



SCOTTISH EXECUTIVE
Education Department

Insight 20

The Impact of Information and Communication Technology in Scottish Schools: Phase 3

Welcome to *Insight*

Insight is a publication of the research group within Information and Analytical Services Division, which is responsible for providing analytical services within the Scottish Executive Education Department (SEED). Their work is part of a multidisciplinary unit (consisting of researchers, economists and statistics staff) and the staff undertakes and funds economic analysis and social research in the fields of: school education; children, young people and social work; architecture; and tourism, culture and sport.

The Scottish Executive is committed to the use of sound evidence in the development of policy and practice as well as in the evaluation of policy and its implementation. We therefore want to disseminate the results of research that SEED has undertaken and funded, in a manner that is accessible, interesting and attractive.

Insight aims to present the essence of research projects in a format that will be useful and informative for practitioners, policy makers, parents, academics, and anyone else who has an interest in economic and social research in these areas.

The views expressed in this *Insight* are those of the author(s) and do not necessarily reflect those of the Scottish Executive or any other organisation(s) by whom the author(s) is or are employed.

Copyright © September 2005, Scottish Executive Education Department

ISSN 1478-6788 (Print)

ISSN 1478-6796 (Online)

Insight may be photocopied for use within your own institution.

A limited number of additional copies can be obtained from the Dissemination Officer, Information and Analytical Services Division, Scottish Executive Education Department, Victoria Quay, Edinburgh EH6 6QQ (telephone 0131-244-0316). Copies of *Insight* and our other publications can be downloaded from our website: www.scotland.gov.uk/insight/

The Impact of Information and Communication Technology in Scottish Schools: Phase 3

Rae Condie and Bob Munro, University of Strathclyde

What is the Impact of Information and Communications Technology survey?

During the last ten years, the Scottish Executive has invested significantly in a series of initiatives designed to support the introduction of new information and communication technologies (ICT) across Scotland. These initiatives focused on the provision of hardware, software and staff development programmes and were complemented by the development of curriculum guidelines setting out the Executive's expectations for the acquisition and development of skills across the school system. All of this has taken place against a background of significant and fast-paced development in the range of technologies available for educational and home use.

In 1999, 2001 and 2004, the Scottish Executive Education Department (SEED) funded investigations into the impact of information and communication technologies (ICT) in Scottish schools. Each survey presents a picture of the experiences of staff in schools and pupils at that point in time and comparisons across surveys indicate the ways in which these have changed. The findings from the first two surveys were previously published by SEED as **Interchange 63** and **Insight 2**. This report presents a summary of the key findings from the third survey in 2004 and reflects on how they have changed over the years of the survey.

What is involved in the survey?

This third survey, the *Impact of Information and Communication Technology (ICT) in Scottish Schools: Phase 3*, was undertaken in 2004 in a sample of primary and secondary schools across Scotland. The key aims were to determine the extent to which the new technologies had become part of the everyday experiences of pupils and teachers. Three cohorts of pupils were involved – Primary 7 (11-12 years), Secondary 2 (13-14 years) and Secondary 4 (15-16 years) – as well as their teachers and the ICT coordinators in the schools. Evidence was gathered by questionnaire and through assessment tasks for pupils. In addition, a small number of case studies of the implementation of specific technologies in schools (5) were undertaken and will be published separately.

The key questions were:

1. What levels of knowledge and skills do pupils in Primary 7 (P7), Secondary 2 (S2) and Secondary 4 (S4) have and how has this changed since 1999?
2. What access do pupils and staff have to ICT within and out of schools and what are their attitudes towards using ICT in learning and teaching?
3. What has been the impact of staff development on teachers' knowledge, skills and attitudes?
4. What impact have the new technologies made on pedagogy, school management and administration?
5. What are the pupils' and teachers' hopes and expectations for the uses and applications of ICT in the future?

What do they know and what can they do?

Overall, pupils at all three stages performed better in 2004 than they did in 1999 or 2001. They were most secure on aspects of word processing, graphics and communication skills, while information and data handling skills were less well-established (as in previous years).

Success rates were high, for all stages, on items that tested knowledge of names of parts of hardware and software as in this example, *Icons*, where P7 and S2 pupils achieved 88% of the marks and S4 achieved 95%.

Icons tell you what the different parts of your computer are for.

Match the icons to their function by using the letters underneath each icon – you will not need them all.



i. _____ is a mouse.

ii. _____ is a monitor.

iii. _____ is a CD.

iv. _____ is a scanner.

v. _____ is a printer.

Pupils were less successful on those tasks that required the synthesis of ideas, critical thinking or problem-solving skills than in those which required the recall of facts or basic procedures. Success rates were also lower and more readily influenced by the context on the small number of items that asked pupils to evaluate the use of various technologies and to consider the social and cultural impact of technological innovations. For example:

Jodie is worried about her friend, Sara. She's become addicted to the Internet and to chat rooms. What advice would you give Sara about using the Internet and speaking to people in chat rooms? Give 3 guidelines for her safety.

i. _____

ii. _____

iii. _____

This task was included at S2 and S4. Approximately 60% of each cohort of pupils were able give 3 acceptable guidelines e.g. *'don't give out your name and address'*, *'don't agree to meet someone you meet on the internet'* and *'don't believe everything they say'*.

In 2004, more pupils were using the Internet as a source of information for project work and similar activities, and were familiar with many of its features. There was evidence of growing familiarity with peripherals and personal technologies such as mobile phones and MP3 players.

The aspects of ICT where pupils were most successful were those that teachers and pupils said happened most frequently in the classroom, e.g. writing stories, producing newsletters, searching the Internet for research activities. Where they were less

successful, the technologies involved (e.g. video-conferencing) and/or the procedures assessed (e.g. data handling) were less familiar; these were also the areas where teachers showed reduced confidence and familiarity. The practical assessment activities showed a very similar pattern of performance at all stages.

Analysis for gender differences showed a slightly superior performance by girls across the stages assessed and in aspects where they have tended to dominate in the past, e.g. language-oriented activities. The differences were marginal, though, and should not be over-emphasised.

Is there evidence of improved performance with age and stage?

Comparisons of performance between the year groups involved showed an increasing awareness and understanding, although the differences between P7 and S2 were not substantial and certainly less than might have been expected from 2 additional years of schooling. There was considerable overlap in performance on many items, with good P7 pupils as able as many S2 pupils. The differences between S2 and S4 were significant and in line with the age difference. (Similar findings have been made in the Assessment of Achievement Programme's surveys of performance in other subject areas.)

What happens between P7 and S2 in terms of ICT experiences?

Where did they learn about ICT?

Many pupils were fairly confident of their ability across various applications and technologies although this was not always supported by the assessment findings. They said that much of what they knew had been learned out of school, particularly at P7 (55% at home; 41% in school), although the balance had shifted a little in favour of the school by S4 (46%: 50%). This might be anticipated given the increasingly specialised support needed as pupils progress through secondary school.

Where did they use ICT and what for?

Over 90% of teachers, pupils and co-ordinators had access to computers out of school – an increase over previous figures – and most home computers were connected to the Internet, many by broadband. The previous surveys indicated that, at home, teachers' activities were often work-oriented while pupils tended to experiment and 'play' out of school. A similar finding was in evidence in 2004 although teachers did appear to be more creative and use a wider range of technologies for personal activities than previously.

Out of school, pupils used computers for playing games, looking on the web, drawing/designing and, particularly at S2 and S4, sending emails. 'Doing homework' was high on the list for all three stages. Teachers' out of school use tended to focus on word-processing (for work and personal use), searching the web, sending emails and displaying and sending photographs – very few played games on their computer. The key difference lies in the range of applications and technologies used, with more pupils than teachers using a range of technologies on a regular basis.

Most primary schools had a number of computers for pupil use in the classroom as well as a computer suite/lab that could be booked. Where computers are readily available, they tend to be used throughout the day in appropriate contexts, becoming a relatively routine part of the day-to-day activities of the classroom.

How do schools meet the needs of pupils who do not have access to computers out of school?

In secondary schools, fewer classrooms had more than one or two computers (other than computing or business studies classrooms) and most relied on scheduling time at the computer suite/lab. Technical failures and the inadequacy of what was available caused frustration for both pupils and teachers. Learning about the new technologies continues to be an issue in both sectors; upgrades, new peripherals, software and the pace of change all make it necessary to keep adding skills and knowledge.

In school, the use of computers within the classroom to support learning was very patchy, with small percentages of pupils experiencing this on a regular basis. Word processing, graphics and searching the Internet dominated. Much of this activity was concerned with writing essays or reports and producing presentations. A key obstacle to extending ICT-related activity is the reported shortage of modern, up-to-date computers available in the classroom, particularly in the secondary school. Pupils (and teachers) reported that the equipment and software that they used at home was superior to that in school.

There is continuing evidence that much learning is taking place out of school and the opportunities for accessing a range of technologies in the home are increasing, potentially widening the gap between those who have and those who do not have access out of school. ICT experience and use out of school has shifted to include a range of peripherals that enable people to use them for a variety of purposes and more creatively, e.g. digital cameras (still and video), mobile phones and MP3 players. A small number of schools are developing strategies that capitalise on the potential of these technologies and use them to support learning and teaching.

How can the new technologies be harnessed to support teaching and learning more effectively and to link home and school learning?

Learning about computers is viewed as almost essential for future employment by many pupils. It has other benefits, though, according to the pupils – it can be 'fun', 'interesting' and 'computers are everywhere - so it you will need to know about them'. Small numbers of pupils and teachers urged a little caution alongside the enthusiasm.

This outward movement of electronic communication from the school brings with it the need to ensure that all involved are clear with regard to ethical and legal requirements. This did seem to be the case in most instances, with policies in place and teachers confident that many of the safeguards were there. Some gaps remained, however, most notably the lack of awareness of pupils of, for example, copyright regulations. In order to become responsible users of the technologies provided, they must come to understand the need for regulations and guidelines and become aware of the possible consequences of not abiding by them.

Staff development and training

How can we ensure pupils become aware of the need for responsible and considerate use of ICT and alert to potential threats to their own safety?

Most teachers and co-ordinators had received ICT training of some kind, the most frequently cited being the New Opportunities Fund (NOF) initiative. Staff development, of whatever form, had benefited them in various ways, the main one being increased confidence in working with technology. This confidence had led them to try new approaches and activities, many of which they felt had been effective and had benefited the pupils. For primary teachers, this was tied to changes in practice:

- *ICT has encouraged me to approach different learning styles in a positive manner.*
- *My assessment and homework activities are much more innovative.*

For secondary teachers, benefits were often linked to specific aspects of the curriculum:

- *Using the Internet for S3 Ordnance Survey map practice;*
- *Can produce films in French. This is a fun way for pupils to practise the language.*

In general, they recognised the potential for enhancing the pupils' learning experiences and identified a number of training needs related to specific equipment and software, e.g. interactive whiteboards, digital videos, video-conferencing and virtual learning environments. Teachers also sought staff development in embedding ICT in the learning and teaching process in the classroom. However, they did not want training in technologies that they could not access in school, and provision of the newer ones appeared to be very patchy.

There remains a significant proportion of teachers who are less enthusiastic about, if not hostile to, the drive to introduce and develop ICT in schools and across the curriculum. For those who are ambivalent, the frequent failures of equipment and software to deliver and the lack of certainty that they will work successfully on any particular occasion are having a negative impact.

How has ICT influenced pedagogy?

It is difficult to discern any clear pattern in the impact on pedagogy. There is certainly evidence of changes in the activities teachers and pupils undertake but whether this means a fundamental change in the pedagogical strategies deployed is unclear and requires research focused on the interaction in the classroom across a range of technological innovations.

Teachers did point to a number of ways in which they felt that ICT had contributed positively to practice in the classroom. Using a laptop and data projector in the classroom, for example, allowed animations and simulations to be displayed and helped pupils access difficult concepts. Other, perhaps more peripheral albeit important benefits, included increased interest and motivation amongst pupils, and greater independence in learning. Over 50% of teachers in both sectors reported that they had evidence to indicate that the use of ICT had raised attainment levels.

There were some excellent examples of good practice in schools where technology has had a fundamental impact on teaching and learning. Where significant developments had occurred, this was often down to the drive of one or more enthusiasts within a school or department, 'champions' who introduced new approaches to teaching and learning and influenced their colleagues by example.

Across the three surveys, it appears that the focus in the classroom has shifted somewhat from learning **about** ICT to learning **with** the support of or **through** ICT. Many teachers were unsure of how to use the technology available for the benefit of the pupils and were looking for guidance. While pupils might know more about ICT and be more comfortable with it, teachers did not see this to be as threatening as did the teachers in the previous surveys.

Where progress was not being made, teachers sometimes commented that ICT was no longer on the development plan. It may be that once schools feel that they have achieved certain (quantitative) targets, the rest will almost inevitably fall in to place. The evidence is that there is a lot more to integrating ICT into the educational experience of

To what extent can 'just in time' staff development be provided for teachers, where training is aligned to the introduction of new technologies in school?

How can 'good practice' be best disseminated such that all teachers can benefit and how might Learning and Teaching Scotland support more effective dissemination?

pupils than ensuring all computers are network and that the recommended ratio of computers to pupils is met.

How has the situation changed since 1999?

Should ICT be a 'standing item' on school development plans, with specific strategies and innovations targeted each year?

Many of the questions and assessment tasks were used in all three surveys, particularly the last two surveys providing the basis for comparisons over time. In 2004, unlike 2001, there was clear evidence of change across most of the aspects investigated. Pupils' confidence and competence had increased alongside an increase in the range and frequency of activities within school, particularly in the primary sector and with regard to the Internet. However, pupils' interest in and enthusiasm for using computers were not being satisfied in school. Pupils wanted more computer time, preferably online, less direction and supervision and, in secondary school, to use ICT in a wider range of subjects. Although the situation had improved since 2001, the picture across secondary schools remains one of considerable variation.

The use of computers across subject areas was low and patchy: would staff development targeting specific subject areas be more effective?

Pupils and teachers tended to use computers more out of school, on a wider range of activities than previously, most notably in the use of email and the Internet. There was evidence of a growing interest in and use of associated technologies such as digital cameras, PDAs, mobile phones. Staff in both sectors were more confident in using ICT across a range of technologies and teachers in 2004 seemed less concerned that pupils might be more competent than they were than had been the case in 2001. Increasingly, work in schools is supported through various policies and guidelines designed to protect children and staff.

Most staff viewed the introduction of ICT into the classroom as a positive and potentially very beneficial development, although some remain to be convinced, particularly in the secondary sector. The main obstacles to further development and integration included funding for the new technologies and the infrastructure to support them, time to develop (staff) competence and confidence and the lack of a ready mechanism by which sharing of experiences and resources can be achieved. There is a danger that, in some schools, achieving the quantitative targets such as the number of modern computers available is seen as the key goal, whereas this is just the beginning: adapting practice to take advantage of the enhanced learning opportunities offered will take longer.

What are the Implications of the findings?

Many of the basics are in place in terms of knowledge and skills for both pupils and teachers. For pupils, these were mostly acquired out of school and therefore they are unlikely to have been acquired systematically, leaving gaps in their ICT experiences. While it is important to attend to these, it may be that the best time is when there is a good reason to acquire the skill, i.e. within the context of a purposeful task. Beyond that, learning about the wider, social implications of ICT use, etiquette, protocol and security dimensions are all important components of being ICT-literate that pupils should acquire.

At present, pupils are developing skills on a range of technologies that have barely made any impact on the school as yet. Strategies for incorporating them into the educational experiences of pupils are developing. Mobile phones are used to compile weblogs when away from home on school visits and can be used as personal response systems (with some modification), similar to those used in several universities and on 'Who wants to be a Millionaire?' School radio broadcasts direct to MP3 players can carry information

immediately and directly. These are aspects that could benefit from additional research and evaluation, drawing on work already going on in schools and colleges.

Alongside such developments, it is necessary to remember the small but important percentage of pupils without access to computers or other forms of technology and to ensure that they are adequately catered for through other strategies.

Staff development made an important contribution to the confidence and attitudes of many teachers, giving them some sense of security as they tried new strategies and technologies in the classroom. Most teachers have undergone some form of basic training and they are looking for further staff development on specific technologies, software and electronic resources. There is a need for short, focused programmes that take account of teachers' existing levels of competence. However, these also need to be harmonised with the installation of the appropriate hardware etc., in order that teachers have a purpose for learning about it and the opportunity to practise in their own time.

Teachers' developing confidence and competence is reflected in the increasing integration of ICT into the everyday experiences of pupils through purposeful tasks and the effective use of different aspects of technology to support learning. The extent to which this has happened is limited as yet, both within and across schools, and progress is slow. An effective strategy for the dissemination of good practice should harness the enthusiasm of the 'champions' out there to spread the word, to demonstrate what can be done. In addition, more focused research on such innovations with the aim of providing support for other teachers is required.

What does the future hold?

The general picture in 2004 was of teachers coming to terms with the (physical) impact of the Executive's ICT initiatives and the presence of the new technologies, and beginning to work out how best to use them. The majority of teachers were positive, if not always openly enthusiastic, about the potential for improving learning and attainment. As in previous surveys, primary teachers saw a greater opportunity for breaking down age- and subject-related barriers in schools than did their secondary colleagues, with almost half in each sector believing that the classrooms of the future would be significantly different from those of today, as a result of the impact of ICT.

With sufficient access to appropriate technologies, most teachers wanted to learn more about and to develop greater skill in using ICT to support learning across the curriculum, in new, relevant and exciting ways. The biggest obstacle to achieving their aims was time – time to learn new skills, find out about resources and technologies, plan and try out new approaches to teaching and learning and time to reflect upon and consolidate their experiences and to share them with others. Competing priorities and, for some, a lack of access to relevant technologies outwith school continue to impede progress. To a certain extent, the teachers want what the pupils have had – time, preferably out of school, to play, experiment, try out new technologies and then, importantly, to have the facilities to use their new knowledge and skills in the classroom. For many teachers, learning from colleagues was the key way in which they developed new skills and learned of resources. There is considerable evidence that 'hot information' such as this is much more effective in bringing about significant change to practice than the 'cold' evidence of printed policy documents and guidelines, and ways of exploiting this should be considered.

How can schools take advantage of the new technologies to bridge the gap between the in and out of school use of ICT and to take advantage of the skills that pupils have developed?

How can we sustain initiatives in schools without depending on individual enthusiasts or 'champions'?

Primary and secondary schools differed in their attitudes and approach to using ICT: how can primary and secondary schools share their experiences and work together to ensure a coherent experience for pupils?

How can more 'hot' support be provided – or, at the least, how can 'cold' information be warmed up?

In summary, the picture presented in the Phase 3 findings shows that ICT is becoming embedded into the everyday experiences of many pupils and that they know and can do more than previously. However, many of the problems highlighted in the previous surveys remain. Both teachers and pupils are positive about the impact so far and believe that considerable potential remains. The tensions between ICT use in and out of school – the different tasks/activities, the quality of provision, nature of provision, time, the social context – are worthy of further exploration.


The *Insight* Series

1. *Classroom Assistants: Key Issues from the National Evaluation*
2. *The Impact of ICT Initiatives in Scottish Schools*
3. *Moving On to Primary 1: An Exploratory Study of the Experience of Transition from Pre-School to Primary*
4. *Accelerating Reading and Spelling with Synthetic Phonics: A Five Year Follow Up*
5. *Assessment of Benefits and Costs of Out of School Care*
6. *Meeting the Needs of Children from Birth to Three: Research Evidence and Implications for Out-of-Home Provision*
7. *Key Findings from the National Evaluation of the New Community Schools Pilot Programme in Scotland*
8. *Scottish Qualification for Headship: Key Issues from the Evaluation*
9. *The Sitter Service in Scotland: A Study of the Costs and Benefits*
10. *Awards in Early Education, Childcare and Playwork: A Qualifications Framework for the Future*
11. *An Evaluation of the Higher Still Reforms*
12. *The Management of Supply Cover in the Teaching Profession*
13. *Parents' Demand for and Access to Childcare in Scotland*
14. *Evaluation of Personalised Laptop Provision in Schools*
15. *Teachers' Perceptions of Discipline in Scottish Schools*
16. *Minority Ethnic Pupils' Experiences of School in Scotland (MEPESS)*
17. *A Seven Year Study of the Effects of Synthetic Phonics Teaching on Reading and Spelling Attainment*
18. *An Assessment of the Support and Information for Victims of Youth Crime (SIVYC) Pilot Scheme*

If you have views on *Insight* or wish to find out more about SEED's research and economics programme, please contact Information and Analytical Services Division, Scottish Executive Education Department, Victoria Quay, Edinburgh EH6 6QQ or by e-mail on recs.admin@scotland.gsi.gov.uk

Astron 210377 09/05

This document is produced from 100% Elemental Chlorine-free material, environmentally preferred material and is 100% recyclable.



ISSN 1478-6788 (Print)
ISSN 1478-6796 (Online)