

A stylized map of Scotland composed of a grid of small squares, positioned behind the word 'education' in the main title.

Improving Scottish
education

ICT in learning and teaching

HMIe



education

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ICT in learning and teaching

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Foreword

Information and communications technology (ICT) has transformed the means by which we inform ourselves, remain up to date with world events and areas of personal interest, and further our learning. For many, books and journals are no longer the first or primary source of information or learning. We now regularly rely on images, video, animations and sound to acquire information and to learn. Increased and improved access to the Internet has accelerated this phenomenon. We now acquire and access information in ways fundamentally different from the pre-ICT era.

These new ways of acquiring and accessing information are also having an increasingly important impact on learning and teaching in Scotland. The potential to transform patterns and modes of learning and teaching is clear. Access to considerable quantities of up-to-date resources and materials by learners and teaching staff can be immediate and have powerful effects. Communication through e-mail, text messaging, blogs, podcasts, discussion groups and the like can lead to wider dialogue than has been possible before, including dialogue between learners at great distances. The use of non-textual approaches to presenting learning can lead to improved learner engagement and motivation. New classes of equipment and service are changing the way we interact: the convergence of technologies now found in mobile phones; the ubiquitous nature of digital cameras; and the opening up of the Internet through personal web space. Most powerfully, ICT has integrated all of these resources and services into a single box sitting on the user's desktop. Today's learner has the potential to exploit them all, through an interface that is mostly intuitive.

Great progress has been made in capacity building for use of ICT in Scottish education in recent years. Large investment, including in the national schools' intranet, Glow, has provided Scottish education with great potential to enhance and enrich learning and teaching. Infrastructure and bandwidth have improved, more equipment and software is now available for learning and teaching, and learner and teacher confidence and competence have increased.

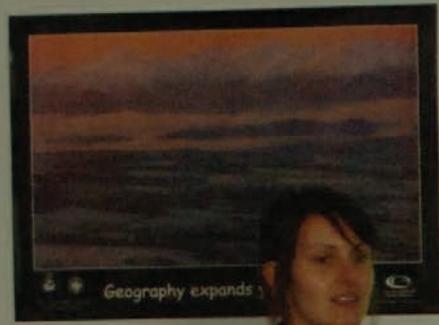
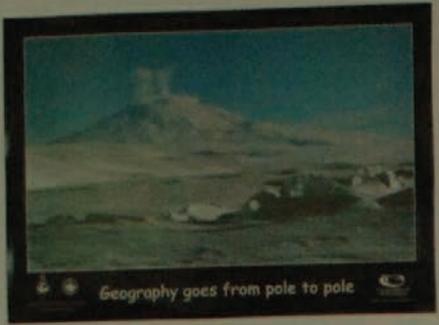
It is important that ICT is seen as a natural part of good learning and teaching. The challenge is to use it effectively to maximise learning and to enhance and enrich teaching and that means that the practice of the best needs to be widely embraced. Although fully effective practice in the use of ICT is not yet the norm, inspectors found many examples of it being used well to promote and enhance learning, especially in primary schools and for learners with additional support needs.

The findings outlined in this report confirm that Scotland is well placed to build on current strengths in order to realise the full potential of ICT to improve learning and achievement. The challenge is to make that happen.



Graham Donaldson
HM Senior Chief Inspector of Education
March 2007

Introduction 1



IMPORT or EXPORT?

The screen displays two bottles of orange liquid. The bottle on the left has a white label, and the bottle on the right has a blue label. A blue square is positioned to the right of the bottles. The background of the screen is light green.



Photocopying
Students will need to photocopy the map and the posters.



Section Two: Factors influencing the use of ICT for learning and teaching

Overview

A number of factors combine to determine the level and quality of use of ICT in learning and teaching, in common from pre-school centres¹ through to colleges and community learning settings. This section of the report evaluates these factors.

Policy and planning are important in identifying the aims of using ICT in education and in determining priorities and resources. Education authorities and the centres for which they are responsible have key tasks related to enabling, implementing and monitoring the use of ICT for learning and teaching. Colleges, community learning services and other institutions of learning have similar issues of planning to meet learning and teaching needs.

The successful implementation of policies and plans depends crucially on the clear identification of key players and their **roles and responsibilities** in taking forward the agenda set by policies and plans. Not all of these key players currently provide the level of leadership necessary for successful implementation of the policies and plans.

In recent years, improvements in ICT **infrastructure and resources** to support learning and teaching have increased the potential availability of ICT for learning and teaching. However, there remains much room for improvement in effective access to ICT for learning and no consistent pattern of use is emerging.

One of the areas that has received least attention by managers in authorities and in centres is that of the **management of learners and digital content**. Effective use of ICT by learners and teaching staff demands that they can interact with ICT-based learning and teaching materials in such a way that learners' education benefits. Issues around this area include user accounts, personal file storage, communication tools such as e-mail and discussion forums, and the storage of and access to appropriate software and ICT-based learning and teaching materials.

The **confidence and competence of teaching staff** in the use of ICT is a key determinant of the effective use of ICT for teaching. Many teaching staff now use ICT routinely in their teaching. In more than a few cases, they use it in a way that enriches their teaching, through, for example, the use of animations, simulations and online video, as well as appropriate use of Internet sites. However, too many teaching staff have levels of confidence and competence that are not yet high enough to enable them to make effective use of ICT in their teaching.

The level and quality of **technical support** is very important in maintaining the confidence of learners and teaching staff in the reliability of access to equipment and software. Where this support is prompt and effective, learners and teaching staff do not hesitate to plan for the use of ICT in their learning and teaching. Where the level of technical support is poor, user confidence that they will have reliable access falls, and learners and teaching staff make far fewer plans to use ICT.

¹ The term "centres" is used generally and as appropriate to the context to refer to all establishments and locations where learning may be delivered: pre-school centres, schools, colleges, and community locations. Pre-school centres include those managed by local authorities, as well as those in the voluntary and private sectors.

Factors influencing the use of ICT for learning and teaching 2



Key positive factors contributing to effective use of ICT in learning and teaching

- Most managers in all sectors recognise their responsibility to provide leadership in policy and planning for ICT in education.
- There are effective relationships between education authorities and schools to provide ICT services where economies of scale produce significant savings.
- Where readily available, technical support staff play an important role in schools, colleges and other centres.
- Recent significant improvements in infrastructure have taken place in almost all centres to support ICT for learning and teaching.
- Robust arrangements are in place to ensure learners' safe and acceptable use of ICT for learning and teaching.
- There is a wide range of online learning and teaching materials available from national bodies.

Aspects for improvement

Notwithstanding the positive factors referred to above, there are a number of areas in which improvement is required to remove remaining barriers to the effective use of ICT in learning and teaching.

- Policy and planning for the use of ICT need to be better related to more general policies and plans for learning and teaching.
- Managers need to improve the level of monitoring and review of the quality of the learner experience of ICT in education.
- Most centres miss opportunities to develop learners' ICT skills through the wider curriculum, for example, through the subject disciplines. Most ICT skills development is not related effectively enough to the wider context within which the learner is studying.
- Many staff at all levels do not understand fully enough their own role in the effective promotion and use of ICT for learning and teaching. More than a few do not fully appreciate the benefits to be gained from the use of ICT in their teaching.
- In most schools and in a minority of colleges, some equipment is outdated and does not support the use of modern software for learning and teaching.
- Short-term funding in youth and community work prevents sustainability of a number of ICT projects.
- Very few centres provide a full range of structured ICT services and resources to learners and teaching staff.

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- In many cases, staff development opportunities are general in scope and do not sufficiently address the specific curriculum-based ICT development needs of staff.
- Technical support arrangements are varied. They include externally managed services, corporate arrangements, in-house provision and peripatetic support. Not all arrangements meet the needs of learners and teaching staff. Managers need to evaluate effectively the quality of technical support and implement improvements to address weaknesses.

2.1 Policy and planning

All education authorities fully accepted their role in taking a lead in policy and planning for ICT in education in their area. In all cases, the authority took responsibility for planning the wider aspects of infrastructure, such as network equipment, connections to the Internet and services for learners and teaching staff. Under arrangements for devolved management of schools, headteachers generally had responsibility for provision of ICT equipment and software within their establishments. One authority had an ambitious policy of achieving one-to-one access to computers for all learners and teachers.

Key features of education authority policies on ICT in education included: development of learners' and teachers' ICT skills; recording and monitoring of pupil progress; e-learning; and ICT equipment and software acquisition.

Education authority managers generally saw the main role of the authority as one of building the capacity of schools and pre-school centres to make effective use of ICT in learning and teaching. In most cases the principal focus was on arrangements for the acquisition, maintenance and replacement of equipment in schools. In this context, a few authorities had contracted with third parties for a managed ICT service in their schools. They offered programmes of continuing professional development (CPD) for teachers and promoted programmes of ICT skills development for pupils under the ICT curriculum area of the *5-14 National Guidelines*.² Education authorities did not, in most cases, have well-developed and comprehensive policies or arrangements to promote effective use of ICT in learning and teaching. Decisions on hardware and software acquisition and deployment were often not linked closely enough to the needs of learners and teachers, nor were these decisions based on a well-considered rationale for the use of ICT in schools or on a wider learning and teaching policy. However, more than a few authorities supported the use of ICT in learning and teaching through locally-devised websites or intranets that gave guidance on materials and methodologies for their use.

² *Information and Communications Technology 5-14 National Guidelines*, Learning and Teaching Scotland, 2000, ISBN 1 85955 704 X, <http://www.ltscotland.org.uk/5to14/guidelines/ict.asp>

Schools and pre-school centres had responsibility for devising their own policies for the use of ICT in learning and teaching. All pre-school centres visited for this report based their programmes of ICT skills development around *Early Learning, Forward Thinking*,³ but very few had an explicit ICT policy. In more than a few primary and secondary schools, there was no distinct ICT policy, but learning and teaching policy documents made useful reference to ICT for learning and teaching. In most schools that had an ICT policy, its principal focus was on setting out guidelines for acceptable use of ICT by pupils. Generally, these guidelines referred to the use of computers and did not include guidance on the appropriate use of other ICT equipment, including mobile phones and portable audio players. Very few ICT policies made explicit reference to the use of ICT in enhancing learning and teaching. This may be explained by the fact that policy statements in many schools were several years old and did not reflect the current approaches to using ICT in learning and teaching in these schools. Commendably, more than a few school managers now placed much more importance on integrating their thinking on ICT in the curriculum into the school's more general learning and teaching policy.

The strategy outlined in *Early Learning, Forward Thinking* and in the *5-14 National Guidelines* had provided clear guidance on the development of young people's ICT skills. However, many recent applications of ICT in education post-dated the 5-14 guidelines. In most pre-school centres and primary schools, teaching staff incorporated development of these ICT skills into the wider curriculum and learners developed their skills through, for example, work in environmental studies or play. In a number of primary schools, classroom assistants extracted small groups of learners to develop their ICT skills through language or number work. This generally worked well. In secondary schools, the responsibility for delivering the 5-14 ICT content lay usually with the computing studies or business studies departments. In almost all secondary schools, learners in S1 or in S2 (or in both years) followed a discrete programme of ICT skills development, largely unrelated to the use of ICT in the wider school curriculum. Schools needed to implement more fully the development of learners' ICT skills through the subject disciplines.

Secondary schools' interpretation of the 5-14 guidelines was at times unduly influenced by the professional interests of computing studies or business studies teachers. As a result, in a few schools, all learners had to develop simple computer programs or understand the working of a central processing unit, knowledge and competence that contributed little to their broad range of ICT skills for learning and life. Very few schools included appropriate educational use of mobile phones, digital cameras or portable music players in their programmes of ICT skills development.

All colleges had devolved to subject departments the responsibility for the use of ICT in vocational studies. Most colleges had an ICT group with an overview of developments across the college and a remit to promote good practice. Part of the remit of these groups was to make recommendations on ICT budget allocation in the light of competing bids from departments. Most colleges had a vision for the use of ICT to allow learners to develop skills in independent learning and to promote enhanced engagement and motivation of learners.

3 *Early Learning, Forward Thinking: The policy framework for ICT in Early Years, Learning and Teaching Scotland, 2003*, ISBN 1 85955 795 3

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However, there was generally insufficient central support for classroom-based curriculum initiatives. Colleges did not generally collaborate effectively enough with each other to share materials and good practice. Commendably, the Scottish Further and Higher Education Funding Council (SFC) had initiated a number of joint further and higher education projects to produce online learning materials and to implement new approaches to pedagogy and use of ICT.

Almost all plans of CLD services contained references to the potential of ICT to enhance learning experiences in communities. In one authority, the CLD service had developed a draft five-year plan for neighbourhood ICT. In more than a few cases, CLD managers referred to budget constraints as a factor that limited their ability to plan effectively for the wide range of ICT-based learning needed in communities.

Policy priorities varied within and between sectors, including:

- implementation of authority-wide managed services;
- developing the use of video technology in pre-school centres;
- equipping teaching areas in schools and CLD centres with ICT;
- improving ICT use in S3/S4;
- increasing use of computer rooms;
- developing further the virtual learning environment (VLE) in a college; and
- rolling out community-based ICT provision.

A common strand linking almost all priorities set by education authorities, schools, colleges and CLD services was the importance placed on providing ICT equipment as the principal driver for increased use of ICT for learning and teaching. While it is certainly true that without equipment little activity can take place, very few centres gave sufficient attention to issues such as the most effective deployment of equipment to maximise opportunities for its use in learning and teaching. Very few centres or authorities placed enough emphasis on developing teachers' and learners' capacity to make best use of ICT equipment in the curriculum. While a few centres identified and disseminated examples of good practice in using ICT for learning and teaching, most teaching staff and learners did not have sufficient opportunities to identify and develop effective approaches to using ICT. One supplier of interactive whiteboards offered subject-specific training in the use of its products and a few members of the teaching staff in a few schools had benefited from this training.

>> Signpost to improvement in policy and planning

- Education authorities have well-developed and comprehensive policies to promote effective use of ICT in learning and teaching.
- Education authorities provide effective support to schools and other centres for the effective use of ICT in learning and teaching.
- Schools, colleges and other centres incorporate their vision and aims for ICT into wider policy statements on learning and teaching.
- Schools, colleges and other centres plan effectively for the use of ICT in learning and teaching across the curriculum.
- Schools plan the development of learners' ICT skills by involving all subject areas appropriately.
- Colleges develop learners' ICT skills in a vocational context.
- Centres plan the deployment of ICT equipment to meet the needs of learners and teaching staff.
- Education authorities and all centres have in place effective quality assurance arrangements to monitor and improve the use of ICT in learning and teaching.

Almost all documents relating to quality improvement contained references to ICT. These documents included service improvement plans for education authorities, standards and quality reports in schools, and operational plans in colleges. Many such references were vaguely expressed and not amenable to effective monitoring. Only a few centres used systematic monitoring tools that led to identification of strengths and weaknesses and appropriate action plans. These monitoring tools included the HMIE guide to self-evaluation of ICT in learning and teaching,⁴ and *Measurement of the Impact of ICT on Children's Education (MIICE)*.⁵ However, in general, centres did not implement effectively enough the planning, implementation and monitoring cycle. As a result, they had only a partial, and sometimes anecdotal, identification of the benefits of ICT in learning and teaching, and of barriers to further progress.

2.2 Roles and responsibilities

Under arrangements for the devolved management of schools, education authorities had given headteachers and other heads of centre a wide range of responsibilities in relation to provision of ICT for both learning and teaching and for administration. These responsibilities included budgeting, decisions on some elements of technician staffing, purchase of software licences and some discretionary element of hardware choice. However, most education authorities maintained a very close relationship with centres to provide services where economies of scale produced significant savings on purchases. These services included authority-wide agreements with hardware suppliers, technical support services and help desk facilities, and schemes of CPD. However, in most cases, education authorities restricted their role to facilitating such services and did not generally require compliance with arrangements for centrally-offered services. For example, an authority may have negotiated with a supplier for computer hardware running a particular operating system, but a secondary school may have bought computer equipment running a different operating system for its art department.

A few education authorities had contracted out to third-party suppliers the provision and management of ICT services for education. These arrangements, including overdue refreshing of equipment and maintenance and support, had not always met the needs of learners and teaching staff in centres across these authorities. Authorities had reflected carefully on the level and quality of service they required from such arrangements and at least one authority had negotiated new levels of service more suited to the needs of its schools.

A few education authorities had very effective curriculum support teams, mainly staffed by seconded teachers and supported by authority officers. The remit of these teams was to support ICT-based learning and teaching approaches in schools. Generally, these teams had a greater impact in primary schools than in secondary schools. This was largely as a result of the greater progress with effective deployment of equipment for the integration of ICT in the curriculum in primary schools. In one authority, the support team had produced a very effective set of learning and teaching materials for the implementation of the 5-14 National Guidelines for ICT.

4 *Using ICT in Learning and Teaching*, HMIE 2004.

5 *Measurement of the Impact of ICT on Children's Education*, SITC, Moray House School of Education, University of Edinburgh, <http://www.miiice.org.uk/>

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In all schools visited, the role of the headteacher included leadership for effective use of ICT for learning and teaching. In almost all schools, a deputy headteacher or other member of staff had a remit as ICT coordinator and shared leadership of this aspect of learning and teaching with the headteacher. The extent to which school leadership focused effectively on realising the potential of ICT was very important in establishing an ethos that promoted effective use of ICT for learning and teaching. It was also very important in facilitating the most effective use of the available ICT by teaching staff and learners. In some primary schools, the headteacher was very proactive in encouraging staff and pupils to use ICT appropriately and in providing appropriate resources. In such cases the ICT coordinator received very effective support from the headteacher for the work of embedding ICT in the curriculum. In most cases, especially in secondary schools, headteachers generally concerned themselves more with policy, guidelines and budgeting, and less with pedagogy and effective learning using ICT.

In all early education classes within primary schools visited for this report, teaching staff enjoyed wide discretion to embed ICT in children's activities. Many teachers worked with other early education staff to do so effectively but, in general, there was too little monitoring of ICT activity in pre-school classes by members of the senior management team (SMT) of the primary school. Managers in education authority pre-school centres that were not attached to a primary school generally provided effective leadership for the use of ICT in children's learning. The variable quality of provision of ICT equipment and infrastructure in private and voluntary nurseries was a result of the often poor leadership for ICT in these centres.

In those primary schools that had appointed one, the ICT coordinator worked well with class teachers to make effective use of ICT. In some cases, no time had been allocated to the ICT coordinator for these duties and a significant minority of coordinators spent large amounts of time attending to technical problems and difficulties with printers, user accounts, software and other non-curricular aspects of ICT. This meant that they had less time to promote effective use of ICT in the curriculum. In schools where ICT contributed significantly to the enrichment of the curriculum, the ICT coordinator had generally played a significant part in this enrichment.

Teaching staff in pre-school centres and primary classes had clear responsibilities to use ICT to enhance and enrich pupils' learning and their own teaching. In some schools, classroom assistants and support workers worked well with small groups of learners to develop their ICT skills or used ICT effectively to enhance the curriculum.

In many secondary schools, an ICT committee had the delegated responsibility for determining policy on ICT for learning and teaching and for recommending aspects of implementation to the school's SMT. In most cases, these committees focused on resource issues, such as recommending how many interactive whiteboards to buy, determining between competing bids from departments and faculties for funding, and liaising with the education authority for hardware upgrades. A few ICT committees promoted effective approaches to embedding ICT in the curriculum.

The recent *Masterclass* project, a Learning and Teaching Scotland (LT Scotland) initiative, trained over 600 teachers and other education workers to be champions of ICT in their establishment. Additionally, over 300 headteachers took part in *Masterclass* under the *Leadership for Learning* programme. These initiatives had provided opportunities for identification, dissemination and adoption of good practice in the use of ICT in learning and teaching. In a few schools, *Masterclass*-trained teachers worked in isolation and did not have sufficient opportunities to disseminate and promote the good practice they had developed through the initiative.

Many principal teachers and heads of faculty in secondary schools recognised fully their role in promoting effective use of ICT for learning and teaching but were often unsure about how to achieve this. In many cases they relied on the initiatives of individual class teachers in their department or faculty who effectively took the lead in ICT developments. In this area of middle manager responsibility for developing ICT in the curriculum, much depended on the priority placed by the headteacher on this important aspect of middle managers' duties.

A significant minority of teaching staff in secondary schools took very seriously their responsibility to make effective use of ICT in their teaching. They understood the potential benefits for them and their pupils of the imaginative use of ICT in the classroom and beyond. However, in too many cases, class teachers failed to understand these benefits or value the potential they offered and therefore did not make serious attempts to incorporate effective ICT resources into their teaching. Many cited lack of access to, or unreliability of resources as a barrier to their use.

Very few secondary schools made explicit to learners the value of their use of ICT to ensure and improve learning. As a result, learners were generally unaware of any responsibility falling on them to enhance their own learning through independent use of ICT. In one secondary school ICT policy, there was even an explicit statement that learners were to use the Internet only under the direction of their teacher. Almost all schools and colleges had an acceptable use policy that they required learners to sign. These policies focused on issues such as security and appropriate use of the Internet, and penalties for infringement of the policy. An increasing number of colleges expected learners to make independent use of ICT through lecturer-directed independent study or a college VLE.

All colleges had a senior member of staff with responsibility for the curriculum and, in many cases, this person took forward the development of ICT in the curriculum. In addition, all colleges had comprehensive arrangements in place for ICT technical support, generally involving a senior post holder with responsibility for academic and administration systems. Department and faculty heads generally had responsibility for promoting the effective use of ICT for learning and teaching. Almost all colleges provided access to online learning materials and resources. In many of these colleges, an e-learning manager or similar post holder had responsibility for promoting and supporting the development of online materials across curriculum areas. However, through the absence of a coordinating strategy across the sector, many colleges were working in isolation from each other and were duplicating resource production at considerable expense.

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Responsibilities for ICT in CLD were generally included within the arrangements of each local authority for the delivery of its education functions. CLD officers contributed effectively to policies on ICT and ensured that proper consideration was given to the place of ICT in capacity building and in the delivery of learning in the community.

2.3 Infrastructure and resources

Schools, colleges and other centres had benefited in recent years from significant improvements in infrastructure to support ICT for learning and teaching. Almost all schools had access to broadband Internet connections. Colleges benefited from fast Internet access through connection to *SuperJANET4*.⁶ Glow (formerly the Scottish Schools Digital Network) will use *SuperJANET4* to supply its high bandwidth interconnections for all Scottish education authorities. This infrastructure has proved very reliable and should provide an effective platform for future developments.

Within schools, colleges and other centres, rapid development of effective infrastructure was evident. Almost all centres had upgraded to switch-based⁷ distribution arrangements and these were capable of delivering data and applications to the desktop at high speed. However, in more than a few school buildings of considerable age, managers had difficulty in installing an effective and comprehensive system of structured cabling to deliver fast, effective services for learning and teaching. A number of colleges and a very small number of schools had implemented thin client⁸ systems as a cost-saving measure, most commonly by way of recycling old computers as terminals but these systems had not met learning and teaching needs in all cases, particularly those where intensive processing was needed, such as in programming development environments or graphic manipulation applications and where this processing could not be achieved quickly enough by the server.

In some rural environments, geographically dispersed centres placed a heavy burden on education authorities to provide the same level of service as in centres in urban settings. The affordability over the long term of high bandwidth rural networks covering very large areas was a concern to a number of rural authorities.

The level and quality of resources within centres varied more widely than did the centrally-procured infrastructure services. Under arrangements for devolved budgets, headteachers in schools made arrangements to purchase equipment and software to meet the particular needs of their schools. This was usually within a purchasing scheme negotiated by the education authority with suppliers, and schools were able to realise best value through participation in such schemes. However, equipment budgets devolved to schools by authorities were not always compatible with authorities' targets for equipment refresh cycles. In more than a few schools, a significant proportion of ICT equipment was more than five years old and included a large number of computers older than the refresh cycle should have permitted. Slippage in authority budget commitments for refreshing equipment was often a contributory factor.

Signpost to improvement in << roles and responsibilities

- Senior managers in centres provide effective leadership for use of ICT in learning and teaching.
- Teaching staff take a leading role in the effective use of ICT in their own teaching.
- Learners understand their own responsibility to make effective use of ICT to enhance their learning.
- Arrangements for the provision of ICT support services and maintenance meet well the needs of learners and teaching staff.
- Purchasing authorities provide services where economies of scale provide significant savings on purchases.

6 *SuperJANET4*: a high bandwidth national and regional educational network managed by the UK Educational Research Network Association (UKERNA), <http://www.ja.net/>

7 A switch is a device that connects elements of a network, for example, computers to servers.

8 Thin client: a computer in a network that relies for most of its processing on a central server. A consequence is that there needs to be fast communication between server and thin client.

All schools had identified benefits to be gained from the use of interactive whiteboards in conjunction with data projectors. Almost all schools had purchased at least one system and many secondary schools had equipped large numbers of classrooms with boards and projectors. Secondary science departments had purchased digital microscopes, data logging applications and simulation software. Art and music departments gave pupils access to a useful range of applications that supported and enhanced creative thinking and processes. In one urban secondary school, teachers and learners were using digital audio players to access podcasts that supported modern foreign language learning.

A number of special schools had acquired sophisticated equipment, with very simple interfaces, to enable and encourage young people with severe learning difficulties to broaden their opportunities to express their feelings and emotions. This equipment, specially configured to address particular problems of communication among the pupils and between them and teaching staff, used sound and light as tools for communication of pupils' feelings and emotions. Although highly sophisticated in its functionality, it was extremely easy to use and was implemented in a whole-room environment so that pupils could make use of it from anywhere in the classroom and could communicate with a freedom of movement and expression not possible without this equipment. Information on such resources is available from the CALL centre at Edinburgh University.*

Pre-school centres and primary schools provided a wide range of ICT equipment for use in learning and teaching. This included programmable roaming devices, digital still and video cameras and technology toys. While most establishments had these items, in many establishments limitation of funding did not permit a level of provision of such equipment sufficient to meet the needs of all children and teaching staff.

Many schools and colleges had purchased laptop computers to allow greater flexibility in deployment of resources to meet need. A few schools were implementing wireless networks, particularly in conjunction with laptop computers. Most teaching staff welcomed this enhanced flexibility of use of ICT but many reported difficulties with arrangements for recharging batteries and for movement of the equipment from room to room.

Almost all schools were unable to obtain sufficient software licenses to allow effective access for pupils and staff to applications that, in many cases, had the potential to transform learning experiences and teaching approaches. Such applications included many examples in geography, art, music, technical education and the sciences. In almost all cases, the price of licenses was such that too few, or even no, licenses could be afforded by departments. No schools or education authorities visited for this report had taken advantage of open source software⁹ to ease the overall financial burden on software budgets. Almost all primary schools had provided simplified office applications for learner use, in particular word processing software.

⁹ Open Source Software (OSS) is software where the source code (the language in which the program is written) is freely distributed with the right to modify the code, and on the condition that redistribution is not restricted, and indeed is obtainable for no more than the reasonable cost of reproduction. UK government policy can be found at http://www.govtalk.gov.uk/documents/oss_policy_version2.pdf. Further information may be found at <http://www.opensource.org/>

* <http://callcentre.education.ed.ac.uk/>

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All colleges had sufficient numbers of computers to meet the needs of their learners. Not all of these computers were of a high enough specification to cope well with the full range of applications that staff and learners wanted to run on them. All colleges had a target refresh cycle but not all achieved this target. The most common cycle length was four years but more than a few colleges specified five years. A five-year refresh cycle meant that learners had fewer opportunities than with a four-year cycle to develop vocational ICT skills on the up-to-date equipment and software that they would find in industry and commerce. All colleges benefited from the infrastructure provided through *SuperJANET4* and, in general, provided fast switched access to services within their institutions.

Under the BRITE¹⁰ initiative, all colleges had acquired a range of assistive technology to meet the needs of learners with additional support needs and most colleges had supplemented this resource with other technology to meet the needs of particular individual learners. More than a few colleges had an extensive stock of such assistive technology, including a wide range of adapted input devices.

Generally, college staff and learners had good access to appropriate software for learning and teaching but there was very little use of open source software. Many colleges had negotiated campus-wide agreements for supply of commonly used software and many of these agreements allowed staff and learners to install the software on their home computers at little or no cost.

All colleges and a few secondary schools had acquired VLE applications. A small number of education authorities had implemented a VLE. Colleges had been working with their VLEs for longer than schools and a few had adopted a systematic and comprehensive approach to making learning materials available through the VLE. However, the majority of colleges had not exploited as fully as they could the benefits of this publicly funded resource¹¹ and in these colleges, learners made little use of the VLE. A small but increasing number of colleges were considering moving away from commercial VLE systems to a VLE based on open source software, with an expected reduction in recurring costs.

The various arrangements for managing CLD in local authorities supported a wide range of strategies for the provision of ICT for learning and teaching in communities. In all cases, local authorities had taken advantage of the *People's Network*¹² initiative to connect public libraries to the Internet and to equip libraries with computers and software to meet local need. CLD staff had devised and implemented a wide range of initiatives to deliver resources to communities. These initiatives included customised websites, wireless access allowing members of the public to use their own laptops in libraries, ICT-equipped vehicles to deliver services to remote areas and the use of mobile phones by remote learners to receive learning materials.

10 BRITE: Beattie Resources for Inclusion in Technology and Education, an initiative arising from the report *Implementing Inclusiveness Realising Potential*, September 1999.

11 In 2000, the Scottish Further Education Funding Council, through the JISC regional support centres, provided all Scotland's FE colleges with a VLE system.

12 All public libraries in Scotland are connected to the People's Network. The New Opportunities Fund provided infrastructure, equipment and training for library staff, as well as funding the creation of resources and learning materials available through ICT in libraries.

Signpost to improvement in << infrastructure and resources

- Centre managers plan effectively to exploit fully for learning and teaching the recent and planned improvements in national infrastructure and Internet connectivity.
- Centres maintain an up-to-date resource of computers and ICT equipment to meet the needs of learning and teaching across all subject areas.
- Centres have sufficient software licenses to meet the needs of all learners and teaching staff.
- Authorities and centres are successful in sustaining ICT initiatives set up through short-term funding.

However, more than a few initiatives in youth and community work suffered from poor infrastructure and resources. Many ICT initiatives in youth and community work had only fixed-term funding and the sustainability of such projects was an area of concern to authorities.

2.4 Management of learners and access to digital content

Centres deployed a wide range of services to manage learners' access to and use of ICT. These services included network accounts, network-based file storage, access to e-mail, shared folders for learning and teaching materials and, in the case of a few colleges, comprehensive managed learning environments. Not all centres offered the complete range of services to all learners and teaching staff.

All schools and colleges with local area networks provided learners with network accounts. These accounts allowed learners to login to the range of services and applications available to them, including commonly used applications, printing facilities and Internet access. In more than a few schools, particularly in the primary sector, and in a few colleges, these accounts were generic. Individual learners did not have individual accounts or access to network storage. In the case of colleges that did not allocate network storage as a matter of course, most learners who needed network storage could arrange access to it but the learner or the class lecturer had to identify the need to the college. The allocation of generic network accounts had the added disadvantage of not allowing all learners to have individual e-mail accounts.

The main reasons for centres not allocating network accounts to individual learners were:

- insufficient server space;
- not enough technician time to create and manage the accounts;
- in schools, lack of confidence in learners' ability to remember their account identifiers and passwords; and
- lack of awareness by teaching staff and managers of the benefits that individual accounts could bring to the learning and teaching process.

The benefits of allocating individual network accounts included:

- secure storage of learner work;
- ready access to files from any networked computer in the school or college;
- storage of large files beyond the capacity of floppy disks; and
- an online area in which learners could showcase their best work.

In a few colleges that did not implement network file storage, learners received solid state memory devices¹³ as part of their bursary allocation and this helped them to take advantage of many of the benefits of the college network. However, not all computers had easily accessible ports into which these devices could be inserted.

13 Sometimes known as pen drives, memory sticks or USB sticks, these devices typically allow storage of almost all sizes of file likely to be created or used by learners.

Factors influencing the use of ICT for learning and teaching 2

Across all sectors, most centres had recognised the value of making learning and teaching materials available online to learners. Some centres used commercial applications to manage structures of shared folders into which staff placed resources and from which learners accessed these resources. These structures were usually organised to reflect the departmental arrangements of the centre and learners accessed folders according to topic and level. Benefits to learners were apparent in centres where this approach was well supported and where staff and learners were proactive in adopting this approach. In one secondary school, the technical education department had collected together a useful range of resources for revision of S4 craft and design topics. These resources were available to pupils through the school network and learners made good use of them.

Almost all centres provided staff and learners with e-mail services but the scope of these services varied from a single account for a whole class, mainly but not exclusively at early and middle stages in primary schools, to individual accounts in primary and secondary schools and in colleges. Many of the systems in primary schools allowed communication by e-mail only when users were in the school, while in some secondary schools and colleges the e-mail service was web-enabled and learners and staff had access to their accounts outside the centre's local area network. Despite this recent significant growth in learner and staff access to e-mail, very few teaching staff promoted its use as an effective tool for communication between staff and learners for homework, announcements, or requests for help and guidance. Commendably, a small but increasing number of learners were using e-mail accounts to store their work so that they could access it from home. They e-mailed their work to themselves and accessed it from home. When complete, they e-mailed it back to themselves and accessed it in their school or college.

An increasing number of teaching staff realised the benefits of the use of e-mail by learners to communicate with other centres, with organisations of use to them in project work and with individuals and bodies interested in the work of their class. For example, in one primary school, a P1-P3 class e-mailed a Museum of London designer for information on constructing a display, and groups of its P6-P7 pupils used the *JapanUKLive*¹⁴ website to correspond with school children in Japan and compare their homes and countries.

Most education authorities were proactive in providing a range of services online to schools. Examples included *Wiredshire*¹⁵ in Aberdeenshire, *Stirling Grid for Learning*,¹⁶ *Highland Virtual Learning Community*,¹⁷ *Edinburgh Grid for Learning*,¹⁸ and North Ayrshire's *Online* service.¹⁹ These online services included links to learning and teaching materials, information about CPD opportunities for staff, authority announcements, library catalogues and a range of policy documents.

14 <http://www.japanuklive.org.uk/english.html>

15 <http://www.wiredshire.org.uk/>

16 <http://www.stirling.gov.uk/sgfl>

17 <http://www.hvlc.org.uk/>

18 <http://egfl.net/>

19 <http://www.ers.north-ayrshire.gov.uk/>

Learning and Teaching Scotland (LT Scotland) was playing a very important role in making available to learners and teaching staff a very wide range of online resources from its comprehensive website that covered almost 30 online services, ranging from *Early Years Online* to *National Qualifications Online*. Of particular note was the area of the website²⁰ that focused on modern foreign languages, the *Modern Foreign Languages Environment* (MFLE).²¹

The Scottish Further Education Unit (SFEU) has a remit to meet the developmental needs of the college sector. It organised activities through two areas, college development and learning effectiveness. From its website,²² it promoted communities of practice, advertised its development events and promoted wider discussion of current issues of interest to college staff. SFEU focused, among other initiatives, on building the capacity of colleges and individual staff within them to take forward curriculum innovation through ICT.

Most schools and many colleges had no clear strategy for selecting, organising, managing and distributing the very wide range of resources available for learning and teaching. Very few schools had implemented a VLE as a structured repository of learning and teaching materials and none used the facilities of the VLE to assign learners to courses, track progress and produce reports on progress in learning (a managed learning environment). There was little collaboration between teaching staff in individual schools or between schools to gain maximum benefit from shared materials development. The richness of online learning and teaching opportunities in many schools was influenced by the importance placed on these opportunities by the headteacher and other promoted staff as well as the individual enthusiasm of class teachers. Too few schools took maximum benefit from the resources of the LT Scotland website.

Most colleges had appointed a manager with responsibility for the development and use of online learning and teaching resources and these managers worked well with lecturers and departments that recognised the benefits that ICT brought to the learning and teaching process. In the few colleges with a well-developed VLE, large parts of the curriculum were available online, including materials from the *National Learning Network*²³ (NLN). The good progress in these colleges was due, in no small part, to the firm commitment by the college senior management team to realise the benefits of ICT in learning and teaching, along with a systematic implementation of a strategy to embed ICT in learning and teaching.

²⁰ <http://www.ltscotland.org.uk/>

²¹ Modern Foreign Languages Environment: <http://www.ltscotland.org.uk/mfle/>

²² <http://www.sfeu.ac.uk/>

²³ National Learning Network: a national partnership to promote the uptake of ICT for learning and teaching in the learning and skills sector in England. www.nln.ac.uk/

Factors influencing the use of ICT for learning and teaching 2

From uncertain beginnings, ICT-based school administration systems had begun to play a useful part in reducing the administration burden on teaching staff. In particular, many schools had deployed computers in classrooms and staff bases to facilitate online monitoring and reporting of pupil attendance, and report creation. Many schools used ICT to produce reports on pupils' progress. Some parents, particularly those with children in primary school, had concerns about ICT systems for reporting progress involving "tick-box" approaches.²⁴ In some cases, unacceptably slow processing times for the online attendance system had led more than a few teaching staff to stop using the system. However, an unexpected result of deploying computers in classrooms for administration purposes was that teaching staff had been encouraged to investigate their use for teaching. One college had invested heavily in ICT for administration purposes and had developed a comprehensive suite of software to manage student applications, enrolments, on-course reporting and activity measurement.

2.5 Confidence and competence of teaching staff

In general, the confidence and competence of teaching staff in their use of ICT had improved in recent years and many staff were now using ICT effectively in their teaching. A number of factors had contributed to this increase in confidence and competence.

- Teaching staff had greater access to computers both at home and in school, college or community centre.
- An increasingly useful range of software for learning and teaching was available both commercially and from organisations such as LT Scotland and NLN.
- Teaching staff had greater opportunities to engage in CPD to enhance their confidence and competence in the use of ICT.

However, in all schools, a few teachers (for example, as many as eight or nine in a large secondary school, or one or two teachers in a primary school) made very little use of ICT in their teaching. In such schools, the detrimental impact on the learning experience of large numbers of children and young people was high.

Many colleges worked in partnership with SFEU to develop lecturers' thinking in relation to pedagogical issues raised by the use of ICT in learning and teaching. In this regard, the *eMerge* programme had been a significant carrier of college staff CPD. Some elements of this CPD advocated a distinct "e-pedagogy" but did not make clear how such a pedagogy built on or extended more general notions of how to make effective use of resources in learning and teaching. More than a few teaching staff in colleges had undertaken study to develop skills in supporting online learners.

Signpost to improvement in << management of learners and digital content

- *Centres make services available to as wide a range of learners as possible. These include e-mail, personal network accounts, and individual file storage.*
- *Centres provide learners with well-structured access to appropriately organised online learning materials. This may take the form of shared folders, a VLE, and directories of appropriate websites.*
- *Teaching staff make effective use of ICT services to communicate with colleagues and learners. This may include e-mail, text messaging, and discussion forums.*
- *Centres have effective arrangements in place to enable access by learners and teaching staff to nationally available online resources.*
- *Centres use ICT effectively to manage a wide range of administration and reporting tasks.*

²⁴ *Teaching Scotland's Children – A Report on Progress in Implementing 'A Teaching Profession for the 21st Century'*, HMIE, January 2007.

All education authorities had arrangements in place to identify the development needs of teaching staff. They provided programmes of CPD to develop and enhance the capacity of staff to exploit the benefits of ICT in learning and teaching. These programmes were delivered both by education authority staff and by third-party providers. All authorities appreciated the importance of targeting CPD on specific needs and priorities, and their programmes included development opportunities in such areas as interactive whiteboards, digital video editing, and use of technology toys. In many cases, uptake of CPD opportunities by teaching staff was hindered by problems in funding class cover arrangements for those who wished to attend CPD events.

Very few education authorities evaluated the impact that CPD in this area had on learning and teaching. Commendably, in one education authority, quality improvement officers identified good practice in the use of ICT in learning and teaching through classroom observations in the authority's schools. This good practice then received wider dissemination through authority-sponsored conferences and events.

In all sectors, the confidence and competence of teaching staff in their use of ICT in their teaching varied widely. A small but increasing number of staff were making imaginative use of interactive whiteboards, materials from the Internet and commercial software to enhance their teaching and enrich the learner experience. However, the majority of teaching staff needed to progress beyond the basic use of presentation software to display the contents of the equivalent of acetate slides previously used with an overhead projector. Such substitution of a computer and data projector for an overhead projector represented little educational gain. However, it was, for many teaching staff, a first step to becoming effective users of ICT in their teaching. Effective motivation for such beginnings in ICT use for many staff was the presence in their teaching room of the necessary ICT equipment to allow them to incorporate ICT into the learning and teaching approaches. While many were competent in their use of the types of application packages for which they had received training under the *New Opportunities Fund*,²⁵ far fewer were confident in the use of imaging or sound equipment and software or in the use of specialist software for their own curriculum area.

More than a few college lecturers had developed useful skills in production of online learning materials and had incorporated into their teaching a wide range of such materials. Most college staff had an opportunity to study for a generic ICT qualification such as the British Computer Society's *European Computer Driving Licence* (ECDL) but such generic programmes of study did not meet the specialist needs of lecturers for ICT skills development in their vocational area, and completion rates were generally low.

CLD staff and librarians had access to CPD relevant to the development of their ICT skills. Typically, staff developed these skills through study for qualifications such as ECDL. Overall, programmes of staff development in ICT for CLD staff gave insufficient attention to the effective use of ICT in teaching.

>> *Signpost to improvement in the ICT confidence and competence of teaching staff*

- *All teaching staff have appropriate opportunities for development of their generic ICT skills and take up these opportunities.*
- *All teaching staff develop confidence and competence in using ICT resources appropriate to their teaching activities.*
- *All teaching staff develop confidence and competence in planning their use of ICT to enhance learning and teaching.*
- *All authorities and centres evaluate the impact of their CPD programmes on the quality of learning and teaching, and plan improvements.*

²⁵ New Opportunities Fund: ICT training for librarians and teachers funded from the National Lottery between 1999 and 2003. HMIE published an interim report *Into the Classroom of Tomorrow* on this initiative in 2002 <http://www.hmie.gov.uk/documents/publication/itct.htm>.

Factors influencing the use of ICT for learning and teaching 2

2.6 Technical support

Education authorities, pre-school centres, schools and colleges had different levels of support for ICT equipment and software. No pre-school centre or primary school visited for this report had a dedicated ICT technician working solely in the centre or school. All secondary schools had one or more technicians, with at least one of these technicians experienced in or qualified in the maintenance of computer systems. All authorities deployed teams of technical support staff who worked to maintain and develop both central and local systems. In some councils, this service was carried out by technical staff working within the department responsible for education. In others, the education authority relied on the council's corporate ICT services for support for its schools. Education authorities that relied on the latter arrangements generally identified more issues with the quality of service provided than did those authorities that managed their own technical support. All colleges had centralised their ICT services and teams under a senior manager.

In pre-school centres and in primary schools, peripatetic technical staff were important in providing technical support. They backed up the first-line support usually available in school through ICT coordinators or enthusiastic and knowledgeable class teachers. In general, pre-school centre and primary school staff reported satisfaction with the level of technical support provided. In some cases, response times from these peripatetic technicians were not good and equipment lay unrepaired for unacceptably long periods. On the other hand, more than a few authorities reported that the first-line diagnostic skills of class teachers were not well developed and that technicians often found that they had been called to schools to deal with problems that should have been resolved at local level. Typical problems that could be resolved locally included paper jams in printers, the cleaning of mice, and inability to install software.

Many secondary school technicians were highly motivated, knowledgeable and very effective problem solvers. They worked well with central ICT support staff to provide an effective service in their schools. Only a few had been given opportunities to update their ICT qualifications and most were self-taught in many aspects of their work. In the majority of secondary schools, technicians received valuable support from staff in the school computing studies department and even, in a few cases, from senior pupils with an appropriate range of skills.

Teaching staff and learners in secondary schools valued the support they received from the school ICT technician but were much less positive about the quality of service provided by support staff from the authority. In a few cases, software problems that had been passed to the central service for solution remained unresolved for several weeks or even months.

All colleges had policies and procedures in place for ICT technical support. Colleges budgeted for their own support service and almost all placed high value on its effectiveness. However, the large numbers of users (up to 15000 in some colleges) and range of equipment in colleges meant that, in order for technician tasks to be manageable, some flexibility in user activities was lost. For example, in many colleges, users could not personalise their desktop or benefit from a roaming user profile. This small loss of flexibility was compensated by a high level of reliability of systems that, in general, met well the ICT needs of learners and staff. Most problems with systems and equipment in colleges related to the age of some computers and their poor performance in running the modern software required by learners and staff.

>> *Signpost to improvement in technical support*

- *In all centres, technical support levels are sufficient and adequate to maintain an acceptable level of service at all times.*
- *Effective systems for reporting technical issues are in place in all centres.*

Technical support for ICT systems in CLD was a mixture of local and central provision. In most cases this worked effectively and was valued by staff and learners. However, in one authority with an outsourced maintenance service, CLD did not receive support from the service provider and CLD staff and learners complained of inconsistency of treatment.

Factors influencing the use of ICT for learning and teaching 2

Section Three: The use of ICT

3.0 Overview

This section of the report describes and evaluates how ICT is used in Scottish education by both teaching staff and learners. It identifies strengths and aspects for improvement in a number of areas.

Teaching staff and learners use ICT most effectively where centres identify and implement the most effective arrangements for **deploying equipment** to enable **access** to ICT for learning and teaching that meet most appropriately the needs of users.

Inspectors found many examples of the effective **use of ICT in teaching** in centres in all education sectors. Such effective use enhances and enriches the learning experience. Effective use of ICT enhances the learning experience by providing a collection of learning and teaching materials that make lessons more attractive and visually or aurally more stimulating than many more traditional forms of resources. Effective use of ICT enriches the learning experience by exposing learners to a wider range of learning opportunities and modes of study than heretofore available. Importantly, effective use of ICT by learners encourages independence in learning. However, inspectors also found many examples of the use by teaching staff of ICT where there was no clear educational gain.

There are many examples of **learners using ICT** effectively in their studies. Centres support this use of ICT by providing programmes of ICT skills development, in the pre-school and schools sectors through the implementation of national frameworks. Elsewhere, support provided through the incorporation of ICT units into programmes of core skills development. However, many learners have not developed sufficiently their information literacy²⁶ skills and are unable to take full advantage of the search and retrieval facilities of the Internet.

A number of initiatives are taking forward the use of **ICT for online assessment** and a small number of pilot implementations of online national assessments have taken place. However, most centres do not yet have in place all of the technology required to enable all kinds of online assessment to take place.

Many opportunities exist for learners and teaching staff to participate in **online communities**. Young people recognise the benefits of such communities more readily than do teaching staff or education authorities, and centres have not yet identified the most appropriate and safest approaches to the use of such resources for learning and teaching.

²⁶ Information literacy: defined by the Chartered Institute of Library and Information Professionals as “Information literacy is knowing when and why you need information, where to find it, and how to evaluate, use and communicate it in an ethical manner.”

The use of ICT

3



Key strengths

- In special schools and for pupils in mainstream centres with additional support needs, assistive technology is available to meet needs.
- Almost all schools and all colleges make explicit provision for the development of learners' ICT skills.
- Many learners in all sectors make effective use of ICT, working independently or in small groups, to conduct research, to prepare reports, and to present their findings. Increasingly, learners present reports confidently to their class using appropriate presentation software.
- Most colleges have installed VLE systems which include online formative assessments, and many schools are using commercial software which provides learners with opportunities for progress checking and self-assessment.
- In most secondary schools and in all colleges, ICT plays an important role in the collection, processing and reporting of assessment results.
- Many headteachers gain support and develop their professional knowledge through their membership of the online community *Heads Together*.
- A majority of schools and all colleges have created their own website to inform learners, teaching staff, parents and other stakeholders of the life and work of the centre.
- Many school pupils make good use of communities of learning and find them enjoyable to use.

Aspects for improvement

- Managers do not deploy ICT resources effectively enough to ensure that classrooms are adequately provided with appropriate equipment for teaching and learning across the curriculum and that computer labs have sufficient resources to allow effective whole-group teaching to take place.
- Many teaching staff do not consider carefully enough how to make best use of ICT resources to gain maximum educational gain from such use in their teaching.
- Almost all learners lack the skills of efficient searching, selection and analysis required to make effective use of information accessed through the Internet.
- There is insufficient liaison between primary and secondary schools to ensure the smooth progression of skills development in ICT at the P7-S1 transition.
- Budgetary constraints do not normally allow secondary departments to purchase as many software licenses as they need and, as a result, learner use of such software is often limited to the small number of computers on which the software has been installed.
- Many college learners on further education (FE) programmes (up to SCQF level 6)²⁷ have not developed their skills of independent learning sufficiently to make most effective use of colleges' facilities for independent learning in learning resource centres.

²⁷ Scottish Credit and Qualifications Framework: All mainstream Scottish qualifications are included in the framework. It brings quality assured qualifications into a single, integrated framework. <http://www.scqf.org.uk/>

3.1 Deployment of resources and access by learners and teaching staff

The pattern of locating ICT equipment was an important factor in determining how effectively it was used by learners and teaching staff.

In pre-school centres the equipment was always deployed throughout the centre and the only limiting factor in learner and teaching staff access was the quantity of computers, imaging equipment and technology toys available for use.

In almost all primary schools sampled, ICT equipment was deployed in the classrooms and this was very effective in allowing teaching staff to embed the use of ICT in learning and teaching where such use occurred naturally in the flow of learning and teaching processes. Typically, equipment deployed in classrooms included a small number of computers: up to three or four with shared printing and, in most cases, with access to the Internet. In such classrooms teaching staff kept a selection of software appropriate to the work of the class. In more than a few schools, a selection of digital still and video cameras, along with equipment such as floor turtles and scanners was deployed in classrooms but on a shared basis. An increasing number of primary schools had installed interactive whiteboards in some classrooms and most teachers with access to them used them effectively for whole-class interaction. More than a few teaching staff in primary schools continued to feel less than fully confident in exploiting the full range of ICT equipment and software in their teaching.

About half of primary schools also had a computer suite. The rationale for this from many headteachers was to promote skills development as a basis for the use of ICT in learning and teaching in the classroom. These suites housed between five and 30 computers. Typically, a computer suite had between 10 and 16 computers. Classes accessed these resources on a timetabled basis. Few computer suites were large enough to accommodate a whole class at a time without learners having to share access to a computer and this limited the range of learning and teaching approaches. Few of these computer suites were supported by adequate bandwidth to allow effective access to the Internet by all members of the class simultaneously.

Generally, primary schools did not have a clearly expressed rationale for the deployment of ICT equipment to maximise opportunities for its use in learning and teaching. Headteachers had to make difficult choices between centralised and distributed resources. Their dilemma was between providing computers in classrooms to promote the embedding of ICT in lessons and equipping computer suites with enough computers to allow whole-class lessons with ICT to take place effectively. In the main, headteachers had not developed their thinking on the deployment of ICT resources effectively enough in relation to intended learning outcomes or teaching processes.

All secondary schools deployed the bulk of their ICT resources to meet the needs of a small number of teaching departments: computing studies; business education; and technical education. This resulted in the location of large numbers of computers in dedicated suites with timetabling of these suites prioritised for these departments. Typically, this deployment of ICT equipment accounted for about half of the computers available for learning and teaching. Other departments booked these resources when they were not timetabled for computing studies, business education or technical education classes. School managers had rarely determined whether such deployment of resources reflected accurately the learning and teaching requirements across the school.

Increasingly, secondary schools recognised the value of making ICT resources available in classrooms, and many schools had equipped classrooms with a variety of resources including small numbers of computers, a printer, a data projector and an interactive whiteboard. In this way teachers had greater opportunities to use ICT for whole-class teaching and, in a few cases, to allow individual or small groups of learners to have access to ICT during lessons where this was appropriate. This distributed approach to embedding ICT in the learning environment was built on recent modernisation of infrastructure in most secondary schools, benefiting from switched systems allowing reasonably fast access to the Internet. However, the size of most classrooms and the space taken up by necessary furniture was a limiting factor in the deployment of ICT, with very many general purpose classrooms unable to accommodate even a single computer and printer. Encouragingly, classrooms in a few recently built secondary schools were big enough to accommodate ICT resources comfortably. In one school, classrooms were clustered round common areas where computers were deployed, allowing learners and teaching staff access to ICT for learning in a flexible and easily managed way.

An increasing number of schools had invested in sets of laptop computers complete with facilities for the rapid recharging of batteries. A number of these schools had facilitated network access for these laptop computers through the introduction of wireless network nodes and many learners and teaching staff valued the additional access to ICT resources that these computers allowed. However, schools found that these laptop systems were not always reliable as a result of poor arrangements to maintain batteries at full strength, and that network access was inconsistent, leading to frustration and disappointment.

Secondary schools had invested heavily in data projectors and interactive whiteboards. In general, school departments were invited to bid for these expensive resources, requiring them to justify their need for acquiring such systems. More than a few schools had purchased portable versions of these systems and these helped in allowing wider access to ICT in teaching.

School departments with a need for specialist ICT equipment, including science, art and music, had their relevant ICT resources located in their teaching rooms. This deployment allowed teaching staff and learners to make use of this specialised equipment within the teaching department and in the context of their wider studies in the subject. However, many teaching staff reported that there was insufficient resource to meet the demands of all learners wishing to use it. In this regard, cost was a significant factor.

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Almost all secondary schools had placed a number of computers in the school library. These computers were regularly booked by teaching staff for their classes but very few libraries had enough computers to allow a whole class, especially at S1–S4, to work together without learners sharing access. In many schools, pupils regularly used the computers in the library at breaks and lunch times to work independently on projects, folio work and revision. In more than a few schools, the librarian had responsibility for delivering programmes of information literacy and used the computers in the library for this purpose.

An increasing number of schools had configured their network systems to allow teaching staff to place learning and teaching materials in common areas and to allow learners to access these materials for personal and independent study. In a few schools this system was well organised and learners made good use of the resources. A few schools had implemented a VLE but development of such resources was at an early stage.

The growth in broadband access to the Internet had allowed many schools to provide Internet services to teaching staff and learners. In more than a few cases the speed of access remained slow but in many schools teaching staff and learners had reasonable access to Internet resources. An increasing number of teaching staff realised that it was important to provide guidance to learners on the most appropriate sites for their studies and had created portals to gather together useful learning or revision materials which they presented to learners through a web page. However, a few schools did not yet realise the potential of the Internet to promote learner skills in independent learning and discouraged learner use of the Internet unless under the direction of teaching staff.

Special schools visited were generally well resourced with assistive technology and appropriate software, and made particular efforts to ensure that learners had access to ICT resources that were appropriate to their needs outside the school premises and opening hours. Equipment was generally well deployed to meet the needs of learners.

The deployment of resources was broadly similar in all colleges. A number of computer suites supported learning and teaching in a wide range of subject areas, including computing, art and design, engineering, media studies, business and management, and languages. In addition, all colleges had open access areas, often linked to the library and learning resource services, with large numbers of computers. These areas were most often used by learners to work independently on course work and, in a few colleges, were the focal point for the delivery of programmes of core skills. The third element in colleges' resource deployment strategies was the resourcing of classrooms and teaching areas with appropriate ICT, including data projectors and interactive whiteboards. Particular areas also had specialist learning and teaching resources such as data logging equipment in science labs and computerised tills in hairdressing and beauty salons.

Computer suites generally contained equipment of modern specification but, with a policy of cascading resources as new equipment was acquired, most colleges had at least one computer suite where the equipment was not always fit for purpose. Open access areas were used frequently by learners, but not always purposefully in pursuit of the aims of their programme of study. Colleges had done little to evaluate the appropriateness of such areas for the range of learning activities expected of learners. Many learners on FE programmes did not have the necessary skills or attitudes to benefit fully from independent and personal study using ICT. Specialist equipment in teaching areas was generally deployed appropriately and valued by learners and teaching staff.

Most colleges had highly developed arrangements to allow learner access to resources to support their learning. These arrangements included:

- shared drives for teaching staff to store learning resources and for learners to access these resources;
- access to external repositories of learning materials such as the NLN;
- VLE with access from home; and
- structured catalogues of useful websites.

However, the extent to which learners made use of these arrangements to access learning materials varied from college to college. A few colleges had well-developed VLEs that were fully populated with appropriate learning materials, while others described their VLE as still “in the developmental stage” and consequently not yet often used by learners or teaching staff. Very few learners used the college VLE to gain access to learning materials from home. Most learners made some use of the network storage space provided by their college and a few colleges provided memory sticks to FE learners as part of their bursary allocation. Very few learners made effective use of the college e-mail facilities available. Teaching staff did not emphasise effectively enough to learners the important role that e-mail had in enhancing communication of such material as course work submissions, assessment specifications, and important announcements. In general, colleges did not exploit fully enough the range of ICT opportunities afforded to them by the infrastructure and resources available.

Within communities, libraries were well resourced with ICT equipment through the *People’s Network*. The situation in community centres was more patchy but had improved as a result of increased learner access to equipment and software, provided directly by the CLD service or through collaboration with other community partners and colleges. In many areas, provision of a set of laptop computers was the preferred method of giving learners access to ICT. In one large urban area, a mobile facility allowed the CLD service to provide community access to ICT at almost any location. Many CLD services enhanced learner access to ICT through partnerships with schools and colleges.

» Signpost to improvement in deployment of resources

- *Centre managers maintain a balance between resources based in teaching areas and those in computer labs to provide effective opportunities for all teaching staff and learners to make most effective use of ICT.*
- *Centres provide a level of specialist ICT equipment in such subject areas as art and music to meet the needs of all learners who can benefit from access to such resources.*
- *Centres make effective use of ICT storage facilities to make learning and teaching materials available online in a way that reflects the needs of the curriculum.*
- *Teaching staff make effective use of the increasing bandwidth available in their centres to include appropriate website content in their teaching.*
- *Teaching staff encourage learners to make effective use of online resources to enrich their learning experiences and develop independence in learning.*

3.2 Enhancement of teaching through ICT

In many pre-school centres, staff used technology toys effectively to engage children in learning through play. Teaching staff in primary schools used ICT most effectively in the development of learners' capacities in aspects of language, number work and environmental studies. Examples included:

- use by teaching staff of the interactive whiteboard, in conjunction with its notebook application,²⁸ to deliver an effective lesson on punctuation and direct speech;
- learners and teaching staff using the floor turtle to investigate concepts of position and movement; and
- use of the Internet by many teachers to research and present information sources to learners in relation to project work in environmental studies. This encouraged learners to use the Internet purposefully and effectively for independent and personal learning.

In other aspects of the primary school curriculum, there were examples where teaching staff made effective use of ICT in:

- provision for pupils with additional support needs;
- research for suitable learning and teaching materials on the Internet for lesson planning purposes;
- science through use of digital microscopes;
- religious and moral education for background research; and
- physical education for data logging in monitoring children's fitness.

A few teaching staff had the confidence and competence to extend their use of ICT for enhancing teaching into more experimental areas, such as the use of mind mapping software to document and organise class discussions, and the use of an interactive whiteboard for the teaching of listening skills in modern foreign languages. Teaching staff in primary schools made less use of presentation software for whole-class delivery of the curriculum than in secondary schools.

Primary teaching staff reported benefits from the use of ICT in their teaching. These benefits included:

- enhanced support for pupils with additional support needs;
- a more interactive approach to teaching and learning;
- the promotion of structured play;
- increased learner engagement through use of images and sound; and
- use of still and video cameras to document learner progress in project activities.

²⁸ Interactive whiteboards generally have a number of applications dedicated to enhancing their use. Among these is a notebook, or simple word processing facility.

More generally, teaching and other staff in pre-school centres and in primary schools did not exploit fully enough the opportunities available to them and their classes to enrich learning and teaching through the use of the available ICT in their centres.

In secondary and special schools, there was no consistent pattern of use of ICT in teaching. Subject areas with extensive use of ICT in one school would make little use of ICT in another. ICT produced real educational gain in a subject area in one school but had little impact on teaching approaches in other subjects in the same school.

There were varying degrees of sophistication in the use by teaching staff of interactive whiteboards. In primary classes, teaching staff generally engaged learners well in interacting with this equipment, thus involving them more effectively in the learning and teaching process. Some teachers in secondary schools incorporated a wide range of resources, including the built-in text processing applications, handwriting recognition, timers and clocks, symbol libraries, sound and animations, and commercial software designed for teaching. Others did no more than use the whiteboard to present teaching resources for which they had previously used an overhead projector. Their approach was often didactic with relatively passive learners. Imaginative uses of interactive whiteboards across a wide range of subject areas included:

- electrical circuit design in physics;
- vocabulary exercises in modern foreign languages;
- demonstrations of application software in computing studies;
- simulation and animation in human biology and in chemistry;
- video clips used by school chaplain at assembly;
- video in teaching of map bearings in mathematics; and
- the use of geography teaching materials and lists of useful websites from the Scottish Association of Geography Teachers (SAGT).²⁹

Many teaching staff with reasonable confidence in their ICT skills were using interactive whiteboards effectively, where security arrangements allowed it, to present interesting and appropriate websites to their classes. These resources added immediacy and currency to lessons, and pupils reported that their use enlivened lessons and enhanced their engagement with the subject. Many teaching staff continued to make good use of recorded video material.

In modern foreign languages, the *Partners in Excellence* initiative, a collaboration by three local authorities in the west of Scotland, had supported S5 and S6 pupils well in their acquisition of foreign languages.³⁰

²⁹ Scottish Association of Geography Teachers, <http://www.sagt.org.uk/>

³⁰ Partners in Excellence: <http://www.pie.org.uk> and <http://www.languagezone.org>

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In the creative and expressive arts, with an emphasis on the production of individual learner portfolios or pieces of work, teaching staff instructed learners in the use of scanners, digital still and video cameras as well as software to support image manipulation, music composition and film editing. This allowed learners to work individually and independently towards the creation of their portfolios. As a result of this approach, teaching staff in these departments placed less emphasis on the use of ICT for whole-class teaching. However, generally, there were insufficient software licenses to meet all learners' needs and they did not benefit as fully as they might from the limited access that resulted. In art departments more than a few teaching staff made good use of the Internet for the retrieval of images of art works of relevance to learners' studies.

Teaching staff in special schools and those with responsibility for learners with additional support needs made appropriate assistive technologies available to learners. These technologies included adapted keyboards, other specialised input devices and specially adapted programs. Teaching staff in special schools promoted effective use by learners of the assistive technology identified in section 2.3 of this report.

In too many cases, teaching staff did not appreciate fully the potential of ICT to change the ways in which they promoted effective learning through their classroom activities. They still placed high importance on copying from the whiteboard, regarding this as a means of ensuring subsequent recall, despite the fact that they could make files available to learners online or print the contents of the whiteboard display. They continued to value the exercise of writing down as a learning tool without considering how graphics, animation and sound could provide valuable interaction between learners and learning materials, thus reinforcing understanding and facilitating recall.

All colleges had equipped a number of teaching rooms with interactive whiteboards and data projectors. Only a few colleges had plans to deploy this equipment in all teaching rooms and others reacted to demand from individual lecturers or departments.

Teaching staff used interactive whiteboards to present lessons, for video projection, and to access Internet sites. More than a few also used the added tools provided with the whiteboard. For example, a teacher of physics used the supplied library of symbols for creating electrical circuit diagrams to construct such diagrams on the interactive whiteboard. He amended diagrams with ease and presented learners with a wider range of problems and discussion points more effectively than he could have done with a traditional whiteboard or overhead projector.

In colleges with a VLE, more than a few teaching staff used the materials stored in the VLE as teaching resources. Although these resources had usually been designed for learners to use independently, staff incorporated them usefully in their teaching approaches.

Specialist equipment and software was available in colleges for teaching in many subject areas, including:

- CNC³¹ lathes in engineering;
- video and image manipulation equipment and software in art and design;
- accounting software in business studies;
- musical instrument digital interface equipment and editing software in music;
- monitoring and diagnostic equipment and software in motor vehicle engineering;
- design software in textiles; and
- design software and specialist plotters in construction and in engineering.

Although all colleges had made efforts to encourage teaching staff to enhance their lessons through the use of ICT, the main focus of colleges' efforts was in relation to the transformation of learning activity through the use of ICT. This topic is covered in the next section.

Where assistive technologies had been identified for use with particular learners in schools and in colleges, staff supported learners very well in their use of this equipment.

Many CLD staff had attended training events to enhance their ability to use ICT to deliver their programmes. However, the focus in CLD remained on the use of ICT to enhance the learning process with teaching staff providing support and assistance, rather than using ICT in teaching activities.

3.3 Learners' use of ICT

Almost all learners had developed, or were developing, a wide range of ICT skills through engagement with ICT at home, in education or in work. Many learners used a few of these skills to support their learning although, for most young people, this aspect of ICT use was perhaps the least significant.

All education authorities had implemented programmes for the development of ICT skills in young people. These programmes were mostly based on *Early Learning, Forward Thinking* in pre-school centres and on the *5-14 National Guidelines* on ICT in primary and secondary schools. Colleges included ICT (along with communication, numeracy, problem solving and working with others) in their programmes of core skills development for all FE learners, with certification generally at SCQF Levels 4 and 5.

>> Signpost to improvement in teaching through ICT

Teaching staff:

- use resources obtained from appropriate websites to enhance their teaching;
- make effective use of equipment and software specific to their subject area;
- plan effectively to use ICT to support whole-class, small group and individual approaches to curriculum delivery;
- make appropriate effective use of e-mail and discussion forums to engage learners in debate and reflection on their studies;
- work effectively with learners with additional support needs to make best use of assistive technologies; and
- review the continuing relevance of traditional approaches to promoting learning in the light of new approaches offered by the use of ICT.

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Learners in primary schools generally developed levels of ICT skills that allowed them to use ICT effectively to enhance and enrich their learning. The *5-14 National Guidelines* provided the basis for a number of effective programmes of study. These programmes were designed to develop ICT skills in young people in a progressive manner from P1 to S2. However, too little attention was given in these programmes to the development of learners' skills in information literacy. Almost all learners rated themselves highly confident and competent in their use of ICT but only a few had the skills of searching, selection and analysis essential for fully effective use of the Internet for learning. They had little knowledge of the techniques that could be implemented to narrow down search results, including the use of logical operators such as *and*, *or* and *not*, quotation marks and parameters. This was also true for a large number of teachers. In addition, many learners did not take enough care to formulate their search terms precisely with the result that too often their search results did not provide appropriate information.

In a large number of transitions between primary and secondary education, secondary school managers failed to take adequately into account the prior learning and skills that S1 learners had acquired at primary school. In more than a few cases, secondary school managers planned their S1 programme of ICT skills development on the basis that learners had developed very few ICT skills in primary school. These managers claimed that this approach was essential as learners from different primary schools had achieved differing levels of ICT skills and that the only practicable approach that the secondary school could take was to start largely from scratch. Secondary school managers underestimated significantly the demotivating effect on many S1 learners of such an approach.

Many college learners used ICT-based learning and teaching materials effectively in their studies and, in addition, developed effective specialist ICT skills related to their chosen vocation. Such skills included diagnostic use of ICT in motor vehicle engineering, spreadsheets for management accounting, and imaging applications in multimedia programmes. More than a few college learners did not develop their ICT skills effectively enough, usually because they failed to realise the importance of these skills in the context of their vocational programme. This attitude was more common where lecturers taught programmes of ICT skills development without a meaningful vocational context with which to retain student interest and motivation.

Community-based learners used ICT and developed ICT skills in using community Internet or intranet resources, as well as for programmes of communication and numeracy skills.

The extent to which learners used ICT to enhance their studies differed across sectors. In many pre-school centres and primary schools, learners had very good opportunities to develop knowledge, skills and understanding through use of ICT, independently, in groups or under the guidance of staff. In many cases, learners had excellent ICT skills that they had developed outwith school but did not have an opportunity to exploit them in a learning context. In secondary schools, the emphasis was on learner use for project work throughout the school and for independent study in the upper school. In colleges and, to a lesser extent in CLD, staff expected learners to take a measure of responsibility for their own learning through the medium of ICT.

In the majority of pre-school centres, teaching staff provided good opportunities for learners to use ICT to enhance their learning opportunities. For example, learners shot video sequences and staff then edited them to create their own movies. There was good use of technology toys. In more than a few centres, learners used ICT to form links between home and the pre-school centre. For example, with the help of parents they recorded on video family activities or aspects of their home life. They then used this material as the basis for discussions in the centre. In a few centres, teaching staff were less proactive in their approach to the use of ICT and learners had discretion in relation to their use of computers, technology toys and imaging equipment. On occasion, this meant that staff missed opportunities to lead children's use of ICT effectively.

In primary schools, the presence of computers and other ICT equipment in classrooms provided ready access to ICT for learning activities but the small number of computers in classrooms generally meant that not all learners could use ICT readily when its use fell naturally within a learning activity. In such cases, access to a computer suite was very useful.

Almost all primary pupils reported that they used ICT for individual research into project or topic work. They found this aspect of their studies particularly enjoyable and motivating. In addition, they developed their understanding of movement, space, direction and angles through work with floor turtles.

Most learners began to develop their word processing skills at an early stage. The use of simple word processing applications helped in this development. By the later stages of primary school, learners had sufficient skills in word processing to be able to focus on their language work, rather than on the mechanics of the word processing application. They incorporated images into their documents, thus adding interest and colour to their work. In many schools, learners in the upper primary became skilled in reporting on their projects through the use of software and presented their reports confidently to their peers and teaching staff. Presentations of project results nearly always included images and, on occasion, video clips.

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In a few schools, learners made use of spreadsheet applications for number work but learner skills in the production of graphs and charts were not well developed. In most schools, learners were exposed to number concepts through educational computer games. More generally, most teaching staff did not fully appreciate the potential of computer games to promote the development of learners' skills in strategic thinking, problem solving, and collaborative and competitive interactions with peers. As a result, teaching staff did little to encourage learners' use of appropriate computer games to develop the skills identified above.

In other areas of the primary school curriculum, ICT provided valuable stimulus to learning in expressive arts, where learners in more than a few schools made extensive use of digital stills cameras, video cameras and sound files to develop their skills in this area. In environmental studies, in health and in religious and moral education, learners made good use of the Internet to broaden their knowledge and to research topics of study.

Learners with additional support needs benefited from use of ICT. Teaching staff used drill and practice software with pupils to support development of literacy and number skills. Children with autistic spectrum disorders used online documents that supported their work with adapted books. Readers needing additional support used grid-based writing and reading tools to improve their reading and writing skills. A few schools used software successfully to support learners with dyslexia. A range of adapted and assistive technology was in use in a large number of primary schools and in special schools to support the learning of those with additional support needs.

More than a few learners in secondary schools used ICT effectively to enhance their learning experiences across a range of subject areas and through a wide range of applications. Occasionally, they used ICT for trivial purposes such as word searches or for work unconnected with the timetabled subject. In the latter case, learners could choose what they used the computer for, as a reward for completing work early. This did not often lead to enhanced learning in the subject area.

Increasingly, departments such as English and social subjects encouraged and expected learners, especially in the upper school, to use word processing software to prepare essays and project reports. Learners valued and were proud of the professional appearance of their finished work. A few learners had begun to incorporate images into their work but this was not yet widespread and not always encouraged by teaching staff. Few teaching staff encouraged learners to submit their word processed files through e-mail.

Many schools had adopted the SCHOLAR³² suite of online courses in a range of subjects at Higher and Advanced Higher levels. Although in some schools, teaching staff used the SCHOLAR materials for teaching purposes, the main use was by learners for independent study. Most learners active in SCHOLAR valued the resource and reported that it helped them to revise and to continue their studies both in school and outside school hours, mainly at home.

32 SCHOLAR: an initiative of Heriot-Watt University, <http://scholar.hw.ac.uk/>

In many subject areas, learners used presentation software well to prepare and present project findings to their peers and to teaching staff. They usually presented their reports orally, supported by their presentation files. A valuable spin-off from this was increased learner confidence and competence in standing up before a group of their peers and teachers and talking about their work. This had the potential to contribute effectively to learners' skills for employability. Almost all of these presentations followed a linear pattern of exposition and very few learners or teaching staff used, for example, mind mapping³³ software to organise and present their ideas and reports.

In all secondary schools, learners at all stages made use of the Internet for research and independent study. In many schools, such use of the Internet had replaced much of the former use of library books for researching project topics. However, because learners had generally not received adequate or sufficient training in skills of information specification, retrieval and analysis to allow them to make the most effective use of the Internet, searches for information were often badly specified. This resulted in many thousands of matches, leaving learners unsure of how to make best use of the information presented to them, most of which was not relevant to their needs. In many cases, teaching staff had identified useful websites for their subjects and directed learners to these sites. This provided a more focused approach to information retrieval for learners.

In many secondary schools, the art and music departments provided learners with opportunities for some of the most imaginative and effective uses of ICT. In music, learners, especially in S3 and above, benefited greatly from use of software for:

- music composition and editing;
- virtual ensemble playing;
- experimentation with virtual instruments; and
- immediate feedback on the sound of their compositions.

In art, learners made effective use of hardware and software to:

- capture digital images;
- scan freehand graphics for later digital manipulation;
- manipulate graphics and photographs;
- experiment extensively with the creative features of software; and
- produce artefacts of very high quality.

Teaching staff in these subjects reported regularly that the quantity of hardware and software available to their departments was a limiting factor in their ability to meet the demand for places on courses in S3-S6, and learners reported that departments often cited this shortage as the limiting factor in offering course places. Ironically this demand had come, in part, from the highly interactive nature of the software available for learning in art and in music.

³³ A mind map is a diagram used to represent words, ideas, tasks or other items linked to and arranged radially around a central key word or idea. It is used to generate and visualise ideas and thoughts.

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In a few schools, modern language departments had begun to explore the potential of podcasts³⁴ to enhance foreign language learning. Learners listened to podcasts either on their personal music players or on school computers.

Colleges promoted learner use of ICT in four main ways.

- Teaching staff encouraged learners to use word processing applications to prepare course work and assessments.
- Learners made use of learning resource centres or open access centres to work independently on course work, either through Internet research or through access to courses mounted on the college VLE or through materials stored in shared folders.
- Where there were enough appropriately deployed computers, teaching staff directed learners during lessons to appropriate online materials.
- In more than a few colleges, teaching staff adopted a blended learning approach to delivering the curriculum. This involved learners in an appropriate mix of online and traditional approaches to learning.

Learners generally used ICT well in class when supported effectively by teaching staff. They used word processing software to good effect to produce their finished course work and assessments. However, many learners, especially those on FE programmes, had not developed their skills of independent learning sufficiently to make most effective use of colleges' facilities for independent learning in learning resource centres. As a result, many learners were not able to benefit fully from this mode of study. Learners on higher education (HE) programmes generally made more effective use of colleges' facilities for independent study and welcomed the opportunity to take more personal responsibility for their learning.

Learners on CLD programmes benefited from using ICT to enhance their life prospects. They accessed information related to employment opportunities or to further education. They used ICT to prepare their curriculum vitae and to word process job applications. They used the ICT skills they learned in CLD programmes to develop their personal, social and recreational interests through access to the Internet.

Signpost to improvement in << learners' use of ICT

- Centres deliver well-designed and up-to-date programmes of ICT skills development for all learners.
- Programmes of skills development give particular importance to the development of information literacy skills.
- At transition stages, particularly between primary and secondary, centres take good account of learners' prior achievement when designing programmes of ICT skills development.

Learners use:

- ICT effectively to extend their learning experiences and to develop skills in independent learning;
- ICT effectively in all subject areas;
- word processing software and e-mail facilities routinely to complete and communicate course and project work; and
- appropriate ICT resources to store and present a portfolio of their work and achievements.

³⁴ Podcast: a media file that is distributed by subscription over the Internet for playback on mobile devices and personal computers.

3.4 ICT for assessment

At a national level, SQA piloted online assessment for elements of Biotechnology at Intermediate 2 and Higher in 2006 and planned to extend the pilot in future years. Through its SOLAR³⁵ project, SQA was developing online summative assessments to support its programme of HN modernisation. The Colleges Open Learning Exchange Group (COLEG)³⁶ received funding from SFC to develop online formative assessment items across a range of subject areas at SCQF Levels 1-8. These assessment items were designed to be incorporated into the range of VLE in place in Scottish colleges. SCHOLAR courses contained online formative assessment, generally used by learners to check their understanding of a topic before moving on to next steps. Most commercial software for the curriculum offered learners opportunities for progress checking and self-assessment. Most learning materials in college VLE were supported by formative assessment items. However, across all sectors, individual centres had carried out very little development work in relation to online assessment.

A small number of centres had identified the potential of video technology to record learner performance and activities and to analyse progress. Teaching staff in pre-school centres used video footage to review children's progress in learning and to plan next steps. In one special school, teaching staff used video technology to analyse their interactions with pupils. They watched this with specialist staff and observed how their own non-verbal cues influenced children's behaviour. In secondary PE departments, staff regularly recorded learner activity in sports and used the resulting video material to analyse and suggest improvements to learner performance. To a lesser extent, teachers of drama recorded learners' practical work and discussed their performance with them.

The technology to allow online assessment of all kinds, including marking of extended essay responses, was not yet readily available or affordable in schools and other centres. The available technology coped well with multiple choice assessments and was improving in relation to short-answer responses. Critics of online assessment referred to this partial coverage of assessment methodologies to question the value of online assessment in general, but the existing coverage represented a promising start to work in this area. The benefits of online assessment, including immediate feedback to candidates, improved flexibility of access to assessment. Savings in valuable teaching staff time had the potential to contribute to the flexibility of the curriculum advocated in the programme for *A Curriculum for Excellence*.³⁷ However, in almost all centres, insufficient facilities and resources were in place to allow online summative assessments to be carried out simultaneously for more than a few learners.

>> Signpost to improvement in the use of ICT for assessment

- Teaching staff and learners make effective use of the formative assessment opportunities available through the learning and teaching software in use.
- Where appropriate, teaching staff use video evidence to record and assess learner progress and outcomes.
- Centres review their ICT deployment with a view to facilitating appropriate use of online summative assessment.

35 SOLAR: <http://www.solarproject.org/>

36 COLEG: <http://www.coleg.org.uk/>

37 *A Curriculum for Excellence*: A programme to improve the learning, attainment and achievement of children and young people in Scotland. Partners are Scottish Executive Education Department, LT Scotland, HMIE, SQA.

3.5 Online communities

Communities of learning, through online resources based on websites, make available to users of the websites a range of services to support learning, usually in an aspect of a particular subject area. These services include access to learning materials, advice on learning strategies and approaches and opportunities to engage in discussion with other learners. Many of these resources, especially in colleges, take the form of discussion forums. Communities of practice relate more to the work of teaching staff and provide an online forum for the discussion of teaching approaches in a particular subject area, access to useful teaching and learning materials and sometimes an evaluation service for online teaching resources.

Attitudes among teaching staff in all sectors varied towards the value of online communities of practice. There was no activity in this area in pre-school centres. A very few headteachers saw no value in online communities, discussion forums or special interest groups and did not use them. For these headteachers, this included the online community *Heads Together*.³⁸ However, among those headteachers across all school sectors who used *Heads Together*, almost all valued their membership of the group.

A number of communities of practice had evolved round the wide range of subject associations linked to secondary education. Many of these associations had websites that had useful resources for teachers and a few supported discussion forums. Many teachers found these sites of particular value in identifying useful online learning and teaching resources and in promoting discussion of learning and teaching issues in their subject area. Of particular note were the website of SAGT for geography and the MFLE area of LT Scotland for modern foreign languages. The *Masterclass* community of trained ICT champions was hosted on the LT Scotland website.³⁹

National organisations such as the BBC, LT Scotland, SQA, SFEU and others had websites with significant resources of interest to teaching staff, learners and parents. Many individual teachers (and pupils) had created their own weblog site (blog)⁴⁰ where they promoted discussion of educational topics. An increasing number of websites now offered web feed services, such as Really Simple Syndication (RSS)⁴¹ and more than a few teachers used these services to gain access to up-to-date content from websites of interest to them in their teaching.

38 Heads Together: an online community of practice for headteachers only, supported by LT Scotland: <http://www.ltscotland.org.uk/onlinecommunities/aboutheadstogether.asp>

39 Masterclass: <http://www.ltscotland.org.uk/onlinecommunities/aboutmasterclass.asp>

40 Weblog (blog): a user generated website usually devoted to a particular topic or based on a personal diary. The ability for readers to leave comments in an interactive format is an important feature of many blogs.

41 RSS: Really Simple Syndication (or Rich Site Summary), a service to download information automatically, from selected web sites, as new content is placed on the site, facilitated by an aggregator application running on the user's computer.

Learners made use, in class and at home, of a number of communities of learning. In schools many learners were members of *Think.com*⁴² or *Grid Club*.⁴³ At times, the burden placed on teachers by the need to monitor the content of learners' personal pages on these sites led some teaching staff to question the net value of these services but all learners found them valuable and enjoyable to use.

An increasing number of schools, both primary and secondary, had created their own school website and these sites were useful in informing learners, teaching staff, parents and the wider community of the life and work of the school. They were often the focus of celebrations of achievement by members of the school community and served to present the face of the school to the wider world. Most of these sites had been created by and were maintained by enthusiastic teachers and learners. As a result, they were not always sustainable if these teachers or learners moved away from the school and more than a few were of poor quality.

A few colleges had made efforts to foster discussion forums among their learners, especially those on HE programmes, particularly in social science. Typically, these discussion groups were hosted on the college VLE and teaching staff encouraged discussion of topics related to learners' programme of study. These discussion forums were rarely successful. Teaching staff attributed this to a lack of awareness by learners of the benefits to be gained through peer discussion, and to an unwillingness among large numbers of learners to work beyond the minimum level required to pass assessments. College websites acted as focal points for the dissemination of information to the local community as well as enabling potential learners to apply for programmes online.

The most successful online discussion forums were those devoted to the efficient and effective use of commercial applications in widespread use. A few teaching staff were aware of these forums, particularly in the areas of art and computing studies and they directed learners to these forums as a useful source of information and help for the applications they encountered in school or college.

Learners in the community had access to a rich range of online websites designed to develop communities. Many of these had been set up by the local authority and provided valuable information and advice to local people on opportunities to become involved in the development of their communities.

>> *Signpost to improvement in the use of online communities*

- *Staff at all levels are aware of and use effectively an appropriate range of online communities of practice.*
- *Teaching staff make effective use of learning and teaching materials available online from communities of practice and other interest groups.*
- *Centres use their own websites to communicate effectively with key stakeholders.*
- *Learners make effective use of appropriate communities of learning and discussion forums.*
- *Teaching and other staff have skills and time to moderate discussion forums.*

⁴² Think.com: http://www.think.com/en_gb/

⁴³ Grid Club: <http://www.gridclub.com/>

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Section Four: The impact of ICT

Overview

While much progress has been made in recent years in the impact that ICT has had on learning and teaching, excellence exists only in isolated pockets. There has been a general improvement across all sectors but the overall impact of the adoption of ICT in learning and teaching does not reflect its potential. This section of the report identifies where progress has been made and where improvement is required.

There is a clear link between appropriate and effective use of ICT in learning and teaching and increased **learner motivation and engagement**. This is confirmed by learners and by teaching staff. This section of the report identifies a number of examples of the link between use of ICT and increased motivation and engagement.

The issue of the impact of the use of ICT on **learner progress and outcomes** is less clear. Learners' use of ICT broadens and deepens their learning. This is notable in relation to learners with additional support needs. The report identifies a number of examples of improvements in learning. However, inspectors found no evidence of increased attainment, in formal qualifications or against nationally defined levels, that could be directly attributed to the use of ICT in learning and teaching.

The impact of ICT on learners' **development of wider skills** is evident in a number of ways. They use a broad approach to communication, incorporating sound and images into their presentations. In CLD, ICT enables learners to develop competences that enhance their life chances.

Only in a few centres has the use of ICT in learning and teaching brought about permanent change, with educational gain, in learning and teaching approaches. There are pockets of excellence but the general picture is one of only limited success in achieving such **transformation**. The report identifies the elements that need to be in place before there can be permanent change with educational gain.

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Key strengths

- The use of ICT has a positive influence in promoting learner motivation and engagement. This is particularly apparent in some aspects of boys' learning.
- There is improved learning across a range of subjects through use of ICT.
- Learners with additional support needs show improved learning when they use ICT effectively.
- Learners' wider achievement is improved and enhanced through use of ICT.
- Learners use ICT well to develop their understanding of the world in which they live.
- Community learners recognise through their community-based learning the contribution that ICT can make to the enhancement of their life chances.

Aspects for improvement

- Establishments do not consistently and comprehensively have in place all the elements necessary for learning and teaching to undergo transformation through effective use of ICT.
- Although there is extensive and intensive use of ICT in all sectors, very little of this use of ICT has transformed learning and teaching.
- Very few centres have carried out a comprehensive or systematic evaluation of the extent of improvements in learner motivation and engagement through use of ICT.
- Teaching staff use an insufficiently wide range of ICT-based teaching approaches to maintain and increase learner motivation.
- Colleges do not evaluate effectively enough the impact of ICT-based learning centres in facilitating learning.
- Centres do not have effective arrangements in place to identify the impact of ICT on learner attainment.
- Many teaching staff make no distinction between information search and retrieval, on the one hand, and plagiarism on the other, and reject learners' researches inappropriately. Learners do not understand fully the importance of identifying sources of information.
- More than a few teaching staff in secondary schools and in colleges do not value or recognise the role of ICT in enhancing a broader range of learning for life, society, culture and personal development than is typical in the formal taught curriculum.

4.1 Learner motivation and engagement

Staff in centres in all sectors found that when learners made use of ICT their motivation and engagement improved. Very few centres had carried out a comprehensive or systematic evaluation of the extent of such improvement or the circumstances under which it occurred but these findings by staff were consistent with external evaluations by HMIE. Learners also reported increased motivation and engagement when they used ICT in their learning but, in a few cases, were demotivated when teaching staff used only a narrow range of ICT resources in their teaching.

In almost all pre-school centres, all learners engaged enthusiastically with ICT in their learning and play. In particular, boys showed marked improvements in their motivation, particularly in aspects of language work. There were also examples of enhanced engagement with learning in those with additional support needs. In primary schools, clear benefits included:

- enhanced interaction by learners with learning materials;
- learners spending more time on task;
- peer support when using ICT;
- improved willingness to write, especially among boys;
- less disruption to learning activities through keen engagement;
- improvements in the readability and attractiveness of written work;
- development of skills in working with others through collaborative activities; and
- improved perseverance when solving problems.

Learners' engagement with the teaching process increased when teaching staff used the facilities offered by interactive whiteboards to deliver whole-class lessons. However, learners were often demotivated if they were unable to gain access to ICT equipment or materials because of malfunction or insufficient resources.

In secondary schools, more than a few staff found improvements among boys in relation to motivation, time on task, behaviour and attendance. More generally, there was improved learner motivation and engagement across a wide range of subjects. These improvements did not occur in specific subjects. They occurred most frequently where the ethos of the school or department and the enthusiasm of individual members of the teaching staff combined to embed ICT effectively in learning and teaching activities. Benefits related to:

- learner motivation, behaviour and attention;
- independent study by learners;
- increased pace of learning and teaching activities;
- the motivating effect of computer games and quizzes; and
- drafting and redrafting of written work.

Where schools used ICT effectively (through e-mail or text messaging) to contact parents in the case of their children's unexplained absence, their attendance improved.

In special schools, learners' motivation and engagement improved through the use of specialised equipment and ICT-based formative assessment. This led to improved learner self-esteem and better work rates. Learners became better engaged with the life and work of the school.

A few teaching staff noted adverse effects of the use of ICT in learning and teaching. These effects included:

- the demotivating impact of unreliable ICT equipment leading to a general lack of confidence in ICT as a serious tool for learning and teaching; and
- reinforcing learners' short attention spans through "bite sized" learning materials.

In general, pupils spoke more enthusiastically about their use of ICT in school than did teaching staff. Pupils confirmed that their motivation and engagement was enhanced by:

- use of the Internet during lessons to retrieve additional information;
- simulations and animations;
- computer games;
- ease of drafting of essays using word processing software;
- ability to work independently using ICT;
- more lively lessons when teaching staff used ICT appropriately;
- use of imaging hardware and software;
- use of graphics and sound in lessons; and
- less disruption from peers.

More than a few learners complained that teaching staff made too much use of presentation software in lessons, and learners not uncommonly experienced lengthy sequences of lessons based on teaching to presentations made up of bulleted slides. Teaching staff did not liaise sufficiently with each other to discuss the cumulative implications of their approaches to using ICT in lessons and were too often unaware of these difficulties for learners.

The impact of ICT 4

In colleges, teaching staff had not evaluated effectively enough the impact of their use of ICT on learner motivation and engagement. However, they found that, where their teaching and lesson materials incorporated graphics, sound or animations, learner attention was more keen and retention of information was enhanced.

Learners in colleges appreciated the occasions when teaching staff used ICT effectively to deliver lessons. Many learners valued their access to college VLE systems and worked effectively and independently in these environments. However, most colleges assumed that their learners were sufficiently motivated and engaged with their studies to make effective use of ICT-based learning materials at home or in college learning centres. This assumption was more justifiable in the case of HE learners than in the case of FE learners. Colleges had not evaluated effectively enough the impact of their ICT-based learning centres in facilitating learning.

4.2 Learner progress and outcomes

No centre visited for this report had carried out a systematic study of the impact of the use of ICT on progress in learning and attainment of formal qualifications. No centre reported improved attainment in award-bearing courses or programmes that could be directly ascribed to the use of ICT in learning and teaching.

Many staff found that the use of ICT had broadened and deepened learning in subject areas. There was clear evidence of improved progress in learning when learners with additional support needs used ICT to meet those needs.

In pre-school centres, children's learning through play with an ICT element had often developed much further than anticipated by staff. In one centre, use of ICT had contributed well to aspects of citizenship, including sharing of resources and working with peers.

In primary schools, progress in particular aspects of learning was linked to effective use of ICT. Examples included:

- spelling and writing, particularly for boys;
- problem solving in mathematics;
- research skills;
- presentation skills;
- breadth of learning in topic and project work, through the range of source materials identified; and
- development of independence in learners.

There was a positive impact of ICT use on the language work of learners with a range of additional support needs. In particular, learners with reading difficulties showed improvements in their reading.

Signpost to improvement in learner motivation and engagement

- *Learners' motivation improves when they make appropriate and effective use of ICT in their learning.*
- *Teaching staff make effective use of ICT in their lessons to broaden and deepen learners' understanding and skills.*
- *Teaching staff adopt a variety of approaches to the use of ICT in order to maintain learner interest and engagement.*
- *Teaching staff liaise with colleagues to ensure that learners experience across the curriculum a range of approaches to using ICT for learning and teaching.*

In secondary schools, the range of benefits to learners included:

- improvements in the quality of learner work in art and in graphical communication;
- enhanced learner performance in team games in Higher physical education through use of games analysis software;
- a greater focus on improving core skills such as communication and team working through such projects as school newsletters incorporating multimedia;
- use of a digital language lab in modern foreign languages to encourage pupils to work more independently;
- improved learner performance in the solution of mathematical equations; and
- the use of assistive technology in improving learner progress in special schools.

Schools also recognised improved achievement beyond the academic curriculum. This progress stemmed from initiatives such as:

- compilation of a school yearbook using ICT;
- learner contributions to a school website;
- a digital arts group for learners with behaviour difficulties in a mainstream school, as part of the school's promoting positive behaviour initiative; and
- production of DVDs to report on school trips and to introduce the school to new learners and parents.

In a few schools, staff perceived a direct correlation between high attainment in external examinations and school departments that were effective users of ICT for learning and teaching. There was, however, no objective evidence of cause and effect. These departments varied from school to school.

Many teaching staff claimed that extensive use of the Internet by learners had led to an increase in the prevalence of plagiarism in written homework, and a failure to acknowledge sources obtained from the Internet and quoted verbatim in learner submissions. While teaching staff rightly marked down work where plagiarism was apparent, there were cases where selection and incorporation of verbatim material was entirely appropriate. In this regard, teaching staff often failed to identify clearly enough the purpose of a piece of homework or to explain the purpose to learners and advise on presentation. Where pupils were required only to find and present information, teaching staff often took exception to them copying and pasting material from websites and inserting it into their homework. Teaching staff often as a matter of course required learners to express in their own words the information they retrieved from the Internet, even though that retrieved information was well expressed. Teaching staff did not ask learners often enough to talk about their homework, to summarise orally the information they had obtained or to explain its significance. For their part, learners did not understand fully the importance of identifying in their work sources of information obtained from the Internet.

The impact of ICT 4

In colleges and in CLD settings, there were benefits in very similar areas to those in secondary schools. Learners developed skills in independent learning through open access centres and through use of the Internet but teaching staff in post-school sectors did not evaluate effectively enough how well this approach to study benefited all learners.

4.3 Development of wider learning and skills

Teaching staff in pre-school centres and in primary schools recognised that learners developed awareness of the world in which they live more effectively when this included engagement with the world through ICT. Learners used video cameras to record their world and comment on it. Their explicit choices of what to record were effective indications of emerging creativity. More than a few teaching staff recognised individual and group views of the world contained in learners' videos and used them to explore issues in areas such as citizenship and the environment. Access to the Internet also developed learners' appreciation of other cultures and encouraged them to reflect on their own world.

Many teaching staff and learners in secondary schools noted improvements in learners' communication skills and a greater use of image and sound in communicating messages or information. However, many teaching staff did not value or recognise the role of ICT in enhancing a broader range of learning for life, society, culture and personal development than was typical in the formal taught curriculum.

Very few teaching staff in colleges recognised the contribution to wider learning for life that ICT could make in learners who developed ICT competence. They recognised that ICT improved motivation and engagement and that it provided a rich source of information on which learners could base discussion, analysis and conclusion. However, in general, they had not considered how learners might apply more widely those ICT skills that they promoted. On the other hand, staff and learners in CLD recognised that the development by learners of ICT competences opened up a broad and stimulating range of possibilities for the enhancement of life chances, mainly through use of the Internet.

Signpost to improvement << in learner progress and outcomes

- Teaching staff and curriculum managers identify and adopt effective approaches to the use of ICT teaching in order to improve learner progress and outcomes.
- Teaching staff and curriculum managers identify and promote an effective range of learner activities using ICT in order to improve learner progress and outcomes.
- Teaching staff promote and develop effectively learner skills in independent learning using ICT.
- Centres implement clear and meaningful arrangements to evaluate the impact of the use of ICT in improving learning.

Signpost to improvement << the development of wider learning and skills

- Through their exposure to ICT, and in particular the use of image and sound, learners develop their creativity.
- Learners' use of the Internet leads to a greater knowledge and appreciation of cultures other than their own.
- Teaching staff recognise the role of ICT in the development of wider skills.

4.4 Transformation in learning and teaching through ICT

To what extent has the use of ICT enabled schools and other centres to make progress towards becoming excellent organisations? The answer is mixed but, for large areas of learning and teaching activity, there is not much evidence of transformed practice. Very little progress has been made in applying ICT towards the development of personalised learning. Learners' sense of the contribution that ICT could make to enhancing and enriching their learning was not apparent in all learners. They were not using ICT effectively to develop independence in learning. That is not to say that ICT was not used extensively and intensively by learners and teachers. It was undoubtedly the case that the provision of appropriate infrastructure, hardware, software and materials resulted in most teachers and learners engaging with ICT to some extent. But several elements which have to be in place before transformation in learning and teaching through ICT can take place include:

- effective and informed leadership at senior management, departmental and classroom levels;
- access to reliable and appropriate hardware and software;
- high levels of confidence and competence in, and commitment to the use of ICT by teaching staff;
- high levels of learner competence and confidence; and
- availability of, easy access to, and effective use of learning and teaching materials that exploit the strengths of ICT.

No centre visited for this task, from pre-school centres to colleges, managed to put all of these elements in place consistently throughout the establishment. This was consistent with findings in wider HMIE inspection programmes. Many centres managed most of these but were usually let down by lack of appropriate access to ICT to allow permanent change in practice, leading to loss of motivation by teaching staff.

There was clear evidence that learner motivation and engagement was enhanced by effective application of ICT. There was anecdotal evidence that the use of ICT brought about progress in learning, particularly in topics that many learners found difficult to assimilate. Many teaching staff claimed that learning and teaching were transformed through the use of ICT in their classroom. However, in many cases, these claims did not bear close examination in terms of demonstrable educational gain. For example, the use of a data projector to present a linear sequence of pre-prepared pages of material in place of an overhead projector was not transformational. The use of a data projector, combined with imaginative choice of learning and teaching materials had potential to transform teaching activities and the learner experience. The further opportunities offered by appropriate use of an interactive whiteboard offered far more possibilities for new and effective learning and teaching activities beyond those available with an overhead projector.

The impact of ICT 4

In the schools sectors and, to a lesser extent in the college sector, much effort had gone into equipping classrooms with data projectors and interactive whiteboards. Many teachers believed that the use of such equipment had transformed their teaching. Certainly, imaginative exploitation by some teaching staff of the rich environment of an interactive whiteboard had made learning more enjoyable. Learners attested to that. In addition, more than a few teachers reported that they enjoyed their teaching more when they used such equipment.

There were examples of the use of ICT in many establishments that, if sustained and further developed, should lead to transformed learning and teaching practices. These included the use of:

- technology toys in early education;
- increased use of ICT in number and literacy work in pre-school centres and primary schools;
- well-designed software for learning and teaching in secondary school subject areas;
- software for creative expression in art and music in secondary schools;
- learning materials outside timetabled classes and away from school or college;
- podcasts in modern foreign language learning;
- mobile phones for community learners in remote areas;
- VLE for learners in colleges; and
- the Internet as the preferred research and information-finding tool in most sectors.

The transformation of learning activities through use of ICT was evident in many centres but not consistently across all areas within them. This transformation included:

- development of independence in learning, particularly in special schools;
- exploration of topics through the Internet more widely and deeply than prescribed by their teacher;
- development of more effective problem-solving skills, especially in mathematics;
- more effective team-working skills, including peer teaching; and
- more effective communication between and among learners and teaching staff.

The conditions for effective use of ICT to transform learning and teaching, as identified above, were not in place in all centres. The future challenge for staff and learners in all establishments is to create those conditions and then to embed ICT in their learning and teaching in ways that will produce real educational gain.

Signpost to transformation <<

- *There is effective leadership at senior management, department and classroom levels for the use of ICT.*
- *Learners and teaching staff have access to reliable and appropriate hardware and software.*
- *Teaching staff are highly confident and competent in their use of ICT and are committed to its effective use in their teaching.*
- *Learners have high levels of confidence and competence in the use of ICT.*
- *Teaching staff and learners have ready access to, and use effectively, learning and teaching materials that exploit the strengths of ICT.*
- *The use of ICT in learning and teaching is targeted on clear educational gain.*

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