EENet

How
learning is
changing:

information and communications
technology
across Europe

ICT in education policy

European Experts' Network for Educational Technology

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The European Experts' Network for Educational Technology (EENet) was established in January 1997, by representatives of organisations from 12 EU Member States and one EFTA country. EENet's mission is:

to spread knowledge about multimedia and ICTs in education in order to promote individual growth and European co-operation, and develop competitiveness.

The foundations for this report lie in individual country reports, all written to a common structure by members of EENet.

An electronic version of this report and the individual country reports are available at:
http://www.becta.org.uk/EENet

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Section 1   *Introduction*

Over the past twenty years, one can detect three stages of policy development in the adoption of information and communications technology (ICT) in primary and general secondary education within Europe.

Stage 1 saw the first computers in some schools, mainly in northern Europe in the late 1970s and early 1980s – often with the aim of teaching computing as a subject. There was little thought, planning or regard for integration across the wider curriculum. Financial investment during this phase was considerable within pioneer countries but frequently lessons learned and benefits to the learner were few and far between.

The experiences from that period demonstrated that new strategies were needed for taking ICT tools out into the schools.

Stage 2 saw the arrival of multimedia computers and their new position as a learning resource within the curriculum. Pilot projects in most countries provided early funding for the nascent educational software industry and allowed large commercial producers to see the potential of products and services for the education market. Educational software in appropriate European languages format was (and remains) a major issue of concern for many countries, however.

Now, at stage 3, all European countries are declaring as a key objective the connecting of computers locally within schools and classrooms and linking those up to regional, national and international networks via the Internet. Schools, libraries, museums, central/regional governments, and commercial companies are increasingly seen as part of this educational network.

> " ...large investments were made in computer technology. Hardware and software to the value of 120 million ECU were pushed into schools... the effects of that era and the investments were minor." **Sweden report**

This is a highly complex and challenging objective and this series of reports (*How learning is changing: information and communications technology across Europe*) from The European Experts' Network for Educational Technology (EENet) will attempt to chart progress towards this goal and show what the implications are for the process of teaching and learning across Europe.

The series aims to:

- highlight main issues of ICT policy and its implementation

- disseminate effective implementation strategies and show barriers to progress

- provide a critical overview of the challenges and implications confronting the development of ICT in education within Europe

- where there is evidence, show the effects of introducing new digital technologies into education on learning and its organisation.

This first report, *ICT in Education Policy*, is a starting point and an analysis of the policies and actions designed to implement new technologies in education systems (mainly at school level) in countries across Europe. It builds upon previous European documentation within this area, including the European Commission 1993 *New Information Technologies in the Education Systems of EC Member States Synthesis* report and the 1996 *Educational Software and Multimedia Task Force* report and country reports.

It reflects the fact that, in this area, many countries are just at the start of a very long and challenging road ahead, but it is intended to make that path somewhat easier by distilling the wisdom from what others have learned and sharing the results.
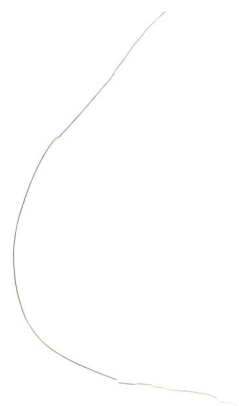
Policy making

The profile of ICT in education is being raised throughout Europe at both national and European level. There is an increasing awareness among politicians of the need to give more prominence and in some cases resources to ICT. There is an expectation from a number of countries that investing in new digital technologies in education may bring significant social and economic implications and consequently policy sometimes originates from the highest political level, resulting in strong government support and commitment.

"The main lines for the development of information and communication technologies have been subjected these last months to interventions from the Prime Minister and the Ministry of Education, showing a strong government willpower." **France report**

In many European countries, ICT in education policies comes from central government ministries of education, while in others where there is more regional autonomy, the role of central government is to provide guidance and advice. In some instances, the policy-making process is fully devolved to regional state authorities, as is the case with the German federal states.

The implementation of policies usually relies on three mechanisms:

- legislation
- funding incentives
- information.

Legislation

The use of legislation and regulations is still important as a basic strategic instrument in some countries, but it is widely recognised amongst de-centralised systems that this must be only the starting point – providing a framework on which to build, rather than a strict directive.

"A letter constituting an order is no longer the way to get things done under the new decentralised policy." **Finland report**

"ICT cannot be imposed by decree" **Austria report**

Funding incentives

Often, whereas the responsibility for overall policy development may rest with central government, the means of making that a reality through funding and administration of specific parts of the school system are devolved to local or regional authorities or communities. Where priorities for school management are decided locally, it is harder for central government to use funding as a direct lever to drive through change on a national scale.

Information

Seminars, conferences and the publication of case studies, good practice guides and support materials (in hard copy and electronically) are increasingly being used to help implement policy change in this area. The intention is to support decision makers at local, regional and institutional level to implement ICT effectively within a school, based upon impartial advice and information.

Policy documents

Most European countries have recently produced key policy documents relating to ICT in education which incorporate elements of the three mechanisms described above. A full list of these can be found in the Appendix. In many cases these provide a statement of intent and can form a sound basis for further consultation and debate, giving impetus to the formation of specific planning groups and working parties to establish national policies relating to ICT. The role of these groups is to define and refine aims for ICT in schools and to report on current progress through a process of ongoing consultation. Some also articulate a vision of how the learning environment and curriculum might change.

"Although local politicians in principle are given much more room and responsibility for the school system, they are struggling to set a local political agenda for school issues beyond questions of school buildings and budgeting." **France report**

An analysis of policy documents such as the above leads one to conclude that for the implementation of ICT in education to start from a solid base, those documents should:

- articulate the vision – state where these policies should lead
- provide evidence – show how learning for all can be improved
- point the way – provide guidance on overall direction and appropriate stages
- define targets – state ways in which progress and outcomes may be measured
- define scope – identify people, sectors and organisations that need to co-operate.

Strategy documents and the processes behind them are important, although their mere existence is insufficient to bring about the sort of change to which most countries aspire.

Policy objectives

A careful look at these policy documents reveals that there are three main drivers underpinning thinking in this area: educational imperatives, social concerns and economic competitiveness. They are expressed separately here for analysis, but in reality are often to be found mixed together.

Educational imperatives

This strand of thinking stresses the need to raise educational standards by the introduction of ICT into schools and locates the curriculum as an important focus underpinned by teacher training.

"The National Grid for Learning (NGfL) will provide a national focus and agenda for harnessing new technologies to raise educational standards and improve quality of life... especially the new literacy and numeracy targets." **UK report**

Social concerns

Objectives here are to do with avoiding social dislocation and exacerbating the gap between the haves and have-nots, removing barriers to progress, and delivering an ICT entitlement for all, regardless of age, gender or ability.

"The foremost objective in the Ministry of Education... to guarantee all members of Finnish society the basic skills required by the information society regardless of the person's age or gender... " **Finland report**

Economic competitiveness

This strand of thinking reflects worries about countries' economic competitiveness in the 21st century, where workers need ICT skills to compete in world markets built on information access and processing. This requirement is found in almost all documentation in this area. A common strand in many policies is the thinking that policies launched primarily for social or educational reasons will also create economic opportunities in their wake.

"Up-to-date qualifications gained against the background of a high general level of education in the population will be decisive if Denmark is to maintain competitiveness and its share of the global labour market in the information society. IT skills and IT understanding are thus central prerequisites for the individual, both now and especially in the future." **Denmark report**

Elements of all three of these drivers can be seen coming together in the widespread recognition that all learners, and teachers too, will increasingly need well-developed information-handling skills for the next century. In Germany, these skills are described as 'media competence' (*Medienkompetenz*), emphasising not only technical, but also ethical, social and communicative dimensions. In the UK, the phrase 'network literacy' is used. In an age increasingly dominated by information, Europeans will need to be producers of knowledge in digital form as well as consumers and some countries show a refined understanding of the distinction between information, knowledge and understanding which only education can elucidate.

"The prerequisite for sense of responsibility and social involvement is the ability of the individual to turn information into knowledge." **Denmark report**

The Millennium target

All countries' policies reflect these three drivers, albeit in differing degrees – with some setting specific targets to meet all, or part, of an objective. However, regardless of which of these is the dominant driving force in any particular instance, the approaching new millennium is providing a convenient focal point and is a lever in its own right. Virtually every country has developments and targets written into their policies which are specifically linked to the year 2000. Examples of this are shown in the next section.

So far we have discussed rather generally ICT policy and its objectives in education within Europe. What these policy objectives actually mean in terms of actions can be summed up as:

1   providing the equipment infrastructure for schools to connect to electronic networks

2   training teachers to ensure that they can use digital media with their classes

3   reviewing the curriculum in the light of the increasing impact of ICT

4   producing electronic educational content related to local, regional, national and international need

5   monitoring, researching and evaluating these measures.

Funding these changes across whole education systems while maintaining spending on other items at the same level is a major challenge, particularly in view of the downward pressure on public expenditure in European countries. This has led to some innovative approaches to inject into the system new resources such as public/private partnerships and private-sector sponsorship. The terminology varies slightly, but all the major approaches involve a certain investment by governments on behalf of tax payers in order to attract further investment by the private sector.

The challenge still remains, however, to find ways of embedding innovation into national systems and turning funded projects into sustainable development.

1 Equipment and networking infrastructure

All countries are endeavouring to increase the number of machines available to learners in schools. The trend now is towards more multimedia machines on the desktop, connected to both local area networks and wide area networks – the latter principally via the Internet. This is stage 3 of the analysis offered by the Introduction. Despite the costs of high-specification servers and multimedia machines as well as cabling, maintenance and support, increasing the equipment and networking infrastructure is a priority for all countries who contributed to this report.

For example:

- Finland's aim by the year 2000 is to network all schools and public libraries to international data networks.

- In November 1997 the French government launched a three-year development project to give all students and teachers access to educational multimedia tools and an e-mail address. The budget for the first stage is 15 million ECU from the government. Overall funding will be up to 2.3 billion ECU once local authorities and commercial partners are involved. Priority will be given to schools in difficult neighbourhoods; and rural schools could be connected by satellite. French telecommunications operators have been invited to offer schools preferential tariffs.

- One of the goals of the Italian four-year educational technology development programme is to provide schools with the multimedia systems (hardware, software and networks) that are most suitable for the educational needs of each type of school and each school level.

- In Germany, the federal initiative 'Schulen ans Netz' (Schools onto the Net) is supported by several complementary programmes at Länder level that all strive to build up regional networks to support equipment and other measures.

"Less than a quarter of primary schools are for the moment connected to Internet compared to around half of the lower secondary schools. Nearly all upper secondary schools are connected and their local standards are usually on a much higher level, with local school networks." **Norway report**

The focus of these measures, however, is towards general secondary schools. With one or two exceptions, the connection of primary schools in large numbers to the Internet is rare in Europe. For instance, only 9% of primary schools in Austria are connected, compared to 38% of general secondary schools. Both Finland and the UK, however, have a particular emphasis on equipment and connections for primary schools in their plans. (Finland has 65% of primary schools connected to the Internet.) Getting comparable data in this area is difficult, given the different ways of organising schools and capturing data across age bands.

At present, Internet access in secondary schools is greatest in countries like Sweden, Norway, Denmark and Finland (65% of schools in Finland are networked by ISDN or connections of greater speed.)

Funding the connection of schools

Schools are being networked in a number of different ways through public/private partnerships, sponsorship and traditional central funding. An example of public/private partnership is Germany's 'Schulen ans Netz'. The Federal Ministry of Education, Science, Research and Technology and Deutsche Telekom will finance the project with altogether about 80 million ECU (30 million ECU of which have already been spent) targeting all 44,000 schools, all of which have subsidised equipment and Internet connections. By December 1997 about 6,500 schools were connected by this initiative, which is supported at Länder level. Numerous Internet providers, such as DFN (German Research Network), help by providing free access for schools for the first couple of years.

In the UK, with its mature market for educational products and services, the funding strategy behind the National Grid for Learning is that an increase in government funding for equipment and network connections (£100 million in 1998–99) will bring into the market more and bigger companies providing services at what is hoped will be an affordable price to education. This coming year should tell whether this strategy is successful or not. If it is successful, it could provide a sustainable basis for ICT expansion in schools.

Also in the UK a development led by the private sector and known as UK NetYear is one of a number of initiatives stimulating interest and raising money from sponsorship to offset some of the costs of equipment for schools. In Denmark, the Ministry-funded network Sektornet is provided for by TeleDanmark against a contract with the government.

Another means of generating sponsorship is through advertising. In Germany, for example, the use of advertising will no longer be prohibited for schools in Berlin. On instructions from the municipal administration, schools are asked to use all justifiable sources of income. At present, the education authorities decide how this can be realised. Advertising for tobacco and alcohol, for religious communities and for political parties will continue to be prohibited.

"In the building of new schools one of the priorities is the planning of their connection to the network." **France report**

The more conventional mechanism of state funding is being used in Spain to connect 40,000 teachers to the Internet with access provided by the National Ministry along with the education authorities of the Comunidades. In Portugal, the Ministry of Science and Technology is putting one multimedia computer in every secondary school and linking all 1,600 to the National Scientific Network.

In 1997, the European Commission launched the Europe Netd@ys initiative, which for the first time made small sums of money available to support projects that encouraged the connection of schools to the Internet.

Some 15,000 European schools took part in Netd@ys Europe 1997, nearly 1,000 events took place, the official Web site was accessed more than 500,000 times, and more than 5,000 schools were connected for the first time to the Internet within the framework of national or local equipment policies. This initiative will be repeated in 1998, hopefully with the support of more companies.

Provision

As the above example indicates, many of the initiatives referred to are intended to provide:

- Internet access within a school
- e-mail access to pupils
- e-mail access to teachers
- school intranets.

However, perhaps not surprisingly, what is noticeable about many of these ambitious schemes is that there is much less detail when it comes to the actual educational application of the new technologies. Politicians and policy makers generally have been much more comfortable when establishing targets of PCs per pupil, but actual curriculum use and benefit have received much less attention. This is something we shall come back to.

Telecommunications companies

Because of the emphasis on connecting schools to the Internet, European telecommunications companies are important actors. Establishing the right framework and partnership between them and governments has become critical in encouraging schools to connect to networks. These frameworks vary according to the degree of liberalisation in the separate countries'

markets for telecommunications. In Sweden, Telia has been connecting schools to the Internet with government funding, and then offering services which enable schools to minimise on-line costs. Liberalisation in the UK has left British Telecom competing with cable franchises and other competitors and this, plus the intervention of the regulatory body OFTEL, has helped to reduce the costs to schools of telecommunications charges and to introduce a fixed monthly rate. As European monopolies disappear and competition increases, it is hoped that the telecommunications costs for schools will drop too and that ways will be found of making those costs predictable against fixed monthly payments.

Telecommunications company Telia

Telia is an international telecommunications corporation with its home base in Sweden. Telia was earlier a national public organisation, but has been transformed into a company, although still publicly owned.

Under the heading 'Telia's Global School', the company, as a specific task force, is investing in schools. One branch of projects they sponsor are projects using audio and video communication between schools or other institutions in real time. Another branch is communication with databases containing interactive multimedia tools. A third area is to stimulate and support the production of new interactive and computer-based teaching aids. (Sweden)

Intranets

The role of intranets (in-house networks using Web protocols) is also seen as increasingly important. Some schools are building their own intranets so that students and teachers can become authors as well as readers of digital resources; they provide a way of sharing learning resources within schools, and allow schools to download, adapt and deliver information from the World Wide Web without incurring high tariff charges through long periods on-line.

School classroom structure

Many countries recognise that the traditional school classroom structures do not support the introduction of multimedia equipment connected to electronic networks for use by pupils and teachers.

However, school classroom structures are only slowly beginning to change, with few countries having specific national or regional actions to address how school buildings might be restructured to aid the introduction of ICT into every classroom.

Overall

Connecting every school to the Internet is not the same as connecting every classroom, nor is it the same as giving every teacher an e-mail identity – let alone giving every pupil over a certain age an e-mail identity. Some educationalists might argue that what is important is firstly giving *teachers* access to networks and digital resources so that they can then judge what is appropriate for their pupils and students. There are, however, differences of opinion here reflecting different cultural standpoints on the role of the teacher. In some countries, that mediating/filtering role by the teacher might be seen as a very necessary protection of minors from undesirable material. On the other hand, mediating content in the growing number of networks and digital resources would create additional responsibility and workload for teachers. Another and opposing standpoint could be to leave judgement of quality to the users. Equipping pupils with critical minds and showing them the importance of asking questions as well as getting answers could be more future oriented and empowering.

"The classroom structure of schools and the traditional timetable is a difficult working environment for the implementation of new ICT." **Austria report**

"The Province of Genoa has produced a research project to study how school buildings might change in response to the introduction of new technology and the new learning techniques it has made possible. However, apart from isolated initiatives like this, there is no general plan for restructuring school buildings." **Italy report**

What is certainly arguable is that waiting for all teachers to be trained before allowing any learners access to networks will place a considerable delay on developing ICT competence in a fast-moving and competitive world. Although relying on teachers themselves as the sole agents of change is insufficient, it is to teachers that we now turn.

2 Teacher training

Most countries now place teachers at the centre of proposed ICT developments in schools. This is welcome since it reflects an understanding that no matter how great the penetration of equipment and networks, it is only through trained teachers that pupils will come to understand fully the potential of new technologies to assist with learning. However, many country reports comment that teachers often feel sidelined or insufficiently skilled to meet these new opportunities. Therefore teacher training in using ICT is a pre-eminent measure within all the country reports.

Role of the teacher

The ICT skills that teachers need for the next century are complex. They are not mere users of IT who can be trained in office applications like employees in some employment sectors. They need to be able to use all the generic packages, plus multimedia applications on CD-ROM, subject-specific software, find suitable resources on the Internet and, crucially, *judge when this is appropriate within school work*. Moreover, they have to show their pupils how to use the technology to find information from on-line and off-line sources, help develop information-handling skills, communicate with others and create information in digital form. This is a tall order.

"In the highly decentralised Swedish school system, teacher training plays a very important role. For the government it is one of few ways to influence schools." **Sweden report**

"No further ground can be covered without a massive upgrading of teachers' ICT qualifications." **Denmark report**

"Computers and the Internet, if heavily used in the classroom, change the roles of teachers and pupils, leading for example to forms of co-teaching between teachers and 'PC-gurus' among the pupils." **Austria report**

There is much talk of how the role of the teacher should be changing in the digital age from a classically didactic role to one that is more subtle and complex, interacting when appropriate between the learner and the new technologies. For many, however, the role is still essentially the same, although new digital resources are undoubtedly providing access to a potentially enormous wealth of content. Teachers will therefore need to guide and coach pupils to navigate, save and interpret material to assist with learning.

While it is easy to over-emphasise the point about the changing role of the teacher, it is hard not to over-emphasise the scale of the challenge facing all national education systems in bringing about the sweeping programmes of ICT training needed to help the mass of teachers to enter the digital age.

Types of training

Across Europe, two types of training have been identified:

- basic functional ICT competence
- the pedagogical skills and understanding of ICT in the classroom.

The second of these requires teachers to understand what new learning opportunities ICT may offer, how technical resources can be managed in the classroom and how learning might change as a result. Convincing teachers of the pedagogical benefits of using ICT is a key challenge for policy makers and this is where arguments have to be made on the basis of solid research evidence.

Most countries have identified the need for both initial and in-service training.

Initial teacher training

In some countries there is a move to make ICT a compulsory part of the teacher's induction course. In France a two-year emergency programme beginning in 1998 will place the focus on showing trainee teachers how to integrate ICT into teaching methods.

Of course, simply decreeing that something should happen is no guarantee of real progress. Time, access to technical resources and teacher-training staff with recent relevant experience to pass on to the teachers of tomorrow all appear to be in short supply. This latter expertise is more likely to reside in leading-edge schools than in the universities and colleges that traditionally train young entrants to the profession.

In-service training

Important as pre-service training is, the bulk of the teaching force is already in the system and will be there for 15–20 years to come, so in-service training is the biggest challenge. A wide

range of methods are used to provide in-service training – both formal and informal. This includes traditional courses, open and distance learning, one-to-one support in the classroom and providing teachers with personal equipment. In many cases needs are identified locally, and training is arranged locally, although in some countries there is a tendency to deliver the more advanced pedagogical training nationally and at a distance, using the technology as a medium.

"The aim of teacher ICT training in Spain is to provide the technical support and a training which will enable the teachers to use computers as pedagogical tools and instruments for innovation and improvement, to enable them to select and analyse the resources best suited to their environments and their specific tasks and to improve the management and organisation of schools." **Spain report**

Several teacher-training projects in Germany at Länder level and the 'Licence to Run a Computer' qualification in Finland illustrate how successful teacher-training schemes often start with small building blocks of competence to break down 'techno-fear'. Training needs to be customised to teachers' level of skill. Pre-sifting of teachers for training so that they are at the right level contributes to success. In Portugal, the Minerva project which ran from 1985 until 1994 established a teacher-training tradition which led to many informal sessions in schools. These were formative first steps for many teachers.

In Finland a rolling programme of training will see 9,000 teachers (10% of the workforce) trained in ICT pedagogy over a total of five weeks on a course with 7–10 days of direct tuition followed by distance training and private study. The National Board of Education purchases the training from universities with faculties of education (12 in number) and offers it free of charge to teachers. Only those with a 'computer licence' – a vocational certification of basic competence – are accepted. By 1998, 5,500 teachers had started the course. Trials are also taking place in Finland with students receiving bursaries to train teachers in ICT. Seventy bursaries were awarded in 1997.

In Denmark, the Danish National Centre for Technology Supported Learning (CTU) focuses on teacher training, with programmes for teachers.

Without exception, all countries note the powerful developmental role played by large ICT education conferences and exhibitions. Sweden, Norway and the UK made particular mention of the developmental effect played by teacher attendance at these events.

Providing teachers with equipment

"Recognising the fact that there is very little ongoing research in the traditional educational research institutes concerning technology-driven forms of learning, the Ministry has found it necessary to stimulate the connection of ICT and pedagogy. The new centre in ICT and pedagogy will be given national responsibility for developing and co-ordinating activities related to ICT and learning issues in the educational system." **Norway report**

Another measure intended to improve teachers' confidence and competence with ICT is to provide them with their own personal equipment. Although few countries are undertaking this, the Multimedia Portables for Teachers Pilot in the UK shows that, once they have uninterrupted access, teachers are prepared to invest time outside school to build their own ICT skills. Research figures for the scheme (where selected ICT-novice teachers were given their own portable computer) show a dramatic increase in the participant teachers' use of IT: over 90% successfully used CD-ROMs, 76% successfully used the Internet and 95% used the portable at home and at school for planning and delivering their teaching.

"From 1998 all newly educated teachers shall in their teacher training gain knowledge and experience of the use of computers and networks in teaching and learning. They also ought to have capacity after their training to develop computer-based educational tools." **Sweden report**

As the price of computer hardware drops, assisted purchase schemes for teachers are also likely to form an effective part of teacher-training strategies. In future, a basic device could cost less than a day's training.

Peer support

"Teacher trainers are key people in this process and their knowledge about ICTs therefore must be on a high level. The government has set aside 2 million ECU for the training of teacher trainers and 0.6 million ECU to support this issue with relevant research." **Sweden report**

A few countries, like France, Denmark, Germany, Finland and Spain, are establishing ICT specialists or leaders to increase the use of ICT in schools. In some German Länder, one teacher per school is to be trained as a multimedia specialist to assist staff with technical and pedagogical issues. In Spain, one teacher in each school is responsible for ICT and they then support colleagues in ICT classroom activities. Where these ICT pathfinders are likely to be successful is where they themselves are

> *"Training will be hierarchically organised by the Pedagogical Institute in co-operation with the Department of Secondary Education of the Ministry of Education. In a first stage the personnel of the regional support centres will be trained to become trainers. These trainers will then train the school-level trainers, who in turn will train the teachers and heads of the high schools."* **Greece report**

supported in their professional development by being given the training resources and time to perform their in-house consultancy role effectively as in the following comprehensive approach to training vocational school teachers in Denmark.

IT qualifications for all vocational school teachers

In January 1997, the project 'KOM-IT' was started in the vocational school area. The purpose is to promote qualifications, frameworks and networks for a pedagogic application of information technology in vocational training.

At every single vocational school, a pedagogic IT-skilled team will be trained. The team will undertake teacher development etc. and is to promote these qualifications at its own school. Moreover, a plan of strategy and action for the IT-qualifying of teachers and leaders is to be prepared. Quite specifically, each school must carry out four IT projects aimed at helping to create networks between schools. School IT projects will be the central element of this project and preparations are being made for IT school development projects in the following four categories: pedagogics, management, teaching practice supervision and one of a cross-disciplinary nature. Expected to cost 24 million Danish kroner over four years, the project is backed by the leader and teacher organisations of the vocational schools. The Danish National Centre for Technology Supported Learning (CTU) has supplied 800,000 Danish kroner for a pilot project and the Vocational Schools Department of the Ministry of Education will grant 4 million Danish kroner mainly for pedagogic development projects. The rest of the funding will be covered by the vocational schools and by student fees.

The effect of the project is expected to be that the individual school will achieve extra competence and organisational frameworks for the continued pedagogic development and utilisation of IT and that, in future, the pedagogic use of IT will be included in the planning of teaching and curricula on the same footing as other pedagogic considerations. (Denmark)

It appears that individual teachers need support and training to reach a point of competence with ICT. Then they are able to begin to explore how ICT can provide new learning opportunities. Interaction between teachers on longer-term courses has proved a successful way of accelerating this process. UK experience is that teachers learn effectively when there is the opportunity to exchange ideas with peers during face-to-face training.

Human contact is also noted as an essential factor at all initial stages of development. Many of the most successful projects began through staff training and human networking opportunities. Even when development projects are in place, the opportunity to meet face to face and exchange experiences with peers is still highly valued and seen as a positive factor in ensuring success.

Overall

Many of the developments referred to above are still in their infancy and will take time to bear fruit. It may well be that the scale of the training challenge presented in Europe will take several years to overcome. Certainly at the moment it is too early to say anything with confidence about the impact on national systems of the effort being put into training teachers for ICT. It can be said with confidence, however, that without this investment, pupils in schools across Europe are unlikely to gain maximum benefits from new technologies.

3 The curriculum

Most countries view ICTs as tools to be used across all the curriculum, and reflect this in their policies and statements.

Rather fewer countries – Denmark and the UK, for instance – have taken measures to embed this by law, with the UK possibly going furthest in developing statutory orders for IT in the national curriculum across all subjects and for all ages 5–16. It is a moot point, however, whether making something compulsory by law is more likely to increase really imaginative practice on the ground. This probably depends upon a whole set of cultural factors in different countries and the degree of centralisation or de-centralisation of educational systems.

What is rare is to find examples of countries that are seriously re-examining their curricula in the light of the potential of new digital technologies to change not only how teaching and learning take place, but the actual subject content itself. For example, when graphical

calculators can output instantly in graphical form the relationship between different variables, and when geometrical packages can bring complex shapes to life immediately on the screen, then arguably the content of the mathematics curriculum needs to change to acknowledge this. When children can access information from thousands of servers on the World Wide Web, then the challenge is to develop network literacy or media competence, so that learners have both the technical and intellectual skills to cope with the information age, including the skills to become producers as well as consumers of information. There is much talk of this happening but, so far, school curricula – and examination systems in particular – are proving somewhat resistant to change and are still 'secret gardens' guarded jealously by national bodies. Norway and France, countries actually tackling this, report the following:

> *"Computing must be an educational tool, not a subject of education..."* **France report**
>
> *"The aim is not to create a new school subject, but to use the computers as tools to enhance the process of learning."* **Spain report**

"A re-structuring of national evaluation activities and exam programmes will take place as an integral part of the reform programmes." (*Norway*)

"In primary education, the curriculum revised in 1995 – which is available on the Internet – takes into account the transverse dimension of computers and in particular through the use of word processing... In secondary education, computer learning is planned precisely in the programmes of technology at secondary school and is offered as an option from the 5th form. As for the other subjects, some science subjects integrate it very directly – physics, mathematics, life and the earth sciences, for instance, whereas in the other subjects it is only lightly touched on in comments... The Ministry of National Education has announced that he will refer to the National Council which is in charge of giving advice on the curriculum so that he can investigate this matter urgently." (*France*)

4 Electronic content

All countries agree that having access to appropriate educational content is crucial, whether it is stored on a local computer hard disk, CD-ROM, distant Web site via the Internet, or in the future some variant of digital TV. To date, a lack of appropriate software in national languages has impeded the spread of ICT and this has been a particular problem for those countries whose national languages do not provide world markets for developers. The costs to schools of purchasing good quality content can also be a disincentive.

> *"The production of learning material is the exclusive domain of the private sector. Almost all publishers of educational material are currently examining ways of re-using available material to create multimedia systems for schools. Another recent trend is for large-circulation newspapers to distribute low-cost multimedia systems that can be used for educational purposes (electronic dictionaries, encyclopaedias, packages devoted to an individual artist, for instance). The public sector is not involved at all in the multimedia market."* **Italy report**

In order to provide teachers with impartial information about educational content and software, organisations in some countries are starting to review software and Web sites and publish their findings. In the UK, Becta (formerly NCET) has been doing this for some time via its Web site; ORAVEP in France, ORFEUS and CTU in Denmark and the National Board of Education in Finland are all undertaking similar activities.

Opinions differ about whether the creation of digital educational content should be left purely to the market, or whether government intervention and pump-priming are needed to stimulate business activity.

Many countries, however, have programmes to encourage the digitisation of content currently held in museums, art galleries and libraries and in this are supported by various EU programmes: Info 2000, the Telematics Application Programme and the Education Software and Multimedia joint call.

Curriculum 2000+

'There will be rapid expansion of Austrian School Net with voluntary participation by schools with increasing bandwidths starting from a standard line 64Kb minimum. Next will be the establishment of education servers to generate subject matters that are relevant to the school, followed by enhanced communication via e-mail: a pilot project in Vorarlberg (e-mail for all teachers and students).

The next priority is the transformation of school libraries into multimedia information centres (multimedia workstations with Internet connection).' (Austria)

Educational servers

The appearance of national networks and educational servers, such as the Nordic Schools Data Network with its own national application in each country and the National Grid for Learning Virtual Teacher Centre (VTC) in the UK, is also helping contribute to the availability of quality-controlled content for teachers to download and use. The drawback to these as dissemination devices is that, of course, they reach only those teachers who are already on line. The European Commission, backed by member states, is supporting an initiative led by the Swedish government – EUN, the European Schools' Network – which aims in time to provide a platform giving access to high-quality information services and pedagogical content linking national school networks. It is too early at present to judge the effectiveness of this well-supported and substantially-funded project.

France is following the line of encouraging both the commercial sector and teachers to produce quality digital content.

The idea of bringing practising teachers and commercial companies together to produce quality educational software seems sensible. It is much more difficult to see how the market issues of producing content for small (in world terms) language markets can be overcome without the injection of government subsidies in some way.

> *"The Ministry of Education will subsidise the development of the appropriate software and retain the right to use it within the frame of secondary education at ... no extra cost."* **Greece report**

5 Monitoring, research and evaluation

Few European countries are monitoring with any precision the spread of new technologies in their education systems and there is a distinct lack of solid statistical information in this area. To be fair, the difficulties of obtaining reliable comparable data in this area are considerable, since some countries organise their schools according to different ages, while in other countries there is no central education ministry and often responsibility for managing schools at primary and lower secondary level is devolved to local and regional authorities.

Without data of some sort, though, it is hard for policy makers to judge the impact of policies designed to increase the spread and access to new technologies, or where priorities should lie. It is still early days, however, and it may take some time for the results of national evaluation programmes, where these exist, to come through.

The UK is quite well served by data in this area via the statistical bulletins on IT in schools prepared annually by the Department for Education and Employment, but this refers only to England and mainly, but not exclusively, to the deployment of equipment, not to its use. For that, one has to go to the qualitative observation-based reports published by The Office for Standards in Education (OFSTED), which has built up over the years a considerable body of knowledge of IT in schools.

The Austrian Ministry for Education and Cultural Affairs through Techno-Z FH Research and Development is evaluating the laptop project 'Networked Education'. Since February 1996, the laptop experiment has been continuously evaluated in qualitative and quantitative surveys. The focus has been to identify and define the requirements to make successful use of new technologies in schools. Based on these results, the research team will formulate guidelines, recommendations and action plans on best practice. The project is also monitoring the development of ICT usage in Austrian schools and internationally. The comprehensive final report *Networked Education* will be available at the end of 1998.

The Finnish Parliament has launched a large research project on the impact of ICT in education. The work has been carried out by the National Fund of Research between June 1997 and June 1998.

In North Rhine-Westphalia, Germany, evaluation and research is an integral fourth part of the Länder programme 'Schulen ans Netz', which includes equipment, teacher training and an

> *"In Germany, 14 of the 16 Länder maintain at least one educational server, backed by several federal servers such as the DBS (German educational server) and the Schulweb. 'Bildung OnLine' a consortium of four major school book publishers set up an educational server with educational material information and services."* **Germany report**

> *"A funding scheme to help the local communities regarding equipment is being set up for three years. Partnership with companies will be systematically developed and the multimedia industry will be supported through a policy of invitation to tender. Aids will be offered to teachers wishing to create private companies specialising in multimedia."* **France report**

" ...the publishing of computer-based material, such as multimedia, in Finland depends solely on public monies. The chances of producing Finnish-language materials are fairly small. However, about 20 CD-ROM products are ready and over ten others are in process. When viewed against the overall need, this is still very little. Government money is also being used to produce teaching materials for the Internet." **Finland report**

"The process of educational reform has only just begun and as many measures are still in the legislative phase, they have not yet had a direct impact on schools. The reforms have yet to have any concrete impact on the organisation of learning. Nevertheless, numerous experimental projects involving the introduction of technology in schools have profoundly changed the student-teacher relationship, student attitudes to the subject studied and also subject contents." **Italy report**

"Being in the midst of several large change processes, we do not know right now the effects of the huge investments made in recent projects. The major differences compared to earlier activities are that even more money is involved and that the financial resources are concentrated to a limited number of well-defined projects. So far we have seen some totally new school milieus being created, new architecture, other ways of working, no timetables, mixed age groups, international co-operation... In a few years time we will know if this was the right move!". **Sweden report**

educational server. This on-going qualitative research, conducted by a university, is based on in-depth interviews of learners. First results highlighted initial frustration caused by technical problems, the importance of teachers' motivation and the integration of media competence in teacher training.

It is a sobering fact that although there is a growing corpus of international research evidence that points to improved motivation and attitudes, better pupil/teacher relationships and better quality presentation of work when learners use ICTs, there is little conclusive research upon which a purely educational case can be built for the considerable public sums that are currently being invested. There are other reasons for going down this path, of course, such as the social and economic concerns alluded to in section 2. Only time and more independent research and evaluation will tell whether the policy objectives are really being met.

Conclusion

Looking back now at our original five actions, we see that not all countries cover all five of these points equally thoroughly and, in general, much attention and resource is often focused on the first action related to equipment and connectivity (1). The greatest challenges are posed by teacher training (2) and the curriculum (3), while many countries struggle with electronic content (4) and few tangible results have yet to emerge from monitoring, research and evaluation activities (5). However, these are still early days.

Introducing new information and communications technologies into European education systems on the scale generally envisaged is an enormous, complex and challenging task. Europe is probably just at the start of a long winding road and while there are lots of examples of interesting projects and some particularly fruitful-looking national initiatives, in general, there is as yet little impact on systems as a whole.

Based on the evidence presented in the country reports, EENet has identified nine major findings and recommendations for action that it believes will help to spread the effective use of ICT in education across Europe:

1 **A holistic approach to policy development**
2 **Bottom-up/top-down convergence**
3 **Sustainability**
4 **The curriculum**
5 **Teacher training**
6 **A wider concept of learning**
7 **The importance of research**
8 **Content and national languages**
9 **Monitor and evaluate the system.**

A holistic approach to policy development

Successfully introducing ICT across the entire education system requires the active co-operation of central government, local and regional authorities, teacher-training establishments, curriculum bodies, school management and teachers. In addition, hardware, software and service suppliers in the commercial world and telecommunications operators all need to be involved. Policy making and planning for ICT integration thus needs to be holistic and comprehensive and not just focus on parts of the system.

Recommendation 1

A holistic model for policy development for ICT in schools should be considered by policy makers. Future innovation needs to involve all players in the education system, including the public and private sector.

Bottom-up/top-down convergence

Policies and actions that have been developed with consultation and the active wide participation of key players, and that take into account classroom imperatives, teacher knowledge and technology limitations, are most likely to carry weight and encourage the involvement of all the necessary participants. The most successful policies and measures are often those which combine central directive with local initiatives (policy coming down meets innovation coming up).

Recommendation 2

For teachers to take ownership and implement ICT strategies effectively, policy makers should listen and respond to successful and appropriate ICT developments which start at the school level, when developing large-scale policies.

Sustainability

The key to moving on from subsidised/funded projects to embedded systemic innovation or generalised ICT use lies in achieving sustainability. There are two aspects to this: the economic and the human or social. First, investment has to be built into the core school or local/regional authority budgets year on year to fund and maintain initial investment in equipment, infrastructure and teacher training. ICT is not a one-off capital cost. Linked to this is creating a healthy open market for educational products and services; and ways need to be found to encourage long-term public/private partnerships and sponsorship. Second, sustainability requires that the hearts and minds of teachers, managers, administrators and policy makers are won over and, particularly at school level, this has to be done sensitively and arguments carried on the back of educational goals.

Recommendation 3

Policies and strategies for implementation should be designed to achieve the sustainable and generalisable use of ICT in education. It should be borne in mind that sustainability can only be achieved through a synthesis of economic and human measures.

The curriculum

Educational targets often feature less prominently in countries' plans than pupil:computer ratios or numbers of schools to be connected to the Internet. There is also little real evidence that many countries are seriously re-examining their curricula and examination systems in the light of increasing use of new digital electronic technologies.

Recommendation 4

Ideally, comprehensive plans for implementing ICTs should start with learning targets related to the curriculum. Linked to this, examination and assessment systems should be reviewed to ensure that they are appropriate to the digital age.

Teacher training

This is undoubtedly one of the most exacting and exciting challenges and one which will require government intervention to set frameworks. Pedagogical use of ICTs as well as basic beginner training will be needed in both pre-service and in-service training; approaches which include the use of peer support, personal access to the technology and the opportunity to learn from more skilled teachers are likely to have the most impact.

Recommendation 5

Specific measures need to be taken to ensure that ICT use is covered in all pre-service training courses and that all serving teachers have access to appropriate in-service training that responds to their individual needs.

A wider concept of learning

As new digital technologies become more generalised in their use in education, the process of learning will become less dependent on the constant presence of the teacher, particularly with older learners. The teacher will still have a vital role in mediating 'formal' learning in the classroom, but networks and digital media will put learners in touch with a wider range of people and resources in the community, at universities, on the Web etc. This will be most marked in those cases where the training and awareness of the teachers lags behind the technical skill of pupils.

Recommendation 6

Policies and implementation actions need to recognise the wider concept of learning that generalised ICT use will bring and should reflect the consequential empowerment of the learner that is likely to take place. This empowerment will demand new and more subtle skills from teachers as they are less able to rely upon the formal didactic aspects of their role.

The importance of research

Many of the countries' policies and implementation strategies would benefit from more input from educational and organisational research. Implementation strategies including teacher training should be informed by best knowledge of learning with digital technologies. As ICT becomes more widespread, there will be an impact in terms of organisational development at school and college level which so far has seldom been reflected in policies and strategies.

Recommendation 7

Decision makers at all levels must take more account of existing educational research, within Europe and beyond, when formulating their education policies and actions. Research on new topics with relevance for this area should also be initiated. Consideration should also be given to the literature on innovation and change at organisational level.

Content and national languages

Lack of appropriate educational software in national languages impeded the spread of ICT in earlier phases. This problem has not yet been overcome and may well inhibit some Internet-based activities.

Recommendation 8

Most countries need to address the issue of the shortage of multimedia and Web-based content for educational use in national languages. It may in some cases require government pump-priming to stimulate market activity and it is sensible to encourage commercial developers to use teachers and others as advisors or to help at the trialling stage.

Monitor and evaluate the system

The absence of reliable data on the spread, use and effects of ICT in the countries of Europe is remarkable. Without good data, it is impossible for policy makers to judge the effectiveness of plans for innovation.

Recommendation 9

Central ministries and regional authorities should co-operate in gathering, analysing and disseminating data, not only on inputs into the system such as pupil:computer ratios, but also on process variables such as deployment and pupil/teacher access times and actual outcomes.

The following documents and reports have been identified as influencing the implementation of ICT in education systems across Europe.

Austria

Information Society: Report of the Working Group of the Austrian Federal Government, Vienna, November 1997, published by Federal Chancellery, Federal Press Department

The report has approximately 75 pages, and includes special items about education generally and especially networks for schools and education.

On-line version: the chapters are indexed via the navigation frame on the left side or can be reached via the detailed table of contents. Possibility of download versions of the complete report from the Web.

English version: http://www.austria.gv.at/infoges/english/index.html
German version: http://www.austria.gv.at/infoges/index.html

Networked Education, Austrian ICT research project since February 1996:

http://www.newmedia.at/proj/vb/index.html (information in German and English)

Denmark

Information Society 2000, Copenhagen, October 1994

The government appointed a committee in March 1994 with the purpose of illuminating the whole area of IT in Danish society. The report has a high impact on the way the government addresses IT questions.

http://www.fsk.dk/fsk/publ/info2000-uk/

Statement to Parliament and IT-political Action Plan 1995

http//www.fsk.dk/fsk/publ/it95-uk/

IT-policy Statement 1996 and IT-political Action Plan 1996

The parliament receives this annual IT policy report and IT plan of action from the government, making it possible to monitor the area from national level. The 1997 statement and plan are still under preparation.

http//www.fsk.dk/fsk/publ/1996/it96-uk/

Finland

Ministry of Education: ***Education, Training and Research in the Information Society: A National Strategy***, 1995

Strategy plan aimed at utilising information and data communication technology.

www.minedu.fi/infostrategy.html

France

Press conference of 17 November 1997 at which Mr Allègre, Minister of Education, Research and Technology, launched a global ICT development plan until the year 2000. The plan deals with access to multimedia resources through equipment and networking (EDUCNET), teacher training and new ways of learning.

http://www.education.gouv.fr (Chapter 'actualités')

Press conference of 16 January 1998 by the Prime Minister to launch the governmental action plan to enter the information society (programme d'action gouvernemental pour la société de l'information).

http://www.premier-ministre.gouv.fr (Chapter 1 'ICT in education')

Press conference of 9 June 1998 by Mr Allègre: 'How far have we got six months on?'

http://www.education.gouv.fr (Chapter 'actualités')

Germany

The German federal government's action plan about Germany's way to the information society: *Info 2000 – Deutschlands Weg in die Informationsgesellschaft*, Bundesministerium für Wirtschaft, Bonn, Februar 1996

http://www.bmwi-info2000.de/gip/programme/info2000/index2.html

Update:

Dokumentation Info 2000 – Deutschlands Weg in die Informationsgesellschaft, Fortschrittsbericht der Bundesregierung

http://www.bmwi-info2000.de/gip/programme/fbinfo2000/

The Kultusministerkonferenz (KMK: Conference of Ministers of Cultural Affairs) and the Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (BLK: Federal States Commission for Educational Planning, Research and Development) has the job of clarifying questions regarding cross-border co-operation between the states, and of making recommendations regarding the educational policies of the individual federal states.
In the context of ICT in schools and media education, three documents are important:

Sekretariat der Ständigen Konferenz der Kultusminister der Länder der Bundesrepublik Deutschland: *Neue Medien und Telekommunikation im Bildungswesen – Sachstand und Perspektiven im Schul- und Weiterbildungsbereich*, Beschluß der Kultusministerkonferenz vom 28 Februar 1997.

Bund-Länder-Kommission für Bildungsplanung und Forschungsförderung (BLK): 'Medienerziehung in der Schule – Orientierungsrahmen' in *Materialien zur Bildungsplanung und zur Forschungsförderung*, Heft 44, Bonn, 1995

http://www.iid.de/schule/sonstiges/heft44.html

Kultusministerkonferenz (KMK): *Medienpädagogik in der Schule*, Bonn, 1995

Italy

The Italian Ministry of Education is adopting a policy of sweeping reform within the school system. So far this policy has resulted in draft parliamentary bills which include an educational technology programme 1997–2000.

Norway

Ministry of Education, Research and Church Affairs (KUF): *IT in Norwegian Education – a Plan for 1996–1999*

Document based on a white paper Stortingsmelding 24 (1993–1994) from the government, debated in Parliament.

http://odin.dep.no/kuf/publ/it-plan/eng/

Sweden

IT Commission: *Information Technology – Wings to Human Ability*, Stockholm, Alfa Print, 1994

The IT Commission was created in 1994 with the purpose of encouraging the use of information technology in Sweden. The Prime Minister chaired the commission and no fewer than six other ministers took an active part in the work. During the same year they published this policy document with recommendations for specific actions.

http://www.itkommissionen.se

United Kingdom

Department for Education and Employment: *Connecting the Learning Society – National Grid for Learning, The Government's Consultation Paper*, 1997

The document introducing the National Grid for Learning (NGfL) was presented to industry and education by government as a consultation document to inform debate and lead to large-scale investment over four years.

http://www.open.gov.uk/dfee/grid/index.htm

European Union

European Commission: *Learning in the Information Society – Action Plan 1996–1998*, 1996

The Action Plan proposed four main lines of action for European schools, including connecting them to the Internet, developing electronic teaching materials, training teachers, and promoting best practice.

http://europa.eu.int/en/comm/dg22/planht.html

European Council: *Council Resolution relating to Educational Software and Multimedia, in the Fields of Education and Training*, 6 May 1996

A guide to action for the Commission and the Member States in particular in bringing forward relevant proposals within the context of several existing education and training programmes.

European Commission: *Educational Multimedia Task Force Report*, 1996

Describes the state of educational multimedia in Europe and makes a number of recommendations for Community action.

http://www2.echo.lu/mes/home.html