The National Grid For Learning – A School Plan

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Introduction

Albert Einstein said that the atomic bomb changed everything but our thinking. The Internet is changing everything and our thinking.

The information and communication technology-driven new world order is defined by connected thinking. To fully participate in society, people will have to become connected thinkers. In turn, connected thinkers will have to learn through connected learning.

If the Internet represents connected thinking, the National Grid for Learning (NGfL) represents connected learning. In a nutshell, the NGfL is an attempt to harness the Internet, both as a resource and a technology, to leverage learning nationally. The NGfL is currently in an embryonic stage, but much of what defines it already exists either as Internet content or technology. Indeed, the NGfL will be a subset of the Internet itself. Much of this pack, therefore, deals with the Internet.

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What this pack is about

Getting onto the Internet is likely to top every school’s agenda soon – if it hasn’t already. Over the next few years, the NGfL will harness the Internet for use in schools. This pack is designed to help your school get the most out of it by explaining the issues and giving planning guidance. It aims to explain what the entire school community needs to understand and do in order to respond to the challenges and opportunities that the NGfL will bring.

The NGfL may have only just been initiated but it is already clear that its impact on education will be profound. Schools wishing to take advantage of the huge benefits the NGfL is expected to bring need to start planning and laying down foundations right now.

A fourth generation of computing in schools

The first generation of computing in schools came with the arrival of the microcomputers, many of which were BBCs. These were usually the domain of the maths or computer studies departments. A second generation came with the PC.

The third generation was defined by the arrival of the local area network in schools. These let people share resources and some were set up to enable people to send electronic mail. With a much wider range of software, and the introduction of the graphical user interface, the whole school could now make use of computers.

The fourth generation of schools computing is characterised by the Internet, of which the NGfL will be the most significant development for schools. This represents a paradigm shift; it means the extension of the school’s network beyond the school boundaries. People learning from the school need no longer be pupils at the school. People teaching pupils at the school need no longer be teachers employed by the school. The opportunities for teachers, schools and learners alike are fantastic. To take advantage of these opportunities, a clear understanding of the issues, processes, options and approaches is crucial.

A brief history of the future

In 1969, a US Defence Department project started a chain of events that would lead to one of the most significant technological developments ever – the Internet, a system which was developed for connecting computers together in ways that could withstand bomb attacks. Who, at the time, would have thought that by the end of the century, this system would have proliferated so widely and be responsible for dramatically altering institutional, business, financial and political boundaries?
The convergence of information and communication technologies will undoubtedly cause upheaval in education, as it has in every other sphere of human activity. For those involved in education, the Internet represents a technological advance as significant as the printing press. It has become a cliché to say that the world of work that our current pupils will enter will be very different from this one. Most will go into jobs which have yet to be invented. Many will become ‘teleworkers’ – logging into virtual workplaces from home. Chris Yapp of ICL points out that going from education to training to work and then to retirement will no longer be sequential, and that technology-enabled lifelong learning will be the catalyst for this.

The Internet is changing what needs to be learned, what can be learned and how learning takes place. In setting up the National Grid for Learning, the Government has begun a programme that will transform the classroom.

Other resources available from Pearson Publishing include:

- *Fresh Approaches to Funding ICT*
- *Introducing the Internet*
- *Building a School Web Site*
- *ICT Development Planning*
- *Using the Internet – Geography*
- *Using the Internet – Science*
- *Using the Internet – Mathematics*
- *Using the Internet – Careers*
- *Using the Internet – English*
- *Using the Internet – Business Studies*
- *Using the Internet – RE*
- *Using the Internet – History*
What is the National Grid for Learning?

The National Grid for Learning has its roots in Australia, where online learning has been well established for a number of years, and in the United States. Amongst the current US President’s and Education Secretary’s priorities is that ‘every classroom will be connected to the Internet by the year 2000 and all students will be technologically literate’. An organisation called NetYear has been set up as part of the NGfL initiative; this is an extension of the concept of the US’s NetDay programme, where schools are supported by local business in getting connected to the Internet.

Connecting the learning society

The aims of the National Grid for Learning were set down in a consultation paper, *Connecting the Learning Society*, published in October 1997. The central vision is of ‘interconnected networks supporting teaching, learning, training and administration’.

The Government has stated that it wants the following to happen:

- by 1999, up to three-quarters of staff and half of all pupils to have free email addresses
- all UK schools and colleges, universities and libraries to be connected to a purpose-built Internet service by 2002
- all 450,000 teachers to receive training in the use of Information and Communications Technology (ICT)
- National Lottery money to provide every teacher in the country with around £400 of ICT training
- ICT to be a mandatory part of initial teacher training by 1999
- by 2002, all teachers to reach National Curriculum Level 7 in ICT competency.

In order to do this, the Government has initiated:

- funding from central Government, local authorities and business
- a series of computer and communication business initiatives
- online learning resources – some free, others available by subscription
- a prototype NGfL ‘gateway’ – a first point of reference for teachers and learners on the World Wide Web
- NetYear – a Government/private sector partnership which aims to implement the technology in schools.
New Labour, new network

On the 25th November 1997, the first building block in the National Grid for Learning was laid by David Blunkett, Secretary of State for Education and Employment, when he opened the Merseyside Education Online Network (MEON).

MEON, which is being run on commercial lines, will provide computer-based education services to secondary school children, young people and adults.

Each school in the scheme has unlimited access to the Internet, email, open integrated learning system (OILS) software, an Intranet (where resources are placed on a central file server which acts like an enclosed Web site), video conferencing, CD-ROMs, and an online helpdesk.

The vision for the National Grid for Learning is that every school has access to this kind of technology: every region links its school into a MEON-type network and these will be linked together nationally.

Joined-up learning, joined-up thinking

The big idea behind the Grid is a very simple one: learners and ‘teachers’ interacting through computers, irrespective of geography.

Nicholas Negroponte, in Being Digital, provides us with an idea about the potential for the NGfL:

‘Over time, there will be more and more people on the Internet with the time and wisdom for it to become a Web of human knowledge and assistance. The 30 million members of the American Association of Retired Persons, for example, constitute a collective experience that is currently untapped. Making just that enormous body of knowledge and wisdom accessible to young minds could close the generation gap with a few keystrokes.’

Connecting people through computer networks is an idea that is certainly not lost on business. For a long time, commerce has been using networks to enable teamworking and leverage productivity.

The nation as classroom

Computers in the classroom are already powerful learning tools, but connecting them to the Internet puts the possibilities for learning into another dimension. The Internet connects students and teachers to people, places, and ideas from around the world.
There are a number of ways in which the Internet can be used in the classroom:

- online libraries (accessing reference material with computers)
- resource repository (archives of material for the support of learning)
- shared lessons (where a teacher can deliver a lesson to more than one class at the same time)
- collaborative learning (where pupils in one class work with pupils in another)
- distance learning (tasks set and assessed beyond the boundaries of the school)
- synchronising work between home and school through accessing the school computer system at home
- extended learning activities for the able
- virtual experiments, etc
- access to material not available in schools due to cost, eg certain science activities/astronomy
- access to up-to-date information, eg stock markets/weather/political information.

These processes can work independently of the National Grid for Learning. However, the Grid ought to:

- bring some order to the growing repository of information on the Internet
- bring relevant and quality material into the reach of pupils
- facilitate communication between users.

Funding

- The Government is supporting an investment of over £700 million for ICT in schools up to 2002. This is matched funding (half is provided by central Government; the remainder is matched by local authorities).
- £230 million from the National Lottery will be used to train Britain’s 450 000 teachers in the use of ICT and £20 million will be used to train librarians.
- £50 million will be invested by the Government to create digital educational content from sources such as museums and galleries – much of which can be used on the Grid.
- £23 million is being used to purchase 10 000 multimedia portable PCs for teachers.

Source: DfEE

When spread throughout the UK school system, however, the picture seems quite different. A recent report by computer company Xemplar claims that the money earmarked for purchasing additional ICT equipment only equates to £1500 per school.

With a finite public purse, it is clear that alternative sources of funding need to be found. It is likely that those schools who attain the best levels of access to ICT will be the ones that have developed additional sources of funding for it.
Harnessing the Internet

The NGfL initiative is about many things but essentially it is about using Internet technologies, content and methodologies to raise standards. Internet technologies will be used to deliver the NGfL, and the NGfL itself will, naturally, constitute a part of the overall Internet. Internet content, which gives learners explanations, experiences and the opportunity to experiment, will be gleaned, evaluated and indexed – though how, exactly, this will be done is not yet clear. New content will also be commissioned.

What is the Internet?

The Internet is a global network that links millions of computers together. It enables over 90 million people worldwide to communicate with one another and makes vast amounts of information available.

No single organisation owns or controls the Internet. What makes it work is a protocol called TCP/IP that enables computers to ‘talk’ to one another. This protocol was developed in 1969 for military use in the United States to enable computers to communicate over a wide distance, in times of nuclear war. The most important technical feature of the Internet is that ‘packets’ of information find their way between computers, via other computers. If one computer in the system is out of action, the ‘packet’ finds its way to its final destination along another route.

The Internet, or Net, soon became the de facto method of communicating and sharing research material within the academic community. There are now a host of private providers offering access to consumers. All that is needed now to access the Internet is some low-cost computer hardware and software and an ordinary telephone line.

It is worth noting that, often, the terms Internet and World Wide Web (also known as the WWW or Web – see page 13) are used interchangeably but actually mean different things. The Internet carries a range of services, which includes the Web but also includes electronic mail (email), discussion groups and an increasing number of multimedia applications.

How can the Internet benefit pupils?

The Internet in school is at a very early stage of development but already some key advantages are clear:

Explanations

The Internet can be used as a tool to obtain explanations. This can be done either through educational content placed on the Internet, or through using the Internet to track down, contact and communicate with experts.
Experience
Using the Internet can provide learners with a range of experiences, from controlling a space telescope to collaborating with other learners across the globe on projects.

Experiment
On a local level, resources such as the Science Museum’s vision and optical illusion experiments (http://www.nmsi.ac.uk/on-line/outofsight/) have much to offer. There are also opportunities to participate in global experiments on subjects such as pollution or weather.

Developing skills
When children use the Internet, they are learning the skills that will prepare them for the next generation of work:

- information processing and research
- communication skills
- international collaboration
- learning how to acquire new skills and knowledge
- interaction with technology.

Using the Internet also:

- helps to develop literacy and extend vocabulary by motivating pupils to communicate
- helps develop conversational, social skills
- encourages lateral thinking
- prompts pupils to make cross-curricular and cross-topic connections
- provides effective differentiation, especially for the most able.

Building knowledge
Giving pupils access to the Internet:

- provides opportunities to locate and adapt materials for use in learning tasks
- provides personalised answers to pupils’ own questions
- gives access to online learning materials
- also allows access to up-to-date international information from sources such as newspapers or stock exchanges
- enables pupils to pursue their own inquiries, possibly through direct access to experts and native speakers of foreign languages
- develops a geographical awareness
- develops an awareness of organisations, governments and businesses.
Motivating learners

Anyone who has run a lunchtime Internet club knows by the size of the queue outside the door how motivating working on the Internet can be. It has equal attraction to boys and girls and appeal across all age groups.

For a start, the medium itself is exciting. The World Wide Web (see page 13) is highly visual and increasingly makes use of animation, video and sound. The World Wide Web is also an interactive environment, and good educational Web sites are designed to encourage the user to interact with them.

The Internet enables pupils to communicate with pupils from other schools, and when doing so they may be encouraged to use correct language, grammar and spelling.

Using the Internet creates opportunities for ‘real-life’ contexts and teamwork. It also gives pupils a choice of learning styles and gives them different ‘ways in’ to comprehend material.

What can you do with the Internet in schools?

There are three principal Internet functions:

- communicating
- finding information
- online publishing.

What makes the Internet so powerful in the classroom is that it enables pupils to acquire skills and knowledge and gain experience. The ways in which the Internet can be used are expanding as quickly as new technologies are developing.

Online libraries

The Internet contains an extraordinary amount of information, much of which is available freely. It spans all areas of human endeavour. There are many ways in which this can be sifted and useful information found.

The Internet enables you to have resources from the world’s greatest libraries, such as the British Library or the Library of Congress, accessible directly within the classroom.

The illustration on page 10, for example, is an image of one of several ancient manuscripts made available to the public, via the Internet, by the Bodleian Library at Oxford University. It can be used to stimulate teaching and learning in a number of ways: ‘What does it say?’, ‘What is the document about?’, ‘Who wrote it and why?’, ‘If you don’t know, find out: send an email message to the library, or any of a number of experts in manuscripts.’
The Bodleian is one of hundreds of delightful online library resources worldwide. Other notable resources are NASA (http://www.nasa.gov/), The Exploratorium (http://www.exploratorium.edu/), and the Vatican Museums (http://www.christusrex.org/www1/vaticano/O-Musei.html). Each one has its own archives of graphics, text, video and sound files – each one is an exceptionally powerful and cost-effective learning resource.

The most recent pictures from Hubble; animations of hurricanes; the world’s greatest works of art; quizzes and online competitions; free software for science experiments; maths tutorials; interactive maps; a virtual human being – these are all resources that can be viewed and downloaded for use in the classroom.

For example, a geography teacher may want children to research into the Thames as part of a rivers module. Pupils could be set questions around the topic and could use the Internet to find the answers. Advantages over a conventional library are that, depending on the site being used, the information is more likely to be fresh and is often presented in an interactive way.

**Resource repository**

A key idea behind the National Grid for Learning is that it will be used for teachers to share teaching material. Teachers spend considerable amounts of time preparing material for lessons, exercises, worksheets, schemes of work, assessments, etc.
If a teacher in one school develops a good scheme of work, any other teacher with access to the Grid can access and use it. A teacher with a 'good line' in algebra lessons could have their lessons 'video conferenced' to other classrooms across the county. Using email, pupils in one part of the country can compare rainfall levels with pupils in another part of the country.

**Collaborative learning**

As a communication tool, the Internet provides some excellent opportunities for both pupils and teachers.

The K12 network is an Internet-based resource for schools, teachers and pupils. K12 is the electronic equivalent of a national school noticeboard dealing with everything from timetabling issues to the use of cadavers in science classes. Interestingly, the biggest users of K12 seem to be pupils.

The Internet is also home to the European Schools Project (ESP), an initiative of the University of Amsterdam (http://www.esp.educ.uva.nl/). Dozens of 'teleprojects' have been performed, as part of the ESP, on topics such as water pollution, the differences and similarities between young people in different countries, being young in the past and present, hostility towards foreigners, tourism, everyday life statistics, food, music, employment, etc.

Dialogue between pupils in different countries has led to improved language skills, to increased educational motivation, to mutual understanding, and has helped to reduce existing prejudices. Awareness of the world as a global village is also raised and, above all else, participants learn valuable networking skills.

**Distance learning**

The Internet is transforming distance learning. For example, the North Seattle Community College Virtual College (http://www.virtualcollege.org/) is one of a host of organisations now offering courses with lessons delivered over the Internet. Diversity University (http://www.du.org/) offers text-based lessons through 'virtual classrooms'. Students navigate a virtual campus and can enter 'rooms' where lectures or other learning services are held.

Other distance learning resources on the Internet include online interactive tutoring centres and computer modelling – for the enhancement of chemistry lessons, for example. As processing and communication speeds increase, it won't be long before multimedia virtual classrooms become more widely available.
Linking the home to the school
Linking the learning done in school with computer-based learning at home is another possibility that the Internet opens up. Schools ought to be prepared to tap into the potential of pupils using their own computers at home to carry out homework and research tasks.

Publishing
The Internet, and the World Wide Web in particular, could be used as a ‘shopfront’ for a school. School Web pages can include text, pictures, graphics, sound and even video clips. As the software required to do this kind of work improves, producing Web pages is coming within the capabilities of even the youngest learners. With the aid of a digital camera (which stores images electronically), photographs showing school life can enliven a Web page and capture the attention of viewers. Online publishing can be used by schools for a range of items such as:

- prospectus
- galleries of children’s work
- newsletters and bulletins for parents
- highlights
- annual reports
- pupil progress checks and reports.
Email

Electronic mail is one of the most used Internet features. A message written on one computer can be quickly and easily sent to another computer. It is reliable, effective, and inexpensive.

Sending electronic messages locally, nationally and globally has grown so popular that it has started to replace some postal mail and telephone calls. It is not restricted to exchange of text messages either, and is regularly used to deliver documents, images, sound and video. Another big advantage of email is that you can send messages to a large group of people just as easily as you can to one person.

Using email in the curriculum can be particularly good for:

- enabling pupils to find and reach experts and ask them questions
- developing language, communication and interpersonal skills
- enabling pupils to find out about other countries and cultures
- inspiring reluctant writers to put messages together and send them
- motivating pupils to be accurate in writing messages.

Email addresses are written as name@domain.extension, for example:
    joebloggs@open.gov

World Wide Web

The World Wide Web, or Web, gives users a graphical, easy-to-navigate interface for accessing text, graphics, video and sound. The Web is accessed with a browser, a piece of software that enables users to look at Web multimedia content. The two best known browsers are Microsoft® Internet Explorer and Netscape Navigator.

The Web is made up of pages containing hyperlinks. These are seen onscreen as either highlighted words or icons and, when clicked on, allow you to jump from one Web page to another. Pages can contain text, images, movies, sounds, 3-D virtual worlds – just about anything that can be held in digital format. These pages can be located on computers anywhere in the world.

The Web is changing the way people communicate and is gaining popular acceptance faster than any other communications medium in history. It includes a vast array of information – everything from stock quotes to job opportunities, literary reviews to news, previews of movies to games – information and resources from the most obscure to the most globally important.
For teachers and learners alike, there really is a wealth of material on the Web – teaching resources, maps, guides, online journals, student projects, company information and much more.

Typical classroom uses of the Web include looking at distant planets, translation, GCSE revision, maths challenges, reading foreign newspapers, accessing daily news, and visiting distant art galleries. The sheer scope for using the Web in class is the subject of an entire publication on its own. As suggested in the section on Publishing (page 12), many schools now have their own Web sites which can be used as a window on their activities – an evolving prospectus.

Full Web addresses are written as http://name.domain.extension/, for example:
http://www.ngfl.gov.uk/

Increasingly the 'http://www' at the start of an address is being dropped.

**Mailing lists and newsgroups**

Email users can receive regular messages broadcasted for special interest groups from automated mailing services called listservers.

A listserver works in the same way as a newsletter. At regular intervals, the server sends out identical email messages covering a specific topic. The listserver keeps a list of ‘subscribers’ and serves them with these regular electronic newsletters.

To receive a regular newsletter from a listserver you first have to subscribe to one. To do this, you have to send an email message to the listserver, requesting that your email address is added to the list.

Once your email address is added to the list, you will automatically receive the listserver’s regular email newsletters. To remove your address from the list, another message needs to be sent to the listserver.

Another popular way of communicating on the Internet is through newsgroups. A newsgroup is an ongoing conversation between Internet users, not unlike a common room noticeboard. A member of a newsgroup can ‘post’ a message for everyone else in the group to see. Responses to this are posted alongside the original message, again for everyone else in the group to see. ‘Threads’ of conversation develop and can easily be traced.

There are thousands of newsgroups on a diverse range of subjects.
Video conferencing

With email, lists and newsgroups, there is a delay between the message being sent, picked up and responded to. Video conferencing, on the other hand, is live communication.

It is currently best, and most usually done, using ISDN (see page 33) to place a call between two computers, although video conferencing over the Internet is becoming increasingly popular.

In a video conferencing session, a camera and microphone are attached to participating computers. Users can see each other on their screens and hear each other's voices. They can collaborate on a task by sharing a 'workspace' such as a word processor, 'whiteboard' or spreadsheet.

This is an excellent medium with which to give pupils the opportunity to communicate directly with people who could be very far away. Video conferencing has especially benefited schools that are geographically isolated.

Some of the applications that video conferencing can be put to include:

- working with teachers based elsewhere
- communicating with people in their workplaces
- linking with schools abroad, and holding conversations in other languages
- remote INSET for teachers.

Video conferencing is in its infancy and its potential use must be tempered with a recognition that there are a range of technical issues such as getting a good audio signal and smooth moving images, and the complexities involved in arranging conferences between more than two sites.

Internet telephony

Gaining popularity is Internet telephony. This is very much like video conferencing except that only people's voices are transferred between computers. The big advantage of Internet telephony is cost – even the longest distance calls are virtually free.
Views of the Grid

The National Grid for Learning has the potential to turn school networks into community hubs for learning. In order to connect to the Grid, schools will need to have access to the Internet, and the Government is committed to connecting every school in the country.

Everyone will have different reasons for accessing the Grid, and different areas will be open to different people. There will be an emphasis on key skills – for example, a Literacy Time activity centre offering practical ideas, discussion areas, resources and contacts to help teachers implement the National Literacy Strategy.

NGfL ‘gateways’

A ‘gateway’ on the Web, is a starting point. It is the first point of reference for the user and several types of gateways are currently being developed.

Virtual Teacher Centre (VTC)

BECTa (British Educational Communications and Technology Agency – formerly the National Council for Educational Technology) is developing a ‘Virtual Teacher Centre’ (VTC), a Web site providing educational resources for teachers (http://vtc.ngfl.gov.uk/). This was unveiled at the British Education and Training Technology (BETT) show in January 1998. The VTC includes a ‘meeting room’ for teachers to exchange information and ideas, and a library of educational resources.

Scottish Virtual Teachers’ Centre

Though focused on teachers working in the Scottish education sector, the Scottish Virtual Teachers’ Centre (http://www.svtc.org.uk/) is well worth visiting from any part of the country. It assists with the integration of the Internet into teaching and learning, disseminates good practice and facilitates the exchange of ideas.

The DfEE’s standards and effectiveness database

Also available is a standards and effectiveness database, which will provide schools with guidance on subjects such as target setting, summer schools and literacy initiatives (http://www.standards.dfee.gov.uk/).

This is designed to ‘disseminate good practice, and measures which help raise standards, including guidance on target setting, literacy, numeracy and benchmarking’.

Other gateways

Under construction are areas for school governors, to give them access to guidance on their role and responsibilities and to put them in touch with each other. A Further Education gateway is also to be available shortly.
**What the NGfL will deliver**

**For learners**
The Grid will provide a range of online services to learners at all stages – in schools, higher education, libraries and at home. It aims to provide a resource to help deliver improved learning performance particularly in literacy and numeracy. It will also provide learners with a link between ‘commerce, culture and sport, education and lifelong learning, health, charitable endeavour and politics’. The Grid will also help learners identify courses they may wish to follow.

**For teachers**
There will be resources for teachers to use in their daily work, and for their own continuing professional development in ICT. Materials will be delivered to teachers through a range of means including remote tutorials or helpline facilities. High-quality educational content, including software, online services and interactive digital TV will be available for classroom use fairly soon.

Content will include ‘sites and, particularly, space for discussion by teachers and school management, for example on benchmarking and target setting, development planning, sharing of schemes of work, lesson planning, timetabling, peer reviews of software and other resources, reviews and coordination of external school visits and training activities, a forum for creative ideas in the use of ICT in teaching, professional development and administration, and other facilities’.

There will be opportunities for teachers to contribute to the NGfL by developing online learning materials and programmes.

**For schools**
Besides ‘piping in’ online learning for pupils and teachers, the NGfL aims to provide a means of ‘supporting and streamlining the administration and management of schools’.
Curriculum matters

Understanding how to integrate the NGfL into classroom practice is going to pose a serious challenge to most schools. Harnessing the vastness and variety of the Internet demands the application of imagination, technical and organisational skills.

There are, however, a number of underlying principles that can be applied.

Fit the NGfL around the existing curriculum

There will be no need to rewrite the curriculum in order to take advantage of the NGfL. It might help to ask the following type of questions:

- Could pupils in English benefit from visiting Web sites covering topics spanning Chaucer to the 20th century, including the complete works of Shakespeare?
- Could pupils in maths benefit from participating in Internet-based challenges and quizzes?
- Could pupils in science gain from visiting the NASA Web site as part of an astronomy module, or from becoming involved in an international comparison of ecological data?
- Could pupils in modern foreign languages gain from participating in a key pals (email penfriend) project?

The Internet and NGfL are media for online learning and schools need to develop an awareness of what possibilities this offers.

Start by using the Web

Projects in which pupils use the World Wide Web are technically easier to manage than email-based projects.

Pupils can get an enormous amount out of using the Web, but there is much more that they can get from using email and newsgroups. Once teachers have mastered the use of the Web, the transition to more interactive tools should be easier than starting with these from scratch.

When teachers feel comfortable with the medium, Web-based electronic mail such as Hotmail (http://www.hotmail.com/) and Web-based newsgroup systems such as Deja News (http://www.dejanews.com/) provide an easy pathway.

Finding resources

Reference CD-ROMs

Many reference CD-ROMs, such as Microsoft’s Encarta Encyclopedia, contain Web links to extend the scope of their articles.
The press
Most newspapers, magazines, journals and TV programmes now carry Web site addresses. The TES, for example, is an excellent source of addresses for Internet resources.

Web-based lists
The Web itself is an excellent place to get lists of resources from. The TES Web site is at http://www.tes.co.uk/. Other sites containing lists include:

- Busy Teachers’ WebSite K-12 – http://www.ceismc.gatech.edu/busyt/homepg.htm

Commercial online learning services have sprung up and, to an extent, some of these can reduce the need to search for and find sites.

Anglia Interactive, for example, provides extensive curricular coverage for all learners. The service comprises: curriculum-based content for all age ranges; learning activities for home or classroom use; projects involving communication with other learners; and ‘major interactive events’. Anglia also enables schools to conserve bandwidth by mailing the entire Web site to schools every term. Their address is http://www.angliainteractive.com/.

The BBC Education site at http://www.bbc.co.uk/education/ is excellent. The Bitesize site is a must for pupils taking their GCSE examinations. BBC Learning Station is an Internet service for primary children, secondary students and teachers at home and school, and provides useful information for parents online. The BBC Education Web Guide site lists 200 sites, totalling 25 000 pages.

Research Machines’ Living Library (http://livlib.eduweb.co.uk/library/html/index.html) is an online reference resource for schools. It features thousands of articles, classified by age range. Living Library includes: encyclopaedia entries; an online dictionary and thesaurus; newspaper articles; a picture library; revision guides; modern foreign language resources; and business/technology news. Pathways, which is part of this system, lists over 5000 expert-approved links and includes a top 20 Web site chart.

Professional associations online
Professional associations are increasingly providing their members with Web addresses that point to resources that can be used in the classroom, for example:

- The Association for Science Education – http://www.ase.org.uk/tchres.html
- The Association of Teachers of Mathematics – http://acorn.educ.nottingham.ac.uk//SchEd/pages/atm/
Search engines

The most common way to find resources is to use a search engine. A search engine is a Web site that can be used to search for other Web sites across the Internet. Yahoo (http://www.yahoo.com/) and Infoseek (http://www.infoseek.com/) are well known search engines.

How to give children access to material

There are a range of options open to a teacher wishing to make use of material from the Internet. In all of these methods, Internet users will need to consider copyright issues (see page 62).

If a room full of Internet-connected computers is available, children can be given direct access to the source of information. Lessons can be enriched by pupils being able to access Web pages containing explanations, pictures, animations and a host of multimedia aids to understanding even the most difficult concepts.

Learning is much more effective if the material has been located before the class comes into the room. Directing children straight to the material that you want them to use is much more effective in a structured lesson than giving them free range to search and find resources which may be of use.

To save time and connection costs, a caching system can be used. This copies recently used Web sites onto the server or the local machine. Web sites can be ‘bookmarked’ in the browser, which enables teachers, network managers or pupils to build up lists of links to resources they have found interesting. Children can then select sites from the list on the browser and the cached copies will appear onscreen as if the computer is connected to the Internet.

If a room full of Internet-connected computers is not available, Web sites can be downloaded in their entirety and put onto the central curriculum network server. If a
Web browser is made available to users, they will be able to pick up the Web site off the local network.

An indexed mixture of material copied from the Web and links to cached sites can be built into a school Intranet (see Setting up an Intranet for internal communications, page 78). This will mimic the Internet but will place resources within the school local area network (LAN) with advantages of speed, focus and cost.

For schools with limited Internet access, material from the Web can be copied, pasted and rearranged in a screen-based presentation package such as Microsoft PowerPoint, or placed onto worksheets and printed.

Connecting learners with others

There are many ways in which communicating with others outside the school can enhance learning. Email is a principle way of doing this and mailing lists such as KidLink (http://www.kidlink.org/) help pupils find ‘key pals’ (electronic equivalent to penfriends). There is also a set of link-up links at http://www.eduweb.co.uk/ which help put learners in touch with one another.

The Global Schoolhouse Project, which is sponsored by Microsoft, is another initiative aimed at linking children around the world – http://www.gsh.org/.

For video conferencing links, users can get lists from the Web. For example, CU-SeeMe is a piece of software that enables video conferencing over the Web. A fun way for pupils to find other CU-SeeMe users is to log into http://www.rocketcharged.com/cu-seeme/boards.html.

There are also a large number of Internet equivalents of telephone directories – Yellow and White pages. Individual email addresses, home pages or addresses for businesses and organisations can be found using Yahoo (email search) or through the Infoseek reference channel.

Subject-specific uses

The application of the Internet and online resources in the classroom is the subject of several publications. The following is an edited selection of possible uses of the Internet in specified subject areas. This analysis is meant only to give a flavour of what can be done.

English

Though the Internet contains enormous amounts of multimedia, the glue that holds it together is words. Sending electronic mail heightens the awareness of audience and causes pupils to pay more attention to clarity, accuracy and good grammar and spelling. When return messages are received they have to be interpreted and summarised.
An enormous spectrum of writing styles can be seen on the World Wide Web. For example, most newspapers now have a Web site and the style of writing used in these differs greatly with the styles used in entertainment, academic and technical sites. To help develop skills, several writing lab Web sites are available.

The complete works of Shakespeare are available online as are 2000 out-of-copyright books. Scripts from TV comedies and dramas, reviews of films, books and plays are all freely available and instantly accessible – if you know where to look.

Mathematics

There is a wide range of mathematics resources for pupils on the Internet including interactive online geometry, animations, puzzles, fractals, GraphMaze, Aerobi-graphs, MathsArt, quizzes and challenges.

There is also a vast amount of raw data that is available for download and mathematical analysis. Microsoft® Excel now enables completed spreadsheets to be picked up directly from the Web. For example, financial data from the Dow Jones can be directly imported into Microsoft® Excel for mathematical analysis.

Science

The Web itself evolved to facilitate scientific research so there is a very strong science presence on the Internet. Many science journals are available online, including The Scientist (http://www.the-scientist.com/).

NASA has one of the best sites on the Internet and pupils can explore galleries of photos of stars and galaxies taken by the Hubble telescope.

There are several sites dedicated to frog dissection and, for those studying human biology, there is a host of medical sites that allow learners to, for example, take a virtual tour of the human heart or obtain an explanation of the human muscular structure. A clickable magnetic resonance imaging (MRI) map of a human male from the University of Kentucky College of Medicine allows learners to explore a digitised human being in intricate detail (http://www.comed.uky.edu/body/mainbody.html).

The Internet is used to post data from ongoing observation projects such as weather or pollution. Pupils can also follow major scientific surveys as they happen.

A major resource is Passport to Knowledge (http://passport.ivv.nasa.gov/), an ongoing series of 'electronic field trips to scientific frontiers’. Supported by the National Science Foundation, NASA, public television, and other collaborators, it enables students to interact with real science and scientists working in real-time.
The resources include ‘Live From’:

- Antarctica
- The Stratosphere
- The Hubble Space Telescope
- Mars
- The Sun
- The Rainforest
- The Poles.

In ‘Live From the Sun’, pupils can go behind the scenes at NASA’s Goddard Space Flight Center, the National Solar Observatories, and the Space Environment Center in Colorado, where ‘space weather’ is monitored and forecast just like storms on Earth. The most dramatic and informative images of the Sun gathered in the last decade are explained by Earth’s foremost solar scientists, and pupils have the chance to interact with them online and on-camera.

Comparing pollution levels and weather details between countries is popular, as are schools communicating via email to share and analyse data, and form hypotheses. An online collaborative observation is Journey North (http://www.learner.org/jnorth/). Pupils participating in this global study of wildlife migration send in sightings of birds and animals as they migrate, enabling others to track their progress.


**Design and technology**

Industry has heavily exploited networking technology to synchronise manufacture between countries and it is possible to emulate this in design and technology.

An advanced but feasible application is for a design for a product or component to be produced in one school using computer aided design (CAD) and then emailed to another school for production using computer aided manufacture (CAM). Another approach is for the school to do the design work (in virtual reality, perhaps) and then email the design to a manufacturer.

The Internet can also be a rich source of project ideas and expertise. For one recent GCSE project, a pupil obtained assistance from a NASA engineer in finding out how the Challenger space shuttle exploded on take-off. She was able to access a NASA archive of detailed engineering drawings of space shuttles over the Internet and use the drawings in her research.

Design ideas, fabric designs and recipes can be passed between creative collaborators in different schools – each adding something to it.
Modern foreign languages

Having access to communication technology is a clear advantage for any pupil studying a foreign language.

Contact with people who speak the target language is a great motivator. The scope for video conferencing with people in another country is enormous. Electronic mail exchange between pupils and classes learning each other’s language is popular.

Online translation is available on the Internet. A piece of English can be typed into an online translation system and a crude translation will be returned. Online translation has yet to develop beyond the point at which the context of language is considered so has some way to go before offering a serious challenge to a human translator. However, this can still be exploited in the classroom by setting pupils the challenge of correcting and refining the computer translation.

The Web is also home to newspapers such as Le Monde and El Pais – which are excellent subjects for translations and class discussions (http://www.lemonde.fr/ and http://www.elpais.es/).

Also available are services such as sound samples of spoken languages, listening exercises, online dictionaries and expert help.

For example, Lingu@NET (http://www.ncet.org.uk/linguanet/index.html) provides quality-assured information and materials for foreign language teachers and learners. Language learning materials, training and professional development, research, and links to over 200 selected Web sites in the UK and worldwide make this a very useful site.

History

The Internet enables children in class to connect to museums around the world and to access resource banks of primary source materials including ancient manuscripts, photographs, charts, texts, historical documents and access to experts.

For example, pupils can get first-hand descriptions of major historical events, virtual tours of historic sites, and follow archeological digs.

Geography

Most of the geography curriculum can be enhanced in some way by the Internet. Just using the Internet on its own can build up a curiosity about geography. There are vast repositories of maps and photographs. Many tourist boards across the world are using the Internet as a marketing tool and provide a rich source of geographical information.

The CIA World Factbook (http://www.odci.gov/cia/publications/factbook/index.html) is another good source of country-specific data.
Some geography lessons could benefit from accessing the wide range of photographs of the Earth – aerial, low altitude and high altitude satellite pictures.

Live weather data and satellite images can be used to enhance the teaching of weather in the classroom.

There is also much crossover between science and geography in the Passport to Knowledge resource mentioned on page 22.

The physical locations of computers being accessed can be traced and displayed on a globe using a piece of software called Geoboy (see http://www.ndg.com.au/products/gb/).

Art
Some of the world’s finest art galleries have substantial presences on the Internet. Access to these opens up a world of possibilities for learning. The Internet is also becoming widely used as a medium for school pupils and young artists to publish their work. Collaboration on projects with pupils in other schools, or with working artists or designers, becomes a real possibility with electronic communication.

Music
The Internet is becoming an important tool for producing and disseminating music. So much so that Alan McGhee of Creation Records (Oasis’s label) recently predicted that the Internet will cause major structural changes to the record industry. There are thousands of Internet sites covering the widest range of interests in music, leading to a wealth of learning opportunities. For example, MIDI (electronic music) files can be exchanged over the Internet, again opening up possibilities for creative collaboration with pupils in other schools or even working musicians.

Special educational needs
Microsoft® Windows 95 and 98 have a range of accessibility options that can help people with physical or sensory disabilities make use of a computer. Your network manager should know about these and should be able to adjust these to support individual special needs requirements.

The Internet/a school Intranet provides an effective way of sharing differentiated materials and enables the speed and style of learning to be tailored to their needs.

Using the Internet encourages pupils with learning and behavioural difficulties to share and discuss their thoughts with others. It can provide a positive socialising experience and improve confidence and basic skills such as reading and writing.
Many pupils able to work independently on a computer find learning less taxing and more rewarding than with traditional classwork. It can help children to develop their skills in problem solving, critical thinking, collaboration, communication and presentation.

For pupils who cannot attend school, for whatever reason, the Internet can give them access to the school, teachers, resources and other pupils.

Email reduces isolation and provides a reason for writing. Using email develops personal, social and communication skills.

The Chatback Trust (http://www.rmplc.co.uk/sites/chatback/) is a charitable organisation which provides email facilities for schools catering for children with mental or physical difficulties in communicating. The project encourages young people to correspond with each other for social interaction and classroom work.

**Structuring the curriculum to take advantage of the NGfL**

In order to take advantage of online learning opportunities, pupils need to have the best possible computing skills – in addition to skills specific to using the Internet (see E-skills, page 62).

These new demands require that pupils are given a taught ICT programme throughout Key Stage 3. The key features of this programme are given on page 74.

Schools need to establish a benchmark skills profile – a minimum expectation of everyone’s abilities in relation to dealing with the Internet.

These skills then need to be applied across the curriculum. An overview of what pupils could be doing in each subject area is given in Department goals and targets (pages 71 to 75).

**Developing outputs into the NGfL**

With the growth in use of networks comes the opportunity to cut the amount of paperwork floating around the school.

The school local area network, especially if running an Intranet, can easily become the principal platform for distributing information. Daily and weekly bulletins, schemes of work, lesson plans, learning material, school and department policies, minutes of meetings, etc, can all be published over the school network, potentially making big savings in reprographics.

Bearing in mind that most of what ends up on paper is produced on computers in the first place, Web-based publishing should not be as daunting a prospect as it sounds. Most of the latest productivity software — word processors, spreadsheets and database packages — enable documents to be saved automatically in HTML (the language that can be read by Web browsers).
Access issues

Appropriate technology

There are very many access models and schools are facing much pressure to provide as much of the latest and best equipment and connectivity as possible. The key issue for schools is what technology is appropriate; the following factors will determine this:

- What is the current level of provision?
- How many members of staff have Internet competencies and/or enthusiasm for using the Internet in the classroom?
- How good is the current network infrastructure?
- How much can the school afford to spend and over what timescale?

Platform issues

Most schools are likely to have a mix of old and new computers. Internet software will run on a wide range of platforms including:

**MS DOS**

It is possible to use a DOS system for email and news.

**Microsoft® Windows 3.1**

Most Internet functions can be performed comfortably on a Windows 3.1 system. Depending on the network operating system in use, each computer need not necessarily have a local hard drive.

**Microsoft® Windows 95**

This platform is very popular and offers a full range of Internet functions. However, it requires a higher specification computer to run on than Windows 3.1 and requires a local hard drive to be present on each of the workstations.

**Microsoft® Windows NT Server/NT Workstation**

Windows NT Server can comfortably host server-based Internet services such as email or Web servers, whilst NT Workstation provides a client operating system very similar to Windows 95.

**Microsoft® Windows 98**

The latest operating system offering from Microsoft extends integration with the Internet further than Windows 95. In fact, the operating system makes integration with the Internet seamless, with the desktop itself becoming a browser and all objects – whether on the local hard drive or at a remote site on the Internet – appearing the same.
Apple Macintosh
System 7.5+ will give users good Internet connectivity and the full range of functions. Apple is the preferred network/Internet platform for many schools. Their acclaimed and popular E-mate (which is no longer being produced by Apple) gives pupils mobile access to a limited range of Internet functions, whilst their server software provides the platform on which a full range of Internet server software can run.

Acorn
Acorn users can connect to the Internet and use a full range of Internet tools.

Unix
If there is a natural platform for Internet software, then Unix is it. Most of the original Internet development work was done on Unix machines and still, today, Unix systems lie at the heart of many ISP and large-scale Internet operations.

Other platforms
PDAs (personal digital assistants, or small hand-held computers) are becoming increasingly connectable to the Internet. Psion organisers, for example, have their own operating systems that can offer users email and basic browsing services.

Making the best use of existing facilities
As most schools have a range of equipment, a single Internet solution for all schools is not an option. It is important to consider ways of getting older systems to perform an appropriate Internet function.

For example, a Windows 3.1 system running on a Research Machines Net LM network operating system could be used to host an Intranet site (see Intranet, page 35). Using Netscape Navigator or Microsoft Internet Explorer for Windows 3.1, an Intranet can be set up by simply making one area on the server, containing HTML and graphic files, accessible to anyone. A single computer on the network with a modem could be used to find and retrieve material and to act as a 'gateway' for email.

The cost of this kind of solution is limited to one modem, and running a dial-up Internet connection.

There may be a number of standalone computers spread around the school, that could each be connected to the Internet via a modem and telephone line. However, beyond around four or five standalone connections, it is worth considering connecting the local area network, for speed, cost and functional gains.
There are several components to an Internet connection:

- computer(s)
- software (operating system, Web browser, Web server, email and email server, filtering)
- connection hardware (routers, modems)
- Internet addresses (addresses for the computers themselves and for services such as email)
- telecommunications
- connection to the Internet (via an Internet service provider).

Access models

Standalone, dial-up access

The most common way to access the Internet, for both schools and home users, is from one or more standalone computers. This is the least complicated and least expensive way to get connected.

In this model, a single machine is connected by an ordinary telephone line to the Internet.

For around £1000, it is possible to set up an Internet-connected computer. To do this, the following is required:

- an IBM-compatible PC, running Windows 3.1, 95, 98; or an Apple Macintosh, running MacOS 7.5 or higher; or an Acorn, running RISC OS 3.60
- a standard telephone line (dedicated preferably)
- a modem
- a subscription to an Internet service provider (ISP)
- Internet software including a Web browser and an email package.

This is a good solution for allowing individual or very small groups of pupils to research or use email. For the teacher to show the class material, a data projector or LCD/OHP display panel is needed. If using this kind of equipment, it is essential that the room can be darkened. An alternative is to use a large monitor, 17-inch minimum, or television.

To save time, entire Web sites can be picked up and downloaded using ‘site grabbing’ software, and viewed from the computer's hard drive.
Dial-up on a network

Regardless of the size of the network, a computer on it could be connected to the Internet using a standard telephone line. Ideally, the connected computer will have its own hard drive. The advantage of it being on a network is that material can be picked up from the Internet, and can then be made available to all users on the system.

<table>
<thead>
<tr>
<th>Uses</th>
<th>Requirements</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupils in pairs or small groups researching or using email or news</td>
<td>A standalone computer with a hard drive</td>
<td>Low cost</td>
<td>Low access and exposure levels</td>
</tr>
<tr>
<td>Pupils taking it in turn week by week to use a small number of computers</td>
<td>Dedicated, direct telephone line</td>
<td>Easy to manage</td>
<td>Not suitable for some Internet functions because of low speed</td>
</tr>
<tr>
<td>Whole class presentations</td>
<td>Data projector, LCD panel, large monitor or television</td>
<td></td>
<td></td>
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</table>

Small cluster: the lab/suite

A computer lab or suite needs to have enough computers for whole classes at a time to be effective. Most schools now have such facilities. Computer labs/suites can be used for a mixture of timetabled lessons and booked sessions.
The advantage is that whole classes at a time can be catered for. Disadvantages include cost and having to dedicate a room to sole use as a computer facility.

### Large cluster

Beacon Community College in Brighton uses Learn Centres housing 100 computers in a single area. This system is helping to reduce the need for cover lessons with cover teachers. When a class teacher is away, entire classes can be sent to work on computers in a Learn Centre. This facility needs only a minimal level of teacher supervision and subsequent savings from the cover budget have helped pay for the equipment.

### Whole school access

The Internet needs to be ‘on tap’ as a research tool to support curriculum-based work as widely across the school as possible. One approach is to have between five and ten computers around the outside of designated classrooms.

The wider the access, the more a school will be able to take advantage of the full range of possibilities opened up through networks. In addition to the obvious benefits of the Internet, these possibilities include:

- centralised and computerised reporting and progress checking
- electronic communication across the whole school community
- schemes of work and learning goals online and available for everyone to view
- supporting material
- galleries of exemplar work, photographs or video clips of activities or even lessons
- access to a whole school information system – daily/weekly/monthly bulletins and news.

<table>
<thead>
<tr>
<th>Uses</th>
<th>Requirements</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole class accessing the Internet</td>
<td>Server, router, ISDN, leased line or cable modem</td>
<td>Easy to manage whole class activities</td>
<td>High setup and running costs</td>
</tr>
<tr>
<td>Whole class presentations</td>
<td>Network OS with TCP/IP support</td>
<td>‘Free’ researching capabilities</td>
<td>High network administration costs</td>
</tr>
<tr>
<td>Research or email by individuals and groups</td>
<td>Client OS with TCP/IP support Web browser Intranet software (optional)</td>
<td>Material and resources can be shared widely</td>
<td>Takes a room out of use for other purposes</td>
</tr>
<tr>
<td>Video conferencing</td>
<td></td>
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<td></td>
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</tbody>
</table>
Giving everyone a notebook

Notebook computers are small portable computers that have very similar capabilities to desktop systems. They are coming into their own as a tool for pupils, and there are several pilots underway to evaluate their use in the classroom. In 1995, Tony Blair set out to provide every pupil in the country with this type of computer. At the time, notebooks (or laptop computers as they were referred to then) were very expensive, but falling hardware prices have put notebook computers within the reach of many schools.

Bandwidth options

The rate at which a piece of computer data travels along a network cable is measured in ‘bits per second’ – also known as ‘bps’. A bit is the smallest unit of computer information and the number of bits per second relates to the number of bits passing a single point in the cable over one second.

\[
1 \text{ Kbps} = 1024 \text{ bits per second}
\]

\[
1 \text{ Mbps} = 1,048,576 \text{ bits per second}
\]

\[
100 \text{ Mbps} = 104,857,600 \text{ bits per second}
\]

The greater a cable connection’s bandwidth, the more bits are able to travel along it. However, having a high bandwidth connection is not a guarantee that data will travel along a network connection quickly.
The following factors affect this:

- computer type, processor speed and RAM
- types of network cards, modems and routers used
- the number of steps data has to take before reaching its destination
- network cable types and length
- operating systems, network software and protocol
- the amount of ‘traffic’ flowing over a connection – often affected by the time of day.

All of these factors affect the rate at which information is downloaded from the Internet.

Below are the technical options for accessing the Internet in ascending order of bandwidth capacity.

**PSTN**

Ordinary (voice carrying) telephone lines have the capacity of carrying up to around 50 Kbps with the fastest modems.

**ISDN**

ISDN gives one or multiples of two channels of 64 Kbps. This is adequate for screen video conferencing. Depending on how the system is set up, up to 30 computers per channel can connect to the Internet.

If your budget is less than £100 a month, you have fewer than 30 machines to connect and are able to limit usage time, simple ISDN is the best option.

If your budget is between £100 and £500 a month you may consider combining ISDN (2 x 64 Kbps) and either a satellite link or a single 64 Kbps leased line.

ISDN calls are charged on usage, just like an ordinary telephone line. If you use two channels, then you pay twice as much. There is a point at which it becomes cheaper to switch from ISDN to a leased line. For business, this is 3 to 3.5 hours of use a day. For schools, this point will be determined by the amount of use that the system will get during vacations and weekends.

**Satellite**

Some satellite systems can offer Internet access – at 400 Kbps. This type of bandwidth can deliver a whole CD-ROM (635 MB) of material in around thirty minutes. The biggest advantage of satellite is that it is available across the UK, regardless of how remote the location. This type of system can also be used to obtain foreign TV stations.
However, only the incoming Internet data is delivered via satellite. Outbound communications still have to be handled using a ground-based link so an ISDN or leased line solution is required to make a satellite system effective.

Some satellite systems will charge for the quantity of data transmitted, so charges can quickly mount up.

**Cable**

Schools in an area where cable TV has been installed can take advantage of the bandwidth available locally by connecting to the Internet using cable modems.

Depending on the modem manufacturer and the types of tasks being carried out, cable modems can give speeds ranging between 512 Kbps and 10 Mbps. This kind of bandwidth gives more than enough speed for video conferencing and connecting entire LANs to the Internet. Connection costs will depend on what can be negotiated with the cable company – who may well charge for connecting the school to their network.

**Leased line**

A leased line option involves having a high bandwidth line installed. This is connected to the supplier’s network and leased from them.

Leased line comes in the following speeds: 64 Kbps, 128 Kbps, 256 Kbps, 512 Kbps, 2 Mbps. A leased line is an expensive option but it does give the school 24-hour use as well as the capacity for handling all voice and fax telephony services. The distance between the school and the nearest point to which the line can be connected into the supplier’s network can be a cost factor.

**ADSL (asymmetric digital subscriber loop)**

A technology to watch carefully is ADSL, which uses compression techniques to increase the capacity of a telephone line 30-fold.

Currently under trial, ADSL, and its variants, will deliver a high-speed (around 1 Mbps but up to 6 Mbps) Internet and multimedia connection with the capacity for carrying TV-quality video and CD-quality audio through an ordinary voice-carrying telephone line.

Clearly then, ADSL has the potential to radically change the face of Internet service in the UK and needs to be taken into account when planning for the future.

**Bandwidth summary**

As a rule of thumb, the more computers accessing the Internet, the greater the bandwidth required.
## Network issues

### Tiered access

For some applications, such as video conferencing abroad, there is no escaping a heavy demand on bandwidth. For other applications, such as email and browsing the Web, much lower bandwidths are required.

In addition to this, it is unlikely that access to bandwidth will be uniform across the network. Nor does it need to be. For a start, the computers themselves are likely to be a mix of old and new and therefore will have varying degrees of Internet capability.

The internal cabling and bandwidth to the Internet will differ according to what curriculum goals are set by each area.

Networks therefore need to be developed to allow different speeds in different parts of the network according to the identified curricular needs of each area.

In order to optimise access, networks need to be developed on three levels:

#### Intranet

An Intranet is an internal Internet. It is possible to run a Web service on a local area network which can contain the school’s own Web pages, adapted into an internal information system. Entire Web sites, subject to copyright agreement, can be downloaded onto the school’s server and made available in the same way as any other Web site.

<table>
<thead>
<tr>
<th>Narrowband</th>
<th>Intermediate band – kilostream leased line</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 56 Kbps. Requires a telephone line and modem. One computer per telephone line. Useful for text, online searches and basic graphics.</td>
<td>64 Kbps-2 Mbps. Requires a router. Four computers per line. Useful for text, searches, graphics and Web servers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intermediate band – ISDN</th>
<th>Broadband – leased line or cable modem</th>
</tr>
</thead>
<tbody>
<tr>
<td>64-256 Kbps. Requires up to four ISDN channels and ISDN router. Up to 20 computers per channel depending on how well caching is used. Good for Web browsing and video conferencing.</td>
<td>Fibre-optic cable or copper wire with compression hardware. 2 Mbps+. Around 60 computers per line. Useful for multichannel video and video conferencing.</td>
</tr>
</tbody>
</table>
This is easily the most important area for development. This is because the school Intranet should be the first thing that users of the network come to. Much of the material they need should be on the Intranet, and connections to external sites should be made from this point.

An Intranet should facilitate the following:
- email across the school
- a whole school information system, bulletin board, notices and news
- the school Web pages
- downloaded, cached Web pages, indexed, organised and regularly updated
- CD-ROM and other aids to self-directed research.

If the school Intranet is sufficiently well developed, access to the Internet can be limited to a single dial-up connection, but pupils will be able to get many of the benefits of the Internet.

There are several tools on the market which can help network administrators build an Intranet. These include Lotus Intranet and Artisoft i.Share.

Before embarking on any major Internet or NGfL project, schools should consider the state of their existing LAN cabling and move towards a structured cabling solution.

**Extranet**

If an Intranet is an internal Internet system run over a LAN, an Extranet is an Intranet that is accessible beyond the organisation. An organisation in this sense could be a consortium of schools, a local authority or schools, parents, libraries and museums linked together by their own private network. As with an Intranet, Internet technologies are used to deliver a range of Internet-type services.

To connect with an Extranet, a school will need to talk to its ICT supplier, the LEA, and telecom and Internet service providers. Extranet technology can allow the school to connect with:
- other schools – locally or across the country
- parents and local business
- the local authority
- local learning resources.

Whilst this could be done via the Internet, advantages of using an Extranet are:
- high-speed connectivity – particularly useful for video conferencing between schools, virtual classrooms and online learning
- security – information that is only for the benefit of the members of the Extranet is kept out of reach from the rest of the Internet community.
All schools need to have some direct access to the Internet. However, giving everyone direct, high-speed access to the Internet right across the school network in most cases will be neither feasible nor necessarily desirable.

**Network case study 1: Tiered Internetworking**

Akhter Computers Ltd, an Essex-based computer company, has an interesting approach to tiered Internetworking. The company’s Internet service is based inside Telehouse in London’s Docklands. Telehouse is the main entry and exit point for UK Internet traffic. With an Internet server inside Telehouse, Akhter are able to access the whole of the Internet at the maximum possible speed.

To ensure that users of the service also obtain the highest possible speeds, the company stores cached Web pages on the Telehouse server. When these are called up on users’ terminals they only travel from Telehouse – not the other side of the world. This ensures that the bandwidth that the school has at its disposal is being fully utilised.

Secondary schools act as regional hubs, connecting primary schools and parents throughout the local community. Once accessed from the Internet, Web pages are cached first at Telehouse, then on a proxy server at the school. This means that once one school has accessed a site on the Internet, all the other schools on the Extranet get speed benefits when downloading these sites themselves.
The system also enables teachers to determine what Web content is accessed by adding selected Web site addresses to the system. Schools in the Extranet can also benefit from higher speeds when video conferencing between one another.

**Network case study 2: NetSchools**

NetSchools is a company based in the United States. They equip entire schools with notebook computers.

The system is based on the StudyPro—an easy to carry, rugged notebook computer designed for student use. The notebook has no moving parts, and a toughened outer casing.

Pupils and teachers connect from both home and school to a central server. From home, users connect via a modem. Within the school building, the notebook computers automatically connect using infra-red, wireless, technology (see page 49). This means that they do not need to be plugged in using cable and when turned on, they automatically connect to the network. Once logged on, pupils are automatically registered and can download and upload assignments.

An academic information system (AIS), based on the server, controls the operation of StudyPro computers within the classroom, and coordinates the resources available within the school and on the Internet. The AIS features an electronic version of the curriculum, resources, lessons, online quizzes, attendance and classroom administration tools.

The NetSchools model points the way forward in network development and sits comfortably alongside the NGfL.

**Accessing the Internet**

**Content issues**

The Internet has no membership rules, and any sort of information and views—from the most beneficial to the most destructive—can be freely expressed. Accessing pornographic or violent material in a class can be very embarrassing or potentially disruptive for a teacher and, of course, parents are naturally concerned that children should not have access to it. Controlling access to undesirable material is therefore a justifiable priority for most schools.

However, pupils and teachers should not be deterred from using the Internet, since its educational value far outweighs its drawbacks.
The following systems are available to address the problem of undesirable content:

**Walled garden**
This is where pupils are provided with access only to sites that teachers or the Internet service provider enable. Both an advantage and disadvantage of this system is that children are restricted to selected material.

On the one hand, this speeds up accessing specific material in a structured learning situation. Children waste little time freely browsing the Internet or accessing unsuitable material. Another advantage is that this type of system is indexed and, with 200 Web sites being added every four hours, this is one way of making sense of the vastness of the Web. The walled garden approach can help younger pupils develop research skills in a safe environment.

On the other hand, when children are researching independently, they are somewhat restricted to what they can access until the teacher enables the site. The walled garden may not satisfy all resource or research needs.

The Akhter system, described on page 37, and BT's CampusWorld work on this basis but allow teachers free and open access.

**Attended garden**
In this approach, the Internet service provider makes some sites off limit. An advantage and disadvantage of this is that children's research is much less restricted. The ISP keeps a list of barred sites. Offensive material is removed from the access list in retrospect – often as a result of schools phoning or emailing in with the addresses of offensive sites.

On the one hand, this allows children access to most of the material on the Internet when researching independently.

On the other hand, this has to be managed more carefully in a structured learning situation and there is a likelihood that some pupils may access inappropriate material.

Research Machine’s Internet For Learning takes this approach.

**DIY filtering**
If the school wishes to use an unfiltered service provider, they can buy in and install software that can be used to do the filtering for them.

Software such as Net Nanny or WebScanX, allows network managers or teachers to exclude Web sites or newsgroups. As with the attended garden, excluding sites often has to be done in retrospect, often after some damage has been done. There are time implications for the network manager, and therefore a cost to the school, with this approach.
Security

There are two problems which need to be addressed by security measures. Firstly, there is the problem of people inadvertently changing the way in which the system is set up. This can cause the system, or parts of it, to malfunction. Secondly, there is the problem of people deliberately attempting to cause damage, disruption or a nuisance.

Attempts at getting into secure areas should be considered inevitable. Some security measures are built into network operating systems such as NT4 or NetWare. There are other packages of security software which can be used in addition to that which comes with the operating system.

Bear in mind also that any security system that has been built by one person can be undone by another person. Most modern network operating systems now have excellent security but often human error or carelessness can allow opportunistic hackers to penetrate even the tightest of security.

Below are some common security measures that can be employed:

What the network manager should know

Make sure that your network manager is familiar with RFC1244, the Site Security Handbook. This is available for download at http://taorp.math.hr:800/doc/sas/rfc1244/. This is a fairly old but well tested document that details ways in which a network manager can secure the network.

Enabling specific programs to run

Much damage can be done by people running the wrong kind of programs. For example, there are a range of programs designed to help people breach security on the Internet. More innocently, test versions of commercial software are widely available, but when run these could corrupt data on the system.

If it is not possible to prevent people from downloading programs from the Internet, then it is essential to control what programs users are able to run. For example, if using an NT4-based system, make sure that ‘Run only allowed Windows applications’ is checked under ‘pupil policies’ in the administrator’s area. This will enable only those applications deemed to be appropriate to run.

Password protection

One of the most common breaches of security is when a user obtains the password of the administrator or someone with high levels of privilege, such as a teacher. At worst, this can let someone change the administrator password and hence lock out someone or everyone from the system by changing their passwords, or delete anything on the system.
There are several ways in which passwords can be obtained:

- watching the administrator enter their password
- using a ‘password capture’ program
- using a logged-on but unattended workstation.

Lay down and enforce a policy that no one leaves their workstation logged-on and unattended. People should be encouraged never to write down their passwords.

**Virus protection**

Viruses can cause a multitude of problems and are very widely distributed. For someone intent on damaging a network, viruses can be very effective. Stopping viruses can be very straightforward by using commercially available anti-virus packages. For an entire network this could cost over £1000, but it is really worth having.

**Encryption**

Encryption is a way of protecting those files, areas or messages that require the maximum amount of security. One person scrambles the data with a unique ‘key’. In order to unscramble it, another person has to have the same ‘key’.

McAfee, an American software firm, has an encryption package called PGP (Pretty Good Privacy). This can be purchased from any reputable software retailer.

**Firewalls**

When a LAN is connected to the Internet, it is vulnerable to being penetrated by hackers the world over. Whilst perhaps less of a target for serious hackers than banks or military targets, an attack by a hacker could cause serious problems – especially if the school administration system can be accessed.

To protect LANs from attack from outside, special software called a firewall is used. This lets in only those people to whom you want to give access. Setting up firewalls is a specialist task but most large companies will be able to advise on this.

**Handling email**

There are two ways of handling email. The first way is to set up a mail server on the LAN. There are administrative and financial overheads involved in this. The setting up and management of email accounts becomes the responsibility of the network manager.

The other approach is to use a third party ‘free’ Web-based mailing system such as Hotmail or Yahoo Mail. These mail services are accessed via the Web browser and administration and management of the account is transferred to the service provider. Besides communication costs, the only price paid is that the user receives advertising by email when using the service.
The development process

“Eat the elephant one chunk at a time”

There are many facets to putting a school onto the NGfL. The development process will:

• change the way in which pupils learn – more learning will be online and pupils will have a much wider menu of learning experiences to choose from
• involve the development of people – the whole school community will need to adapt to new working and learning methods and everyone will be on a steep learning curve
• require long-term network planning – the development of the computer network will need to be thought through over five-year periods.

Why take on a NGfL project?

A NGfL project involves going through a particular set of processes in order to take advantage of new and emerging online learning opportunities.

Before taking on a NGfL project, it would be well worth asking why. Some of the benefits are listed in Harnessing the Internet, pages 7 to 12. It would be worth finding out how widely the views expressed here are shared amongst the school community. OHTs 4, 5 and 6 (pages 100 to 102) could be used to explain these views to the school community.

Audit

Before undertaking a NGfL project, the school should conduct an audit. This should include the following:

Curriculum – how is the Internet already being used?

Even if the school is not yet connected fully to the Internet, pupils and teachers could well be using the Internet and other forms of computer-based learning at home.

Some departments may also have ‘gone it alone’ and obtained an Internet connection before a whole school project is undertaken.

Departments, teachers and pupils need to complete an initial profile in order to determine how the Internet is already being used.
Technology – what have you already got?
In order to determine what hardware, software and network development needs to take place, a list of the different types of computers and their specifications is needed. This needs to be cross-referenced against the computers’ locations, the software run on them and the types of network connection they have.

ICT skills
Much has been reported in the press about the Government’s Lottery-funded teacher training initiative (see page 55).

Before taking on an ICT training programme, an attempt should be made to quantify the ICT skills that already exist within the school. This can be done through building up a profile on each department, pupil and member of staff. Example NGfL profiles are given on pages 106 to 113.

These will help determine:
• where teachers need to be attending courses
• where outside training needs to be brought in
• where some teachers could be helping other teachers
• where some pupils could be helping some teachers.

Potential partners

Business
Before making any firm plans or purchases, you will need to find out what businesses may be able to make a contribution to your NGfL project. Do not expect a ‘free lunch’; the purpose of a business is to make money, not to subsidise schooling.

Make approaches first to local firms to see whether they can make use of the kind of Internet facilities that you intend installing or if they can use some of the online learning that you will have available. They may also be interested in advertising their products or services on the school Web site.

When dealing with business, put yourself into their shoes first and ask what you can do for them before asking them to do something for you.

You may be lucky and find that they could make use of some of the facilities that you intend to bring on board. If this is the case, negotiate a contribution to the cost of the project from them. If you are able to do this, you will profit not only by having a financial contribution but also by having closer ties with a local firm – which in itself could spin off a number of benefits.

You may be luckier still and be able to persuade a company to sponsor a part of your NGfL development. For example, you could ask a business if they’d be prepared to sponsor an individual department’s NGfL development.
Local organisations

As with businesses, local organisations such as libraries, hospitals, charities, leisure centres and Training and Enterprise Councils won’t be in a position to subsidise network developments in schools. They may, however, find it useful to work in partnership with schools in areas such as:

- ICT/Internet training
- online learning
- advertising on the school Web site.

Again, you may find yourself in a position where you will be able to negotiate a contribution to the cost of the project in exchange for a service.

Primary feeder schools

One part of the NGfL vision is that primary schools will be linked to secondary schools. Benefits of this include:

- cascading of learning material from the secondary to the primary and vice versa
- ease of transfer of pupil records
- primaries coming under the umbrella of the secondary school for technical support and training
- primary schools can enjoy the benefits of sharing bandwidth.

Again, there may be opportunities for secondary schools to form consortia with primary schools to spread the costs of bandwidth and training.

Below are some practical examples of where cooperation could work:

- A primary school finds that with computer resources spread throughout the school, getting all teachers in front of a computer in the same room for ICT training is not possible. The local secondary has a 20-station lab which it can make available with technician support and, if required, a trainer.
- A consortium of primary schools wishes to share teaching materials and communicate online. They don’t need full-blown Internet access but need to be on an Intranet. The local secondary school lets the primaries dial in and use its server as a hub for the primary Intranet and provides occasional Internet access when required.
- A number of primary schools have formed a SCITT (School Consortium for Initial Teacher Training) to deliver school-based initial teacher training. They do not have the resources or staff to deliver the ICT component, but the local secondary school is well placed to help with this.
What would success look like?

Every school will have different reasons for using the NGfL and different starting points. Therefore success will look different to everyone.

Whilst developing the technology is crucial to the success of an NGfL project, it would be a mistake to make this the focus or to see success in terms of what hardware, software or network access is available. As one advertisement in the national press recently said 'Computers suck. People are cool.', ie it's what computers can do for people that counts.

It is important to 'begin with the end in mind' and below are some examples of what success may look like:

• pupils on-task more of the time
• pupils learn more
• pupils build up a range of 'e-skills'
• full integration of ICT across the curriculum
• a local grid for learning (integration of the network into the community)
• school as open learning centre
• paperless administration.

Defining the goals

As with the success factors above, every school will have different reasons for using the NGfL and therefore different goals when setting out. Below are some exemplar goals which could be used to help define the project.

Goal 1: Raising examination achievement

Much GCSE work is now self-directed research. The Internet makes this more productive for pupils (see Quality of self-directed research, page 68). One would expect, therefore, to see an improvement in the quality of coursework where self-directed research plays a significant role. This, in turn, ought to have a knock-on effect on examination results as a whole.

Goal 2: Raising standards of literacy

Whilst much use is made of multimedia on the World Wide Web, it is still largely a written medium. The Internet gives pupils a range of opportunities to communicate in written English. One might reasonably expect, therefore, to see a rise in the standard of literacy.

Goal 3: Improving language skills

It would also be a reasonable expectation to see foreign language skills improve if pupils are given access to the Internet.
Goal 4: Pupils form their own network of contacts
The better developed a pupil’s network of contacts, the better the position they will find themselves in when they come to leave school. For example, following a line of enquiry for GCSE or A-level coursework could bring the pupil into direct contact with a potential employer.

Goal 5: Synchronisation between home and school learning
In time, pupils ought to be able to access assignments and learning material from home.

Development of the NGfL project
If projects are to be successful, it is essential that those involved feel some ownership and stake in the enterprise.

Decide the aims, budget and length
How could the project help to raise achievement? How will you use the budget allocated to you and will you attempt to augment this money in any way with other human or financial resources?

Decide who will do the administration
Who will organise meetings, keep tabs on the technical development team, keep the accounts, etc?

Involve people
This is dealt with in detail in Involving people (pages 65 to 67). Include those who will be involved in the initiative at an early stage – local authority personnel, heads, teachers, governors and parents. Ask them their views. They may have some very good ideas and they are much more likely to implement what is decided if they have been part of the planning.

Establish a steering group
A steering group can be very useful, especially if its members are experienced and influential. However, they can also interfere unnecessarily and inappropriately, so it is important to agree the remit at the beginning.

Create an identity
Logos help to make people feel they belong and are part of a coherent, exciting, innovative initiative. Designing a logo can be fun and can also be a good vehicle for discussing the project.
Decide how it is going to be managed
The project manager must have time and energy to devote to the job and the appropriate status. A project of this importance should be shared with the head/deputy head working in partnership with a project coordinator, who needs good interpersonal skills, credibility as a good practitioner, good technical knowledge and enthusiasm.

Briefings and meetings
Get dates in people’s diaries for briefings and meetings so they know what they are working to and what to expect.

Ensure understanding
Once people are appointed responsibilities, aims, objectives and strategies can be reviewed to encourage people to play the same game on the same side.

Training
Training is dealt with in detail in Training teachers, page 55. Inevitably, the commissioning of new computing facilities will have wide-ranging training implications. Technical personnel such as the network manager will need training first, as their understanding of a new system will be critical to its operation.

A framework programme must be prepared but you also need to respond to things as they arise.

Evaluation
The purpose of the evaluation is to monitor progress. Allocate some funding towards this and, if possible, bring in an external evaluator.

Celebrate success
Let people know when things have been achieved. Local newspapers and radio stations are good ways of building enthusiasm. An imminent event for the press is also a good way of bringing deadlines into focus too!

Share good practice
Get articles about your project published in newspapers and magazines. This is a great motivator and helps clarify thinking.
Increasing access to computers

Clearly, most schools are going to need to increase access to computers. Few schools will be in the position of starting completely from scratch. Most schools will have a mix of older machines and some new ones. In planning for the future, the emergence of the notebook as a learning tool needs to be given serious consideration.

Whilst new computers are always welcome, it would be a mistake to think that this is the only way to access the NGfL. All computers are useful to some extent, even old BBCs. Each type of computer can be used in a different way.

Older, low specification computers

Email and text-based functions can work well on older computers, but there can be a considerable time cost in setting the systems up.

Microsoft® Windows 95/98 – desktop multimedia machines

These are ideal for a range of high-demand Internet functions including:

- Web browsing, running Javascript and ActiveX (for multimedia and interactivity)
- multimedia and browser-based email
- desktop video conferencing
- multimedia presentation of retrieved and edited material.

PDAs

Personal digital assistants are miniature computers that can fit comfortably into a jacket pocket. Better known makes are Psion and Sharp. They are gaining in popularity and many now have the same level of functionality that desktop computers had less than a decade ago. Many include Internet functions such as email and text-based Web browsing.

Notebooks

The average notebook now has pretty much the same functional capability as low-level desktop packages. When given to individual pupils for exclusive use, these computers can make a considerable impact on learning. Page 60 deals with this use of notebooks in more detail.

This emerging technology should be taken very seriously when planning for the future. There will be a need for desktop computers well into the future, but it would be reasonable to assume that, with time, notebooks will proliferate. Planning for the longer term should take into account the widespread use of notebooks.
Structured cabling

With the exception of brand new schools, most computers in schools are linked together with a mixture of cabling solutions. More often than not, school systems have grown piecemeal. To take full advantage of the NGfL, a structured approach now needs to be adopted:

- Servers are strategically placed throughout the buildings to distribute the traffic flow across the network.
- Servers are linked by a cable 'backbone', often extremely high-speed fibre-optic cable.
- Outlets are placed in every part of the school building to allow computers to be deployed as required.
- The network technologies used should include:
  - UTP Category 5 data cable – a type of cable that enables the fast transfer of data (100 Mbps).
  - Patch panels which rationalise the organisation of cables.
  - LAN hubs – these are like small telephone exchanges for data cables. They enable 20-30 computers to connect to the network from one room or one section of the building.
  - Ethernet switches – devices on the network which regulate network traffic to optimise the flow of data. Using switches is a way of ensuring that the network is running at its maximum possible speed.

NB: This is only the current specification; network technology is constantly evolving.

Infra-red

An emerging technology in schools is infra-red (IR). Instead of having to connect to the network via cables, computers can be fitted with IR ports to connect to the network via a single, strategically placed IR 'hub'.

Data transfer via IR is slower than over cable. Also, infra-red data transfer is prone to being disrupted, especially if something gets in between the transmitting and receiving devices. However, given the inflexibility of cables, it seems a reasonable assumption that the future of computing is going to be wireless-based and, indeed, many high-quality notebook computers, such as those made by Toshiba, come with an IR port as standard.

JVC Professional is one company making IR equipment that allows users to link portable computers to LANs. One of their products, for example, is a 10 Mbps wireless infra-red LAN device that works with an ethernet network. A computer can be up to 10 metres away from the IR device to work.
Advantages of IR are that it is:

- fast, easy and cost-efficient to install
- ideal for solid-floored buildings (where laying cables under the floor is difficult)
- ideal for classrooms which have frequent changes of furniture.

Five-year planning needs to take into account the possibility of integrating infra-red, or another form of wireless technology such as radio, into the network infrastructure.

Increasing Internet capability

Given the speed of technological change, there is nothing to gain by carrying out immediate and wholesale change. The widespread introduction of what may seem as ‘must have’ at one point in time will be quickly superseded by another equally as imperative solution shortly after. ICT in schools is a huge investment and should not be rushed into. Major investments can deliver short-term impacts but equipment implemented today will very quickly become dated and obsolete. This means that a school could become saddled with both obsolete technology and a debt that may prevent future spending on technology.

When introducing new Internet capability the impact that spending has on the whole school needs to be taken into account. For example, there is much pressure for schools to connect to 2 Mbps broadband Internet services. Such a service can cost at least £10 000 a year. This would enable direct Web services across the network (limited by the capabilities of the system). The main advantage of having this level of bandwidth is that it would enable high-quality desktop video conferencing, though this would be limited to a very small number of computers at any one time.

Another way to spend £10 000 a year would be to put it towards the cost of a range of measures designed to increase Internet capability across the entire network.

A possible upgrade path

The average secondary school spends around £24 000 a year on ICT equipment. Within this spending framework, and ignoring the possible benefits of additional NGfL funding, the following upgrade path could be implemented.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to computers</td>
<td>Structured cabling</td>
</tr>
<tr>
<td>Upgrade system to make Web browsers available as widely as possible.</td>
<td>Bring in and distribute new servers. Connect these to the existing system to spread network traffic.</td>
</tr>
<tr>
<td>Purchase a new suite of workstations.</td>
<td>Install ‘backbone’ between servers.</td>
</tr>
<tr>
<td>Year 3</td>
<td>Introduce notebooks or PDAs to new Year 7 pupils.</td>
</tr>
<tr>
<td>-------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Year 4</td>
<td>Introduce notebooks or PDAs to KS3.</td>
</tr>
<tr>
<td>Year 5</td>
<td>Introduce notebooks or PDAs to rest of school.</td>
</tr>
</tbody>
</table>
Financial options

Financing ICT is a subject in its own right. The NGfL offers schools a range of ways in which to generate revenue, which make the issue of funding options more complex still. For this reason, a complementary publication, *Fresh Approaches to Funding ICT*, published by Pearson Publishing, covers this area in depth. Below, is a brief overview of the financial options facing schools who wish to take advantage of the NGfL.

**Purchase**

With the price of computers tumbling, outright purchase looks a good option. Computers can be bought according to the budget available. There is one big drawback with outright purchase, and that is the rapidity with which computers become obsolete.

Another approach to outright purchase is to take advantage of the speed with which new computers lose value and to buy second-hand. ICL is one many companies that sell reconditioned computers. Provided that you don’t necessarily want all the very latest technology and that the used computers are covered by warranty, there is every reason to expect a reasonable term of good service from them.

Another way to increase your buying power if going for an outright purchase is to club together with a number of other schools who may also be considering making outright purchases. The bigger the order, the stronger your negotiating position.

Schools should budget for maintenance as well as allowing for end-of-life value and replacement cost.

**Lease hire (rental)**

This is where a lease hire company owns the computers and the school hires the computers for a minimum number of years. At the end of this period, the school can extend or terminate the lease hire.

Another variant of lease hire is exchange hire, which allows schools to upgrade after an agreed period by extending the lease.

Lease hire makes large-scale access available immediately, and spreads the cost over longer periods of time. However, bear in mind that the speed of technological change means that, shortly after an initial implementation, schools could be paying for obsolete equipment. Also, a school will be tied in with a single supplier for an extended period. If, on the other hand, equipment is upgraded periodically, this solution can offer value for money as the capital costs are met by the lease hire company.
Lease purchase

This involves borrowing the money to make a large-scale purchase. Depending on the type of school, it may not even be possible to own the equipment at the end of the lease term. Before considering lease purchase, check that the arrangements being offered conform to the law and, if your school comes under an LEA, make sure that the arrangement conforms to the LEA’s regulations.

As with lease hire, lease purchase makes large-scale access available immediately, and spreads the cost over longer periods of time. Again, however, this is a poor longer-term alternative because:

• the speed of technological change means that, shortly after an initial implementation, schools can be paying for obsolete equipment
• a school will be tied in with a single supplier for an extended period
• interest charges over a number of years could have financed improved access.

Remember that annual repayments on a system bought now will constrict future purchasing. The question that needs to be asked is whether the immediate costs involved in providing the learning gains now are worth the extra interest costs incurred over the next three or five years.

With the speed of technological development, constraining future spending, by having widespread access to state-of-the-art equipment now, may be taking too short-term a view.

Managed service

Whilst business has used this approach for a long time, managed service is quite new in education. In essence, it is the outsourcing of providing a computing service to a contractor.

The managed service contractor provides the following types of services:

• hardware and software
• installation
• LAN, Intranet, Extranet and Internet services
• system management (which could be effected remotely)
• maintenance and support
• training
• online curriculum and learning material
• administrative facilities.

Managed service sits comfortably alongside the National Grid for Learning, in that it allows schools to concentrate on delivering the curriculum rather than concerning themselves with technical issues.
Rent/earn

Another approach is to rent a system from a computer company at low cost and then use revenues from re-renting during the evenings, weekends and vacation times to training companies.

Courses bring in a reasonable revenue but when coupled with computer, software and Internet service sales, the revenue could make a serious contribution to the development of ICT.
Staffing issues

Training teachers

“We do not want any teacher to fear the information age.”

David Blunkett

£230 million from Lottery funding has been set aside so that all teachers will receive ‘intensive in-service training’ to ensure they have the necessary ‘skills, confidence and ability’ in using ICT in the classroom.

The Teacher Training Agency has devised an ICT curriculum for all new postgraduate trainee teachers to follow from September 1998. All practising teachers will undergo a process of self-evaluation from 1999 to determine their training requirements.

Before commissioning training, schools should be aware that there are standards for training in operation, and that training providers should be quality assured through either:

• the NAACE Kitemark Scheme or
• the Quality Information Technology Training (QITT) scheme.

Training and accreditation

There are two types of training needs. Firstly, before guiding a class through an online learning task, teachers’ own ICT competence needs to be at a reasonable level.

Secondly, teachers need to be trained in the application of online learning in the classroom.

In addition to most of the main educational ICT suppliers (see pages 93 to 94), there are many other organisations offering training.

Building teachers’ ICT competencies

The Royal Society of Arts has a basic competency qualification called CLAIT (Computer Literacy and Information Technology). The award is based on a supervised practical examination and could be useful for some teachers wishing to improve their own ICT competency and obtaining accreditation for this.

The British Computer Society has introduced a new qualification called The European Computer Driving Licence. It has wider scope than the RSA CLAIT award and is based on a single agreed European syllabus. Again, it would be useful to those teachers who wish to develop their basic ICT skills and get them accredited.
Classroom application
Anglia Multimedia Professional Development provides a range of material that is focused on using ICT in the classroom. These conform to the Quality Information Technology Training (QITT) standard.

Assigning responsibilities
Assuming for now that there are no plans to implement a managed service, the following staffing framework should be considered.

There are two distinct but closely related tasks in running ICT in schools. Firstly, there is the management of the technology; second is the management of the curriculum.

ICT coordinator
The role of the ICT coordinator will be extended due to the NGfL. They will need to keep department heads up to date with the latest NGfL material and ensure that departments have the skills and access required to take advantage of any opportunities to enhance learning that may arise.

The specific responsibilities entailed in this are discussed in detail in Setting and meeting targets (pages 68 to 76).

Network manager
To take full advantage of the NGfL, a full-time network manager should be on the payroll. This person should be directly answerable to the ICT coordinator. The essential job functions of this person should be:

• ‘front-line’ maintenance of all ICT equipment
• daily system backups
• maintenance and development of the network infrastructure
• managing the equipment and maintenance service contracts and budget
• development and maintenance of school Intranet and Web sites
• Internet/Intranet/Extranet management and network security
• ensure Y2K (millennium bug) compliance across the network
• assisting staff and pupils with software problems.

The network manager should be qualified in the relevant network operating system. If the network manager can also take on the role of network technician (see page 57), a higher salary could be considered.

It should be borne in mind that ICT professionals can earn good salaries in industry. To attract and retain a good network manager, schools need to offer attractive packages including training and career development.
Network technician
The role of the network technician is to support the network manager in maintaining and developing the network. Job functions could include:

- ‘front-line’ fixing of printer, monitor, mouse and keyboard problems
- rebooting the network when appropriate
- changing or adding user IDs and passwords
- drilling holes in walls, laying ducting and trunking, running cables between network components
- assisting staff and pupils with software problems.

The network technician could come from a range of maintenance or engineering backgrounds but should be highly computer literate. Depending on the scale of the network and ease of maintenance of the network, the network technician could be shared amongst departments throughout the school. Again, bear in mind that salaries for computer technicians in business and industry are at a high level; therefore, schools should expect to pay more for a computer technician than for other types of technicians. This will depend on local supply and demand.

Using teaching staff for technical duties
Not all schools will be able to afford a full-time network manager, let alone an additional network technician. The temptation is then to use teaching staff to take on the task of running and developing the network. This may be fine for small networks with limited function or for larger networks with significant and rapid service support. However, there are many good reasons for not using teaching staff to take on the function of network manager.

Firstly, training – teachers are not usually trained to maintain and develop computer networks.

Teachers work to a timetable and the school calendar, but network problems can occur at any time. Clearly, there are going to be problems if the school network goes down at the same time as the network manager is teaching. Both teaching and managing and developing a network require undivided and professional attention. These roles can be compromised if mixed.

Help from pupils
Many schools obtain support from their pupils for an array of tasks. There are many routine and low-level jobs that pupils can do such as keeping printers stocked up with cartridges and paper, formatting disks, helping others with software problems, etc. In some schools, the roles of pupils have been extended to network administration and upgrading the system.
There are both advantages and disadvantages to this approach and both need to be weighed before involving pupils in any form of serious work within the school.

**Advantages**
- Gives pupils opportunities to develop new skills and knowledge.
- Gives them increased trust and confidence.
- Pupils often know more and can pick up new knowledge faster than staff.
- Takes some of the strain of running a network off the school staff.

**Disadvantages**
- Depending on what tasks they are carrying out, they could be an insurance liability.
- If pupils are too heavily involved in the work, it could upset the balance of their schooling. In extreme cases, it lays the school open to accusations of exploitation.
- Pupils, like teaching staff, are not trained in the management of networks and a little knowledge can cause a lot of damage.
- Pupils can become a serious security risk if entrusted with administrator or high-level-user passwords.

**Local support**
The Neighbourhood Engineering Scheme puts retired engineers in touch with schools in order to help with curricular and technical development. There is much goodwill amongst parent bodies and it is surprising what people are prepared to do to help.

In the United States, a high-profile national scheme called NetDays has encouraged people and companies to help their local schools cable-up and connect to the Internet.

Open evenings and ICT events are a good way to find out what help may be out there and to solicit assistance with a myriad of tasks.
Approaching new pedagogies

New paradigms

Online learning

Many online learning protagonists put forward the idea that the Internet will enable learning to be simply selected from a menu and used on demand. However, there is a very long way to go before the kind of online learning available approaches the scope and depth of what is actually needed.

Online learning means that much of the learning that has traditionally been the domain of schools is no longer restricted. Learners no longer need to wait for a topic to appear on the formal school timetable before they can be in contact with a teacher, or can access engaging interactive learning material, that can teach them what they need to know.

Though early days yet, online learning is beginning to put learners in touch with teachers in a different way. In the United States, for example, telephone helplines manned by teachers to assist children with homework are well established and widespread.

The NGfL will help put teachers in touch with learners via the Internet both inside and out of school.

‘Just in time’ learning (not ‘just in case’ learning)

When fully developed, online vocational learning will give people the opportunity to acquire knowledge and skills just when they need it in order to perform a task. This is a much more efficient use of time and resources because people need only spend time learning what really needs to be learned.

Synchronising home–school learning

Between a quarter and a third of UK homes now have a computer. The exponential rise of the use of educational software packages at home has profound implications for teachers and schools. Schools need to recognise their value and synchronise the work done in school with that which can be done on computers at home.

This is one area where an Extranet can be useful. The entire school curriculum – all subject area schemes of work and lesson plans with links to relevant supporting material – could be posted on a Web site. Children with computers at home could then call up assignments from the Web site, carry out Internet-based research and mail in completed tasks for marking. Of course, this could be done via the Internet, but an Extranet is likely to be faster and more secure.
Even without the use of an Extranet, teachers should be aware of what children have available to them for use at home and should gear their homeworks or self-directed research accordingly.

Importantly, there are concerns voiced here, by parents and governors, about equal opportunities and these need addressing.

**Anytime, anywhere learning**

Anytime, Anywhere Learning (AAL) is a phrase coined by Microsoft to describe children working with their own notebook computers and connecting these to the school curriculum.

Until now, cost, size, weight, screen size, display quality, and overall specifications of notebook computers have made them inappropriate to give to every pupil. All this is changing very quickly, however. Many schools in the United States and Australia have already made a success of AAL. In fact, the state of Texas is currently considering equipping their entire school population with notebook computers.

With each successive generation of notebook computers, their specification has radically improved. Some versions have been specially adapted to classroom use and have been built to withstand the kind of abuse that children are likely to put them through!

Giving children their own notebooks in school:

- allows schools to transfer the cost, or some of the cost, of access to computers to parents
- gives children exclusive use of their own computer for every subject – impossible to do with desktop computers
- allows children to have access to the school Extranet and the Internet from home.

**New threats**

There are many perceived threats from online learning to schools. If the learner is freed from the constraints of the formal classroom for much of what is taught in schools, questions are bound to arise about the costs and efficiencies of the schooling system. The Royal Society for the Encouragement of Arts, Manufactures and Commerce (RSA) recently published a discussion paper entitled *Redefining Schooling* in which such questions were seriously posed.

There are now many examples of where learning through software is becoming highly efficient. For example, new software available teaches modern foreign languages not only by speaking but also by listening to and analysing responses. Maths packages are getting better—though they don’t as yet have the immediacy and diagnostic skills that a good teacher will have.
The hype surrounding computer-based learning has been compared to that surrounding the introduction of TV into schools and the way in which that too was supposed to revolutionise learning. Ironically, a recent survey put television at the top of children’s list of places of where they get most of their knowledge from – but out of school. Will the same be true of the NGfL in time?

**New opportunities**

The biggest opportunity for schools is to be able to educate beyond their traditional boundaries. Their clientele could also expand beyond just children to adult, lifelong learners.

Flexible schools, offering access to online and other forms of learning, could be centres of community education and training.

Teachers could take opportunities to deliver their lessons online and find audiences and markets for their schemes of work, lesson plans and supporting materials.

Learners will be able to choose from a much bigger menu of learning and providers of learning services.

**New problems**

**The design of the education system**

Schools, and schooling, as we know them were never designed to deliver education electronically. The schooling paradigm needs to shift if the formal education system is to survive in the longer term.

We could be entering a golden age of learning, fuelled by computers, software and the Internet, but the entire education system needs to change. Schools cannot change in isolation – OFSTED, SCAA, the examination boards also need to see where the Internet and the NGfL are going to take us, and reflect it in their actions.

**Plagiarism**

The temptation that children face when using the Internet is to download, or copy and paste, large chunks of information and incorporate it wholesale into their work. Much of what is picked up and re-presented is irrelevant to the task in hand. Also, little of the material dealt with in this way gets read and assimilated.

Children need to be taught that what they have to say is of real importance and that the purpose of working with the Internet is to help them to develop their own insights, views and skills in interpreting what they read and see.
Copyright
The issue of copyright on the Internet is a minefield and the subject of intense legal discussion. There are a number of ways in which copyright laws can be broken:

- taking images from Web sites
- downloading software and not paying for it
- taking copyrighted text.

If everything on the Internet were copyrighted, it would be less of a useful resource. As a rule of thumb, providing that the material is not going to be sold on for commercial purposes, selective copying and subsequent editing for personal use is acceptable practice. Users need to be careful, however, and should always read and take notice of copyright notices.

E-skills
Recent Government and corporate initiatives have highlighted the advantages of doing business online, for example: teleworking (working at home but linking to your employer via your computer); video conferencing; using the Internet to reach and service new customers, etc. In the United States, online trading over the Internet is expected to reach more than a trillion dollars over the next five years. New and emerging online business practice has become known as e-commerce. It stands to reason that for e-commerce to work, it will require ‘e-skills’.

E-skills include learning to use the Internet, though using the Internet alone is not sufficient to develop e-skills fully. It is important also to develop a range of thinking skills. E-skills must be developed on a solid platform of literacy and numeracy and through using a range of media in addition to that which is computer-based.

Generic skills
When combined with other thinking skills development, using the Internet develops problem solving, critical thinking, collaboration, communication and presentation skills. Much has been said about the Internet causing people to be isolated, but it can open up a wealth of communication channels between people, and has the potential to help develop a range of interpersonal skills.

Hypertext and new approaches to reading and writing
The kinds of reading and comprehension skills required in using the Internet are quite different to those required when reading printed material. For a start, a principle on which the Web works is the use of hypertext. This is text that, when clicked on, will cause a new piece of text to appear on the screen. Clicking hypertext can also cause a graphic to appear, or a video or sound clip to play.

Hypertext, then, can link the reader to a range of media objects. Unlike the printed word, a piece of writing which includes hypertext is non-linear. In other words, it has
no real beginning, middle or end because the reader can choose where to go next, and
where the reader chooses to go could be beyond the boundaries of the piece of text
being read.

Therefore, hypertext puts the burden on the reader to organise how the text is read.
For this reason, novices to the Web can find reading hypertext extremely difficult.
Also, evidence shows that hypertext makes searching for information less efficient
when the reader knows precisely what they want to find out.

Charles Deemer notes in What is Hypertext? that hypertext ‘is still read sequentially,
one word after the other. However, the order of the sequence is open to change.
Hypertext is continually asking us what we want to read next.’

This means that the reader has to impose their own structure on what they are
reading – a new skill that has to be taught and learned. Central to this is the child’s
ability to scan text and select key words.

The other key difference in reading from the Internet is the heavy use of graphics and,
most importantly, icons and symbols. The interpretation of what small graphical
symbols mean, and what they are likely to do if you click on them, is another key
skill that needs to be taught and learned.

Looking for information
With hundreds of Web sites being put onto the Internet every hour or so, finding
what you are looking for is a major task. Unless learners are first shown how to
structure a search, the amount of information they retrieve may overwhelm them.

Search facilities (search engines) on the Internet allow users to find sites by
categorising Web material. Search engines let users type in keywords, and when
information is found, lists of Web sites are returned for the user to browse through.

Yahoo is perhaps the best known search engine, but there are many more. Each search
engine has a different way of organising the information and links, and has a different
way in which the user can enter search terms. Key skills that need to be taught and
learned are:

• what search engines to use for different types of material
• how to use the full range of search functions
• how to frame questions to get the most out of search engines.

Selecting, evaluating and adapting material
Ideally, quality-assured information and resources would always be found on the
Internet. This is unfortunately not the case and skills in evaluating and using the
material found need to be developed.
Very often there are many sites dealing with the same issues and there are many ways to differentiate them:

- relevance of the material to the original research task
- credibility of the organisation whose site is being explored
- quality of the text
- quality of the graphics/multimedia
- depth of coverage
- links to other sites
- how easily contactable the owners of the site are.

**Editing material**

Once material – text, graphics and multimedia – is found on the Internet, it can be copied and pasted into a range of software tools. For example, text and graphics can be pasted into a word processor, DTP or presentation package for either paper- or screen-based presentation. Rows and columns of numbers can be pasted into a spreadsheet – in fact, Microsoft® Excel allows direct links to be made between spreadsheets across the Internet.

It is essential that children be taught that there is no value in simply copying someone else’s work and, in fact, it is often illegal to do so. They have to apply their own knowledge and skills to the material and represent their own thoughts, opinions and knowledge.

**Quoting sources**

When quoting anything found on the Internet, the identification of the primary author should be clearly retained during re-use. The person using the source should also question its validity, find and discuss opposing views to add weight to the argument.

**Internet driving licence**

This is something that pupils could work towards. For example, by completing a foundation level of Internet use, perhaps in Year 7, and signing (with their parents) an ‘Internet acceptable use agreement’ (see page 114), pupils can be given a licence to use the Internet freely. Any breach of the acceptable use agreement means that the licence receives penalty points, or is taken away for a fixed period or permanently.
Involving people

All the people who will be affected by the NGfL will have two basic needs:

• the need to understand the benefits of the system to them
• the requisite skills and knowledge to take advantage of the system.

Pupils

The reasoning behind the NGfL is to raise pupil achievement. In order for it to work, children need to be fully integrated into the process. They first need to be given the skills necessary to make use of the NGfL. They then need to be made aware of the benefits of working with it.

They also need to learn how to make contributions to the NGfL by publishing their own work and material.

Parents

The NGfL represents a major shift in the way in which learning takes place. There is inevitably going to be confusion about its impact on children.

Few parents will have experienced computers in their own schooling so they will need to be told about the full range of benefits that computer-aided learning offers. These are listed on pages 7 to 9 in How can the Internet benefit pupils? Parents will need to have the NGfL explained to them and the OHTs on pages 97 to 105 should help with this. They also need to be told of the benefits that the NGfL can deliver to them, and be encouraged to access it themselves.

Those who are without computers need to be told where they can obtain free or subsidised access.

All parents will need to be shown how to access the NGfL and make the best use of it. They will also need guidelines for supporting their children.

Teachers

Staff will need to be given the same information as parents. In addition to this, they will need to be shown how to integrate the relevant parts of the NGfL into their own schemes of work and how they can synchronise home- and school-based learning within their subjects.

There will be great opportunities for those teachers wishing to publish their own material within the NGfL. To start off with, teachers need to learn how to convert their word-processed documents into Web pages and how to publish these within the NGfL.
Governors

Governors will need to be informed on the following points:

Will the NGfL change the culture of the school?
Yes. The NGfL is a way of bringing other classrooms into the classroom and extending the boundaries of what, where and when pupils learn. It will inevitably change the school.

What are the financial implications?
For those schools that have not yet committed to an annual ICT budget, the NGfL brings added reason to start spending in this area.

For those schools that have an ICT budget, there may be a need to increase provision, depending on the extent to which the school wishes to take advantage of the learning opportunities that the NGfL offers pupils.

There is additional funding available from local and/or central government to support the development of ICT within the context of the NGfL.

What are the implications for staffing and recruitment?
The more access to computers the school makes available, the greater the need for a full-time network manager and/or network technician.

There will inevitably be continual increase in demand for ICT skills amongst teaching and support staff. This should be reflected in recruitment policy.

Contracts may need to be reviewed in light of the need to encourage teachers to publish (for payment) their work within the NGfL. Schools may wish to consider the possibility of asking for a percentage of any earnings to be channelled back in exchange for use of facilities, etc.

Communities

Events
Computer-based learning, the Internet and the NGfL are terrific technologies that deliver amazing learning experiences – so celebrate them! A big event can do an enormous amount to motivate and direct people. Any event should:

- show what children can learn
- display children’s work
- make clear the benefits of this type of approach over other methods
- give people the chance to see where their money (as taxpayers) is going
- demonstrate the full range of technologies
• allow people to try things out
• encourage people to invest in ICT for their children and themselves
• explain how they can get access to the NGfL and related services, training, software and equipment.

Courses
To most people, using the NGfL will require some training as well as the opportunity to try out services with guidance on-hand. Schools are well placed to offer NGfL access courses and revenue from this can be used to help support its deployment and development.

ICT beginners’ courses are a must for most communities. IT for All is a national campaign to bring those people who are furthest behind in terms of IT skills up to speed. IT for All advertise on local radio and in newspapers. Schools who have at least one suite of computers and people available to teach beginners’ courses are eligible to apply to become approved IT for All Training Centres. People responding to the advertisements are then given the names of the approved training centres in their area.

Before running courses for people other than their enrolled pupils, schools must make sure that they have adequate insurance cover.

Products and services
Many people will require guidance on what computer products and services they should use. Schools need to be careful about directly offering advice in this area as it leaves them open to litigation should the advice turn out to cause problems.

Schools should, however, consider offering products and services such as hardware, software, Internet and online services in partnership with third parties. If set up and managed carefully, revenue can be brought in without the school being liable financially, and without running the risk of being sued over bad advice.
Setting and meeting targets

Raising expectations

The whole point of bringing the NGfL on board is to raise achievement. In order to do this, the primary task is to raise expectations about a range of aspects of pupils’ work.

Quality of self-directed research

The amount of information that is put within easy reach will rise sharply once the school is connected to the NGfL. The quality of self-directed research ought to reflect this. The following types of improvements should be expected:

- increased range of sources
- increased depth
- larger range of views
- use of expert sources
- better explanations
- increased use of graphical and multimedia representation of data.

Quality of questioning

With so much information available, the quality of questioning used is of the greatest importance. As mentioned on page 64, the relevance of the material to the original research task and the credibility of the source need to be questioned. Also, a sense of who provides what type of information and why should be evident in the kinds of questions posed.

Quality of written English

It should be expected that the quality of pupils’ English should reflect that found on good and, if possible, quality-assured Web sites. The difference between American and UK English should be pointed out and pupils should be encouraged to avoid using US expressions and spelling.

Pupils should be given the opportunity to have their written work reviewed by their peers – both in their own school (through the school Intranet) and throughout the UK and abroad (through the school’s Web site).
Quality of presentation
When using a word processor, the presentation should reflect the following rules:

- a plain serif font such as Times New Roman is easiest to read
- a point size of between 8 and 12 points
- text to the left, pictures or illustrations to the right
- graphics should be bordered.

Word-processed work, presented on paper, is just one of a myriad of ways in which pupils can present their work. As the world of work becomes more and more computerised, the appropriateness of presenting assignments exclusively on paper should be questioned. Teachers should be encouraged to consider taking in work in electronic formats. For example, it is easier to convert a Microsoft® Word document into Web pages than a printed document.

There are several presentation packages that should also be considered, eg Microsoft® PowerPoint or HyperStudio. These enable pupils to construct computer-based or multimedia slideshow presentations and are excellent tools for presenting thoughts, ideas and explanations.

Setting successive short-term goals and targets
Another key to success is the setting of successive short-term goals and targets. These need to be clearly defined, clearly assigned and need to have deadlines.

Every school will have different goals and targets and these will be a function of the technical resources and skills available. Some examples follow (note that timescales such as ‘From term 1’ refer to goals set from the start of a NGfL project).

Pupil goals

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aim to make as much use of electronic media as possible throughout school</td>
<td>From Year 7</td>
<td>Use the World Wide Web and email at least once a week</td>
</tr>
<tr>
<td>Aim to build lists of as many Web site addresses and personal email contacts as possible throughout school</td>
<td>From Year 7</td>
<td>Add a new Web site address or email contact every week</td>
</tr>
<tr>
<td>Conduct research as part of classwork</td>
<td>From Year 7</td>
<td>Produce high-quality pieces of teacher-directed research</td>
</tr>
<tr>
<td>Establish an email link with a pupil living in a country whose language is being learned</td>
<td>From Year 8</td>
<td>Build a bank of email messages written and received in target language by the end of Year 8</td>
</tr>
</tbody>
</table>
## Goal

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publish a piece of work on the school Intranet</td>
<td>From Year 8</td>
<td>Put some Web pages on the internal school Web site by the end of Year 8</td>
</tr>
<tr>
<td>Extend email links to include ‘expert resources’</td>
<td>From Year 9</td>
<td>Get expert source email address for four subjects by the end of Year 9 and for each subject being studied by the end of the first term in Year 10</td>
</tr>
<tr>
<td>Publish a piece of work on the Internet</td>
<td>From Year 9</td>
<td>Put some Web pages onto the Internet by the end of Year 11</td>
</tr>
<tr>
<td>Conduct a piece of self-directed research</td>
<td>From Year 10</td>
<td>Produce high-quality self-directed research assignments where required for GCSE and A-level</td>
</tr>
<tr>
<td>Participate in a video conference</td>
<td>Whenever resources permit</td>
<td>Video conference at least once before the end of Year 9 and once again before the end of Year 11</td>
</tr>
<tr>
<td>Visit Web sites of prospective employers or future colleges or university</td>
<td>From Year 11</td>
<td>Build a detailed knowledge of, and establish email dialogue with, each target organisation</td>
</tr>
</tbody>
</table>

## Teacher goals

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
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</thead>
<tbody>
<tr>
<td>Create a set of worksheets using the Internet and/or the NGfL as a source</td>
<td>From term 1</td>
<td>Produce one set of worksheets every half term</td>
</tr>
<tr>
<td>Establish email contact with another teacher in another school and exchange lesson plans or worksheets</td>
<td>From term 2</td>
<td>Communicate with another teacher at least every half term</td>
</tr>
<tr>
<td>Build up email contacts</td>
<td>Ongoing</td>
<td>Add a new email contact every few weeks</td>
</tr>
<tr>
<td>Build up lists of Web sites and resources to bring into schemes of work</td>
<td>Ongoing</td>
<td>Add a new Web site address every few weeks</td>
</tr>
<tr>
<td>Participate in video conferencing</td>
<td>Whenever resources permit</td>
<td>First communicate with other teachers. Aim to take part in a broadcast lesson</td>
</tr>
</tbody>
</table>
### Department goals and targets

**All departments**

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learn how to create Web pages by using the ‘save as HTML’ functions in common applications</td>
<td>As soon as a suitable course becomes available</td>
<td>Convert worksheets, documents, etc into HTML and explore the possibilities for using hypertext in learning material</td>
</tr>
<tr>
<td>Publish personal Web pages</td>
<td>Once basic HTML skills are acquired</td>
<td>Build a personal Web site within one year</td>
</tr>
<tr>
<td>Put lesson plans, pupil tasks, supporting material and links to other sites into personal Web site and make accessible to pupils in own and other schools</td>
<td>Built up once HTML skills are acquired</td>
<td>Produce a high-quality Web site that attracts visits from outside the school within four terms</td>
</tr>
</tbody>
</table>

#### Goal Timescale Target

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure that subject schemes of work take full advantage of the possibilities offered by the Internet/NGfL</td>
<td>From term 1</td>
<td>Schemes of work clearly showing where online learning will take place and how learning will be managed within a term</td>
</tr>
<tr>
<td>Establish email contacts</td>
<td>From term 2</td>
<td>Within 12 months, a list of email contacts should include local advisor and departments in at least one other school</td>
</tr>
<tr>
<td>Explore possibilities for collaboration and exchanging schemes, lesson plans and material</td>
<td>Ongoing</td>
<td>Dialogue with another school should include project proposals</td>
</tr>
<tr>
<td>Find relevant mailing lists and subscribe to them</td>
<td>From term 2</td>
<td>Should be in receipt of a steady flow of useful information from external sources</td>
</tr>
<tr>
<td>Develop a departmental Web site containing schemes of work, lesson plans, links to supporting material and links to subject teachers’ Web sites</td>
<td>Term 3</td>
<td>Produce a Web site that is well used by pupils and teachers within and beyond the school</td>
</tr>
</tbody>
</table>
**English**

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorporate the teaching of reading and writing hypertext into schemes</td>
<td>From term 1</td>
<td>Ensure that children are skilled at reading and writing hypertext and that they are comfortable with, and able to exploit, the potential of the medium</td>
</tr>
<tr>
<td>Make use of numerous English Web sites</td>
<td>From term 1</td>
<td>Within one term, the use of specific sites are mapped against the scheme of work</td>
</tr>
<tr>
<td>Pupils to explore the principal methods of communicating on the Internet</td>
<td>From term 2</td>
<td>Pupils progressively use email, lists, and newsgroups as communication tools over the course of a year</td>
</tr>
<tr>
<td>Pupils to write their own Web pages</td>
<td>From term 3</td>
<td>Pupils produce creative writing about themselves for an Internet audience within two years</td>
</tr>
</tbody>
</table>

**Maths**

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use online interactive maths Web sites such as MathsNet</td>
<td>From term 1</td>
<td>Pupils use Web-based resources to increase understanding and build skills. They also build up a list of maths Web sites</td>
</tr>
<tr>
<td>Pupils participate in Internet-based international mathematics competitions</td>
<td>From term 2</td>
<td>By the end of KS3, teams from each year group will have participated in an Internet-based competition</td>
</tr>
<tr>
<td>Set up communications with other schools to work on maths challenges and quizzes</td>
<td>From term 3</td>
<td>Pupils collaborating with pupils in other schools to solve maths problems within a year</td>
</tr>
<tr>
<td>Set a maths challenge for pupils in other schools using the Internet</td>
<td>From term 4</td>
<td>Pupils from other schools participate in a maths challenge set by pupils and staff</td>
</tr>
</tbody>
</table>
## Science

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore science Web sites including <em>The Scientist</em>, NASA and Virtual Man</td>
<td>From term 1</td>
<td>Pupils build a list of good science Web sites</td>
</tr>
<tr>
<td>Follow an ongoing online observation such as weather or pollution</td>
<td>From term 2</td>
<td>Pupils develop an awareness of science from a global perspective</td>
</tr>
<tr>
<td>Follow a major scientific survey on the Web as it happens</td>
<td>From term 3</td>
<td>Pupils gain an insight into a significant scientific experiment</td>
</tr>
<tr>
<td>Participate in an online collaborative project, eg taking and comparing soil, water or air samples or weather data</td>
<td>From term 4</td>
<td>Pupils extend their global scientific perspective and list of contacts in other schools</td>
</tr>
</tbody>
</table>

## Modern foreign languages

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupils to visit Web sites such as target language newspapers, tourist information, etc</td>
<td>Before the end of Year 7</td>
<td>Pupils build up a list of useful modern foreign languages related sites</td>
</tr>
<tr>
<td>Department subscribes to a mailing list of an organisation such as KidLink to help pupils find key pals</td>
<td>From term 1</td>
<td>Regular bulletins containing offers of email exchanges between pupils</td>
</tr>
<tr>
<td>Pupils to develop email correspondence with pupils abroad</td>
<td>By the end of Year 7</td>
<td>At least one key pal per pupil in a country where the target language is spoken</td>
</tr>
<tr>
<td>Department to organise the use of video conferencing to optimal effect</td>
<td>Whenever resources are available</td>
<td>Pupils should see video conferencing used often and participate in a video conference at least once before the end of Year 9 and once again before the end of Year 11</td>
</tr>
<tr>
<td>Make some use of online translation</td>
<td>By the end of Key Stage 3</td>
<td>Pupils should, by the end of KS3, have seen and used online translation</td>
</tr>
</tbody>
</table>
### ICT

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure that pupils have core ICT skills necessary for taking advantage of online learning</td>
<td>By the end of Key Stage 3</td>
<td>Pupils will be within the range 3 to 7 in the ICT NC. They will know how to use a browser, copy and paste, send and receive email</td>
</tr>
<tr>
<td>Pupils understand how to use the Internet</td>
<td>By end of Year 8</td>
<td>Pupils will know how to use a browser, copy and paste, send and receive email</td>
</tr>
<tr>
<td>Pupils develop a responsible attitude to using the Internet</td>
<td>By the end of Key Stage 3</td>
<td>Pupils demonstrate responsibility when using the Internet</td>
</tr>
<tr>
<td>Pupils develop a growing awareness of how to find what they need on the Internet</td>
<td>By the end of Key Stage 3</td>
<td>Pupils demonstrate a growing ability to ‘zoom in’ on specific resources, depending on the task in hand</td>
</tr>
<tr>
<td>All pupils take internal and/or externally accredited certificate of ICT competence</td>
<td>By the end of Key Stage 3</td>
<td>All pupils to get a certificate acknowledging their achievements in KS3 ICT</td>
</tr>
<tr>
<td>All pupils to take a minimum of a GCSE short course</td>
<td>By the end of Key Stage 4</td>
<td>All pupils to achieve a C grade or above</td>
</tr>
</tbody>
</table>

### Design and technology

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore relevant Web sites</td>
<td>From term 1</td>
<td>Pupils build a list of useful design and technology Web sites</td>
</tr>
<tr>
<td>Conduct research for a design project using expert sources</td>
<td>From term 2</td>
<td>Pupils build up a list of contacts</td>
</tr>
<tr>
<td>Participate in a collaborative design and make project with another school or company</td>
<td>From term 3</td>
<td>Over the course of a half term, pupils manufacture something designed somewhere else and design something that is then made somewhere else</td>
</tr>
</tbody>
</table>


**Humanities, arts and music**

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>All departments to make appropriate use of the World Wide Web</td>
<td>From term 1</td>
<td>Pupils to have visited all the major humanities Web sites before the end of KS3, and built up lists of useful site addresses</td>
</tr>
<tr>
<td>Develop an awareness of the world’s cultural heritage</td>
<td>By the end of KS3</td>
<td>Pupils to have visited the key art galleries and museums</td>
</tr>
<tr>
<td>Develop a sense of the Internet as a gallery for all users</td>
<td>By the end of KS3</td>
<td>Pupils to post their own work on an online gallery</td>
</tr>
<tr>
<td>Develop an awareness of the possibilities for making music over the Internet</td>
<td>By the end of KS3</td>
<td>Pupils to have uploaded and downloaded sounds and midi files over the Internet</td>
</tr>
</tbody>
</table>

**Management goals**

<table>
<thead>
<tr>
<th>Goal</th>
<th>Timescale</th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decide who is going to teach the e-skills required by pupils, and assign responsibilities</td>
<td>Term 1</td>
<td>Departments and teachers responsible for teaching e-skills understand what to do</td>
</tr>
<tr>
<td>Decide how to monitor and develop an e-skills programme</td>
<td>Term 1</td>
<td>Monitoring and development of e-skills programme clearly set out, understood by all involved, and implemented</td>
</tr>
<tr>
<td>Develop a set of priorities for making resources available</td>
<td>Term 1</td>
<td>Where resources are shared, department heads understand what they can expect to receive and when</td>
</tr>
</tbody>
</table>

**Monitoring**

The person responsible for monitoring, in the first instance, needs to be the ICT coordinator, supported by the SMT. This person firstly needs to:

- make clear what is expected from departments, teachers and pupils
- show concrete examples of what is expected
- negotiate goals, targets and timeframes
- ensure that resource provision and training is adequate.
Once the project is up and running, they will need to:

- look at schemes of work
- look at what pupils are producing
- look at wall displays.

Where support for meeting the targets is required, they will need to:

- ensure that the tasks are clearly understood – perhaps by showing additional or different concrete examples of well developed schemes, good-quality pupil work and displays
- review resource provision and make adjustments if required
- review the need for training or informal technical or classroom management support and organise support.

It would be useful to know whether online learning is helping to raise standards in each subject. In order to do this, the specific requirements of the National Curriculum should be looked at in terms of online learning opportunities. For example, the design and technology National Curriculum states that to attain a Level 4 in AT1, one of the things that pupils have to do is show that when they are ‘designing and making, pupils gather information independently, and use it to help generate a number of ideas’. Clearly, using the Web is going to help pupils hit this target.

Across the curriculum, there should be a clear picture of:

- where the opportunities for raising achievement lie
- where these opportunities are being realised
- where they are not being realised
- what can be done to raise achievement further still.

Crucially, this will help to illustrate the value of online learning and give clear direction and guidance for planning.

To do this, it would help to have a copy of each subject’s National Curriculum requirements, and to map the opportunities for online learning against these. This could then be cross-referenced with individual departments’ schemes of work.

**Evaluation of progress**

One way to measure performance and development is to profile departments, teachers and pupils (see pages 106 to 113). Each profile should be completed and reviewed once a year. Data generated by these profiles can be used both to find and highlight strengths and to identify where action needs to be taken.
Adapting administrative procedures

The whole school development plan

Any major initiative in a school will only work if it has the support of all the key 
stake-holders. There must be full backing from the headteacher and governors but, if 
the implementation is to be successful, pupils, parents and all staff must gain some 
ownership of the development planning process. Once the strategic objectives have 
been approved, development planning needs to be a cyclical process, where the 
individual targets of departments and teachers feed into the whole school plan. This 
creates further goals for the whole school, in turn creating the foundation for the next 
set of individual targets and goals.

In order for the radical change to ICT-based learning to have credibility, the whole 
school must drive to create a digital community. This means a shift in the way a 
development plan itself is prepared. Gone should be the days of paper moving round 
the school with endless redrafting. All input should be completed electronically, and 
placed on a Web site. Documents should be seen as ‘live’ and constantly evolving.

Bringing the NGfL into departmental plans

Subject teachers must first grasp the two-fold purpose of using ICT: to improve their 
subject methodology and to improve pupils’ core skills. Both must be seen as of 
parallel importance.

They must then incorporate short-term, achievable targets into a long-term vision. 
Again, all teachers must share in the vision and the process of the development plan. 
The NGfL will change the way we teach; pupils will come to expect the same 
facilities in all lessons; access to the Internet will be no longer be restricted to an 
enthusiastic few.

Further details and examples are given in Setting and meeting targets, pages 68 
to 76.

Handling incoming email

In addition to individual pupils and members of staff requiring email addresses, the 
school itself will need one. Many schools now include their email address (and Web 
site address) as part of their normal contact details, on the school headed notepaper 
and in job advertisements. If an email message is sent to the school, someone needs to 
take responsibility for reading it and ensuring that the right person deals with it. 
Considering confidentiality issues, the person best placed for doing this is probably 
the secretary to the headteacher.
Keeping Web site and Intranet information up to date

Worse than not having a school Web site at all is having one that contains old information. It is crucial that the school Web site and the Intranet are kept up to date and do not contradict one another.

One approach to this is to train one or more members of the office staff to edit these sites. They will need to be able to take information from the daily, weekly, termly bulletin, school calendar and news items, convert them into HTML and weave these items into the Intranet or Web site. This should be done every day. Bulletin items should be put in at the end of school the day before they are needed, and news items should be added throughout the day, as and when information and resources become available.

Whilst this may seem like a costly exercise, the approach described here could end up saving money if managed properly. For example, there could be serious savings on paper and the duplication of tasks.

Pupils could also be asked to help do this, but should not be relied upon to provide a continuous professional administrative function.

Setting up an Intranet for internal communications

Setting up a school-based Intranet can make commercial and school-produced resources available to pupils of all abilities, where and when they are needed.

Developing an Intranet is not in itself a major undertaking. Maintaining an Intranet and keeping it up to date is a different matter however and, like maintaining the Web site, needs careful management.

What is needed is the establishment of a culture of Web-based publishing. If a Web browser is available on every desktop, all that is needed is an area on a server which everyone has access to containing the Web site files. An Intranet package, such as Lotus Intranet, or Web server software can make the organisation, upkeep and maintenance of the site that much easier.
Beyond the NGfL – the local grid for learning

One of the key concepts behind the National Grid for Learning is that it connects learning resources and people across the country. There are three levels at which the NGfL needs to operate – national, community and local.

Staffordshire Learning Net (http://www.sln.org.uk/) is a good example of a LEA community grid for learning. Also, the Hampshire Training and Enterprise Council run an embryonic community grid for learning site for the county at http://www.hantslin.org.uk/.

Schools are well placed to become the focus for community grids for learning. The Highdown Information Hub in Reading (http://www.highdown.berks.sch.uk/) is a community grid for learning based in a school. It connects a range of local learning resources and makes them available from home or at school. The Highdown Information Hub is discussed in detail in the complementary publication, Fresh Approaches to Funding ICT, published by Pearson Publishing.

Before becoming a grid for learning for the wider community, schools need to set up their network to meet the needs of the immediate school community, starting with the pupils. A specification for such a local grid for learning is given below.

Principles

There are three underlying principles that should guide the development of a local grid for learning:

- The purpose of developing a LGfL is to improve pupil learning.
- Eventually, a LGfL has to become self-financing.
- A LGfL must enable teachers to be more productive.

Content

Structured learning

This is delivered through the elements in the following hierarchy:

Schemes of work

These detail the work to be covered in the courses across the curriculum. Most schools will already have these in digital format if schemes have been word-processed.

Courses

A string of lessons leading to an assessment.
Lessons

These comprise the following elements:

• tutorials
• tasks
• assignments
• tests
• assessments.

Library

The function of the library is to provide information that pupils need to complete assignments and tasks.

The library will contain a mixture of Web pages downloaded from the Internet, pupil-generated material, teacher-generated material and published material.

NGfL

It is probable that the National Grid for Learning will provide a range of material, assignments and access to learning support.

Shopfronts

Pupils (and teachers) will have home pages. The content will be determined by the pupils, who will be expected to show their best work. All pages will be moderated for decency and legality by teaching staff.

Access

Pupils

Pupils are taught with the aid of computer-based learning.

They are given access to a set of productivity tools, an online library and the NGfL. This provision will vary depending on the tasks and assignments set.

When pupils have completed work, they are able to store and display it in their own site which has a shopfront (home pages) for displaying their best work.

To make the system attractive for home use, and to encourage the use of online time, chat areas should be made available.

Subject teacher

The subject teacher uses an electronic markbook. This feeds into a central pupil database that retains the marks and comments fed in by the teacher.
Teachers feed material into a courses section in the database. These become shared repositories of learning material, tasks, assignments, tests and assessments. The teacher will need to know how to use the ‘save as HTML’ functions in their software in order for them to produce Web pages, from which the pupils can learn.

Teachers should also be able to access an online library, the NGfL and have free and open access to the Internet. Like pupils, teachers will be able to have their own site and shopfront.

The subject teacher should be able to obtain a full pupil profile of any of their pupils. Personal details, information about their academic development, achievement, behavioural issues, special educational needs and primary school histories should all be accessible from individual pupil profiles. Teachers should be able to input free text into the profiles.

Tracking tools will enable the teacher to determine the progress that a pupil is making across the entire range of the pupil’s formal learning and extra-curricular activities. The teacher will also need to see what progress is being made by the pupil against targets agreed between the teacher, pupil and parents.

The subject teacher should be given an opportunity to enhance their income through contributing to this system, as it will be available for the use of others on the NGfL.

**Form tutor**

The form tutor will have access to the same tools and information as the subject teacher with access to additional confidential information (such as problems at home, special illnesses, etc) that may be flagged as being restricted personal data.

**Parents**

Parents will have access (from home, the school site or local library) to the pupil profile for their son or daughter. They will also have access to a tracking tool that enables them to evaluate for themselves where their child is in relation to National Curriculum targets.

Parents will also have access to shopfronts, performance tables, and other data that enable them to compare the progress of their child with that of others. It should not be possible for them to make comparisons with named individuals.

Parents should be able to communicate electronically with individual teachers and other parents.

They should be able to comment on the school’s performance, suggest improvements and contribute learning material. This would be enabled through email, newsgroups and chat areas.
At first, parents should be able to access the school’s Web site. They should then be able to access local information, advertisements and electronic equivalents of the local newspapers via the school’s Web site. Eventually, the school could become the channel through which parents get their Internet access. Schools are well placed to act as Internet service provider in the community because the speed of Internet access is mostly about proximity to servers and lines. A school in Canterbury is currently doing this and a school in California is making enough money every month to be able to employ extra staff. However, there are an increasing number of free Internet services, so schools will have to find additional online services to draw revenue from its Internet services.

Parents logging onto a school-based LGfL should be provided with:

- data about their children
- a communication link with the school
- school information – news, bulletins, calendars, etc
- online learning – NGfL
- local information.

 Depending on circumstance, location and parents’ attitudes, a small charge could be built into the service in order to fund its startup costs and continued development.

**Potential employers/FE/HE**

Pupils’ shopfronts will be made available to potential employers, FE and HE establishments at a small cost.

**Local advertisers**

Revenue could be generated from allowing advertisements to appear on the school Web site.

**Management**

Teachers must be able to manage the learning aspects of the system. They should be able to do the following:

- set academic targets for individual pupils (based on National Curriculum requirements)
- set tasks and assignments
- review progress
- maintain courses (through user lists, etc)
- develop content
- obtain a revenue from contributing to material used outside the school.
Tools

Pupils and teachers will have access to HTML authoring tools. To start with, these could be the Microsoft® Internet assistants for the Microsoft® Office suite.

Tracking

Being able to track progress or a decline in performance would be a major asset to any teacher or parent. The current paper-based systems show problems after they have occurred and are inefficient in determining the causes of problems. Were a computer-based tracking system to be developed sufficiently, it could have the advantage of showing problems as they occur and could enable teachers and parents to pinpoint problems immediately.

A tracking system needs to enable teachers and parents to see:

- progress toward pre-defined National Curriculum targets expected for the given age range, as defined by SCAA
- progress towards negotiated National Curriculum targets for those exceeding or falling behind expected levels
- progress towards behavioural targets set by tutors and subject teachers
- progress towards targets dealing with special learning needs
- progress towards targets relating to extra-curricular activities.

Reporting

Reporting operates within the following hierarchy:

Access to pupil profiles ensures that pupils, parents and teachers get live data showing a range of indicators and comments.

Progress checks provide frequent summaries of progress and effort for each subject and are reported to parents at parent consultation evenings.

Interim reports are given for each subject area and outline progress against given criteria. They are used to communicate performance data, and details of targets, tasks, tests and assignments against which performance is measured.

End of year reports summarise performance and progress towards targets at the end of the academic year. They enable new targets to be set for the next academic year.

Individual subject areas can issue individual end of course reports and certificates as required.
Security

Pupils

Pupils can view:

- their profile in the pupil database
- their performance against that of others.

Pupils can write to:

- their own user area (account or site) from school or home
- their individual shopfront
- school internal Web site (moderated).

Pupils have access (from home or school) to:

- courses
- NGfL
- productivity tools
- library
- email
- pupil special interest newsgroups
- an online magazine
- school internal Web site
- staff and pupil shopfronts
- chat areas.

They cannot:

- write to the pupil database
- see other pupils’ individual profiles
- send messages to other pupils’ parents.

Teachers

Subject teachers can view everything on the system apart from restricted personal data.

Form teachers can view restricted personal data only for those pupils in their care.

Teachers can write to:

- courses
- pupil database
- individual pupil profiles
- their own user area (account or site)
- their individual shopfront
- school internal Web site (moderated).
Teachers have access to:

- productivity tools, content development tools
- NGfL
- library
- email
- teachers’ special interest newsgroups
- online magazine
- school internal Web site
- staff and pupil shopfronts.

Teachers can:

- assign tasks
- assign targets
- add course material
- remove course material
- edit course material
- review activity and performance
- edit user details
- issue reports
- delete or add files in pupil sites.

**System summary**

- Schemes of work
- Detailed lesson plans
- Learning material
- NGfL
- Statement banks
- Tests
- Assessments
- Summative data
- Pupil profiles
- Reports
- Digital images of work, events, etc
- Web browser
- The pupil database (at the core of the system)
- Individual teacher markbooks which are used as the primary inputting tool
- Courses – structured learning packages containing lessons, tutorials, tasks, assignments, tests and assessments
• Progress tracking tools
• Productivity tools (eg Microsoft® Office)
• Content development tools (eg Microsoft® FrontPage, Asymetrix ToolBook, Adobe PageMill)
• Email
• Newsgroups

Hardware
Whilst notebooks for the entire school community would be the ultimate aim, a realistic goal would be to have a mix of computers – PDAs, notebooks and desktop systems. Everyone in a LGfL needs to have access to a point into which they can plug their computer, be it a telephone line or data point on a LAN.

For those who cannot afford a PC, open access – at school, and in other public places – should be given.

The backbone for a local grid for learning is a series of powerful servers, connected by the highest possible bandwidth cables.

Training
The need for 'absolute beginners' packages, especially in basic ICT, should not be underestimated.

Training for this suite of products needs to be delivered face to face – especially for the core components – and online through help files, tutorials and computer-based training (CBT).

Funding
The purchase, running and development of the system needs to be self-financing. There are a number of entry points for money to flow into the school through a local grid for learning:

• Some aspects of the local grid for learning should be sold on to the NGfL – especially those aspects that have a genuine value to others and are copyrighted to teachers or developers.
• Parents, and other members of the community, could be asked to pay for access to the system for their own learning.
• The school becomes an Internet service provider through the local grid for learning.
Example elements of a model local grid for learning
The future isn’t what it used to be

There is a long way to go before the NGfL is fully functional. For it to reach its potential, a massive amount of curriculum-specific content needs to be generated, indexed and made simple for teachers and learners to access and use. However, it is clear that the Internet is opening up a world of learning unimaginable a decade ago.

In 1992, in *Schools Out*, Lewis Perelman claimed that online learning – ‘hyperlearning’ – is not only radically transforming the world of learning but rendering schools as we know them redundant.

Most of those who strongly support the use of ICT in schools wouldn’t go as far as to suggest that computer-based technologies will replace schools. However, Perelman’s vision of ‘hyperlearning and the end of education’ as we know it is compelling and well worth a read.

Whether Perelman is right or not, schools, teachers, learners, parents and communities will all have to embrace connected thinking and connected learning in order to survive in the emerging networked world. The educators and educational organisations who will gain the most from the NGfL are:

- schools who become the focus for online learning in their communities
- teachers who can exploit the NGfL in the classroom
- teachers who can contribute to the content and development of the NGfL.

The Internet and the NGfL represent a paradigm shift in the learning process that will require an equally profound paradigm shift in the thinking of all those involved in education.
References and further information

Publications


*Being Digital*, Nicholas Negroponte, Hodder and Stoughton, 1995 especially p203


*Improve and feel no pain*, adapted from the *TES Management and Finance* section, by Kate Myers, May 15 1998.


Web addresses

Anglia Interactive Education – http://www.angliainteractive.com/

BBC Education – http://www.bbc.co.uk/education/

BEAM: Be A Mathematician – http://giraffe.rmplc.co.uk/eduweb/sites/beam/

BECTa – http://www.becta.org.uk/ncet-info/links/trendslinks.html

Biz/ed – http://bized.ac.uk/

Bodleian Library, University of Oxford – http://www.bodley.ox.ac.uk/

Busy Teachers’ WebSite K-12 – http://www.ceismc.gatech.edu/busyt/homepg.htm


Diversity University – http://www.du.org/

Education Online – http://www.edon.org.uk/

EduWeb – http://www.eduweb.co.uk/
The Global Schoolhouse Project – http://www.gsh.org/

The Highdown Information Hub – http://www.highdown.berks.sch.uk/

The Independent Schools Art and Design Association –
http://www.rmplc.co.uk/orgs/isada/index.html

The North Seattle Community College Virtual College – http://www.virtualcollege.org/

*The Scientist* – http://www.the-scientist.com/


The Standards Site – http://www.standards.dfee.gov.uk/

The Times Educational Supplement – http://www.tes.co.uk/


University of Kentucky College of Medicine, MRI map –
http://www.comed.uky.edu/body/mainbody.html

Virtual Teacher Centre – http://vtc.ngfl.gov.uk/

Yahoo – http://www.yahoo.co.uk/

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**Organisations**

**NGfL**

Not surprisingly, The National Grid for Learning has a Web page. This contains the ‘gateways’ described on page 16.

http://www.ngfl.gov.uk/

**BESA**

It is essential to deal with reputable companies when purchasing any ICT service. The British Education Suppliers Association is the trade association representing the educational supply industry. It has a code of practice to safeguard schools and its members are asked to sign up to this annually.

BESA has produced a buyers’ guide as part of the UK NetYear initiative. The guide gives practical advice to teachers and buyers on what kind of equipment you need to get your school online or, if already online, to develop a network. For a free copy telephone 0171 537 4997.

BESA

20 Beaufort Court
Admirals Way
London E14 9XL
DfEE: Department for Education and Employment
http://www.dfee.gov.uk/

UK NetYear
An initiative to match schools and LEAs with suppliers, sponsors and supporters. Since the launch of UK NetYear in January, over 8500 schools and over 100 education authorities have registered. UK NetYear will continue beyond 1998.

UK NetYear
Beaumont
Old Windsor
Berkshire
SL4 2JP
Tel: 01753 604082
Fax: 01753 604208
http://www.uknetyear.org/

BECTa
One of BECTa's key remits is to support the future development of the National Grid for Learning.
http://www.becta.org.uk/index.html

SCET
SCET's site has similar content to BECTa, but is for Scottish schools.
http://www.scet.org.uk/

DENI
Department for Education in Northern Ireland.
http://www.deni.gov.uk/index.htm

Northern Ireland Network for Education
http://www.nine.org.uk/
Suppliers

Akhter Computers Limited
Head Office
Akhter House
Perry Road
Harlow
Essex
CM18 7PN
Email: jennie@akhter.co.uk
http://www.akhter.co.uk/

ICL Education Systems
Ambassador House
Concorde Business Park
Theapwood Road
Wythenshawe
Manchester
M22 0NE
Tel: 0800 252674
Email: netyear@icles.com

Pearson Publishing
Chesterton Mill
French's Road
Cambridge
CB4 3NP
Tel: 01223 350555
Email: info@pearson.co.uk
http://www.pearson.co.uk/

Relay Business Systems
3 Riverside Court
Riverside Court
Bath
BA2 3DZ
Tel: 01225 484449
Email: marketing@relay.co.uk
http://www.relay.co.uk/
Research Machines plc
New Mill House
183 Milton Park
Abingdon
Oxon
OX14 4SE
Tel: 01235 826868
Email: salesdesk@rmplc.net

Xemplar Education Ltd
The Quorum
Barnwell Road
Cambridge
CB5 8RE
Tel: 01223 724724
Email: netyear@xemplar.co.uk
http://www.xemplar.co.uk/

Advisory services

National Association of Advisors for Computers in Education (NAACE)
PO Box 60
Tipton
West Midlands
DY4 OYS
Tel: 0121 530 9732
Email: mikesmith@rmplc.co.uk

Sparrowhawk & Heald
Midsummer Studio
5 Kimberley Road
Cambridge
CB4 1HG
Tel: 01223 576241
E-mail: info@s-and-h.co.uk
http://www.s-and-h.co.uk/
The Advisory Unit: Computers in Education
126 Great North Road
Hatfield
Herts
AL9 5JZ
Tel: 01707 266 714
http://www.advisory-unit.org.uk/

The IT Learning Exchange
School of Education
University of North London
166 Holloway Road
London N7 8DB
Tel: 0171 753 5092
http://www.unl.ac.uk/itle/
## Index to forms and OHTs

<table>
<thead>
<tr>
<th>OHT</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>OHT 1</td>
<td>What is the National Grid for Learning?</td>
<td>97</td>
</tr>
<tr>
<td>OHT 2</td>
<td>What the Government will do</td>
<td>98</td>
</tr>
<tr>
<td>OHT 3</td>
<td>Funding</td>
<td>99</td>
</tr>
<tr>
<td>OHT 4</td>
<td>The Internet in class: Developing skills</td>
<td>100</td>
</tr>
<tr>
<td>OHT 5</td>
<td>The Internet in class: Building knowledge</td>
<td>101</td>
</tr>
<tr>
<td>OHT 6</td>
<td>Net benefits summary</td>
<td>102</td>
</tr>
<tr>
<td>OHT 7</td>
<td>The NGfL project</td>
<td>103</td>
</tr>
<tr>
<td>OHT 8</td>
<td>Goals</td>
<td>104</td>
</tr>
<tr>
<td>OHT 9</td>
<td>Potential partners</td>
<td>105</td>
</tr>
<tr>
<td>Form 1</td>
<td>Departmental NGfL profile</td>
<td>106</td>
</tr>
<tr>
<td>Form 2</td>
<td>Teacher NGfL profile</td>
<td>109</td>
</tr>
<tr>
<td>Form 3</td>
<td>Pupil NGfL profile</td>
<td>111</td>
</tr>
<tr>
<td>Form 4</td>
<td>Acceptable Internet use agreement</td>
<td>114</td>
</tr>
</tbody>
</table>
What is the National Grid for Learning?

• The National Grid for Learning is about using the Internet to improve learning across the whole curriculum.

• The central vision is an ‘interconnected network supporting teaching, learning, training and administration’.

• The NGfL is not complete yet but schools can begin to take advantage of what the NGfL offers by connecting to and making the best use of the Internet.
What the Government will do

• By 1999, free email addresses.
• All UK educational establishments connected to the NGfL by 2002.
• All teachers to receive training in the use of ICT.
• ICT a mandatory part of initial teacher training by 1999.

The Government has facilitated:

• Funding from central Government, local authorities and business.
• Online learning resources – some free, others available by subscription.
• A prototype NGfL ‘gateway’.
• Lottery money for teacher training.
• NetYear – a Government/private sector partnership.
Funding

- £700 million to support the NGfL up to 2002.

- Half to be provided by central Government, the remainder matched by local authorities.

- This is a very small amount when divided between all the schools in the country.

- Each teacher will have around £400 for training.

- 10 000 notebook PCs will be provided to teachers.

- LEA schools will apply to a standards fund for funding NGfL projects.

- GM schools will apply to Funding Agency for Schools.
The Internet in class: Developing skills

- Information processing and research
- Communication skills
- International collaboration
- Learning to learn
- Interaction with technology
- Developing literacy and extending vocabulary
- Conversational, social skills
- Lateral thinking
- Cross-curricular and cross-topic connections
The Internet in class: Building knowledge

- Provides opportunities to locate and adapt materials for use in learning tasks.
- Provides personalised answers to pupils’ own questions.
- Pupils can access online learning materials.
- Pupils can also access up-to-date international information from sources such as newspapers or stock exchanges.
- Enables pupils to pursue their own inquiries, possibly through direct access to experts and native speakers.
- Develops a geographical awareness.
- Develops an awareness of organisations, governments and businesses.
Net benefits summary

- Online libraries
- Resource repository
- Shared lessons
- Collaborative learning
- Distance learning
- Home–school synchronisation

The National Grid for Learning ought to:

- Bring some order to the growing repository of information on the Internet.
- Bring relevant and quality material into the reach of pupils.
- Facilitate communication between users.
The NGfL project

The development process will:

- Change the way in which pupils learn.
- Change working practice.
- Feature the development of people.
Goals

• Pupils do more learning
• Pupils build up a range of ‘e-skills’
• Integration of ICT across the curriculum
• A local grid for learning
• School as open learning centre
• Raising examination results
• Raising standards of literacy
• Improving language skills
• Synchronisation between home and school learning
• Towards paperless administration
Potential partners

- Other secondary schools
- FE/HE
- Community groups
- Training and Enterprise Councils
- Initial teacher training providers
- Businesses
- Local organisations
- Primary feeder schools
Departmental NGfL profile

Department: ........................................................................
Date: ....................................................................................

Online learning opportunity – from NC and scheme of work

Opportunity met:

Yes ☐ No ☐

Reason – if ‘No’

_indicator – if ‘Yes’
<table>
<thead>
<tr>
<th>Resource needs</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Teacher NGfL skills profile

Name: .................................................................  Department: .................................................................

Date: ........................................................................

Understanding of online learning opportunities

Demonstrable e-skills

Willing to share following skills

E-skill development needs
Examples of using the Web for research or worksheets

Examples of using the Web with class

Using email? If so, what for?

Email address

Examples of using email with class

Action
Pupil NGfL profile

Name: ................................................................. Form: .................................................................
Date: ....................................................................

E-skills list

Main Web sites visited (list against subject area and teacher)

Number of Web site addresses recorded

Main email contacts
Key pals and language spoken

Teacher-directed research project

Self-directed research project

Published work on the Intranet/Internet
Personal Web page

Action plan
Dear Parent

Your child will soon be making use of the school’s Internet system. The purpose of this is to set up links with pupils around the world and to explore the World Wide Web.

Your child will have the opportunity to correspond by email with other pupils at home or abroad. This means that they will be acting as an ambassador for the school. Consequently, it is important that certain standards are maintained.

Any mail that your child sends must not contain material which could cause offence, either to any person in this country or in the country to which they are sending it. In essence, this means that they would not be embarrassed if this email were to be read by their teacher or by yourself. We also ask that if your child receives any offensive mail, they report it so that appropriate action can be taken.

Equally, when using the World Wide Web, certain conditions apply. Your child should not visit or attempt to visit any site which could be considered offensive. Again, the yardstick is whether their teacher and yourself would approve of the material they are viewing. The Internet service provider we use filters very carefully which sites pupils can visit. However, they cannot offer a guarantee that all offensive sites have been blocked, due to the nature of the Internet.

We also closely monitor both email and Web access.

May I make it clear that we do not think that your child is likely to break any of the rules, but we feel it is important that you stress to your child the importance of not abusing the trust placed in them.

I therefore ask that you sign the following statement to show that you are aware of your child’s involvement in using the school’s Internet system, and that you have reinforced our views. We further ask that your child signs the statement below to say that they will abide by the conditions for Internet use.

In the event of any breach of these conditions, access to the Internet will be withdrawn and the matter will be referred to higher authorities.

Yours sincerely

Network Manager

Pupil’s name:..............................................................

I am aware that my child has been given access to the Internet and I have reinforced the views contained in this letter.

Parent signature:............................................................

Given access to the Internet, I agree to abide by the school’s rules.

Pupil signature:............................................................................
## Contents

Introduction......................................................................................................................1
What is the National Grid for Learning? .................................................................4
Harnessing the Internet ...............................................................................................7
Key Internet technologies .........................................................................................13
Views of the Grid........................................................................................................16
Curriculum matters.....................................................................................................18
Access issues ..............................................................................................................27
The development process .........................................................................................42
Technical development.............................................................................................48
Financial options ........................................................................................................52
Staffing issues .............................................................................................................55
Approaching new pedagogies ....................................................................................59
Involving people .........................................................................................................65
Setting and meeting targets .......................................................................................68
Adapting administrative procedures..........................................................................77
Beyond the NGfL – the local grid for learning.......................................................79
The future isn’t what it used to be .........................................................................88
References and further information .........................................................................89
Forms and OHTs ..........................................................................................................96