Education Departments' Superhighways Initiative

Group A: Curriculum Projects in England and Wales

Final Report

University of Leicester School of Education

Maurice Galton, Chris Comber, Linda Hargreaves, Tony Lawson, Ken Fogelman

University College of Wales, Aberystwyth - School of Education

Richard Thorpe, Dilwyn Roberts-Young

External Consultants

Tony Eldridge, Mike Rumble

The evaluation

1. This evaluation concerns seven curriculum-focused projects that were based mainly in the primary and secondary sectors in England and Wales. Two further projects in the group were located in Scotland, and were the subject of a separate report produced by the Scottish Council for Research in Education (SCRE). The projects were extremely diverse in scale, ranging from a single infants school with two machines to a group of around 30 secondary schools and sixth-form colleges exploring a range of technology. Projects also varied greatly in their organisational and technological structure, and their aims and objectives. What united the group was a classroom focus, with teachers and pupils exploring the potential of a range of ICT technologies to enhance teaching and learning.

2. PROJECT CONNECTED (ALSO KNOWN AS PROJECT INTRANET)

2.1 All schools and colleges active in the Project were visited at least once, during three rounds of visits. The nine most active schools and colleges were visited twice. Those schools which did not achieve connectivity by the end of the Project were surveyed by phone. In addition, events organised by the commercial sponsors were attended. In total, there were the equivalent of 30 full days spent on site in the ConnectEd Project.

Description of project

2.2 Project ConnectEd involved three commercial organisations, 20 schools and colleges, mainly in South London, and Guildford College as a training institution. The Project is focused on the use of the Internet for teaching and learning, e-mail as a means of communication between pupils and teachers, and the potential of video conferencing between schools and colleges. The focus of activity was planned to be the ConnectEd Web site, in which facilities for the sharing of teaching and learning materials and the opportunity of 'creating added-value educational activities' through networked communication with each other, including video conferencing, were provided. There were three main Project activities:

- the use of a dedicated Web site called ConnectEd

- the use of e-mail and video conferencing as a means of communication between participants and others

- the use of the Internet as a source of information for pupils.

2.3 Connectivity was to be provided using existing technologies and networks already established in the schools and colleges. The variation in pre-existing networks therefore provided a model of the real problems which will face educational institutions and Internet suppliers if there is to be a large-scale increase in connectivity. The 20 schools and colleges involved in the Project were all secondary schools, with some post-16 institutions involved. Training was provided initially by Guildford College.

Sponsors and other parties involved with a level of sponsorship

2.4 Microsoft was the main point of contact for the project and provided software tools for participants. Education Exchange (Edex) provided Internet connectivity to participants through negotiating with Telewest for the 2Mpbs connections and BT for the 64Kbps connections. Edex also provided free Web space to all participants through a Schoolsite server. Mast Learning Systems (MLS) began as project managers and maintained the ConnectEd Web site.

Guildford College provided the initial training and later in the Project adopted a lead role in pushing forward project activities.

Size and type of institution

2.5 Twenty schools and colleges took part in the Project, although one withdrew very early. The 17 schools were all secondary, with four 11-16 and the rest including post-16 students. There were two sixth-form colleges and one further education college also taking part. The schools and colleges were mainly in South London, with clusters around Bromley, Croydon and Merton. The catchment areas of the

schools and colleges were very mixed. Some of the schools had significant numbers of speakers of English as a second language and some had a fair proportion of pupils with special educational needs. The FE college was significantly larger than the other participants, with 6,500 on roll. One of the sixth-form colleges was large (1,500) and the other fairly small. The schools ranged in size from 1,315 to around 400.

Hardware and software used

2.6   The number and types of hardware which the participants had were very varied. The range extended from low-specification RM PCs to high-specification Pentiums. In the cohort of schools, there were also examples of Acorn and Apple Mac networks. The number of work stations connected to the Internet varied from school to school, with a minimum of one stand-alone station and a maximum of 40 in a dispersed network. In addition, Microsoft supplied all participating institutions with a range of software, including Front Page, Windows '95, Microsoft Office and Schedule+ on a 30-machine site licence. All institutions were also provided with a free licensed copy of CU SeeMe for video-conferencing purposes.

External connectivity

2.7   The majority of the participants were connected through a 64k cable, while nine had a 2Mbps connection. Edex also provided Cisco routers to Project institutions to enable networking of the connection to the Internet.

Age and range of students involved

2.8   (See school and college information in paragraph 2.5.)

In some schools and colleges in the Project, open access allowed all yeargroups to participate in Internet activities. Other schools restricted access to specific year groups in order to manage the Project more closely. Pupils from all ability levels were engaged in Internet activities across the Project as a whole.

Number of teachers involved

2.9   This averaged three per institution, usually IT/project co-ordinator and some subject specialists who expressed interest in the Project. These latter may or may not have been curriculum leaders. One institution did not participate because of the departure of the IT co-ordinator and project leader at a crucial time, and replacement by a temporary IT co-ordinator. Three institutions had connectivity problems and therefore involvement did not extend beyond the project co-ordinator to other members of staff. A number of institutions took care to offer all staff an opportunity to get involved (see paragraphs 2.16-2.20 on training). Others focused on particular curriculum areas.

Background and experience of the staff/institution

2.10   This was very varied, given the range of institutions involved. There was usually at least one experienced IT user, often the project co-ordinator. The role and experience of the project co-ordinator was crucial in getting other less experienced staff involved. Other staff were experienced with different types of IT but were inexperienced in Superhighways. Some staff had had experience of Superhighways through home connections, or through friends or cyber-cafes. Some were very inexperienced in the use of IT, but determined to try it out because they identified its usefulness. The degree of expertise varied from school to school, ranging from some which had a high proportion (c. 50%) of IT-experienced teachers, to a low of around 10% in certain departments of one large college.

Aims and objectives

2.11 The stated aims, taken from the MLS introductory booklet for participating schools, were:

- to explore the educational benefits of using the Internet

- to encourage the development of curriculum-support materials and make them available to others via a network

- to explore best-practice examples for sharing resources and curriculum-support materials via a network

- to encourage the use of IT as a learning aid by teachers, pupils and parents

- to develop key information-presentation skills in teachers and pupils.

2.12 The original aims identified an initial Web site, ConnectEd, with curriculum materials created by MLS in geography, science and modern languages as a focus of activity. However, the emphasis was on the development of materials by participating institutions themselves. MLS was to provide advice on the construction of Web pages. Video conferencing and e-mail were seen as key features of joint projects between participating institutions.

2.13 Because of a large amount of slippage, as a result of problems in connecting schools to the Superhighway and difficulties in driving the Project forward in a cohesive way, the aims and objectives were scaled down over the course of the Project. A crucial meeting was held in November 1996 between the schools, Microsoft, Edex and MLS. This meeting re-launched the Project and established 'focus groups' to concentrate on specific aims and objectives which were achievable in the limited time-scale available.

2.14 Guildford College took over the maintenance of the ConnectEd Web site and would take a leading role in moving the Project forward. The main aim which emerged from the focus groups was the sharing of curriculum materials, mainly in science, through the Internet by the end of the Project. Other of the original aims and objectives were targeted by individual institutions, such as video conferencing or communication between different institutions.

The timetable

2.15 Because of long delays in connecting schools, most were not 'active' until the beginning of the Autumn term. Even where connectivity was achieved in the Summer term, little Project activity was able to take place. The project was therefore late by some months. A Web-page competition originally planned did not take place. Microsoft called a whole-Project meeting in November. The focus groups only met in December. Edex therefore extended the Project with free connectivity to the end of March 1997. A number of schools only began to generate planned Superhighways activity from January 1997.

Evaluation

Project initiation

Initial training

2.16 Initial training was provided by Guildford College over eight half-days. The courses were called Webmaster 1 and 2, and an Introduction to the Internet. The

training for Webmaster was focused on the aims of the Project, in that the participants were introduced to the basic principles and practices of creating Web pages for their own institutions, such as how to mark up text, scan images and create links to other pages and sites. The Introduction to the Internet was a basic account of the Internet with a good deal of hands-on experience for participants. The sessions were supported by useful materials, which were differentiated to cater for learning needs of the participants.

2.17   The training was intensive, but also responsive to the participants' levels of expertise. The training was organised on a 'mix-and-match' basis, so that each institution could focus on the issues that concerned them most. Interviews with participants both at the training sessions and on subsequent visits to institutions confirmed that nearly all of the attendees had found the initial training useful. However, not all aspects of the aims and objectives of the project were met by the training. For example, there was little mention of video conferencing or the development of curriculum materials to be held on the ConnectEd site. In subsequent interviews, some project co-ordinators expressed a need for an ongoing series of training days, to keep moving them forward and re-focusing them on the Project's aims and objectives. One co-ordinator found that he needed some training in setting up and managing newsgroups as he became more deeply involved in Project activities.

Technical and educational training

2.18   One of the main problems which institutions faced after their initial training was that there was little opportunity to train other teachers and pupils in those institutions for some time because of delays in connectivity. Therefore, the impact of the initial training was diluted. For example, one school had to postpone a half-day INSET in the Summer term of 1996 until the Autumn, as there were not enough machines connected to justify the expense of an earlier course.

2.19   There were a number of strategies adopted by the institutions to train staff and pupils in Superhighways technology. One was to hold a full staff INSET day, in which all members of staff were invited to learn about the new technology. This was often supported by follow-up training sessions with individual members of staff who expressed an interest in pursuing the potential of the newly-available technology. One consequence of this approach was that it was not always the teachers of modern languages, science and geography, targeted in the original aims of the Project, who came forward. Another strategy was to offer INSET to those who wanted to come along, but this had much more variable results. For example, in one mainly academic school, only one teacher attended an initial session, so that no follow-ups were offered. The result at this school was that training of the pupils in the new technology took place only in IT sessions, where the project co-ordinator was available. A third model was to offer one-to-one sessions to staff who were interested, in a more informal system. This often relied on initiation by members of staff and a personal response from the project co-ordinator. Though this worked well as an ad-hoc arrangement, it had the effect of randomising the curriculum areas that were involved in the Project.

2.20   In terms of training pupils, two main strategies emerged. The first involved the systematic training of all pupils in the institution. For example, one college provided training for all pupils at the point of entry to the college and another through a programme of class induction. This had the advantage of opening up the new technology to the majority of pupils, but the disadvantage that, in some institutions, the number of machines connected could not keep up with the demands made upon them. The second strategy targeted particular groups of pupils, usually in the interested curriculum areas and using criteria such as age or responsibility. This allowed a more focused approach to Superhighways activity and the development of

specific projects, but did raise issues of equity of access. However, the use of open-access suites for pupils, without formal introduction, was also seen as a useful strategy for by-passing any techno-conservatism by the teaching staff.

Management strategies

External

2.21   The management of the Project was complex because it involved three commercial organisations. Microsoft defined their role as the point of contact with other important players, through their educational division. Though Microsoft were the lead organisation, they had contracted with MLS and Edex for different aspects of the Project. Connectivity was to be the responsibility of Edex, who would further sub-contract work for cabling, etc. to other companies. MLS's main role was to manage what went on in schools in terms of the curriculum and the Internet. MLS saw their role as providing support for institutions in developing their own materials for the Internet. They believed that the 'educational and subject expertise resides in schools'. Their main function was to maintain and develop the ConnectEd Web site, while encouraging the development of value-added activities and materials in the 20 Project schools.

2.22   Communication between the commercial organisation and the 20 schools, therefore, turned out to be complex, with the result that problems could be passed between participants, rather than being solved. While schools had little contact with Microsoft themselves, except through meetings which Microsoft called, the different responsibilities of MLS and Edex for managing aspects of the Project were not always clear to the participating institutions. As a result, there was some frustration felt by the schools in that, after the initial training, there was a long delay for most institutions in being connected and therefore being able to move forward with the Project.

2.23   Similarly, the commercial organisations felt some frustration with some institutions, where the responsibility for running the Project in-house was not always clear, or where the technological assumptions both were operating under were different. For example, Edex had specified the technological minimum which schools would need for participation, but there was not always a common understanding of what that entailed. Edex's perception was, therefore, that schools had not made the necessary investment in hardware to allow the new technology to run smoothly. The perception of many schools, however, was that Microsoft did not make clear what was required for the technology to work. This failure in communication between the commercial organisations and the schools was fairly common in the early stages of the Project and may have arisen because of the difference between industry-standard operating systems and the non-industry education standard which many schools had.

Internal

2.24   In the majority of the institutions, the management and co-ordination of the Project relied on a specific person, often but not always the IT co-ordinator. In the initial implementation, the commercial organisations had requested that each school or college should identify up to two project 'champions'. This suggestion did not, however, meet with any enthusiasm, and consequently was not taken up in any school visited. The issue was not pursued by MLS in its dealings with the schools. Given that the status, autonomy, available time and other responsibilities of the project co-ordinators varied significantly, then the drive and commitment of the project co-ordinator were crucial for the success or otherwise of the Project in each school. The model of internal management which seemed to result in more effective project activities throughout the schools was one where:

- The project co-ordinators had a fair degree of autonomy, both in respect of how they chose to drive the Project forward and also in terms of their budget, so that they were able to use their available funds to ensure the stability of the connections.

- There was a good grasp of technical issues, or access to appropriate technical support internally. This was particularly seen as important by Edex, which was responsible for connecting the institutions to the Internet.

- There were good relationships with other members of staff, built on a willingness to support others and also on the confidence of the management teams in schools, especially the principal or headteacher.

- Each curriculum area had incorporated IT into their Schemes of Work.

2.25 However, where the role of the project co-ordinator attracted lesser status, then Project activities tended to be much more limited. It is important to recognise that a devalued position for the project co-ordinator was often related to the management team's motivation in applying to join the Project. If the intention was only to gain free connectivity for a time to try it out, rather than a real commitment to explore the educational potential of the new technology, then it was difficult for the project co-ordinator to drive the Project forward in any systematic way. Moreover, where principals decided upon participation in the Project without fully involving IT co-ordinators in planning, the potential for future technical hitches was increased.

2.26 Support from senior management was particularly important in considering whether to continue to fund the connections beyond the life of the Project. It is perhaps significant that in the three schools where Project activities were most advanced, the principals requested to meet with the evaluators and provided evidence of strong support for the activities of their project co-ordinators.

Obtaining and installing equipment

2.27 The problems in this area were legion and were the main factor in causing delays in the use of the new technology in the classroom. The important factor in creating problems was the disparate nature of the hardware which existed in schools and on to which Internet connectivity was to be grafted. While this provided a realistic trial run for any large-scale implementation of connection to the Internet, it also caused a great deal of frustration both in Edex and in many of the participating institutions. The spread of the hardware was so wide that there was no simple solution which could be applied to all sites. Moreover, because Edex were providing their services free, they were overrun with requests for solutions to problems from many participating institutions. While nearly all the institutions reported that the response of Edex had been good, the sheer volume of problems to be resolved had often militated against a speedy resolution. Particular difficulties were reported in one school concerning connections to Acorn machines. The problem underlying these difficulties was never identified during the trial, and thus remained unresolved. Connectivity in this case was established through PCs. The problem of compatibility with some RM networks was also never resolved satisfactorily, so that some schools which were reliant on RM networks did not participate effectively in the Project at all. There seemed to be a basic problem with trying to run a Novell Network with an RM LanManager. In particular, running Windows '95 on early RM machines was very difficult, if not impossible. Other schools reported no difficulty with RM networks or resolved problems themselves.

2.28 The lack of clear division of responsibilities between the different partners in the project conspired to defeat all attempts to resolve the issue. Edex saw its main responsibility in providing the connection to the Internet and the school's

responsibility in managing any LAN they were operating, though Edex always responded to requests for help with problems with the LANs. As in two of the schools a stand-alone machine did operate successfully, Edex believed that successful connections had been made and therefore the problem, and the cost of resolving it should be borne by the school. Edex further believed that the expertise of IT co-ordinators in schools was not always sufficient to the task. From the school's perspective, it was Edex's responsibility to resolve the LAN issue and not for the school to contract with RM for a solution. Moreover, as a rival commercial organisation, RM seemed reluctant to get involved with the problem and would certainly have charged for any consultancy. In these three schools, there was also some reluctance by the project co-ordinators to persist in seeking solutions, through lack of time or a lack of commitment to the overall Project and, in one case, hostility to the commercial sponsors because of their perceived lack of interest in solving problems.

2.29   On a wider issue, there were also delays to most of the schools through the sub-contracting of work. For example, BT did not co-ordinate its connection services to one school, so that, though the external wiring and internal wiring had been completed by two different teams, this was not communicated between the two teams and delay occurred. There was also a delay in the supply of routers from the manufacturers, which prevented the implementation of the Project, even though everything else was in place. This meant that many schools were not operative until the end of the Summer term.

2.30   There were also some problems with the size of cable which was promised but not delivered to schools. United Artists (now Telewest) was committed to providing cable only where their MUX (multiplexor local splitting station) had spare capacity. In some places, the lack of spare capacity meant that Edex installed 64k cables at their own expense. Also, Edex had to provide converters for the 2Mbps cables. This created some tension between Edex and the other commercial partners, as the eventual extra hardware cost to Edex was claimed to be about £100k.

Implementation at project and institutional levels

Creating cross-institutional relationships and support

2.31   Because of the complex relationships between three commercial sponsors and the 20 participating institutions, the need for clear cross-institutional relationships was central. In terms of the commercial sponsors, the division of responsibilities between them was not as clear as it should have been, with the result that relationships between the sponsors and schools were at times fraught, and successful only on a one-to-one, rather than a systematic basis. This was a central issue in the achieving of the aims of the Project, as the development of cross-institutional links between the schools through the ConnectEd Web site, e-mail and video conferencing was planned to be the core of Project activities. Microsoft was the overall sponsor, but left the day-to-day running of the Project to MLS.

2.32   Edex was responsible for connecting the schools and Colleges to the Internet. While it was Edex who were in the front line in terms of school complaints about delay, it was MLS's responsibility to push forward school activities and develop Web-site-related relationships. However, the loss of crucial personnel in the Summer of 1996 meant that MLS did not take a proactive approach to the Project. For example, focus groups were not convened and the Best Web Site competition never took place. Microsoft became disillusioned with MLS's running of the Project during the Autumn of 1996 and MLS finally withdrew at the end of the year. However, when Microsoft became involved again and called a re-launch meeting in November, it was clear that another project they were sponsoring was seen by them as more focal. Despite the appointment of a Microsoft executive to push forward Project

ConnectEd, it was finally the schools themselves, with the help of an MLS-drafted consultant giving his services for free, who drew up action plans for the rest of the Project. The Project therefore suffered from the dispersion of responsibilities amongst the participating commercial sponsors, with no one person having overall responsibility for co-ordinating all the various partners and ensuring that tasks were completed within a reasonable time.

2.33   The potential for avoiding overall responsibility through this dispersion is perhaps best illustrated by the ConnectEd Web site itself. This was supposed to be the focal point for Project activities, providing a means of communication through e-mail for participating schools and colleges, a place for them to organise video conferencing and a depository for curriculum materials which the participating institutions would share. MLS had prime responsibility for the creation and maintenance of the Web site. Initially, one person at MLS set up the Web site, which included a video-conferencing room, e-mail addresses and a place for hand-outs to be lodged. However, the departure of that person from the Project meant that the Web site was left undeveloped. Even when most of the institutions were on line and had e-mail addresses, these were not reported in the Web site. It was also significant that, at the focus meetings in December, representatives from the schools were unaware of the Web site's existence and had never visited it.

2.34   As a result, contact between the participating schools and colleges was virtually non-existent until the Autumn term of 1996. It was only when the focus groups met in December that there were some cross-institution links made and maintained by the schools themselves, mainly through e-mail links. Relationships between the commercial sponsors became more strained as the Project continued, until the departure of MLS from the Project at the end of 1996.

2.35   There was also a clash of cultures between the educational and commercial customers, which manifested itself in the different assumptions each had about the other. From the commercial organisation's viewpoint, the schools did not always respond in a 'business-like' way to requests from the sponsors. This was partly at least based on a lack of understanding of the way schools work. For example, to call a project co-ordinators' meeting with only a week's notice across a half-term break suggests lack of familiarity with the need for cover, clearing absence with management, the teaching commitments of project co-ordinators, etc. Edex was certainly aware of the dangers of a commercial attitude which viewed the free services provided to the schools as a low priority, and ignored the poor reputation which could be quickly established in the educational world as a result of unmet promises or late delivery. The converse of this is the attitude of some of the educational partners, which saw business as an open-ended source of free services and expected the commercial organisations to do everything for them. This clash was exemplified by the problems which emerged from the lack of clear divisions of responsibilities, with schools wanting Edex to sort out all of their network problems, while Edex saw these as the responsibility of the school. Some schools, on the other hand, felt that the commercial organisations did not understand the financial constraints that schools operated under.

2.36   In terms of the aims of the Project, video conferencing was seen as one of the main ways in which inter-institutional co-operation could be achieved. However, there was only limited movement in this direction, because of the late connectivity. Nevertheless, there was a degree of interest in the potentiality of video conferencing, with one school in particular anxious to use BETT97 as a video-conferencing vehicle. This did not happen because of logistical problems. Another school had proposals in place to use video conferencing as a link between PGCE student teachers on teaching practice and the HE institution from which they came. Many schools, however, did use e-mails to connect to other educational institutions throughout the world. There were examples of e-mail being used for job

applications, parent inquiries about the school and, most importantly, requests for solutions to technical problems by Project members. Indeed, the incidence of e-mail traffic between participating institutions took a significant leap forward during the course of the Autumn term 1996. The bulk of this traffic concerned requests for solutions to problems which project co-ordinators had met in implementing activities. Solutions were also e-mailed for nearly all of the problems posted, whether from the commercial sponsors or from other schools which had resolved similar problems. As Guildford College took over as lead institution in late 1996, its involvement in e-mail traffic also increased.

Further training and support

2.37   There was a great need for continued technical support after the launch of the Project, to resolve the problems of connectivity across a wide variety of platforms. The support given by Edex was generally appreciated by the majority of the participating schools and colleges. This was not so with the three schools whose networks never became connected, who saw Edex's role in more negative terms. Edex viewed the delays in responding to all of the school's concerns by the commercial companies as inevitable, given the nature of the Project. They argued that there was an inevitable if unofficial hierarchy of customers in the commercial sponsors' priorities, in which paying customers' needs came a long way before the demands made upon their limited resources by schools who were not paying anything to the commercial organisations.

2.38   One teacher identified the need for future training in:

- finding useful sites

- the best search strategies

- identifying material which is differentially targeted on Key Stages 3 and 4, and post-16.

Maintaining equipment

2.39   Once installed, the maintenance of the equipment became the responsibility of the schools and colleges. However, Edex did provide a phone-support system and was reported as being very helpful by the majority of the schools. The existence of a contact name at Edex was vital in producing confidence amongst the schools that their needs would be met. As the expertise of the project co-ordinators varied, it was important that there was someone within the school who understood the workings of networks sufficiently to maintain a stable environment for Superhighways activity. Many of the participants used the Project e-mail facilities to post problems to other members of the Project and to receive solutions. This proved to be effective, as those who may not have yet come across that specific problem would already have a template for solution on file. Instability in maintaining connectivity was particularly evident in RM LANs, where various 'tweaks' to keep the system up and running did result in some system crashes.

Implementation at classroom level

2.40   The original aims of the Project identified modern languages, science and geography as particular curriculum areas to be targeted. In the event, there was a much wider focus in terms of curriculum areas. This was partly a result of the open-access policies which some of the participating institutions adopted, so that individuals could pursue their own individual curriculum interests. However, even where there have been attempts to restrict usage to particular curriculum areas, the appeal of the Internet, once word gets round, usually ensured that other areas quickly asked for access. For example, in one school, all curriculum areas had been

involved in some type of activity, though the main areas involved were science, geography, English, GNVQ and MFL departments. IT departments were also heavily involved in the beginning of the Project, though activity quickly spread to other departments. Over the 20 schools and colleges, all National Curriculum subjects were mentioned as being involved in project activities. In post-16 education, most A Levels and GNVQs were involved in some ways, including the social sciences and other non-National Curriculum subjects. All age ranges and all ability levels were represented across the 20 schools.

Raised standards, value added and improved quality of work

2.41   Even where there is open access and the use of the Internet seems to be casual, most pupils do explore what is available with some purpose. For example, observations were made of a pupil visiting boxing sites and another reading Tamil magazines. On subsequent interview, both were involved in Advanced-Level projects which were connected to the sites they visited. So what seemed at first sight to be a casual browsing turned out to be central to their strategies in completing examination course work. Where the use of the Internet as a resource was more structured, there was clear evidence of enhanced learning. In one college, an assignment in A-Level IT on Computer Crime, set in the previous year without access to the Internet, was also set in the Project year. The resulting reports from the students achieved higher marks than the previous set, as a consequence of access to up-to-date materials on the Net and because of the application skills the students had to use to cut down the information to fit the criteria of the assignment.

2.42   Though the use of video conferencing was limited throughout the participating schools, where it was used teachers and pupils did gain a great deal. For example, one college was able to 'look in' on a video conference between NASA and the Space Shuttle on the day that it docked with Mir. There were also examples of video conferencing between project schools and schools in the United States, to establish contacts for future co-operation.

Evidence of increased motivation

2.43   The main measure of increased motivation reported across the schools and colleges is the limited number of occasions on which open-access facilities actually stand idle. Pupils use the facilities constantly, not only during the course of the school day, but also early in the morning and after school as well. In the words of one project co-ordinator:

> *I know of no other facility in the school that has had so much voluntary uptake by pupils in the 26 years that I have been here.*

2.44   One geography teacher suggested that the visual displays to which the Internet gave access were a great motivator of pupils. In particular, the maps, the diagrams and photographs of physical features stimulated interest amongst both younger and older pupils.

2.45   There was also evidence of increased motivation of teachers, in that many project co-ordinators reported interest from previously techno-phobic teachers, as the word spread about the usefulness of the Internet in other subjects.

Productivity gains

2.46   One potential saving in terms of school budgets can be seen in the availability of commercial products on the Net. For example, one science tutor was able to download a selection of slides which were on offer and assess whether they would be useful to the department. This allowed the teacher to make an instant judgement on the usefulness of the materials without sending off for trial materials or buying them

unseen with the possibility that they would be of no use. Similarly, because *New Scientist* is available on the Net, it is more cost-effective to down-load the magazine for all pupils than run the subscription scheme that the college had.

2.47   There was some concern about whether the Internet was efficient in terms of time consumption and that there was a danger it could become repetitive. Time was seen by most teachers as less 'wasted' where there was a specific outcome of the Internet session to be achieved. This is not to say that teachers did not like open access. On the contrary, they were aware in the main that the ability to surf was in itself a useful way of exploring the vast amount of information available on the Net. However, when it was their classroom time that was being used to access the Internet, they felt that there should be more specific outcomes if the use of the technology was to be justified. This meant that classroom sessions on Superhighways needed to be integrated into Programmes of Study or the learning objectives of the particular lesson and not just an opportunity to explore.

Changed teaching styles

2.48   One clear focus of resistance to the Internet was the implication that the technology could substitute for teachers. However, there was a general recognition from teachers that the Internet offered a complementary pedagogy to the normal classroom practice, in that it was a source of up-to-date and relevant material which was unavailable elsewhere. It was the contemporary nature of the material on the Net which offered teachers a resource of intense relevance.

2.49   The impact of the Internet on teaching styles seems to go through a number of stages as the teacher's experience develops. For example, one science teacher began by collecting Web sites for himself, but soon realised that he could spend an enormous amount of time searching the Internet himself, with very limited results. He therefore gave the responsibility for reporting useful science sites to his post-16 students. This handing over of responsibility to the students was noted in several contexts. Another teacher argued that, with the Net, it was impossible to say to students that they must do work in a particular way. Rather, students had to be allowed to experiment and 'play' with the technology, while teachers had to force themselves to sit back and wait for students to ask questions and then try to respond to their needs.

2.50   Among many teachers, the use of the Internet had increased their own focus on how their pupils applied information to specific tasks. Given the wealth of information available, the teachers quickly recognised the need for some discussion of how pupils were going to filter and use the information other than just reproduce it verbatim. The role of the teacher was thus increasingly seen as one in which they needed to teach their pupils to fine tune their information-handling skills. There was thus a fundamental shift to teaching the pupils to be in control of what they received, instead of just being given information by those in control of it.

2.51   There was a slight concern in one college that wiring up more machines in the Resources Learning Area might lead to a displacement of other activities, including other IT applications which up till then had been valued by the students, such as CD-ROMs. It was therefore decided that, for the length of the Project at least, only a limited number of machines would have Internet access. However, in another school, the teachers argued that using the Internet in the classroom with a large group of students changed the nature of the IT teaching that went on. While, with Word or Excel or other applications, the teacher was always able to bring pupils back to a specific place in order to demonstrate a particular application, with the Internet there is a potential to go in hundreds of different directions just through changing the URL (Uniform Resource Locator) on each machine. Therefore there

had to be a different strategy for teaching with the Net than with other IT applications.

2.52   The role of the teacher changes in subtle ways. While there is clearly a transfer of responsibility to pupils for collecting information for themselves, the teacher has to act as a facilitator if the use of the Internet is to remain focused on the National Curriculum, educational objectives or examination syllabuses. This includes guidance before the event, in producing materials or advice which directs learners towards particular sites or applications which they might find useful. But it also includes a reactive role, in responding to the results of the research and teaching pupils skills of application in using the huge amount of potential material in a focused way. The question-setting skills of teachers therefore become very important in directing students towards an effective use of information from the Net.

Enfranchisement of previously disaffected learners

2.53   In one college, a Czech pupil was able to access papers from the Czech Republic and thus gained access to cultural resources which were previously outside his reach. While this was an interesting and potentially important development for this pupil, it was too recent an initiative to identify any specific effects in terms of learning outcomes by the end of the evaluation.

2.54   One teacher used the Internet to gather information about the education systems of countries where some of her pupils had previously resided. She argued that this allowed her to gain a greater insight into the prior-learning experiences of these pupils and she could adjust her teaching accordingly.

2.55   In some cases, it was techno-phobic teachers who benefited most from exposure to Superhighways technology. For example, a very hostile English teacher became converted through the wealth of modern poetry she was able to access. In another college, previously hostile humanities teachers were impressed by the information that their pupils were bringing back from using the open access to the Superhighways to the extent that they ended up demanding a PC on their desk by the end of the Project.

Learners with special educational needs

2.56   Few schools or colleges had, as yet, given specific consideration to this area. Nevertheless, some interesting examples were beginning to develop. One school, with refugee children whose first language was not English was using the Internet to access sites for information about the pupils' countries of origin and/or in their first language. Observation confirmed the school's claim that this improved motivation and self-esteem. One major problem with the Internet is the pitch of material which is often unsuitable for many pupils with special educational needs. On the other hand, the visual potential of the Internet can act as a motivator for such children.

Development of information-handling skills

2.57   The process of handling information from the Internet varied according to the approach adopted to access. Where there was open access, pupils tended to be more casual in their approach and many would end with the chat lines. However, where access was more controlled, either physically or through directed tasks, pupils tended to visit nominated or appropriate sites in the first instance. They then either began to move away from the nominated sites as links were explored in classroom time, or returned to the Internet in their own time to continue to explore the issues they were being taught. In both cases, information was seen as more useful where there was a specific learning task to achieve rather than a general instruction to find

out about something. This necessitated that the teacher should be familiar with the material available on the Net before the session and either direct pupils towards it or be able to give them some guidance about the most suitable sites for the specific task in hand.

2.58 Some pupils identified the Internet as a way of presenting information to others. For example, one pupil learned HTML in order to write a home page for their Church.

Fundamental new skills

2.59 The potential of e-mail for communication with others is beginning to be appreciated only in those institutions which have chosen to give all pupils an e-mail address. Much of the new communications, where there is open access to the Internet, is through the chat lines. Pupils invariably justify their use of chat lines in terms of 'learning about different cultures and ways of life'. Teachers are much less sure about the value of chat lines, and those institutions which allow open access are looking for ways to curb their use. Nevertheless, teachers do see some validity in the chat lines, in developing written communication skills in a new dimension, which also have a different etiquette.

2.60 Most teachers and co-ordinators who have considered the issue do not see the learning of the shorthand 'language' of the chat lines as a useful skill at all. On the other hand, they also justify the use of chat lines in terms of the practice of keyboard skills. Similarly, the limited amount of video conferencing which has taken place suggests that there are new etiquettes developing in the use of these communication technologies and that these need to be learned if the video medium is to be an efficient device for teaching and learning.

2.61 One project co-ordinator was using the Project as a way of dispersing IT throughout the whole curriculum. His argument was that all pupils would be in a good position when they left school, in terms of their IT skills, but also in terms of their concept of the world, communication and technology. He believed that their knowledge about how to access information would be superb, but that they would also develop skills of discrimination through making judgements about the accuracy and the source of the information they researched.

2.62 New skills of Web authoring were also being developed, as some pupils moved from a passive approach to the Net to wanting to create their own pages, with the encouragement of staff. In one school, pupils from Year 8 were being trained in the basic concepts of authoring, being shown how to create links, headings, employ graphics, etc. in order to put their own work on to the Net.

2.63 There was a concern in some schools that ethical and moral issues needed to be taught in parallel to the acquisition of Internet and other ICT skills, so that the impact of information handling, in its social and moral dimension, should also be addressed, rather than just leaving, especially younger pupils, to explore the morality of the Net on their own. In the light of current discussions about the role of schools in transmitting moral values and good citizenship, this is an important issue.

How information was used

2.64 There are two issues about how to handle the wealth of information on the Net. The first is how to focus attention on the more useful sites and weed out the uninteresting or inappropriately-pitched material. The second is how to place that material in the learning context of the classroom.

2.65 Where there was surfing allowed rather than focused searches, the teachers tended to be more doubtful of the value of the Internet activity. This was often expressed as

the limited amount of information collected compared to the time taken to find it. There was often an implicit comparison to what might have been achieved in the classroom for the same time. However, there was a recognition amongst the more IT-literate teachers that the acquisition of information was not the only benefit which accrued from allowing pupils to surf the Net. Where specific instructions were provided and the search of the Net linked to specific outcomes, there was likely to be a much more positive response from teachers, who often voiced enthusiastic support for the idea of being able to access up-to-date information unavailable elsewhere. For example, one Business Studies teacher was able to direct pupils to information on individual companies, trade unions, health and safety sites, etc., and described it as a 'fantastic tool for business studies'. This was reflected in many pupil responses, which suggested that it allowed them to access information which they would not normally be able to.

2.66   Those subjects in which projects featured as part of the examination process or as part of a Programme of Study were the first to attract pupils to the Internet. Where there was less focus in searching the Net, some teachers believed that tedium quickly built up and the pupils turned to more active uses of the Net, such as chat lines or e-mails.

2.67   In post-16 institutions, the ability to access information about university courses was seen as a useful facility for those engaged in the UCAS process. However, with younger pupils, many teachers expressed reservations about the pitch of much of the material that was available on the Net. There was a general consensus across the Project that the material to be found on the Net was usually more suitable for the post-16 student than for younger pupils.

Access and equity issues

2.68   Different institutions chose different strategies in terms of access for staff and students. While staff, in the main, had greater freedom of access, in terms of time that was available, applications they were permitted to use and the choice of sites, pupils have been restricted in different ways in various institutions. All institutions exercised some restrictions for pupils. Some strategies were:

- limiting availability to pupils by:

  - restricting the time on the system in one session

  - restricting the number of machines with Internet capability

  - restricting the use of the system to classes under supervision only

- limiting the applications which can be used by:

  - restricting non-work applications to outside of school hours

  - disallowing e-mail addresses to pupils

  - using 'censorship' programs or proxy servers

- limiting the conditions under which access is allowed by:

  - keeping access to a single supervised room

  - shutting down access if no supervision is available

  - using passwords/security devices to permit access only under agreed conditions.

2.69   In terms of general arrangements, there was a good variety of access policies in the different schools, as the project co-ordinators wrestled with the problems of siting, the number of workstations available for the Internet and the most appropriate use

for educational purposes. One policy was a deliberate attempt to place IT across the whole curriculum by disallowing a departmental booking system. This had important pedagogical consequences, as any integration of the Internet into Schemes of Work had to happen through worksheets or some other form of tasking. One secondary school had moved from open access to a 'loose' form of supervised access, combined with a contract system to ensure good behaviour. This was the result of a small minority of younger pupils visiting unsuitable sites.

2.70   One college restricted the number of machines in its Learning Resource Area, in order to keep control over what was going on. They also introduced a system of booking through floppy-disk issue, which allowed them to monitor usage and potential costs, in preparation for a possible return to a dial-up access. They restricted e-mail facilities to staff only, as they were concerned about some of the information that their older pupils might pass out. This view was influenced by the pupils creating at a local cyber cafe for the college their own Home Page which contained a number of spelling mistakes as well as inaccuracies.

2.71   The issue of unsupervised access is important. One school automatically turned off access on the hour every hour, as the lesson changed, to ensure that there was no unsupervised access during the change-over. Another favoured tactic was to insist that, during the normal school or college day, the facilities were used only for academic or related activity, but outside of these hours it could be used for personal purposes. While there were limited check ups to ensure this was being observed by members of staff, observations by the evaluators suggested there was little, if any, abuse of this honour system.

2.72   In terms of preventing access to unsuitable sites, there was a difference of opinion between those in favour of some form of physical or technological prevention and those who preferred an honour system. The provision of screening programs or proxy servers was one solution favoured by the former. These were either negative, in that unsuitable sites were blocked, or positive, in that only screened sites were allowed. The former had the disadvantage of being incomplete. There were always more unsuitable sites than could be identified. The latter had the disadvantage that it prevented access to potentially useful sites. Honour systems could be formal or informal. Formal contracts were favoured by those dealing with younger pupils. Any honour system seemed to be reinforced when pupils were told that their individual histories of site visits could be monitored by the project co-ordinator. In practice, little monitoring was actually done because of the time involved, yet this combination seemed to be most effective in minimising unsuitable material being surfed.

2.73   The issue of what is an undesirable application or site is a difficult one. Whereas there is general agreement that pornographic, racist and subversive sites should not be accessed by pupils, whatever their age, there is less consensus as to the best means of achieving this. While screening mechanisms had a great deal of support for work with younger pupils, as the age group advanced, the debate about free or controlled access became more intense. For example, in a 12-16 school, an exploration by some pupils on sexuality used 'gay' as a search tool and inevitably produced some highly obscene sites. Close supervision on a potentially delicate issue meant that the pupils did not gain access to these sites, after a careful discussion about the issues with the teacher. More fine tuning of the search terms produced better-quality resources for the topic they were researching. Conversely, a Project on AIDS in a post-16 institution was curtailed by a filter which prevented searches using the word 'gay' and led to a protest from the student concerned. It is, therefore, not just a simple matter of screening search terms or denying access to sites, but the area raises fundamental issues about the freedom of speech and access to information which is at the philosophical foundation of the Internet.

2.74   In the ConnectEd project, decisions about the location and distribution of Superhighways facilities were related to the existing networks in the schools and colleges. Where computing facilities were based in one or two rooms, then this tended to continue when the connection to the Net was introduced. Some institutions chose to restrict access to one room, even where there were opportunities to extend the facilities, in order that usage could be monitored more closely. Another advantage of concentrating the facilities in a single area, is that it is possible to staff one room for a longer period in the week than a dispersed network would allow. For example, in one college, the Learning Resources Area allowed access for 51.7 hours per week, with staff always on duty. One disadvantage that emerged when the Superhighways facility was located in the Library or Resource Area was that some non-teaching staff felt uncomfortable with the supervisory role and tended to close down the facilities at every opportunity rather than be responsible for young pupils reaching inappropriate sites.

2.75   However, the more developed institutions had plans in place to disperse the networks throughout the institution into curriculum areas. This decision depended on the provision of funding for cabling the institution or the existence of a whole-school cable network already. The aim in one case was to place about 10 machines with Superhighways facilities in each curriculum area. This involved a loss of control over the Superhighways by the Learning Resource Area (LRA) and the taking over of responsibility for maintaining the dispersed network by the Computing department. However, the deciding factor in moving to dispersal was that it was difficult to persuade teachers to come to the LRA in any systematic way and therefore opportunities to use the technology to back up their teaching were being lost.

2.76   There are more problems with a dispersed network where you have highly IT-literate pupils who have the potential to access and damage the network. So, while there may be a better network in place, there is less control over it than before. However, the issue of security of the network was not a problem for most of the participating institutions. While there were one or two instances of pupils interfering with the operation of the network, these were small compared to the number of pupils who used the facilities. As one project co-ordinator commented, "the time it takes to solve the percentage of problems we have had, given the use, does not warrant the time and expense of security systems".

Implications for learners with special educational needs

2.77   In one school, there was, for pupils with special educational needs, a specific IT policy which fitted well with the use of Superhighways facilities. The management saw the employment of the Internet with these pupils as offering a huge potential for boosting self-esteem and confidence, as well as allowing them to manipulate text in ways which were not possible with books. IT had an impact on such pupils' motivation.

2.78   The availability of appropriate freeware on the Internet is a bonus for special needs teachers, who may, for example, down-load Maths speed games at the appropriate level for pupils with special educational needs.

Gender issues

2.79   In one school, a compulsory GCSE IT has been introduced and the school has been able to include some Internet training in this course. It was noted that this was particularly successful with the female pupils, who dominated the computer room on subsequent days.

2.80   A previously successful IT intervention strategy which centred around lunch-time IT clubs for female pupils alone meant that there was a fairly equal number of males

and females using an open access Superhighways facility. This suggests that, rather than there being any specific implication for gender equity, it is the culture of the school in its approach to gender issues which is important in determining equal access.

Services and applications

Frequency and type of use of facilities

2.81   The most popular facilities amongst the pupils in the Project were accessing the Web and e-mail. As an example, during one session of IT at one school, it was reported that, of the 46 pupils in the room, 44 used Netscape, 32 used e-mail and that about a third used both these facilities every day they were in school. Only one pupil in this group rarely used the Internet.

Data speed

2.82   The comparison with a previous dial-up facility left staff in one college amazed at the speed of access to information through the 2Mbps cable. The dial-up account had been slow enough to deter busy teachers from accessing material, though a few pupils, the most technically advanced, had taken advantage of it. However the waiting tended to be 'dead time' on the dial up. In considering future provision, most of the project co-ordinators accepted that they may have to go for a lower specification of connectivity in order to limit costs. While they accepted that a reduction to 128k or 64k connectivity would lead to only a small loss of speed, which pupils would just have to put up with, they were more concerned that future, more sophisticated, uses of the Superhighways might be curtailed by the lower specification.

User friendliness

2.83   There were very few observed incidents where pupils had any difficulty with using the new technology. Indeed, they were reported as being able to gain the necessary technical skills with relative ease. This was so for e-mail and for video conferencing as well as use of the Internet. While there may have been some frustration where searches resulted in little useful information, the problem usually lay in the search terms employed rather than any difficulty with the technology itself. Most pupils were then able to adapt their search strategies to reach appropriate material.

Meeting the aims

2.84   The difficulties which the Project experienced in terms of connectivity and the lack of a single driving force meant that, by and large, the project did not meet any of its specific aims. In particular, use of the ConnectEd Web site and the development of shared curriculum materials were very limited. Instead of the schools and colleges in the Project operating together, it was largely left to individual schools and colleges to make progress in those areas of Superhighways technology they found attractive. The result of this was that the aims to do with sharing across a network of colleges were unfulfilled, except on an ad-hoc basis. One side effect of this was the relatively undeveloped nature of video conferencing in the ConnectEd Project.

2.85   However, in the larger aims of exploring the benefits of using the Internet and encouraging the use of IT as a learning aid by pupils and teachers, much progress was made, albeit on an individual-school basis. There were many examples of innovative use of the technology and a number of instructive models of use developed in different institutions. In all the schools and colleges which were connected by Christmas 1996, there were significant curriculum developments in the use of Superhighways technology. The patterns and models of use were sufficiently varied to provide a reasonable account of the differing ways in which the technology can be used. In all cases, there were clear benefits recorded in the

use of the Internet, from the way in which it brought in previously hostile teachers and pupils into IT usage to the value that access to the Superhighways added to the quality of teaching and learning.

2.86   Moreover, by the end of the evaluation, project co-ordinators and teachers were beginning to widen their appreciation of the potential of the technology and to re-focus their interests into applications other than just access to the Net, such as video conferencing. Most of the participating institutions had started to plan for future developments and for ways in which other curriculum areas, pupils, teachers, parents, local businesses, etc., could become involved. In many IT-rich institutions, the Project had reached curriculum areas which previous IT developments had left standing. In the more IT-poor institutions, Superhighways had proved a catalyst to interest in IT as a medium for teaching and learning. In the two key aims of exploring the educational benefits of the Internet and encouraging the use of IT as a learning aid, the Project was therefore a success.

Costs and cost effectiveness

2.87   Like the BEON project (see Report A2-1), ConnectEd involved considerable input from major commercial players. However, where BEON schools all enjoyed the same technological environment and a fully-managed service, in ConnectEd there was a huge variation among the participant schools in the type and quality of school LANs, hardware, speed of connectivity, technical support and so on. In many ways, therefore, this represented a much more realistic model, since it started with where schools were, rather than creating a completely new environment.

2.88   There were clear drawbacks with this approach, however, and these had become very evident in the fragmented nature of the project, with little sense of coherence or collaboration between the parties involved, educational or commercial. Some months into the project, it appeared that much time and effort had been expended for relatively little progress. However, towards the end of the trial, individual schools had made significant advances. While there were considerable educational benefits for certain schools, however, overall there were also considerable costs, with some schools having to upgrade their equipment in order to benefit from the project. Here, too, negotiation has been protracted and schools have, as in BEON, held out against initial tariffs. There were signs, at the end of the trial, of a substantial reduction in costs on the part of the company offering connectivity, but accompanied by a dramatic drop in capacity.