



Project 5: models of access to ICT in secondary schools

The research on which this synopsis is based was carried out by Advisory Matters Limited.

Introduction

When planning their strategies for ICT access, secondary schools have to meet three key requirements. First, there exists the statutory duty to deliver ICT as a subject at Key Stages 3 and 4; second, ICT must be developed as a key skill across the curriculum; and third, ICT provision needs to be extended beyond the classroom.

In meeting these demands secondary schools need to consider a number of factors, ranging from those of a local kind which pertain to a particular establishment, to ones of a more general nature. For example, making best use of limited teaching space and securing ICT funding relate, on the one hand, to the physical layout of a school and, on the other, to financial sources and the degree to which their availability may be affected by regional variations. Other issues will be more universal, such as the need to locate computers appropriately to ensure they are used effectively as teaching and learning tools.

The question of networking equipment is also fundamental when considering the location of ICT provision. Many secondary schools are developing local area networks and intranets, as well as employing laptops, whiteboards and browser technologies. This focuses attention on additional issues, including access to software and server capabilities. The need in certain areas for specialist software, or simply the school's physical layout, may necessitate more than one server or require that computer resources are 'clustered' around points of use. Any number of local and national factors have an effect on the model of access employed in each school.

Ofsted states in its interim reports on ICT in schools (April 2001 and April 2002)¹ that access to accommodation for ICT use in schools varies widely. The British Educational Suppliers Association² (BESA) reports that in 2001, 86 per cent of secondary schools located the majority of their computers in suites. Computer suites are the traditionally accepted model of access and usually house between 15 and 30 stations. However, Ofsted reports that most secondary schools are also providing, or planning to provide, additional facilities in the form of 'clusters' or 'mini suites', so that a 'mixed economy' model of access to computers is available.

This project set out to explore the ways in which schools use a variety of models to provide access to ICT, how teachers take up and use the access options available to them, and what influence these factors have on teaching practice and pupil engagement. The project's aims were to:

¹ *ICT in Schools, an interim report April 2001* (HMI 264, May 2001) and *ICT in Schools, a progress report April 2002* (HMI 423, April 2002) both published by the Office for Standards in Education (Ofsted) [<http://www.ofsted.gov.uk/publications/>]

² *ICT in Schools, 2001* [<http://www.besonet.org.uk/ict2001/index.htm>]. More information about BESA and its annual survey of ICT in UK State schools is available online [<http://www.besonet.org.uk/index.htm>].

- observe, record and compare the different models of access to ICT (and to note how these had developed in relation to ICT development plans, funding, space and legacy equipment)
- study accessibility and the use of each model across all subjects
- identify what worked well and what factors contributed to successful models, including the specific benefits and issues of each model for both teachers and learners.

Methodology

Ten secondary schools were selected for study, all but one of which employed a mixed economy model of access. Each school was asked to identify six staff who did not teach ICT as a subject but who used ICT more than twice per half term. Informal, but structured, interviews were conducted with these staff. (Subject coverage was achieved by spreading the requirement across all ten schools.)

Interview questions were designed to explore the teacher's use of the school's computers for certain activities related to common teaching methods such as the introduction of new concepts, reinforcement, assessment and testing, skill acquisition, and so on. In addition, the questions aimed to tease out any perceived 'barriers' to access.

Headteachers or ICT co-ordinators were also interviewed. These interviews were aimed at gaining an overview of matters such as:

- the curriculum objectives that steered the development of the existing ICT provision
- how the school's access to ICT might develop in the near future and the likely factors influencing this
- the degree to which the current ICT model has had an impact on pupils in terms of their involvement, commitment and achievement.

The data collection process also included classroom observations to ascertain:

- pupil engagement and skill development through the particular model being employed
- pupil perceptions about its value and effectiveness.

Four lesson observations were carried out per school and, at the school's discretion, researchers spent two or three days in each school.

Each school visit therefore consisted of three elements:

- interviews with six teachers who frequently use ICT in their teaching
- an interview with the headteacher or the ICT co-ordinator
- four lesson observations.

In addition, the ICT co-ordinator (or an appropriate member of the senior management team) completed and returned a questionnaire before each visit. The questionnaire probed issues such as the developmental process of the school's chosen model and the factors influencing its implementation, such as curriculum, space, and legacy equipment.

Overview of the participating schools

The main characteristics of the participating schools were as follows:

Status of the schools – of the ten participating schools, five held Technology College status (one of these being a City Technology College), two were Language Colleges; and one had achieved specialist status as a Maths and Computing College.

Funding - six of the schools were LEA funded; three were voluntary aided; and one was a state-funded independent school. All the schools had a fully comprehensive intake, although

two of them employed a non-academic selective admissions policy based on religious grounds, and all were co-educational institutions.

Location - two of the schools were in rural locations; six were situated in semi-urban/urban residential surroundings; and the remaining two had, respectively, city-centre and inner city settings.

Numbers on roll and pupil age range – eight of the schools had more than 1,000 pupils on roll, the largest population being 1,950. The smallest school, which catered for 11- to 16-year olds only, numbered between 600 and 700 pupils. The age range of pupils in eight of the nine remaining schools was 11 to 18 years, and in the ninth school, it was 14 to 18 years.

Models of access to ICT - nine of the ten schools operated a broad, mixed economy model of ICT access, which consisted of a varying number of dedicated computer suites, curriculum and departmental clusters, individual workstations and banks of stand-alone and wireless-networked laptops. The remaining school relied almost exclusively on the computer suite model.

Key findings

Although, in view of the timescale, the objectives of the project were quite ambitious, a number of interesting trends have emerged from the observations made, and these tend to reflect trends noted in larger investigations.

The computer suite model

The majority of teachers interviewed mentioned this form of access as a significant factor in enabling them to teach whole classes and for large numbers of pupils to have simultaneous use of computers. It was felt that computer suites best enabled teachers to introduce new software; demonstrate particular skills and allow pupils to practise them; move through low-level activities quickly; and engage in common practical tasks. This was especially true when a digital projector or large screen was also available. For some teachers, having all pupils in view, in the same room, was preferable to having them dispersed around a curriculum area or the school.

Nevertheless, almost universal frustration was expressed about the limited availability of this particular facility. Computer suites needed to be timetabled and booking procedures had to be enforced. Keen competition for timetabled 'slots' was seen as prohibiting the use of ICT as a tool that could be 'picked up and used' as and when required. Most teaching periods in a computer suite's weekly timetable have several potential 'takers', which makes it difficult for the teacher who wishes to book the same time for three or four successive weeks. This may be necessary to introduce a topic and then follow it up with progressive hands-on work but colleagues can see it as hogging the facilities unfairly. Often, therefore, ICT elements have to be built into schemes of work as a 'one off'.

Some computer suites doubled up as teaching spaces - quite often, it seemed, in English and mathematics. This exacerbated the problem of restricted access for other subject teachers. The increased provision of discrete ICT courses at Key Stages 3 and 4 was identified as a further obstacle to access. (This provision can demand up to three-quarters of a computer suite's available time in any week.)

In spite of the difficulties that impede access, the computer suite remains a popular model with a sizeable number of secondary school teachers because it fits the traditional pedagogical model whereby pupils are all in one room working on a common task at the same time. Even so, some staff felt that the computer suite was only viable if it was located near their usual teaching base. Walking a class, in some instances, 'from one end of the school to

another' was seen as an unwelcome complication. It was clear that a fair proportion of the teachers interviewed were fiercely territorial.

As the curriculum expands and more pupils stay on at school, so the demand for extra rooms rises. Therefore, this model's need for dedicated space makes it very difficult to accommodate when, in many schools, areas for teaching are at a premium. Among the sample, however, one English department had sacrificed a standard classroom so that it could be furnished as a computer suite (primarily for that department's own use).

Many of the senior managers interviewed considered computer suites inflexible and 'old fashioned'. They viewed them as expensive to install (or upgrade) in terms of electrical work, furniture and new equipment, and they felt that funding such a resource was a considerable disincentive. It seems unlikely, therefore, that these schools will voluntarily increase the number of purpose-built, specifically designed computer rooms.

The cluster model

To some extent, all the schools in the sample made use of clusters as a model of access to ICT. Some of the clusters consisted of several more than the 'typical' six computers and sometimes more than twice that number. As a model of access to ICT, clusters were valued chiefly where they were the responsibility of, and in close proximity to, specific curriculum areas.

The cluster model was, on evidence, more effective at embedding ICT into subject teaching than the computer suite model. This was particularly so in practical subjects such as design and technology, art, and to some extent science, where staff and pupils were already familiar with an autonomous approach to learning. In this study, the clusters were generally networked and, where they were used for disciplines such as the three mentioned above, each machine had subject-specific software loaded on its hard drive. In addition, teachers expressed a greater sense of ownership for computers loaded with subject-specific software and located in their teaching areas. Under these circumstances, they also appeared more likely to share classroom practice with their departmental colleagues.

Teachers recognised that to get the best out of a departmental or curriculum-based cluster, good classroom management had to be exercised so that all pupils obtained their 'slice of the action'. Such management strategies included managing the class by setting up a programme of rotation or splitting students into two groups with one group occupied on an ICT activity while the other engaged in alternative but related work. Teachers also deemed it important to cater for the individuals who wished to use a computer as the need arose - pupils should not be made to feel as if they were being held back.

For demonstration purposes many of the teachers appreciated the value of a digital projector or large screen connected to one of the clustered machines or a laptop. Groups of pupils then used the remaining cluster machines for follow-up work. However, where there were only two or three such machines for the whole school, trying to book them raised the same problems as booking a computer suite.

Some teachers believed that computer suites were best for the introduction of new concepts or new software and new skills, and preferred making such demonstrations in a full-sized suite with as near a 1:1 ratio of pupils to computers as possible. But the cluster model was recognised as better for achieving meaningful integration of ICT when it came to individual project work, and for exploring ideas and researching material related to a particular subject (especially as the other support materials used by the subject were available in the same

location). An additional advantage with this model was that departments could, and did, facilitate access outside of curriculum time to support independent learning in their subjects.

On balance, the view of the schools in this study was that to be effective clusters needed to be established in areas that were not formal teaching rooms, otherwise the problems of access that occur with computer suites would also occur with clusters.

The classroom model (laptops)

A relatively recent model is the use of laptop computers as a class-based approach to ICT access. In particular, schools are now beginning to explore the degree to which laptops offer flexibility when coupled with the installation of a wireless network. Eight of the ten schools in this survey used laptops as an access model but not necessarily as a whole class option³. Only four had wireless networking.

In all eight schools, teachers variously employed their own or a departmental laptop linked to a digital projector (in some cases using an interactive whiteboard as well) to introduce lessons and explain concepts. Only in four schools were laptops used as a model for whole-class activity, although this was not the exclusive reserve of those with wireless technology. These four schools had purchased sets of laptops for use in teaching rooms and the subjects that made the greatest use of them were maths, science, technology, geography and religious education (RE). In the special educational needs (SEN) area of two of the schools, pupils with learning difficulties also used laptops.

The teachers who used laptops referred to their portability, ready availability and ability to be stored with reasonable ease as the most valuable assets. In addition, teachers were more than grateful that a set of classroom laptops obviated the need to book a computer suite and move from their normal teaching base with its subject facilities. On the negative side, laptops were seen as more vulnerable to damage and expensive to replace. Where they were used with wireless technology, if the wireless network was not reliable and robust enough for signals to be picked up across the whole site or to cope with everyday school use it gave rise to obvious problems of its own.

In the schools where portable computers were not prevalent and where space and limited access to ICT for all was a predicament, a number of senior managers recognised that laptops and tablet PCs should be considered. The cost implications, both in terms of initial outlay and sustainability, were felt to be the chief obstacles to implementation but there was a hope that by putting out 'feelers', favourable deals might be negotiated.

Pupil engagement

A total of 41 lessons were observed across the ten schools. The subjects covered included: English (2); mathematics (10); science (4); modern foreign languages (5); history (3); geography (3); RE (2); technology (6); art (2); personal social and health education (PSHE) (1); General National Vocation Qualifications (GNVQ) ICT (1); ICT/literacy (1); and e-citizenship (1). Twenty of the lessons observed took place in computer suites and the remaining 21 were conducted in classrooms or departmental clusters.

Some of the pupils questioned had no experience of a model of access other than the computer suite. Where a preference was indicated this was the one favoured by the majority of pupils - even those who had experience of at least one other model. Where practical subjects such as art and design or design and technology were concerned, subject or

³ Two of the eight schools were involved in a laptop-leasing project. Thus in a quarter of the schools using the model, the incidence of laptop ownership by pupils was high. Moreover, to promote the 'mobile computing' ethos, all staff in both schools had been provided with a laptop.

departmental clusters were appreciated for the familiarity of surroundings, ease of access, and the availability of subject-specific software. A few students commented on the fact that machines located in clusters meant that teachers spent more time providing support. This was mentioned with reference to modern languages and mathematics.

When asked about the benefits of using laptops or desktop PCs, the majority of pupils who had experience of both said that they had no preference. Where preference for one type of computer over the other was expressed, opinions were evenly split. Those who favoured desktops tended to do so because of their familiarity and students preferred the larger, sturdier keyboard and separate mouse. Those who expressed a preference for laptops cited portability and compactness as the main reasons.

In 33 of the 41 lessons observed, the model of ICT access used was a significant factor in the level to which the pupils were engaged in their work; and in all 41 lessons observed pupils judged the model of ICT access appropriate. In 27 lessons the pupils' responses to activities, the software and hardware used, and the model of access, was enthusiastic or positive in each respect. However, it emerged that a positive approach given to any one model at any given time did not necessarily mean the pupils preferred that model to another. To them, a 1:1 pupil to computer ratio was more important than the precise model of access.

Other observations

In 22 lessons the teacher led proceedings and in 16 of these there was active learning on the part of the pupils. In 13 of the 16 there was at least some collaboration and/or co-operation between pupils, and in eight of these, it was considerable.

Nineteen lessons were identified where pupil autonomy was the adopted teaching and learning style. All involved active learning with the majority involving considerable collaboration and/or co-operation between pupils.

In 20 of the 41 lessons additional equipment was used. On 15 of these occasions, a digital projector was used and in eight instances this was linked to an interactive whiteboard. Other additional equipment used included: a scanner and graphics tablets (1); dataloggers (1); a large monitor (1); video conferencing suite (1); and a download utility (2). On 19 of the occasions when additional equipment was used it had a significant bearing on pupil engagement. There was only one lesson when this was not the case and even then, the pupils' response to the ICT element of the lesson was, nonetheless, positive.

Conclusions

Given the scope of this preliminary investigation it is difficult to be confident that the findings are universally applicable, particularly because of the lack of variety and real contrast in the access models studied (nine out of the ten schools preferring a mixed economy model). The prevalence of this model, however, may suggest that schools are already progressing towards what they believe to be a workable solution to the problem of providing all pupils with adequate access to ICT. (This would concur with the findings from much larger investigations into the use and impact of ICT.⁴)

Nevertheless, and regardless of the model of access in place, all schools in this study had serious difficulty in enabling departments to gain regular access to ICT facilities. And this

⁴ *ImpaCT2* (2002) - the Impact of Information and Communications Technologies on pupil learning and attainment (DfES 0741/2002, Becta 2002) and *NGfL Pathfinders* - second report on the roll out of the NGfL programme in ten pathfinder LEAs (DfES 0743/2002, Becta 2002). Both reports are available as downloadable PDF files [<http://www.becta.org.uk/research/reports/>].

difficulty has become more prominent due to the additional demands created by the statutory duty to deliver ICT as a subject at Key Stages 3 and 4, as well as the requirement to develop ICT as a key skill across the curriculum. Delivering ICT as a subject has the greatest impact on the availability of computer suites - it drastically reduces the time in which they are available for use by other subjects. Despite the mixed economy model that prevailed in the schools under study, teachers still commented on the problem of lesson delivery hinging on the booking of ICT suites.

The majority of teachers interviewed felt that the computer suite (arguably the least flexible model to run) was still the best means to deliver whole-class access to ICT. Teachers said they valued computer suites because they allowed the maximum 1:1 access and provided a focused environment. Several teachers stated that the nature of computer suites assisted with the management of pupils, making the task easier and more effective.

Despite the continued preference shown for the suite model, the room's location, particularly in large secondary schools, can often determine which departments use it most. Too much distance between a suite and a teaching area can provide an excuse for the less than enthusiastic to 'do something else'. Also, its proximity to other curriculum areas, quite often one of the core subjects of English, mathematics or science, can result in those subjects being identified with the room and other departments being reluctant to 'stray' into 'unfamiliar' territory.

From the evidence in this study, it seems that there is a strong case for establishing more and larger departmental clusters and many teachers in the study favoured this model. If the cluster is too small there may be a problem of organising equitable pupil access; if however it is the prerogative of a particular curriculum area and within easy reach of teaching spaces, pupils can make use of it as directed or as they need to.

Departmental clusters with a larger number of computers are more likely to lessen the classroom management issues and to make it easier for teachers to provide equitable access for all. Similarly, such clusters are likely to obviate much of the frustration that arises from competing for resources with the rest of the school merely in order to deliver the basic ICT elements of a subject's schemes of work.

However, the shortage of space in the majority of schools means it is unlikely that ordinary classrooms will be requisitioned to provide full computer suite facilities for each department. And even where land is available to extend buildings, often the funding is not. Thus for the schools in this study, while more department-based clusters might be both necessary and possible it seems unlikely that departmental computer suites will become a reality.

For several headteachers, the lack of space inside and outside their schools makes adding rooms to accommodate ICT resources unfeasible. For them, the creation or extension of clusters can only be achieved if curriculum areas relinquish or 'double up' on existing teaching space. The headteachers appreciated that this was not a satisfactory option and was likely to prove unpopular with teaching staff. But at the same time there was an awareness of the need to match deployment options to whole-school ICT objectives.

Nearly all the headteachers and ICT co-ordinators interviewed felt that ultimately the way to provide adequate access to ICT for pupils and staff, while operating within considerable physical and financial constraints, was to install a wireless network and deploy laptop or tablet PCs. In this study, the majority of senior management teams were clearly working towards an appropriate and flexible solution to the problem of access to ICT. However, few were prepared to risk scarce resources on a solution that held the promise of total flexibility but which was, in

their view, based on a still emerging technology. Before senior managers will proceed, they require much more evidence about the reliability of wireless networks in situations and conditions that match their own.

They are, perhaps, also mindful of the reaction of the majority of teachers to technological 'glitches'. Even when everything is operating properly, teachers generally see technology-focused activities as challenging, and they often have little tolerance for network systems that crash and computers that prove unreliable. The greater the stress associated with the activity, the smaller the proportion of teachers willing to give such activities a try.

Once wireless-based networks, computers and peripherals can be proven robust then their advantage is patently clear. Among those project schools using wireless technology on a widespread basis, ease of movement in classrooms and across school sites was mentioned as a major benefit, as was flexible deployment related to different types of lessons and individual teaching styles. A further essential consideration is that there is a minimum of classroom disruption involved with this technology.

Therefore although it is making fast progress, wireless networking is still in its infancy and schools will only invest in it when it can be proven both robust and consistent. An expression of interest from headteachers is all that is likely until further developments lead to a reduction, if not the elimination, of reports of installation irregularities and unpredictability. Meanwhile, most schools in this study are moving towards providing more clusters of computers or more computers per cluster in an effort to provide both pupils and staff with equitable access to ICT.

Recommendation

Currently, the use of laptops or tablet PCs with wireless networking would seem to offer the best model of access to ICT. However, as this study shows, the majority of headteachers are still wary of this technology. Further tests need to be carried out to identify wireless systems that are sufficiently robust and reliable in a variety of school situations, and this evidence then needs to be disseminated to all schools.