect data from other pupils taking part in the ImpaCT2 study, including:

- A weekly log of ICT activities at home and at school (completed by approximately half of the Pupil Researchers)
- A special report describing a piece of schoolwork where ICT and networked technologies were used
- A questionnaire to identify when, where and how pupils used the Internet
- Interviews with other pupils: each individual interview was tape-recorded and transcribed by the Pupil Researcher who then submitted it to their Link Researcher for analysis alongside other data; this was a unique feature of ImpaCT2 and captures and records how peers talk to one another about using ICT.

Initial analysis of pupil questionnaires (1999)

The initial interpretation of the data gathered throughout 1999 and 2000 is necessarily tentative and incomplete at this stage. Findings will need to be corroborated by further research and analysis. However, at this stage the ImpaCT2 study reveals some important insights of value to parents, teachers, governors and policy makers about the kinds of activities that children value and that play a large part in their daily lives.

Home use of ICT

Initial analysis of this data reveals the following:

- In response to the question “Do you have a computer at home?” the percentage of pupils claiming to have a home computer ranges from 75 per cent at KS2 to 88 per cent at KS4.
This suggests that some parents may be choosing to purchase a home PC as pupils approach their GCSE exams
- At KS3 there is a statistically significant difference in ICT used at home, between schools categorised as ‘high’ and ‘average’ in ICT resources and attainment. Home computer ownership is 7 per cent higher in the schools in the ‘high’ ICT category. No significant differences are evident at KS2 and 4.
This may indicate that schools in the high ICT category may have a positive influence on whether parents purchase a home computer
- In response to the question “Do you have access to the Internet at home?”, 48 per cent of primary pupils and 64 per cent of secondary pupils reported having Internet access from a computer in their home. There are no statistically significant differences at any key stage between schools categorised as high and average in ICT resources and attainment.
This suggests that some parents make the Internet available at home as pupils approach GCSE course work tasks
- In response to the question “Do you have your own e-mail address?”, 52 per cent of primary pupils and 67 per cent of secondary pupils reported having a personal e-mail address. No distinction was made between home and school e-mail addresses. Possession of a personal e-mail address is 24 per cent higher in the schools in the high ICT category at KS3 and 20 per cent higher in schools in the high ICT category at KS4. No significant differences are evident at KS2.
This suggests that high ICT schools encourage or make available, e-mail addresses for pupils, particularly at KS3

- In response to the question "Have you created your own web page?", 14 per cent of pupils at KS2 and 22 per cent at KS3 say they have created web pages and this increases to 67 per cent at KS4.

This suggests that a big increase in experience of web page creation is directly attributable to GCSE course work requirements

- At KS2 and KS3 there is a statistically significant difference in the number of pupils who have created their own web page between schools categorised as high and average in ICT resources and attainment. Experience of creating a web page is 8 per cent higher amongst pupils in the schools in the high ICT category at KS2 and 6 per cent higher in schools in the high ICT category at KS3. No significant differences are evident at KS4.

This suggests that high ICT schools provide opportunities for pupils to create web pages at earlier ages

- In response to the question "Do you have your own mobile phone?", 19 per cent of KS2 pupils, 49 per cent of KS3 pupils and 60 per cent of KS4 pupils reported ownership of a mobile phone.

The use of ICT in English, maths and science lessons

Preliminary findings suggest that more ICT in lesson time is experienced by students in high ICT schools, compared with those in average ICT schools.

The data also reveals more ICT activity in English and science at KS3 than in maths, and more ICT activity in maths and science at KS4. In response to the questions about ICT use in different subjects in lesson time and outside formal lesson time, pupils were asked to respond on a 5-point scale.

The 5-point Scale

On this scale 1 was low and 5 was high. Pupils could tick:

- 5 if they used ICT for schoolwork every week
- 4 if they used ICT most weeks
- 3 if they used ICT some weeks
- 2 if they hardly ever used it
- 1 if they never used ICT.

The use of ICT in school outside lesson time

- There are significant differences at KS2 in the amount of ICT used in school but outside lesson time in high ICT schools, compared with average ICT schools. This

includes pupils' use of computers at breakfast clubs, lunchtime and homework clubs, and also includes use of ICT in the library or open-access areas outside lesson time. There is a similar picture at KS3, also in favour of pupils in high ICT schools. These early findings indicate that ICT activity reaches a peak in KS3 and falls away as GCSE examinations approach in KS4. It suggests that tried and trusted methods of preparing for examinations are favoured currently.

This suggests that high ICT schools provide more opportunities for pupils to use ICT outside lesson time. The drop in ICT activity in school at KS4 could suggest two possible influencing factors:

1. GCSE exam pressures limit the amount of ICT in school at KS4
2. When the pupils have been given a head start at KS3 their experience and skill enable them to do work at home at KS4

An analysis of the data in relation to socio-economic factors reveals that:

- There is no significant difference in access to a computer at home at KS2. However, there is a significant difference in access at home at KS4. This ranges from 80 per cent for the lowest ranked to 97 per cent for the highest ranked social group (based on socio-economic data collected by the University of Durham CEM Centre on each pupil). There is currently no socio-economic data available for KS3 but this will be included in the final report due to be published in 2002.
- There was a strong relationship between access to the Internet at home and socio-economic status. This ranges from 18 per cent for the lowest ranked to 54 per cent for the highest ranked social group at KS2, and from 45 per cent to 82 per cent at KS4. *This suggests that the high cost of UK Internet access is an issue where the digital divide is linked to socio-economic status*
- There were no significant differences in mobile phone ownership across social groups at KS3 and 4. *This suggests that although there may be some differences in mobile phone ownership in KS2 this is an insignificant factor for older children*

Initial interpretation of the data gathered

Link Researchers have visited all the schools. They have interviewed teachers, senior managers and pupils in each school, observed lessons and held pupil focus groups. Although further data has yet to be collected and analysed, some patterns have emerged from these early findings and are reported below. The analysis falls into four main headings: pupils, teachers, curriculum and resources.

Pupils

- The majority of pupils have a rich ICT experience at home, predominantly on the Internet and with games. This is based on evidence from weekly logs of ICT activity, and interviews with other pupils conducted by Pupil Researchers with their peers.
- The early findings indicate that pupils who use a computer at home also use them in school more frequently and with more confidence than pupils who have no home access.
- Pupils report some frustration with the ICT curriculum in school. It seems that teachers underestimate the ICT capability of pupils. This is not just in terms of pupils' skills but also in their discretion about how, when and why to use ICT. Evidence from observed lessons in secondary schools suggests that some teachers focus on teaching skills that most pupils already possess.
- Current KS3 pupils are perceived by the research team to have had richer experiences of ICT than current KS4 pupils, and each new intake seems to be more skilled than the previous cohort. Pupils are generally enthusiastic about using computers, which they perceive as helping them to learn.
- There are some indications of a digital divide in that there is less reported access to a computer at home in lower socio-economic status families at KS4 (although there is no difference at KS2).
- There are some indications of a digital divide in the type of software packages purchased and used in the home. Higher socio-economic groups perceive educational software as valuable and purchasing patterns appear to reflect this. This may also relate to difference in the availability of disposable income.
- Equity issues are being addressed in a number of secondary schools – by providing separate access for boys and girls, and also extending the school day for those pupils who do not have access to ICT at home.

Teachers

- Reports from Teacher Researchers and focus groups for teachers in ImpaCT2 schools indicate that many teachers have yet to develop confidence and competence in ICT.
- There has been reticence about NOF (New Opportunities Fund) training because of its high demands on teachers' own time. The level of NOF training was reported to be inappropriate for many teachers who had not yet acquired basic skills in ICT.
- Teacher Researchers report that having a computer at home has a significant impact on teachers' ICT capability. Teachers who have access to a relatively new computer at home (one that can handle multimedia and web graphics) report growing confidence and competence.
- Relating ICT capability to teachers' pay seems to have had a positive impact. Teachers' motivation to use ICT effectively in lessons may be enhanced by threshold payments.
- Teachers do not appear to be negative towards ICT, but many do not yet use ICT confidently in their lessons. Classroom observations indicate that relatively few teachers are integrating ICT into subject teaching in a way that motivates pupils and enriches learning or stimulates higher-level thinking and reasoning.
- ICT co-ordinators report working very long hours to develop whole-school ICT policy and practice; often there is little or no compensating reduction in their teaching load.
- A positive effect occurs where headteachers are enthusiastic and visionary about ICT, and can be creative with funds, resources and expertise. Teachers report a positive impact when senior managers in school, not just ICT co-ordinators, lead by example.
- Provision of adequate time for appropriate software training and departmental policies to integrate ICT into specific subjects has a positive effect.
- Many teachers, particularly in secondary schools, commented on how ICT changes the teaching process and particularly the role of the teacher, who can take on a more facilitatory role.
- Recruitment and retention of specialist ICT staff in secondary schools is difficult.

Curriculum

- The degree to which ICT is embedded in subjects varies greatly, sometimes within a school.
- In some subjects ICT is used more frequently and in greater depth than in other subjects. The extent of ICT use in the curriculum appears to be dependent on the individual teacher. Pupils can have very different experiences across different schools and subjects.
- Classroom observations indicate that when teachers use ICT in lessons (such as English, science or history) they often focus on basic rather than higher-order thinking and reasoning skills. Link Researchers report that the use of the computer for 'copying out in best' is still common, and this practice misses the greater potential for learning.
- Many schools are using the Qualifications and Curriculum Authority's (QCA) ICT schemes of work at KS2 and 3 to good effect.
- National literacy and numeracy projects, and end of key stage assessment procedures appear to have reduced the time available for ICT in some primary schools, to the extent that there is less ICT in Year 6 than in Year 5.
- Many schools are using the Internet to make global links by e-mail with other schools and use World Wide Web sites for research.
- Primary schools are teaching ICT skills separately. At KS2 this approach seems to have a positive impact.
- Most secondary schools teach ICT as a separate subject. ICT is also used within other subjects. Ideally both approaches are complementary and conflicting pressures on the school timetable need to be considered.
- The examination pressures on the curriculum in KS4 constrain the opportunities for ICT use.
- In the schools sampled, it appears that video conferencing is problematic technically and financially. This affects its general usefulness in teaching and learning.
- Some schools have invested in interactive whiteboard technologies and others are considering this step. In many instances teachers and pupils have very positive comments on the learning potential of whiteboards.
- Senior staff need to lead and shape an ICT-using ethos in a school, otherwise ICT will continue to be seen as a separate subject.

Resources

- ICT use is detrimentally affected by lack of sustainability of funding for equipment. The available technology changes so rapidly that it is difficult to keep up to date and purchase new reliable hardware and software.
- Sustainable funding for technical support and ongoing staff training is crucial for long-term positive impact.
- Resources and guidance to enhance the spatial organisation of ICT suites, and provide more flexibility in pupil usage, are critical factors for success.
- Technology College status can make a great difference to the resourcing of a school.
- Interactive whiteboards have the potential to be used very effectively in learning and teaching; some observations indicate that at present they are not yet used to their fullest potential and tend to be used primarily for demonstrating how to use software.
- Many schools already have, or are planning, ICT suites. The ideal situation is to have both dedicated ICT suites and clusters of computers in classrooms. This relates to the need to integrate ICT into subject lessons. Many teachers say they would prefer a cluster of dedicated computers running subject-specific software to be available in their department. This may also help to overcome the problem of timetabling access to dedicated ICT suites. In all schools, demand for ICT equipment continues to outstrip availability.
- Most schools have networked machines or are moving towards this.
- There is a need to sustain and resource technical support in schools. ICT co-ordinators need technical understanding of networks; those responsible for large networks feel that they need network managers.
- Some teachers have high hopes of the flexibility offered by wireless networking technologies of the future.
- School networks vary considerably in effectiveness. Some have been professionally installed; others have been built by teachers. Cost is not the only influential factor. Fitness for purpose is vital and many good ideas could be disseminated more widely for general benefit.
- Reports from Teacher and Pupil Researchers indicate that Internet access is perceived as being too slow in

most schools. Pupils report frustration because access from home is much faster and is less restrictive.

- Poor pupil:computer ratios restrict opportunities to practise skills in some primary schools.
- The age and incompatibility of different brands of computers limit the possibilities for networking them and running new software. Continual updates of commercial software can be problematic because new versions often require more memory (RAM) than older versions.
- Although some Apple Macs and a few 'legacy' Acorns were reported in ImpaCT2 schools, nearly all are now purchasing PCs. Since it is impossible to network computers of different types and ages effectively, this is a positive step.
- However, some teachers report concerns that market dominance may have a negative effect on commercial innovation. The fitness of a computer for its purpose to assist learning should still be considered.
- Some secondary schools are creating intranets with subject-specific areas, partly owing to bandwidth issues and partly in order to exercise a degree of control over access. This can increase speed of access when combined with strategies such as local caching of popular web sites on a server.

Some specific resource issues relating to the Internet and safety

- Use of the Internet is often highly structured in lesson time, with visits to specific sites rather than free searches. Safety issues dominate at present.
- Many primary schools do not make access available to the Internet outside lesson times.
- Teachers increasingly perceive the Internet as making learning and communicating more 'global'. The quality and appropriateness of web resources is an important issue for teachers, pupils and parents.
- In many schools, access to ICT in general and the Internet in particular is restricted owing to resourcing levels and bandwidth problems. These technical issues restrict the volume and speed of access. In some schools the Internet is still not fully available for pupils.

Further tasks and analysis to be undertaken

Further qualitative and quantitative data analysis and interpretation are under way and will be published in the final ImpaCT2 report in 2002.

The analysis of the first batch of Concept Maps drawn by pupils is being undertaken by two independent researchers. Additional data will be collected from follow-up interviews with a sample of pupils and by additional case studies. A further round of questionnaires, Concept Maps and interviews is taking place during summer 2001. When comparisons have been made between the two sets of Concept Maps it will be possible to make inferences about the changes in pupils' awareness and experience of networked ICT over a 12-month period.

As a result of initial analysis of work carried out by Teacher Researchers and Pupil Researchers, the Link Researchers have selected six schools for more detailed case study. The sample has been selected to represent the diversity of influential factors and includes primary, secondary, rural, urban, mixed ethnicity and gender and social economic status.

The five special schools included in the ImpaCT2 sample will each be the subject of an individual case study to reflect their unique and interesting ICT practice.

During summer and autumn 2001, the results of national tests taken by the 2179 pupils in ImpaCT2 will be statistically analysed and interpreted to discern how the high or average ICT status of their school influences pupils' attainment. Only at this stage will it be possible to compare the actual test results with those predicted. The examination results will not be available from the CEM at the University of Durham until October 2001, and consequently the findings will be contained in the final report published in 2002.

A new research team from the University of Leicester has been engaged to carry out 15 case studies in a sample of ImpaCT2 schools selected for further exploration of interesting ICT practice. These independent case studies provide new information about the impact of ICT provision out of lesson time such as lunchtime clubs and informal learning opportunities available outside normal school hours or during vacation periods. To capture this data, Teacher Researchers and Pupil Researchers will be creating video diaries of their use of ICT. These case studies (Strand 3) will provide additional triangulation to the findings of the main study team and will enrich the picture that ImpaCT2 is building of the way in which ICT at school and in the home is contributing to pupils' attainment in the widest sense.

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Glossary

PIPS – Performance Indicators in Primary Schools: this covers Reception up to Year 8

YELLIS – Year Eleven Information System, from Year 10 to Year 11

Further information is available from the Curriculum Evaluation & Management Centre at Durham University at <http://cem.dur.ac.uk>

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The research team is led by Professor Colin Harrison and includes:

Sue Cavendish

Chris Comber

Tony Fisher

Annabel Harrison

Kaye Haw

Dr Cathy Lewin

Professor Angela McFarlane

Di Mavers

Professor Peter Scrimshaw

Professor Bridget Somekh

Dr Rob Watling

This report was collated by Helen Brown of Becta.

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DfES
Sanctuary Buildings
Great Smith Street
Westminster
London
SW1P 3BT

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