

**REPORT
FROM THE
INSPECTORATE**

The Use of Technology to Support Learning in Colleges

National Survey Report

May 1998

**THE
FURTHER
EDUCATION
FUNDING
COUNCIL**

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FUNDING COUNCIL**

The Further Education Funding Council has a legal duty to make sure further education in England is properly assessed. The FEFC's inspectorate inspects and reports on each college of further education according to a four-year cycle. It also assesses and reports nationally on the curriculum, disseminates good practice and advises the FEFC's quality assessment committee.

College inspections are carried out in accordance with the framework and guidelines described in Council Circulars 97/12, 97/13 and 97/22. Inspections seek to validate the data and judgements provided by colleges in self-assessment reports. They involve full-time inspectors and registered part-time inspectors who have knowledge of, and experience in the work they inspect. A member of the Council's audit service works with inspectors in assessing aspects of governance and management. All colleges are invited to nominate a senior member of their staff to participate in the inspection as a team member.

The inspection grades referred to in this report are all based on these descriptors:

- *grade 1 – provision which has many strengths and very few weaknesses*
- *grade 2 – provision in which the strengths clearly outweigh the weaknesses*
- *grade 3 – provision with a balance of strengths and weaknesses*
- *grade 4 – provision in which the weaknesses clearly outweigh the strengths*
- *grade 5 – provision which has many weaknesses and very few strengths.*

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SUMMARY

Many colleges have reviewed the use of technologies to support learning and have encouraged a greater awareness of the potential range of their application. The more wide-ranging vision for using technologies is found in colleges where senior staff have a comprehensive understanding of the possible applications of technology. Few colleges have translated this vision into a comprehensive written statement, with clear targets and timescales in their strategic plan against which progress can be measured.

Many colleges have policies which address the educational uses of computers but less frequently cover the whole range of technologies to support learning. Most colleges have policies covering:

- students' entitlement to information technology (IT) skills
- access to computer equipment
- a code of conduct for students while using equipment
- the security of facilities
- the purchase and maintenance of IT and audio-visual equipment
- specific recognition of the computer requirements of students with learning difficulties and/or disabilities
- staff development linked to the college's IT facilities
- learning support.

Implementation of these policies is not always monitored or regularly reviewed. Few colleges have policies and procedures covering the technical aspects of data security.

A strong corporate drive is a key element in making effective use of learning technology. This is best achieved when a senior manager supported by committed staff has overall responsibility for planning and implementation. Frequently, funding pressures make it difficult for colleges to invest in the infrastructure required to develop learning technology. Typically the costs of extending networking facilities can take up to three years of the equipment replacement budget. Annual investment can be as much as 5 per cent of the annual college budget. Variable access to sources of funding other than those administered by the Further Education Funding Council (FEFC) has contributed to the wide differences in facilities between colleges, and there remain some colleges in which facilities for students are less than satisfactory.

Several colleges are developing networks that allow students to use all the electronically stored learning materials and information databases anywhere in the college, including remote sites. These 'intranets' are relatively new and only a few colleges have developed them. Students appear to learn quickly how to make effective use of them. These early developments are a part of the general move towards students studying on their own. At present little use is made of technology to assist students to learn independently. Few colleges have yet devised systems to track

students' progress through the learning modules on the intranet although several are working with commercial organisations to develop this essential capability. Video-conferencing is being piloted in a number of colleges. Successful video-conferencing activities include individual counselling for careers advice and tutorial support and the transmission of some lessons to various outlets within the college and to remote sites.

Since incorporation many colleges have made substantial investment in computer technology. There are an increasing number of well-equipped and effectively used learning centres in colleges. These offer general curriculum support or support for specific curriculum areas such as engineering, science and modern foreign languages. The facilities include general computer facilities, computer-enhanced learning materials and other equipment for students to use on their own or with staff support. College facilities often include electronic library catalogues. Their potential to provide comprehensive support to students and tutors is sometimes missed. All colleges in the survey have an internet connection for the use of staff or students. The internet has been a significant factor in increasing the use of IT by staff and students.

Communication networks linking further education sector colleges are increasing through successful bids from groups of colleges for development funds. The networks provide opportunities for collaborative working to develop learning systems but few pilot projects have yet been completed. Several colleges have links with universities to support the teaching of franchised higher education programmes.

Few teachers routinely use IT in the classroom to improve the effectiveness of learning. There are examples of good practice in most curriculum areas but limited spread of good practice between curriculum areas and between colleges. Staff development events to spread good practice do not always lead to action in colleges. Availability of time for curriculum development is often an issue.

In several colleges, students' computer skills are assessed on entry to identify their levels of competence and the need for further development. For students with learning difficulties and/or disabilities there is frequently contact with their former school or local education authority to identify the equipment needed to support them. A few colleges seek specialist advice to select the appropriate supporting technologies. The lack of expert advice hampers the imaginative use of 'enabling technology' to support students with disabilities in some colleges.

The majority of students across the sector have opportunities to develop basic IT skills but the application of these skills varies significantly between curriculum areas within colleges. Their experience continues to depend heavily on the expertise and perception of teachers. The main use of computer equipment by students is in presenting assignments. Information searches using CD-ROM databases or the internet is the next largest use. Video recordings are an underused resource in many curriculum areas although there are examples of innovative and effective applications.

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INTRODUCTION

1 The promotion of the use of technologies to support learning in further education was the focus of the work of the learning and technology committee of the Further Education Funding Council (FEFC) chaired by Sir Gordon Higginson. The committee's findings and nine recommendations were published in the *Report of the Learning and Technology Committee* (Higginson report) in January 1996. The report and the FEFC's requirement for colleges to regularly review information and learning technologies within their strategic plans, Circular 96/34, have been influential in increasing the level of debate about the organisation and use of information technology (IT) within the further education sector.

2 This survey covers the application of computer, audio and video-based systems to support and enhance learning. All students need to be competent in the use of technology to survive in an 'information society'. Many learning programmes require students to become familiar with industry-standard computing equipment and its applications. Learning can also be enriched through the appropriate use of technology in most curriculum areas. The continuing advances in technology over the last four years have significantly increased the potential uses for supporting learning. Technology is a major expense for colleges and so there is an imperative to use it efficiently and effectively.

Terms of Reference of the Survey

3 The aim of the survey has been to investigate the use and effectiveness of technologies to support teaching and learning in colleges and the factors influencing developments.

Methodology

4 The survey, conducted in 1996-97, included visits to a representative sample of 44 colleges across the nine FEFC regions. Most visits took place in the spring of 1997 and some included classroom observation, discussion with students and a review of their work. Examples of good practice were also drawn from the inspection evidence gathered as a part of the FEFC's four-year college inspection cycle between 1993 and 1997. During the survey, discussions were held with organisations and companies involved in the development of IT and the provision of services and equipment to sector colleges. These are listed in annex A.

INFORMATION TECHNOLOGY INFRASTRUCTURE

5 Although many colleges have made substantial investments in computer technology, which are benefiting students and staff, there remain wide disparities in the levels of equipment within colleges.

Networks and Communications

6 All colleges in the sector have computer networks, though the extent and capacity of the systems vary significantly. The capacity of college computer networks influences students' experience of using IT. Networks affect the availability of information on sites, in rooms and at individual workstations. Some 5 per cent of colleges in the survey are currently at an advanced stage in developing an intranet that provides students anywhere in the institution, including its more remote sites, with access to all the electronically stored learning materials and information databases held on the network. The networks carry multimedia learning materials, electronic library catalogues and links to external on-line services such as the world wide web through the internet. They also carry routine academic and administrative electronic mail. All colleges in the survey have plans for upgrading or expanding their academic networks to individual classrooms and laboratories so that teachers can use technology in their lessons more easily. Occasionally, lesson materials are shared between college sites and with community centres, schools and businesses. Many colleges in the sector still do not have a substantial networking capability. Where they have been developed quickly there are sometimes problems. For example:

- inadequate technician support, resulting in breakdowns to the service
- poor conditions for storage leading to potential loss of important data
- additional costs for printers and other peripherals
- misuse of the network because of inadequate monitoring.

7 Some students are already using intranets. In one college, a group of sports science students in a learning centre were accessing the intranet to obtain basic information for an assignment on health issues. In another college, general national vocational qualification (GNVQ) IT students transferred database records to their own computer accounts before starting an assignment. They were confident in using this method of working and happy about the level of support available.

8 Electronic library catalogues are in use in many colleges across the sector, and libraries that lack them have plans to develop them. Most catalogues are only accessible from terminals within the library. A minority

of colleges, however, have systems which are accessible across the whole college network. These systems contain extensive catalogues of all the sources of information available in the college including the resources held in departmental libraries and curriculum-based resource centres, video and audio materials, CD-ROMs, study booklets, handouts used in curriculum areas and some internet sites. The use of reference and learning materials by students is monitored. The data obtained provide useful information about the students' patterns of study and progress. Students studying for GNVQ awards use the data as evidence of research undertaken.

9 College internet connections range from a single workstation in a learning centre to access on up to 100 machines. In one college, a computer room has been designated the college 'cybercafé' and provides high specification equipment and fast communications to the internet. Another college has an arrangement with a cybercafé in the town to provide students with similar facilities at a discount. In several colleges, cost-effective internet access is provided through a contract with a local university. (The effectiveness and usefulness of the internet is addressed further in annex C.) Video-conferencing is being piloted in a rapidly increasing number of colleges across the sector and several have made a substantial investment in this technology. The use of video-conferencing for education and training, however, is still at an early stage of development. One college with many remote communities has video-conferencing links with five centres. Lessons are organised so that groups of students at these centres can participate alongside students based at the main site. The college is still evaluating the effectiveness of such arrangements. Some colleges hire their facilities to local businesses for conferences with clients worldwide.

10 In early 1997 only 6 per cent of colleges in the survey had effective electronic links with universities specifically to support their franchised undergraduate and higher national programmes although others were considering this facility. This reduces the ability of college staff to communicate easily with university colleagues. Students are unable to participate effectively in academic debate with students at the university and to access the same electronic facilities as their university counterparts. Only 9 per cent of colleges surveyed use electronic mail to help students communicate with tutors or for submitting assignments. Where electronic mail is available, students use it well. There is a low but growing use of electronic mail for internal administration in colleges as the networking facilities are used more effectively. One college in the survey has placed its strategic plan and all its policies and newsletters on the network for easy reference.

11 Groups of colleges have established good electronic links, funded by the competitiveness fund and other development funds administered by the training and enterprise councils (TECs). Staff and some students have benefited from improved communication with each other through

electronic mail. Setting up the networks has also been a useful experience to colleges. Participating colleges will share the development of education and training programmes which can be accessed remotely by learners. Few initiatives to share developments have yet been completed. Some colleges in the sector now provide specially designed training or support for employers in remote locations. Other colleges have set up links with local schools and, in one example, a rural business user provides a regular newsletter and diary about activities and incidents on the farm. These are mainly pilot projects. Reports are produced on all the development-funded projects but there has not been a national report to describe the benefits or to identify the lessons learned. Many of these projects involve considerable duplication of effort across the sector.

Equipment

12 Almost all colleges across the sector have gathered technology-based equipment in learning centres of varying size and purpose to improve efficiency. Generally, computer resources are co-ordinated centrally. Where the responsibility for managing them is delegated to curriculum areas, there are frequently ownership issues, inadequate access to facilities, limited staff support and under-utilisation of equipment. The quality of equipment in colleges is largely influenced by the size of the college and the amount of funding it has gained from outside sources. A table listing the types of equipment found in the colleges surveyed is given in annex D.

13 In addition to their general computer centres, colleges often have a number of learning centres with a specific curriculum focus which incorporate significant amounts of specialist technology and computer-enhanced learning materials. These centres include:

- sound engineering studios
- modern language learning centres
- electronics laboratories with 'self-study' systems including simulations
- motor vehicle workshops with fault finding tutor simulators
- computer-aided design (CAD) suites with CD-ROM facilities
- multimedia rooms with video-conferencing facilities
- science centres providing simulations of experiments to support research and revision
- audio/video recording centres.

14 New equipment and software used by the colleges are generally of an equivalent standard to those found in industry and commerce. Where colleges have a replacement programme based on a four or five-year cycle, this often results in a wide range of standards: the oldest workstations are frequently unable to support the more recent software, and older software is unable to read students' work completed at home. This is forcing colleges

to review the frequency with which equipment is replaced, with three years becoming the typical period. Few of the older machines are still in use and, where they are, colleges plan to replace them as a matter of priority. The lowest standard machines found in the survey do not provide an acceptable educational experience for students. Some specialist areas, such as graphics and multimedia design centres, provide industry-standard hardware and software. The difference in performance between the college workstation and specialist industry-standard equipment is diminishing and some colleges are reviewing the need for equipment which differs from the college standard in some curriculum areas.

15 Colleges are increasingly providing other peripheral computer equipment to support students' work. Printers are standard items although costs often dictate that there are few or that the quality is poor. Many students are able to use digital scanners in building their portfolios of work. Sometimes, however, this facility is misused and students submit assignments and evidence for portfolios where the majority of the work is not theirs.

16 Most students have access to modern industry-standard software, generally based around screen displays where a pointer can be moved around the screen to invoke the desired software application or function. There are now common software standards for general purpose software applications in most colleges and data can readily be transferred between them. A few colleges continue to use inappropriate software which bears additional licence costs. There are also large departments with responsibility for their own IT resources which buy software that is not consistent with the college standard. It cannot then be maintained without additional costs.

17 Only 10 per cent of colleges in the survey monitor the use of hardware and software adequately. Good management information for improving cost efficiency is not generally available. As the annual spend on learning technology can exceed 5 per cent of the college budget, savings could be significant. Most colleges do not even have accurate information on the number of workstations that are needed to meet demands. The software is available to provide the necessary management information, and where colleges have installed this on their networks and issued students with unique identifiers they are able to analyse:

- the use of individual workstations and software applications
- individual use by course and curriculum area
- use of other facilities such as CD-ROMs and the internet
- the actions of individual students in respect of security and behaviour.

This kind of management information allows colleges to identify the most efficient number of workstations to provide a balance between use and convenience of access. For example, good information on utilisation rates

enabled one college to establish a ratio of full-time equivalent students to workstations of 7:1 and another college a ratio of 9:1. Overall, the ratio of students to workstations in the colleges visited ranged from 3.5:1 in one sixth form college to 80:1 on one site of a general further education college.

Access to Facilities

18 The accessibility of learning technology facilities is generally good. Colleges try to reach a compromise between ensuring adequate security of the equipment and students' access to it. The availability of media production facilities, television editing suites and satellite facilities is often limited to office hours because these require specialist technicians to staff them. There is low utilisation where classrooms containing equipment are locked when not in use for formal classes. Some colleges have electronic coded locks that restrict access to authorised students and staff. The most efficient access is provided in centres with bays, with some timetabled for classes and some available for general use. There are also rooms within these centres that could be shut off from the main centre for more formal tutorial groups. Colleges are increasingly opening learning centres from 09.00 to 21.00 hours several days each week, on Saturday mornings and at restricted times during college vacations. Some colleges hire or lend laptop computers to students who do not have computers at home. The development of modern accommodation and good facilities in learning centres has increased the amount of time students spend studying on their own. In one college in the survey, a technology centre created from a sports hall has significantly increased the availability of access to, and use of, a range of learning technology resources, particularly the internet, by students and employers.

TECHNOLOGY AND LEARNING

Participation and Previous Experience

19 Students come to colleges with significantly different experiences of using technology. A few colleges in the sector assess the IT skills of all new students to identify the level of support required to make effective use of the college's facilities. In the case of students with learning difficulties and/or disabilities, there is frequently contact with the educational establishments from which they come and with organisations providing support services. This helps the colleges to assess their skills and decide on the level and type of technological support required. A number of colleges seek the assistance of external consultants to provide the necessary specialist advice.

20 Most sector colleges have an induction and an accredited programme of basic IT skills that allows all full-time and some part-time students to study on their own, at their own pace, with support from tutors. This reduces the need for accreditation of prior learning. Most students studying

for vocational qualifications are required to cover particular applications in order to gain accredited awards for IT competences. Students on part-time programmes use IT when it is an essential part of their course and generally make some use of the common software available within colleges. The extent to which the IT skills of students who are not studying for a vocational qualification are developed depends heavily on the teachers' perceptions of the value of these skills, and their expertise.

21 One of the ways in which colleges attempt to widen participation in further education is by establishing more flexible arrangements for accessing learning materials at all college sites. The provision of learning technology at sites away from the college is more limited. The early efforts of colleges *circa* 1993 concentrated mainly on cable television channels. There were, for example, television programmes on the theory underpinning basic IT skills and supervisory skills, with students subsequently having the opportunity to practise these skills on one of the college sites. There was also a programme on learning sign language. The range of technology used to broaden participation, however, has expanded. Developments over the last three years include a rural training project involving 120 small businesses and individual students that enables people living in remote areas to study at convenient locations including offices and at home using computers linked to the college. At another college, 16 people with mobility problems have been provided with high-quality workstations linked to the college to enable them to study at home, where they are further supported by telephone. A further project at the same college is exploring the benefits of video-conferencing support for study from home.

Range of Learning Activities

22 Students mostly use IT to present their work and this helps them to acquire general IT skills. Most full-time students are expected to be able to wordprocess and this is the most frequently practised application of IT in most curriculum areas. Spreadsheets are used mainly in curriculum areas such as engineering, construction, business, mathematics and science. Students, for example, present mathematical data in a high-quality graphical format for assignments and presentations though they rarely use spreadsheets to model problems. The use of database applications are limited, are not in a subject-specific context, and are frequently too badly contrived to enable students to gain accredited awards.

23 Few teachers routinely use IT in the classroom to improve the effectiveness of learning. Where it is found, it is often the result of the work of individual enthusiasts. There are, however, isolated examples of good practice in most curriculum areas. For example, on a general certificate of education advanced level (GCE A level) politics course the students were following the progress of the general election. The internet was used extensively to obtain information from a range of websites that the political parties had set up and it was accessed daily to get the latest

opinion poll statistics. Students were required to keep a log of the websites used. They were also given a list of websites and this formed a starting point for some research.

24 Although there is a general move towards students studying on their own, little use is made of technology to assist students to learn independently. A major limiting factor is the small amount of high-quality learning material that makes cost-effective use of expensive equipment and provides good feedback to students and teachers. The activities teachers and students find most useful relate to support for students in revising for examinations. Students like the opportunity to test themselves and some teachers have developed multiple-choice and short answer tests that record an overall score and provide feedback to students on incorrect responses. The most popular application of this is in GNVQ programmes. There are also some programmes, produced by colleges on CD-ROM, incorporating video, audio and sometimes animation materials, that cover a range of curriculum topics including woodworking technology, jointing mineral insulated cable, and finance for leisure and tourism.

25 Video recordings are used regularly in some curriculum areas. Humanities is one area in which it is popular. It can provide an excellent facility for illustrating teaching points and providing a change in learning activity. Although some colleges have large video libraries that are well used, the cataloguing of materials is frequently insufficiently detailed for teachers to be able to identify suitable materials. The videos used by teachers are often the ones they have been using in particular teaching contexts for several years. Video recordings were used effectively in several classes inspected during the survey. In one business studies class, for example, students had prepared for the session using a handout provided by the teacher. The video was shown in stages and, at each stage, students were required to discuss what they had seen. Often, however, there is insufficient planning of lessons in which videos are used. The video is not made an integral part of the lesson. Students simply watch it and pass on to other things.

26 Audio tapes are mainly used in specialist areas such as modern languages, media, music and sound engineering. Facilities are generally good, and with some exceptions, teachers use them effectively. Music courses are generally well resourced. There is a range of audio and computer-based equipment which supports the development of appropriate skills.

27 Information searches, as a part of students' research, are a growing activity. In one college there are over 200 different CD-ROMs in regular use. Some of these are totally text-based and fail to make full use of the technology available. The internet is growing in popularity as a source of information. It is highlighted by the national media and has 'street cred' with young people. Students find it a more exciting way to carry out research and use it in preference to CD-ROMs if given a choice. Its use in

curriculum areas is wide and increasing. Students in areas as diverse as hairdressing, humanities and engineering use it with equal enthusiasm. Hairdressing students, for example, were carrying out research to find information on new hair care products and examples of topical hair styles.

Technology in Curriculum Areas

28 This section (paragraphs 29 to 59) summaries the developments and practises observed in colleges during the year of the survey to May 1997. There were significant differences in the way in which technology, particularly IT, was used by teachers to support learning. Enthusiasm by individual teachers, understanding of the time needed for developments, encouragement and recognition by managers, were usually the circumstances in which good practice was found.

Sciences

29 Science departments make little use of technology other than in meeting the requirements of the course and, in the case of GNVQs, developing IT key skills. There are infrequent examples of good practice across the full range of science subjects. Students are sometimes directed to use CD-ROMs for individual assignments and some colleges have software packages that students use for revision. In a few colleges, there are excellent examples of the use of automatic data logging, computer analysis of results and the production of graphs and charts. Field trips have benefited from the on-site use of data loggers and portable computers which rapidly produce a printout of results. One college has used the internet to access a simulation of the fruit fly experiments and students' interest was stimulated by the use of this demonstration which complemented the experiments started in the college laboratories.

30 There has been little investment in IT equipment for science, particularly for practical use. In a minority of colleges, there are network points in laboratories and preparation rooms to improve the availability of IT facilities. A few departments continue to use 10-year-old computers for control and interface applications. While some older equipment adequately fulfils requirements, it presents a dated image to students and it does not match the facilities they find elsewhere in the college.

31 There is limited use of technology as an aid to classroom teaching in computing courses. Few teachers make use of data projection or large-screen facilities to ensure that all students can see software demonstrations. Formal presentations by teachers, when they are required, rarely make use of the presentation graphics facilities generally available. There are good examples of the use of video, CD-ROMs, multimedia packages and the internet to support learning. Many students effectively use the information from these sources for assignments. However, a minority of students, frequently studying GNVQ at intermediate level, used large tracts of text indiscriminately for portfolio evidence without understanding the content. Students usually make good use of the

IT facilities available to them when completing assignments. They frequently use the full range of applications packages and the quality of presentation is good.

32 In only a few colleges is the use of technology an integral part of the study of mathematics. Many GCE A level students are encouraged to use advanced calculators with graphics and statistics capabilities but often only in a limited way. Computer software, which includes graph plotting, solution of simultaneous and differential equations, statistical analysis, and matrix transformations, are used in teaching calculus, algebra and statistics but there is scope for more extensive use particularly in modelling mathematical problems. A few colleges have invested in powerful statistics packages that provide support for mathematics and social science students and these are a helpful preparation for progression to higher education. A significant factor, limiting the use of technology in mathematics, is the difficulty of arranging for whole groups of mathematics students to have access to computer facilities on a casual basis.

Construction

33 Many construction departments have established specialist learning centres of high quality close to workshops. These centres have extensive study areas, often incorporating a well-stocked library of books and other learning materials which are easily available to students during their studies. Supplementary learning aids sometimes include videos, camcorders, computers with industry-standard software, CD-ROM databases, manuals of codes of practice, models, trade literature and technical catalogue systems. Students are encouraged to work on their own using specially designed resources. Staff have developed innovative learning packages which enable students to arrange their studies at convenient times. Over recent years, the quality of learning materials developed by course teams and consortia has steadily improved. However, teachers do not make sufficient use of technology in lessons.

34 A major problem is the lack of opportunity for craft students on national vocational qualification (NVQ) programmes to gain work experience. Colleges, however, have been imaginative in creating simulated work environments. Large-scale training and assessment rigs are available in most workshops.

35 Technician students develop good IT skills but craft students following NVQ programmes make little use of IT because it is not an NVQ requirement. Generally, GNVQ students are provided with good opportunities to develop these skills. In a few colleges, they are encouraged to undertake the BTEC unit on IT applications, or the RSA Examinations Board (RSA) computer literacy and IT award. Technician students frequently demonstrate a high level of competence in IT but they often fail to apply the skills they have acquired in their assignments. Sometimes it is difficult for colleges to keep up with technological developments. For example, even though the students in one college were using up-to-date

laser-guided and computer-operated equipment to undertake a survey, one student remonstrated that the company he worked for was already using satellite-guided instruments for greater accuracy in positioning and measuring.

Engineering

36 Most engineering activity requires the installation, use, or maintenance of equipment which has some form of micro-processor or computer control. The use of technology as an integral part of the knowledge and skills required by technician and craft engineering students is usually well developed. Its use for wordprocessing assignments and the gathering of information is generally appropriate although more effective use could be made of spreadsheets and databases.

37 Engineering students use a range of software packages including CAD packages for mechanical engineering. Some CAD packages now include a detailed help system held on a CD-ROM that can be run at the same time as the main package and this demonstrates the particular software feature being used and provides an added dimension to the teaching notes readily available. Electrical and electronic engineering students use computer packages which design and plan circuits. The latest micro-electronics teaching equipment extensively uses software-controlled self-teaching packages which include regular testing of the student's progress. In a few colleges, students use software which mimics the building and testing of circuits. The simulation can be used to supplement conventional laboratory work. Commercial software for designing hydraulic and pneumatic circuits is occasionally available. Some students also become familiar with the design and operation of programmable logic controllers. Installation and maintenance are also key elements of engineering courses. Electrical installation students fit and maintain micro-processor controlled equipment, especially security alarm equipment. Motor vehicle engineering students service and maintain micro-processor controlled equipment such as that used for anti-lock brakes and engine management systems.

38 Most engineering students use general computer hardware and software to produce their assignments. Full-time students use such resources either in engineering departments or within the college. Most students complete some work using wordprocessing software but few are enthusiastic users. There is little use of spreadsheet or charting software and limited use of database software except for a few specific activities. Many part-time students make good use of IT to produce assignments. Reports are wordprocessed and often contain computer-generated graphics and charts. General CD-ROM databases such as 'Encarta' are used in some assignments but the provision of more specific engineering data on CD-ROM has been slow to develop. Calculators are used extensively but graphic calculators and mathematical software packages are rarely used.

39 The use of IT to deliver teaching is minimal. Some teachers have used wordprocessors and desktop publishing software to produce their notes. Some departments attempt to develop a 'house style' but secretarial support for this is not always available. A few teachers use presentation graphics to make their teaching more effective. A few colleges have the latest commercial equipment for teaching electronics which employs software-controlled self-teaching packages. Its use is still being developed in most of these colleges.

Business

40 Computers are used widely in the business programme area as a routine part of the development of skills such as wordprocessing, presentation skills using graphics, and desktop publishing used in business-related occupations. Students also use software for spreadsheets and databases in business applications. There is limited use of computers and other technology to support teaching and learning in other aspects of business-related courses. Few business administration areas have introduced the software available for simulated applications of stock control, simple accounts and records in training offices. There are some examples of interactive software, the most common area being accounting. Packages have been developed for teaching accounting technicians. A number of colleges are using software to provide data sets for business exercises. There is also isolated use of packages for teaching various elements of customer relations, for GCE A level business studies and marketing. There is increasing interest in self-testing software for use on GNVQ programmes.

41 The use made of the internet varies. A number of colleges have now introduced supervised access in IT and 'business' centres. Most activities are searches for information. For example, company, marketing, financial and economic information is readily available and provides opportunities to track real company performance. A website has been developed by a consortium that includes the Economics and Business Education Association. It contains:

- a section on information about companies
- financial and economic data
- a listing of resources
- a network service of key national and regional contacts
- a study skills support service
- tutor support service with schemes of work and assignments.

It is not used extensively by the sector colleges. CD-ROMs are starting to be used for interactive learning as well as for information searches. Learning packages on topics such as marketing are beginning to be introduced. A recent development is the use of video-conferencing to support applications within the business community.

Art and design

42 The use of technology in the art and design programme area varies widely. In many programmes, particularly the advanced level design courses, technology is an integral part of the curriculum and is well used. There is consistent use of technology in design, media and some specialist music courses. Most tertiary and sixth form colleges have better resources for music than general further education colleges. On media courses there are often insufficient editing facilities. Image scanners, laser printers and, increasingly, digital cameras are the most commonly available equipment for use with computers. The use of technology to support students working on their own is still at an early stage of development. Access to the internet provides students and staff with material directly connected to their studies but few colleges have this facility available in art and design studies.

43 The majority of colleges offering a full range of art and design courses have a suite of industry-standard computers on a network. However, in terms of the effective use of computers, there are frequently great disparities between courses in the same departments. For example, media studies courses may be equipped with industry-standard technologies that are effectively used, while in performing arts there is little or no access to the technologies associated with the subject.

44 On some music courses, particularly those involving popular music, the use of electronic instruments and equipment has been accompanied by increasing use of related software applications. In contrast, some vocational course requirements have not kept pace with the increased use of technologies. Art and design students usually take the same key skills programme in IT as other students rather than follow a vocationally relevant programme. A few students and staff continue to cling to the stereotype that artists and designers have no need of new technologies. Most of the courses using computer technologies have appropriate industry-standard software application packages for graphic design, media and music. There are very few performing arts courses equipped with modern lighting systems with computer control. Sixth form colleges are unlikely to have industry-standard equipment. IT support for art and design in these colleges is usually provided in a general learning resource centre.

45 Many art, design and music departments have computers that are separate from other computer provision within the college. The computers are in close proximity to studio workplaces and this helps to provide a realistic work environment for graphic and three-dimensional designers. Because many of the computers are not linked to a college-wide network there is no local technical support. This reduces their effectiveness.

46 There are a few examples of staff using their expertise to develop teaching methods using new technologies. This is particularly the case where staff in graphic design, media and music courses have industrial or professional backgrounds and experience.

Hotel and catering/leisure and tourism

47 Several colleges have introduced specialist learning resource centres for hotel and catering and for leisure and tourism. However, many still lack appropriate IT equipment and specialist software to support the subject area. A number of colleges are making increasing use of CD-ROM. The best examples include the use of interactive packages of software related to travel and hospitality. The use of the internet is only at an early stage of development, although some staff and students are becoming aware of its potential. In one college, GNVQ leisure and tourism students use it to conduct research for assignments and have been able to gather information on visitor attractions, transport services and tourist destinations.

48 There are a few examples of the good use of technology in realistic work environments. These mainly involve the use of computerised restaurant reservations, billing and stock-taking systems. In addition, some college travel offices have computerised booking facilities and viewdata terminals linked to commercial operators. Students can use the equipment to book holidays for members of the public, other students and staff. The availability of such technology offers students a significant advantage in developing the skills required for employment. In some cases, the hardware and software do not meet industry standards.

Humanities

49 The most commonly used equipment to support teaching and learning in humanities areas comprises overhead projectors, video and audio cassettes and slide projectors. Television provides professional drama productions and documentaries which help students to understand and interpret texts. In geography, videos and slides are particularly useful in developing students' awareness of changes in land use and geomorphology. Many students view videos in their own time in college learning resource centres. The use of IT is a relatively recent development.

50 There has been a rapid increase in the use of CD-ROMs for general and specific subjects. These are widely used by humanities students to research topics and assignments and as an additional source of information, alongside books and journals, for essay writing. In geography, there is a wider use of software packages which present fieldwork data in formats which are useful for analysis. Water tanks can be used to model deposition, and satellites bring up-to-date information on world climate. Although various specialist software packages do exist in other subjects, for example in history, they are not as widely used and their potential is not yet fully developed. Although students use software packages in timetabled sessions they do not always follow this up with further work in their own time.

51 There is increasing pressure in many colleges for all students to acquire general skills in wordprocessing, and in the use of spreadsheets

and databases. However, even when students acquire these skills they are not always subsequently applied within a subject context. Many humanities courses are governed by syllabuses which do not have many specific requirements for using IT and so little emphasis is given to developing general skills. There is, however, an increasing tendency to require some wordprocessed work from students. In geography in particular there is some scope for the use of spreadsheets. Many higher education access courses in humanities make the acquisition of IT skills an integral part of the work.

Modern languages

52 Modern language teachers are often enthusiastic about the use of technology in learning. The success with which they use it depends on a number of factors, including development time available, suitable equipment and software, administrative and technical support and the level of their own expertise. Audio and video cassette players are an essential component of modern language teaching, providing opportunities for students to hear and see authentic speakers of the language and to develop an understanding of the cultural background of the country whose language they are studying. Although wide use is made of such technology, it is not always as effective as it might be. This is particularly true of audio cassettes and some language laboratory work. In some cases, an expensive laboratory may only be used for playing cassette recordings. In the more modern laboratories, links to video monitors enable students to watch and listen to programmes, then carry out comprehension exercises. The latest versions include sophisticated multimedia authoring packages to enable teachers to create their own materials. Staff frequently lack the preparation time to realise the full potential of these resources, however. There is growing use of satellite television, electronic mail and video-conferencing with partner institutions abroad to keep staff and students abreast of language evolution, including colloquial expressions.

53 There has been a rapid growth in language centres, in which students have access to a wide range of resources for studying on their own, although a significant number of colleges still lack such facilities. The most recent of these centres contain some state-of-the-art equipment, including networked CD-ROMs and multimedia packages. Students, particularly those learning English as a foreign language (EFL), make good use of them. Occasionally, a department is fortunate in having the services of a modern language expert to provide technical support and this adds immeasurably to their usefulness. Where support is provided by teaching staff, access for students is frequently limited and resources are sometimes underused.

54 Modern language students make little use of computers for their project work. Work is occasionally presented using foreign language fonts. In one case, for example, a set of poems was wordprocessed in modern Greek. The use of the internet is growing as the number of useful sites with learning materials for language teaching increases.

Basic skills

55 Teachers of basic skills and English for speakers of other languages (ESOL) usually have adequate access to appropriate computing facilities. However, the time taken by teachers to master the technology frequently hinders its use as an aid to meaningful learning. In community locations, learning technology is used even less because teachers often have to carry equipment to their classes. The software and learning resources for students with basic skills needs are frequently unsuitable or in short supply. Many resources are outdated. One college had only one computer in the basic skills workshop apart from an ancient machine with some out-of-date numeracy software. In some sessions, the software was inappropriate for the age or ability of the students; in others, there were few or no resources. In most colleges, the investment in equipment and resources required to provide a good education for these students is inadequate.

56 The quality of teaching materials varies considerably. In the better lessons they are computer generated, attractively presented, appropriately varied and of a suitable level for the students. In less effective lessons, there is extensive use of poor-quality worksheets. Some teachers do not use IT because of their own inexperience and lack of awareness of its potential. Others have no access to suitable equipment or appropriate software. ESOL teachers tend not to use computers except where there is a focused short course linked with developing computing skills. Although students often have good access to computers in open learning or study centres there may be no facilities for computer-assisted language learning in the ESOL area. In some colleges, students are not able to gain access to computers to complete their tasks independently. In one college, a basic skills workshop supporting students throughout the college had only £150 to spend on materials each year. In study skills and basic skills workshops, computers are being used to produce good paper-based materials but there is often little use made of technology to assist learning and teachers lack information on the software available.

Students with learning difficulties and/or disabilities

57 Students with learning difficulties and/or disabilities may require specially designed 'enabling technology' to gain access to the full range of learning opportunities. In the best practice, where colleges are committed to ensuring that these students have full access to the curriculum, there is careful initial assessment of students' needs. This is accompanied by:

- access to appropriate equipment
- the use of IT as an integral part of teaching
- adequate specialist technical support
- access for students to appropriate technology for home study
- training for students and staff in the use of the technology.

58 Many colleges have a good range of enabling technology, including: induction loops; videos with subtitles; voice-activated tape recorders for the use of note-takers to support students who are deaf or hard of hearing; mini-cassette recorders for dyslexic students to record lectures; and adapted keyboards, switches, 'glidepoints' and trackerballs to help physically disabled students use the keyboard effectively. One college worked with a local engineering company to develop an adapted darkroom complete with computer-assisted enlargers, finely controlled through simple switches. Other colleges have established a resource bank of adapted and specialist equipment such as laptop computers, voice recorders and spell-check machines. In some colleges, differentiated computer-aided learning programmes are available on the computer network. For example, a higher national diploma student receives particularly good study and technical support. He is a switch user and has a keyboard emulator, a modem and access to a phone line so that he can send his tutors his work. Staff have put key material onto disk because he cannot use his hands. Specialist equipment including voice synthesizers allow students with visual impairments to follow computing and other courses effectively.

59 In some colleges, the management and availability of enabling equipment is poor. Specialist equipment is not made available, has to be obtained through fund-raising, or arrives too late in the course to help the students. One student with cerebral palsy who required a laptop computer still had not received it well into the course. Some students had inadequate access to IT in classrooms to develop their basic skills. Several colleges had one type of computer for use with basic skills software and another for 'keyboarding skills', causing unnecessary confusion to the students. Sometimes support for students is ineffective because teachers failed to make simple practical adjustments. The most common weakness is the lack of expert advice about the ways in which technology can help students to learn. Often inappropriate equipment was purchased and then rarely used.

STRATEGIES AND POLICIES

Strategic Planning

60 All colleges in the sector keep developments in technology to support learning under review but the rate of change makes it difficult to maintain a comprehensive up-to-date picture. In over half the colleges visited, the Higginson report had led to a review of the college's position on technology support for learning, resulting in improved strategies for development. In about 10 per cent of colleges surveyed, the strategic direction taken had anticipated the Higginson committee recommendations. The nine recommendations of the Higginson committee are listed in annex B.

61 Most colleges in the sector include a strategy for technology in their strategic plans. In about 15 per cent, the strategy is wide-ranging and challenging. Often, it is determined by one senior manager with a detailed knowledge of education and the application of current educational technology, who works closely with the principal and other senior managers. The significant investment necessary to translate vision into reality requires the close involvement of governors. There are also important implications for colleges' organisation and range of staff expertise. Successful strategies embrace four elements:

- use of industry-standard equipment to enable students to develop essential job skills and general key skills
- support for students' general learning experiences
- support in monitoring students' progress towards their learning goals
- the provision of flexible forms of learning aimed at widening participation.

62 The use of technology to support learning varies between colleges and between curriculum areas within a college. The first priority in many colleges is to support the development of essential vocational job skills and promote general IT skills. The emphasis is on the development of existing facilities such as computer workstations, learning centres and on improving students' access to equipment. Lower priorities are given to accessing information electronically, and using technology as a teaching medium or to provide support for individual study.

63 Aspects of both academic and administrative computing, such as systems for monitoring students' academic progress, communication networks serving academic and administration needs, and technical support, were addressed coherently in only about half the colleges visited. Few colleges visited have a comprehensive written statement identifying clear targets and timescales against which progress can be measured. Policies and practices provide an indication of the strategic direction in which colleges wish to move but the lack of an overarching strategy and inadequate co-ordination of activities limit progress.

Policies and Practices

64 Most colleges have policies or have developed regulations covering:

- students' entitlement to IT in terms of general learning support and the development of key skills
- access to equipment
- a code of conduct for students using equipment
- security for equipment
- the purchase and maintenance of IT and audio-visual equipment

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- recognition of the specific requirements of students with learning difficulties and/or disabilities
 - staff development in IT.

The implementation of these policies is not always monitored or reviewed.

65 Most colleges have an 'entitlement policy' under which all students are guaranteed access to IT facilities and may accredit the skills they develop. However, few of the students studying on non-vocational programmes take advantage of this. Only 10 per cent of the colleges in the survey have identified the minimum level of skills to be achieved by all students and have taken steps to ensure that most achieve it. One college attempts to ensure that all students achieve an accredited qualification at a level equivalent to key skills level 2 and that those studying science, technology and business-related courses achieve key skills level 3. Staff are required to identify IT applications within each subject or course so that students can seek accreditation for these.

66 Access for students to IT and staff support varies. In the best practice, learning facilities are open on all sites for up to 12 hours each weekday and on Saturday mornings on the main sites. In some 15 per cent of colleges in the survey there is limited access to, or shortages of, appropriate modern equipment which makes it impossible to meet the policies of access and entitlement. In a few colleges, the lack of staff available for supervision and support leads to locked rooms and a significant reduction in the use of equipment. There is no analysis of the costs of inefficient use of the resources against staffing costs for supervision. Access to non-computer based facilities and learning materials in curriculum areas such as modern foreign languages is generally adequate. In one college, students studying modern languages were shown how to operate the satellite system and were able to work on their own using this and other resources. Several advanced level students took regular advantage of the opportunity.

67 Conduct of students using a college's internet and electronic mail facilities is the responsibility of the college. Most colleges tackle this through a written code of conduct which students are required to sign. Codes of conduct are not always updated. For example, some do not cover use of the internet.

68 The security of equipment has been addressed with varying success in all the colleges visited. All have made a risk assessment of the loss of equipment. Many have installed alarm systems and closed-circuit television cameras. One group of colleges has employed a consultant to advise on the security of computer accommodation and computer equipment, including the use of security tagging of cases and internal electronic components. In general, policies do not take sufficient account of the electronic aspects of system and data security at both user and technical level. In several of the colleges visited it would be possible to access management files from public networks. Few colleges regularly review this aspect of electronic security.

69 In most colleges across the sector, the purchase of equipment is centrally co-ordinated. There are usually agreed standards for equipment and software that are regularly reviewed. Sometimes different standards are set for specialist vocational areas where it is necessary to have equipment which matches industrial practice. Many colleges agree maintenance contracts when the equipment is acquired, which reduces the need for technical services staff. Equipment is acquired either by purchase or lease. In most cases, leasing is used when there is an urgent requirement to update a significant amount of IT equipment and capital funds are not available. A number of larger colleges, with many computers on several sites, are exploring the use of contractors to:

- maintain all equipment and facilities, including networks
- report on recent developments
- advise on the extent to which existing facilities match industry standards.

This arrangement enables the college to receive regular specialist advice on all computing issues, including security and the routine management of all communications within, and external to, the college.

70 The requirements of students with learning difficulties and/or disabilities are usually referred to within a college's entitlement policy, disability statement and charter. References are frequently restricted to computer support and neglect their need for other equipment. In one college, for example, there are excellent computer facilities and peripheral equipment, such as printers and scanners, to meet the general learning needs of individual students, but no assessment has been made of the need for other specialist equipment required for practical work.

71 Few staff development policies refer specifically to technology. Most colleges, however, have undertaken audits to determine the expertise of staff. Annual staff development plans frequently identify relevant training events and there are a number of schemes to help staff purchase equipment. In about 10 per cent of colleges visited, IT training is a part of the induction of new staff. Library staff in an increasing number of colleges are expected to develop IT skills in order to help students to use these facilities in the library. Some colleges expect all staff applying for posts to have basic IT skills.

Implementation

72 A key element in the successful development of learning technology is the support of senior staff. Development is generally effective where there is a senior manager with overall responsibility for planning and implementation. Having one senior manager responsible for management information systems and IT enables colleges to:

- avoid duplication of systems and their development

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- link management information records on students with information about students' progress
 - share technical support efficiently
 - consider curriculum demands for technology within the college's overall corporate strategy.

73 Task groups with specific objectives are used effectively in a number of colleges to consider development issues and recommend action. One task group produced comprehensive recommendations for an IT infrastructure covering networks, internal and external communications links and supporting software. Its work helped to clarify the college's strategic aims in relation to the use of technology to support learning.

74 Of the colleges surveyed, 20 per cent give a small group of staff responsibility for all aspects of IT strategy, policy and planning. Such groups provide a useful forum for debating and resolving issues. Their effectiveness is improved where managers are prepared to accommodate their recommendations by changing organisational structures and taking a fresh look at the roles and responsibilities of staff. Examples of new staff responsibilities include:

- the creation of management posts for developing technology-based learning systems and making these available to all students
- the introduction of 'academic information managers' with responsibility for managing information and learning materials across the college
- extending the remit of librarians to provide learning support for students
- employing staff in learning centres to support students working on their own.

75 All colleges across the sector aim to establish common hardware and software standards. In 5 per cent of colleges in the survey, the lack of co-ordination in developing learning materials and systems has had a significant adverse impact on their applications. In one college in which there were different standards of software in different rooms, managed by different departments, the support for students and the flexibility with which students could access the equipment was noticeably less than it might have been. The lack of common standards for hardware and software places undue burdens on teaching staff and technicians: it discourages staff with limited expertise in IT and increases unnecessarily the need for staff development.

76 In 15 per cent of the colleges surveyed, staff have clearly defined responsibilities for identifying potential applications of technology for learning and developing new approaches. When staff with appropriate expertise are involved, course validation procedures are useful in identifying technology needs. Sometimes departments are asked to identify

ways in which IT could be used to support students working on their own as a means of reducing class contact time. In some colleges, departments have been set reduction targets for class contact as an incentive to make more use of recently developed learning technology. In one tertiary college, a new school of technology and telematics has been created to raise the profile of, and emphasise the priority given to, technology. In several colleges, teams developing college-wide IT and learning technology systems have acted as 'consultants' to curriculum projects and provided effective support to staff in developing appropriate technological applications. Several colleges use newsletters to explain their overall strategy for learning technology and the stage reached in the various development projects. Major constraints affecting change are:

- staff concerns about the effect on students of reducing students' taught hours
- the lack of expertise available to identify appropriate applications
- available expertise, time and funds to create effective learning materials to support students working on their own.

Funding

77 All sector colleges recognise that funds, in addition to those provided by the FEFC, are required to develop a broad technology strategy within a reasonable timescale. Frequently, colleges are forced to choose between meeting the curriculum needs of existing students or investing in networks to increase the flexibility with which students will be able to learn in the future. To upgrade a whole college can cost as much as a college normally spends on routine replacement of equipment over a three-year period. A lack of investment in networks restricts:

- access to the full range of information sources available for research
- the range of learning methods and learning materials available
- the development of systems to support students working on their own
- strategies for widening participation in education and training.

Only about 5 per cent of colleges in the survey have good management information on the use of equipment and have conducted a detailed analysis of this for planning purposes.

78 Most colleges in the sector have been successful in attracting additional sources of funding to develop technology-based education and training materials over the last four years. Amounts vary significantly, however, which partially accounts for the wide differences in the quality of facilities across the sector. In some colleges, external funds, coming mainly from government or European funding for specific projects, provide over a third of the cost of materials and equipment. In many cases, these funds have enabled colleges to strengthen their equipment base substantially. In other cases, the specified use of project funds have not always matched

college priorities and, especially where external funds have to be matched by college investment, effort has been diverted away from planned developments. There are instances of project funds creating well-resourced sites while other sites are less well equipped to meet students' needs. Special funding has also led some colleges to develop high-profile video-conferencing and multimedia learning projects at the expense of adequate IT facilities for existing students.

79 There are good examples of substantial, and sometimes free, industrial support from computing companies involved with the further education sector. One college in the survey needing to update its computing equipment estimated that the cost of this would be approximately £1 million. In order to obtain improvements as rapidly as possible it decided to lease the equipment. The college was able to enter into a contract where the contractor agreed to work closely with the college not only to supply the equipment but also to provide support in developing new learning systems.

80 The sector is currently investing more than £100 million a year in computing equipment. The level of investment required to maintain an acceptable level of computing equipment in individual colleges, however, depends on the provision offered and previous levels of investment. The range of investment in IT for colleges surveyed is shown in table 1.

Table 1. Range of investment in IT by colleges in the survey, 1996-97

<i>College</i>	<i>Minimum investment as a percentage of income %</i>	<i>Maximum investment as a percentage of income %</i>
General further education colleges	0.5	5.2
Sixth form colleges	0.2	5.0

DEVELOPMENT OF LEARNING SYSTEMS AND MATERIALS

81 Teachers find difficulty obtaining high-quality interactive learning materials. Good commercial products are often expensive and generally cannot be modified without infringing purchasing agreements. Materials that allow students to study on their own are the most difficult to obtain and most of them are not suitable for use with the required range of abilities or adaptable for different styles of learning. Many lower cost materials are effectively electronic books with limited facilities for interactive learning. A few colleges have invested in multimedia authoring systems to produce learning materials that meet specific needs across a range of curriculum areas. There are examples of enthusiasts amongst college staff who have produced this type of learning material through

college-based or externally sponsored projects. One innovative project involved learning support staff developing a multimedia low-budget, colourful and interactive induction presentation. This meant that, during induction, students on basic skills programmes were able to explore visually, on their own initiative, the specialist programme areas offered by the college. A small number of colleges are beginning to develop learning materials for commercial publication. Production costs of good quality interactive multimedia learning packages are estimated to be in excess of £100,000 and the costs of development can rarely be met by individual colleges. Issues of copyright add to the complexity of such developments in colleges. A number of colleges have taken a policy decision not to produce and publish learning materials in multimedia formats because of the costs, the expertise required and the difficulties in estimating commercial demand.

82 Many colleges have a substantial quantity of learning materials produced by teachers as a normal part of their work. The majority of learning materials are handouts, booklets, periodicals and books. A small, but growing, number of sector colleges are systematically storing them electronically for use on an intranet. In some of these colleges, teachers are being given guidance on how to develop intranet compatible materials. Commercial products are frequently the first choice where they are available and of the appropriate quality and cost. Preference is usually given to materials and learning systems which allow teachers to modify them to meet specific needs. Some colleges have produced materials to meet particular needs. Several colleges are able to provide expert technical support and some have design teams who are responsible for the quality and consistency of materials used in college. New projects are sometimes identified and managed centrally. These include the development of multimedia learning systems and pilot exercises in the use of video-conferencing.

83 Colleges have demonstrated that by working in consortia it is possible to produce and purchase learning materials cost effectively. A network of over 160 colleges, the Further Education National Consortium (FENC), subscribe to a non-commercial national consortium that produces and exchanges learning materials. The current catalogue has over 1,600 titles representing 25,000 student learning hours covering all curriculum areas. Materials are distributed on CD-ROM and can be modified to meet specific learning needs. A search facility has recently been developed that enables modules on specific topics to be identified and placed together to make an individual learning programme. Materials are designed for supported study and some are effective for distance learning. There is a similar but smaller group of colleges producing learning materials for modern language studies.

STAFF AND STAFF DEVELOPMENT

Staff Skills

84 All full-time staff and many part-time staff receive an induction programme covering college IT systems and facilities. In a number of colleges the induction is similar to that given to students. Teaching staff are also introduced to audio-visual facilities, reprographics and learning technology to support teaching. Most find this useful. However, the induction rarely identifies existing good practice in the use of technology to support teaching and few colleges identify staff needs and design programmes to meet these.

85 Nevertheless, there is an increasing focus on identifying staff expertise. The Higginson committee reported that there was a requirement for considerable staff development to make more effective use of IT in support of learning and that sector training needs should be identified. A significant number of colleges took advantage of the offer by the Further Education Development Agency (FEDA) to analyse questionnaire responses to an IT skills audit in their institution. This provided useful information on existing levels of skill across the college and the training needs. Most colleges have now recently completed some form of skills audit. Many colleges found the training requirement to be extensive. There remain a significant number of staff with little or no confidence in using technology in their teaching. Few colleges have linked their analysis of existing skills to their IT strategy in order to identify gaps in the skills available.

Staff Development

86 Staff development for technology is usually a mixture of awareness raising, general skills training and more advanced training in specific areas of expertise. A range of training strategies has been used to develop general IT skills. In some cases, staff attend college courses with the students; in others, staff are provided with learning materials to study on their own and can seek technical support when required. Staff have often been provided with computers to use at home. A number of colleges have set targets for the levels of skill to be achieved. This is frequently NVQ level 2 or its equivalent. Several colleges indicated that they made significant use of the sector-wide training programme organised by FEDA for developing quality in information and learning technology (QUILT). The QUILT programme is the outcome of one of the recommendations of the Higginson committee. The extensive programme covers curricular, administrative and management topics and has attracted £1.9 million of funding support from the FEFC. The training events draw on existing good practice in the sector and make effective use of teachers as presenters. Many colleges have been involved either as good practitioners or as delegates. College staff attend British Educational Communications and Technology Agency (BECTA) conferences, and BECTA materials are used

by a range of colleges. Other sector organisations such as National Information and Learning Technologies Association (NILTA) and FENC also promote the use of information and learning technologies through a range of conferences and training events for their members. They also make a significant contribution to events organised by other agencies such as FEDA and BECTA. NILTA has also supported its members with reports identifying development issues that college managers need to address in their strategic plans.

87 There are discernible links between a college's strategy for using learning technology and the nature of its staff development programme. Where there is a strong thrust to use technology, staff development for teachers is becoming more focused on specific needs. The blanket training in wordprocessing, spreadsheets and databases offered to all teaching staff is slowly giving way to training in skills more closely linked to curriculum initiatives:

- the use of CD-ROMs and the internet
- using multimedia to develop key skills
- IT in geography and English
- using IT to produce overhead projector slides and make presentations.

Staff development for technicians is less effectively managed. There are occasions when new equipment, networks and software have been introduced into colleges before the appropriate level of training has been provided.

88 There has not been much research on the effects of staff development in technology on classroom practice. A number of colleges require the annual reviews of quality to indicate the progress made in the use of technology in the curriculum and this has been effective in providing information to senior managers. The internet has attracted the attention of staff who previously have had little use for technology in their teaching. A number of colleges reported that this had been the single most motivating development in recent years. Other progress included:

- more effective use of spreadsheets to support engineering courses
- the increased range of evidence in students' work since the introduction of students to the internet and CD-ROMs
- the improved quality of handouts and higher quality overhead projector slides.

89 The roles of technical support staff within colleges are changing. Many now have roles that extend beyond maintenance to providing technical support to students and staff. Although many colleges leave staff to struggle on their own if systems fail, other colleges are increasingly providing direct technician support to teachers in the classroom either on call or by regular arrangement. For staff unfamiliar with some aspects of the equipment, usually printers, this provides added confidence. A few

colleges have even set service standards for 'emergency' call out. Audio-visual technicians in some colleges provide technical support for satellite facilities, in editing suites, and in studios for video-conferencing. They also provide technical advice on the use of portable recording equipment to students and staff. IT technicians frequently spend time monitoring activities in IT centres and providing support for students and some staff. Many technical staff found the extended role more satisfying. Some also have teaching qualifications and switch between the roles of technician and part-time teacher. The level of technical support generally matched the quantity of equipment and number of sites to be served but there are still colleges where the level of support has not kept pace with the growing number of sites holding equipment.

EXTERNAL LINKS

Commercial Organisations

90 Of the 44 colleges visited during the survey, 90 per cent had formed links with another organisation to develop some aspect of technology related to learning or training. Most colleges have collaborated with TECs in bidding for competitiveness and development funds to develop learning technology. Successful bids normally result in pilot projects, related in some way to distance learning and the needs of small- and medium-sized enterprises. Projects have sometimes involved forming consortia with local councils, higher education institutions and other businesses. Three of the projects in the colleges surveyed were to develop internet links, websites or web pages with small- and medium-sized enterprises; one was to develop an internet site for the college; six involved the use of video-conferencing links for education and training in small- and medium-sized enterprises or community centres. Three projects were to set up information networks to serve small- and medium-sized enterprises; two of these provided on-line learning and information services and the third established a database of education and training courses catalogued by content, level, previous experience and mode of study. There was considerable similarity between many of these projects yet most colleges had not been able to obtain information about the other projects. A number of projects involved direct support for businesses. One was to develop a business club with members linked electronically. The services to be offered included the development of IT skills, hardware and software consultancy, an internet connection and an electronic mail facility. Another project involved redeveloping traditional open and distance learning materials into a format suitable for network access.

91 Many of the colleges across the sector have been directly involved with all or some of the agencies promoting education technology in the further education sector. Information on particular projects such as developing networks and bidding for TEC funds is rarely shared with other

colleges in the sector. Links between colleges and a number of commercial organisations in the development and marketing of learning systems, however, are now beginning to have an impact. Some suppliers of equipment provide support for developing facilities and learning materials as part of a long-term commitment to a college. One of the sector associations has negotiated software discounts with a major software company in addition to technical support from other sector suppliers. A consortium of colleges working with a software house to develop software for monitoring students' progress is an example of the sector itself being able to influence and guide the development of the facilities it requires. There are significant benefits to be gained from more joint ventures of this nature.

International Links

92 International links are growing. A number of potentially useful collaborative projects attracting European funding are under way. One project involving partners in France, Germany and Austria is to develop multimedia solutions for the training needs of small- and medium-sized enterprises. Another college, in partnership with a university, has attracted European funds to provide video links via a satellite to out-centres. This will enable lectures to be seen live and permit interaction between students and the lecturer. Another college is producing NVQ IT materials for Thailand. One college has issued 50 licences internationally for the use of training materials to develop the IT skills of home-based workers. One link with the United States of America is providing diagnostic software for assessing students' standards in the key skills of numeracy and English. The link has existed for several years but progress has been slow in developing the software to meet the particular needs of the English educational system. Other links help to broaden students' experience, using international video-conferencing and electronic mail.

CONCLUSIONS AND ISSUES

93 There has been substantial and beneficial investment in technology by many colleges. However, there remain substantial differences in the perceptions of senior managers of the benefits of technology to support learning, and wide variations in the level of equipment held by colleges and the extent to which technology is used to support learning. A strong corporate drive and a shared vision are key elements in the effective development of these technologies. There is increasing pressure to use technology efficiently and effectively and this is being addressed in many colleges through changes in management structures, staff roles and accommodation. However, few colleges have carried out detailed audits of the management and use of their equipment. Many of the conclusions of this survey reflect the findings of similar surveys carried out in 1994 as a part of the learning and technology committee research. Most colleges

have concentrated their resources on improving existing facilities. There has been limited progress in introducing new applications over the intervening three years.

94 The positive findings include:

- many colleges now have an increased awareness of the potential of IT to support learning
- the recent college reviews of how technology can support learning
- the development of policies which support the development and use of learning technology
- the development of an increasing number of high-quality learning centres
- the examples of good practice found in all curriculum areas
- the substantial range of equipment and learning materials available to students in some colleges
- the impact of the internet and presentation graphics software in encouraging more teachers and students to use IT
- developing strategies to increase the accessibility of provision and widen participation
- growing voluntary collaboration in the development of learning materials.

95 The main issues are:

- the lack of a comprehensive strategy for the use of technology in many colleges
- limited management information on the use of IT equipment
- the few colleges that identify students' prior achievements in IT on entry
- the limited expertise and confidence of many staff
- the limited spread of good practice in applications of technology between curriculum areas and between colleges
- the narrow range of IT which some students experience
- the relative lack of technology to support students learning on their own
- the unimaginative use of IT for students with basic skills needs and those with learning difficulties and/or disabilities in some colleges
- insufficiently developed systems for monitoring and recording students' progress.

96 The constraints on further development are:

- limited capital funds to develop the technology infrastructure in colleges while maintaining the quality of existing provision

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- expertise and time required to develop applications and materials
 - limited sharing of information between colleges and between colleges and manufacturers
 - the high costs of developing high-quality multimedia learning materials
 - the similarity of many funded pilot projects, the mismatch between the funds available and the project aims, the duplication of effort involved in many projects, and the failure to collate outcomes.

ORGANISATIONS CONTACTED DURING THE SURVEY

Apple Computers Ltd

British Educational Communications and Technology Agency (BECTA)
formerly National Council for Educational Technology (NCET)

British Telecommunications Ltd

Cambridge Training and Development Limited

Department for Education and Employment (DfEE)

Further Education National Consortium (FENC)

Fretwell Downing

Further Education Development Agency (FEDA)

IBM

LJ Technical Systems

National Organisation for Adult Learning (NIACE)

Open Learning Federation

UK Flexible Learning Forum

RECOMMENDATIONS OF THE LEARNING AND TECHNOLOGY COMMITTEE

Recommendation 1

We recommend the creation of a national staff development programme available to every college in the sector. The programme should cover two levels:

- a foundation programme which provides the skills required by teaching and other staff in accessing information and learning technologies and applying them effectively to teaching, learning and student support
- training the trainers programme which prepares staff for delivering the foundation programme in each college, while providing some further skills enhancement and project-based support in higher level skill areas.

Recommendation 2

We recommend the establishment of an information, advice and learning resource service operating through networked specialist centres. The centres, termed Learning and Technology Centres, should draw upon the services of a network of reviewers, based in colleges and elsewhere, to assess resources. They should also be active in promoting the development and use of technology to support learning.

Recommendation 3

We recommend that funding be provided for a group of demonstration projects which focus particularly upon:

- the organisational and technical infrastructure underpinning student support and learner services. These might include the introduction of learning management systems, the development of student tracking systems and the provision of distributed tutorial support for students using remote learning methods
- effective applications of networked connectivity to improve access to education and training
- the development of courseware, applications and other learning resources as needs are identified through the Learning and Technology Centres.

Recommendation 4

We recommend the establishment of:

- a third party owned flexible bandwidth communications network, managed on behalf of the sector, to link all colleges.

We recommend that a network management team, drawn from college staff with appropriate national agency support:

- identifies the system requirements
- invites and evaluates tenders
- negotiates arrangements with the selected supplier
- plans a strategy for connecting all colleges and existing networks
- provides advice to colleges on accessing the wide area network.

Recommendation 5

We recommend a continuing research programme which:

- examines the effectiveness of new approaches to teaching and learning
- provides insights into ways of applying emerging technologies in order to improve both.

We also recommend that evaluation be undertaken for each of the initiative's components, including the demonstration projects and the work of the Learning and Technology Centres.

Recommendation 6

We recommend that the FEFC invites the National Council for Educational Technology (now BECTA) and FEDA to consider working closely together to implement and manage the initiative.

Recommendation 7

We recommend that representatives of the major national associations and other expert bodies be invited to form a steering group. Its purpose will be to provide advice to those responsible for managing the initiative on both its strategic priorities and its impact on individual colleges, and on the sector overall.

Recommendation 8

We advocate a five-year programme to implement our recommendations, to begin as soon as possible.

Recommendation 9

We recommend pump-priming to funding, whereby the FEFC is asked to provide support over a five-year period, during which time that support is phased out, so that the colleges then take full responsibility for the systems in place.

INTERNET ACCESS AND USE

1 Most colleges have some form of access to the internet. Some use their data links with higher education institutions to gain access to the internet. Other colleges access the internet directly through a range of providers. Some colleges use a dedicated ISDN line or leased line but most use the telephone network and modems.

2 Students' freedom of access to the internet varies from college to college. Some colleges provide unlimited access for students although this is often through a few controlled machines. In some cases, it is restricted to higher education students only. In other colleges, students may have to obtain the permission of staff, or be under the control of staff, to access the internet. 'Patrol' software can be installed to limit access to illicit information. Monitoring software provides a record of sites visited by individual students. Many colleges in one consortium network group have provided students with unlimited access to the internet. These colleges report different degrees of abuse of access.

3 All colleges are listed on a website provided by an independent operator. This gives basic information about the college such as the address, telephone number and principal's name. Some colleges have developed their own website. Typically, they provides students with comprehensive information on the courses available, the general college facilities and contact names for students to obtain further information. A few advertise 'open learning' courses on a commercial basis.

4 The internet provides a vast database of information. Students can obtain general information on a specific topic to support project or assignment work. They can also obtain specific data such as the specification of an electronic component or details of a railway timetable.

5 The internet provides some material of high quality. Many major organisations have websites. Examples include governmental organisations, European bodies, educational sources, military organisations, commercial organisations, and pressure and promotional groups. Information is available on a wide range of subjects and on some subjects which may not be readily available from other sources such as the design of surf boards or help and support with a range of medical conditions. Information on topical events, such as the Olympic games in Atlanta and national elections, can be provided in real time.

6 Information provided on the internet, and to a lesser extent on CD-ROMs, gains an authority and credibility that may not always be warranted. It is sometimes difficult for students and teachers to determine the status of the information available, especially that provided by non-corporate bodies, individual enthusiasts and/or pressure groups.

7 Much time can be wasted whilst carrying out searches for information on a particular topic. Searches often generate results with an American bias. It is sometimes difficult to focus only on United Kingdom or European

information. Teachers may decide to restrict students to previously identified websites to help reduce time and expense. To use the internet successfully, students should have sufficient expertise to find their way around and a clear plan of what they want or need to find. This may involve spending time to explore and gain experience in searching the internet. Some colleges have set up a 'simulated' internet which has been previously downloaded and students are free to explore it. This has provided valuable training on using the internet effectively.

8 The use and role of the internet in the teaching process is still being explored by teachers. Even with a restricted range of sites students can obtain copious amounts of information very quickly on a chosen subject. Assignments which require only the collection of information can be completed with a minimum amount of effort and understanding may not have been enhanced.

9 One modern languages adviser has produced a disk which enables modern foreign language teachers to access quickly sites of real use and interest by setting bookmarks. This use of an expert to provide easier routes to useful information may be the way forward but it needs development time and should not be allowed to block access to information.

10 One college is piloting a TEC-funded remote NVQ assessment project for local and more distant employers in the catering industry on the internet. Participating employers and students using passwords can access, electronically, multiple-choice tests relating to specific NVQ units. The programme allows students to have a maximum number of attempts to answer questions correctly, to analyse their performance, and to record results for external verification.

11 The internet can be used to good effect to encourage groups of students to work together to seek information. Students working in pairs researched a topic of their choice, obtained pictures and text which they then imported into an electronic presentation they were producing.

12 One college's students collect information through the college's electronic mail network and the internet. A student on a computer literacy course gained approved access, electronically, to a space centre in the United States of America and copied digital pictures of the earth to use in an assignment.

13 The history department in a sixth form college is exploring the internet as a research tool for GCE coursework, seeking to obtain access to research papers and to take students beyond standard textbooks.

14 A few colleges are beginning to explore the use of the internet to provide teaching packages and to communicate with community groups. In one rather isolated voluntary external organisation, the internet provides a means for staff and students to communicate with other colleagues making provision for students with learning difficulties.

15 A few colleges have begun to build up an intranet. Several colleges are also in the process of 'unitising' their curriculum. Once this is complete, the next stage is to create learning packages for each unit, all of which will be on the college intranet. Some curriculum material is already on the intranet, though it is not terribly exciting.

16 The use of the internet to promote a product should now be part of the curriculum. Students should learn to build a website or develop web pages to market a product. This might be to market a service, such as a privately owned hotel, or to market a commercial product. One college is using the internet as the context for teaching an NVQ level 3 IT course. Students learn how to create web pages incorporating movement and sound. They have links with local commercial organisations and produce web pages marketing products.

TYPES OF EQUIPMENT IN COLLEGES

The survey gathered evidence of the types and range of equipment and facilities provided in the 44 colleges involved. The findings are listed below.

Table 1. Range and type of equipment

<i>Equipment</i>	<i>Colleges %</i>	<i>Comment</i>
Video (record/playback)	100	
Interactive video	30	No recent investment
Audio equipment	100	
Satellite receivers	73	Mainly used for language teaching. One college linked to a university for teaching
Computer workstations	100	Ratio of computers to students varies widely
Advanced calculators (in regular use)	50	Almost exclusively used for GCE mathematics
Specialist computer-assisted self or supported learning systems	73	The extent of use varies widely All those colleges with this facility would extend the use, given appropriate software

Table 2. Type of network provided

<i>Network</i>	<i>Colleges %</i>	<i>Comment</i>
Complete communications across all sites (broadband)	26	One college network extends to 14 community sites
Complete communications across all sites (not broadband)	26	Most colleges have administrative links across all sites
Intranet developed	14	All are partially operational at present and still under development. Many colleges are planning intranets
Resources catalogue on network	14	All colleges have or are developing electronic library systems accessible across the college
Mix of networking and standalone machines	48	There are significantly different levels of this mix. All the colleges have plans for a college-wide network
Standalone machines only	0	

Table 3. Other facilities

<i>Facility</i>	<i>Colleges %</i>	<i>Comment</i>
Internet access for students	95	Some 20 per cent of colleges have fewer than five computers with access
Electronic mail for students	30	Electronic mail for administration is growing rapidly
Video-conferencing	26	Many colleges have plans for further developments
Joint academic network access	17	A number of these colleges also use this for access to the internet
Further education network access	20	A number of colleges have plans for development
CD-ROM on the network	40	Increasing availability
CD-ROM standalone	60	

Table 4. Workstation standards

<i>Standard</i>	<i>Colleges %</i>	<i>Comment</i>
Have a standard	100	
Revised standard in the last 18 months	100	
386* or equivalent used	20	A few colleges still have some 286* processor machines in use
486* or equivalent used	100	Many colleges consider this the minimum acceptable standard
Pentium or equivalent used	100	All colleges indicated that all new purchases met this standard

**286, 386 and 486 relate to the processing capability of a computer. Lower numbers generally indicate slower operating speeds for a given application.*

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