Tools for Learning

A National Programme for ICT in Schools

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In this communication, "education" denotes education in pre-school classes and compulsory comprehensive schools as well as education and vocational training at upper secondary school level.

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Foreword

The everyday existence facing our children and young people today is largely characterised by modern information and communications technology (ICT). In just a few years, entirely new paths of communication have opened up and created new patterns for dialogue and the quest for knowledge.

This is a development that generates new opportunities, but also imposes new demands on society, and especially education. The new technology will never be capable of replacing schools or teachers in young people's development and learning.

We must therefore ask the right questions when we address the relationship between education and ICT. We must dare to ask whether we have an education system capable of giving every child access to the opportunities afforded by the new technology. Do teachers and other adults know enough to dare to use ICT as an educational tool in school teaching? How is education affected by the constant availability of unstructured information?

We must venture to use information and communications technology (ICT) to bring about development of school work. The new technology should contribute to a new focus on pupils' learning - the focus should not be on the technology itself.

In present-day society, ICT is a key to participating and exercising influence in discussions and debates concerning society. This applies both in the public debate and in the world of work. It is therefore a question of equality of opportunity for schools to provide universal access to this technology, and to the capacity to use it, for their pupils.

ICT can also open up schools to the outside world. Today, teachers and pupils in different countries can make direct contact and thereby generate new, instructive discussions and new contacts. Frontierless conversations are within reach of more people than ever.

In brief, it is a matter of giving schools scope to develop by using a new set of educational tools. This, too, is the starting point for Tools for Learning.

This programme entails a strategic boost to ICT in education. Over three years, SEK 1.5 billion will be invested in strengthening schools' resources. This is our objective – not to introduce new technology for its own sake, but to place a new set of useful educational tools for learning and teaching in the hands of Sweden's pupils and teachers respectively.

The new technology creates new opportunities for learning. And now schools will be able to seize these opportunities.

Minister for Schools and Adult Education
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EDUCATION FOR THE SOCIETY OF TODAY – AND TOMORROW

Society is undergoing ever more rapid transformation, and this increases the citizens' need to constantly renew and extend their knowledge. When pupils leave school and enter society, they must be equipped to relearn, learn what is new and learn more – on a lifelong basis. The primary means to these ends are a quest for knowledge and methods that activate the pupils. ICT is a tool for attaining better education and more profound knowledge. All pupils must be familiar with modern ICT by the time they leave school. This aim is best achieved by ensuring that they use ICT as a tool for their learning.

The ICT society is already here

Development and change, in work and everyday life, are accelerating. ICT is a major driving force in this transformation of society – one as thoroughgoing as when Sweden emerged from being an agrarian society and became an industrial nation.

There are many manifestations of this development. In the labour market, it is evident from the decline in the proportion of employees in industry in relation to other sectors. One major

reason why so many industrial jobs have been eliminated is the massive increase in productivity permitted by increased ICT use. New jobs, often skilled, have arisen in services, and the ICT sector in particular.

The early 1990s saw a sharp rise in unemployment. Within a short time, hundreds of thousands of people had lost their jobs and embarked on an insecure jobless existence. Today, this trend is the reverse: unemployment is falling and employment rising, but the labour market is different.

Another effect of this development is large migrant flows within the country. A raised educational level and enhanced welfare enable more individuals to make active choices. Past migrant flows were from the countryside to industrial towns and manufacturing estates. Today, many people move from small towns to big cities and university towns.

The media situation has changed dramatically, with a far greater but fragmented range. Radio and TV channels have proliferated, and foreign channels reach us by satellite. Today, people have entirely unprecedented scope for adjusting their media consumption to their own interests and needs. The increased range available means that there are no longer just a few arenas that dominate public discussion. The task of understanding and evaluating which information is correct and important makes stringent demands on the media consumer.

Society is undergoing an educational revolution. More people are being educated at every level. In a few decades, young people's average educational level has risen very sharply. Forms of education that were previously reserved for a few are now open to all.

Communication in society has expanded rapidly. Nowadays, we have entirely new means of communicating with one another with stationary and mobile telephones and by fax. Improved transport services enable many people to live in one location and work in another. Accordingly, more people are travelling ever longer distances to work. Substantial groups have gained an opportunity to travel abroad.

Computer technology has undergone unparalleled development. Computer capacity has doubled every 18 months since the advent of the microprocessor 25 years ago. This trend shows no signs of slackening.

The burgeoning Internet is now set to outstrip telephony in scale. The Commission of Inquiry on the Internet (*The Swedish Part of the Internet*, SOU 1997:18, in Swedish) has estimated that Internet traffic will increase by a factor of between 128 and 1,000 over the next five years.

Media that were previously quite separate – such as the telephone, TV and radio – are now rapidly merging. They are all being transformed into digital flows transmitted in various ways, and replayed on computers of diverse types and forms. In the years ahead, certain computers will look like telephones and others like TV sets, while others will become such a natural part of our everyday lives that they are no longer noticed.

Constant updating of knowledge

We have chosen a society and a future that call for increasingly advanced education and abilities. The world of work requires broader knowledge, enhanced skills and a new kind of competence. Today, large segments of the labour market are, in practice, closed to people who lack upper secondary education. For more and more jobs, higher education is required. This imposes high requirements on the education system. All pupils must have ample knowledge and be prepared both for a changing world of work and for further education and training.

Such sectors as retailing, transport and social care used to be open to early school-leavers, but demands are now rising and changing in nature. Narrower knowledge used to be required to perform a given task. Now employees with wide-ranging skills, capable of rapidly adjusting to a changed situation and promptly updating their knowledge, are needed.

Security lays a foundation for change and flexibility. For people to cope with new challenges and develop, they must feel secure and have a sense of participation. The Swedish education system aims to give everyone the chance of a sound basic education and offer scope for lifelong learning. Educational opportunity is intended to confer the security that change demands. Welfare affords security that permits flexibility and growth.

One major change in the world of work is new ways of organising people's efforts. To boost efficiency and bring about constant quality enhancement, organisations have become flattened. Hierarchies have been replaced by autonomous groups that arrange their own work inputs and are responsible for their own results. Work in a non-hierarchic, flexible organisation calls for employees, exercising great personal responsibility, both to work independently and to co-operate with others. Good social skills are also required, and every employee must be capable of showing tolerance and respect towards other people.

Literacy and linguistic skills are increasingly at a premium. More and more people must be capable of reading written instructions and also writing in their own and foreign languages. English is used in ever more areas and situations, especially in the computer industry. For a growing number of people, language has become an important work tool. At work, the importance of contact and communication with others, within and outside one's own organisation, is increasing. Today, mastering a single task is not enough: all employees must also function socially in their own groups and vis-à-vis customers.

ICT is gaining ground at virtually every workplace. The old-fashioned shop till has given way to an advanced computer, connected to a mainframe and capable of issuing complex error messages – perhaps in English. In many cases, storemen must now be able to handle advanced stock-management systems, and drivers must be able to operate booking computers. In such areas as health and social care, advanced ICT is increasingly used. The municipal home-help service uses various types of alarm and connections with pensioners' homes, and care staff constantly encounter ever more sophisticated equipment.

All office work today contains elements of ICT. The classic secretarial role of typing out draft documents has disappeared. Employees have their own computers, on which they perform a growing share of their tasks. Regardless of educational level, people lacking ICT skills have difficulty in finding employment.

Entire companies have changed character. Ericsson was once an engineering company, but has now become an increasingly focused knowledge enterprise. Actual production has been largely outsourced to subcontractors. Ericsson's function is now to develop and design the software and circuit boards used in its mobile telephony, switchboards and other products and services.

Companies can now be established according to new principles. A firm engaged in selling books or CDs, for example, may conduct its business exclusively on the Internet. Its range may comprise millions of articles. No warehouse, in fact, exists – only links with distributors. Articles from various distributors then accumulate at the Post Office, which dispatches them to the customers and is in charge of invoicing. These companies use the new technology not only to rationalise an old organisation, but to establish a radically different and highly efficient structure.

Information management and processing make up an ever larger share of many people's occupational roles. We are entering a new relationship with information and communication. A new communication culture is being born.

ICT is everywhere

Information and communications technology has become an integral part of equipment used for receiving, storing, processing, presenting and transmitting auditory, textual and visual data. The term "ICT" has also come to stand for technology that is more user-friendly and prevalent than its predecessors. In fact, ICT is being inserted into a growing number of products and becoming more invisible. Numerous appliances contain microprocessors that control their functioning.

Use of computers in the more traditional sense is also becoming more widespread. Trade unions, for example, offer their members low-priced computer packages, while these are also offered by employees against pay deductions.

The Internet has rapidly come to be used by several hundred thousand Swedes. It provides an unparalleled range of information. Many professional media organisations use it to create and disseminate content to a mass public. The cost situation is radically different than for traditional media: an on-line publication incurs no printing costs whatsoever, and distribution takes place at

a fraction of what the cost would otherwise have been.

Unlike traditional mass media, the Internet is two-way. All those with the requisite knowledge can, free of charge, obtain a site on the Internet's World Wide Web and spread their message worldwide. People with important things to say no longer need abundant resources to reach others.

Nor is the Internet subject to the space limitations of the traditional media. There is no limit to the amount of information that can be published on the Internet. The Swedish Parliament, for example, places all the minutes of its official meetings and all its reports on its web site.

The Internet is entirely revolutionising the pricing of communication. Prices used to be set in relation to distance. The cost of using the Internet is fixed, regardless of how much one uses it (excluding the costs of telephone connection) and the distance travelled by the information. In principle, an e-mail message costs virtually nothing to send and reaches the other side of the world almost instantaneously.

Learning for the knowledge society

Today, pupils' educational requirements and objectives are entirely different from before. An ever more demanding labour market and a more rapidly changing society are calling for new and higher standards of education and skills. Young people also have their own perceptions of what is important in life and what education they desire. A modern education must therefore be adapted to these requirements.

Education must respond to the transformation of society, and be tailored to meeting present and future conditions. Since society is changing so rapidly, demands for knowledge have changed. Pupils need good and wide-ranging basic knowledge to cope with all the challenges they will meet in life. While the need for basic knowledge is increasing, it is even more important for the pupil to learn how to learn. Knowledge is changing, becoming more of a method and an attitude. Education gives pupils not only a ready-made knowledge package, but also the tools they need to put their knowledge to good use and update it when necessary. A command of the tools of knowledge and learning is essential for lifelong learning to become a reality. A capacity to learn, understand, analyse and select information and transform it into personal knowledge is crucial.

One indication of this is that, in many segments of the labour market, newly trained employees have for some time been more in demand than their elders, despite the latter's long experience and accumulated skills. The reasons why young people are in demand may be their openness to change, desire to learn and interest in new technology.

In order for education to be meaningful and provide useful knowledge, pupils must have some influence over their own learning. This influence is needed at all levels in education, but especially in the way specific subjects are taught.

Today, young people are more independent than in the past. Society is also confronting them with more – and more difficult – choices. They have access to media that give them broad terms of reference. This means that pupils now demand education of a higher standard. They seek to play an active part in the learning process, instead of being passive recipients of teaching. To an ever increasing extent, before absorbing any specific knowledge, they demand to know why this knowledge is important and how it may be useful to them.

Knowledge arises when, alone or in co-operation with others, people absorb information and, through understanding, create their own structures. Accordingly, knowledge becomes the pupils' own: they possess their own knowledge. In order for such a process to take place, the pupils themselves must be active. They cannot be passive objects of teaching; instead, to a greater extent, they must themselves seek and create their own stock of knowledge in interaction with others.

Syllabuses are largely divided into subjects. However, school subjects are merely artefacts that help to structure material, and syllabuses afford great freedom to arrange teaching in other ways. There is a tendency to depart from strict subject boundaries and move towards arrangements that are more interdisciplinary and better satisfy the objectives of education.

School learning is thus converging with the learning process that takes place in the world of work, through a learning organisation and in a learning environment.

New role for schools

Schools no longer enjoy the same monopoly position in providing information and knowledge as in the society of times past. Today, young people have access to ever more media, and they devote a great deal of time to the media. Pupils with special interests have very great scope for acquiring more knowledge on their own. The function of schools and teachers is, as before, to convey basic values and important knowledge. But the educational arena has become broader, and the real-life setting has increasingly become part of everyday life at school and the content of teaching.

Since demands on schools are changing and pupils' needs are now different, the teacher's job is also undergoing development. The educator's task is becoming more advanced, important and difficult than before. Teachers must to a larger extent satisfy their pupils' individual needs, and can no longer rely as before on an authority that accompanies the teaching role. A change in the arrangement of teaching that enables the pupil, alone or in a group, to obtain and create knowledge spells an ever growing challenge to the teacher. Educational professionalism is required to arrange lessons in such a way as to capture pupils' interest and enable them to attain defined knowledge goals.

This development does not spell the demise of teaching in traditional forms. It will, however, entail a shift of perspective towards increased pupil responsibility and more emphasis on the pupils' endeavour to attain knowledge.

The pupils' enlarged responsibility is not devoid of problems, and it calls for more skilled teachers. Some pupils require special teacher inputs to complete courses of studies that call for them to be more active and assume more responsibility.

In October 1997 all Swedish schools were invited to apply for support for local projects to develop the teacher's role in collaboration with teacher training colleges and/or regional educational centres. Interest proved to be considerably keener than expected. By year-end, the Ministry of Education and Science had received some 1,200 applications. This keen interest is, in the Government's view, an indication of strength and a desire to develop in the Swedish teaching profession. In general, education is seeking to enhance pupil commitment and responsibility. In April 1998, the Government decided to allocate SEK 75 million to 168 local school projects.

The directives to the Teacher Training Commission (Dir. 1997:07) emphasise the emergence of new forms of learning as a result of ICT, and that the Commission should therefore consider the need for further inputs in teacher-training courses.

One important precondition for the development of education is educational leadership. Owing to the decentralisation of the past few years, the school head's responsibility has become broader. ICT development in schools depends largely on school managements. School heads' insights into how the quality of the teaching can be raised by the use of ICT for educational purposes have a major bearing on whether ICT can become an everyday teaching tool. As a result of school heads' enlarged responsibility and the demands for greater knowledge in diverse areas, the Government has undertaken special measures to develop school-management training.

Education for adults

The development described above is also evident in adult education. The requirement of meeting the participants' highly varied educational needs, in terms of orientation, scope and arrangement in time and space, constitutes a starting point for the development work currently under way, in the form of the Adult Education Initiative and other measures. In the long term, it is a matter of shaping adult education into part of a local infrastructure for lifelong learning. To this end, ICT offers important instruments. Only by using ICT is it feasible to offer, at a reasonable cost, virtually individualised courses, or courses adapted to small groups, at the times and in the locations where participants need them.

The boundary between more traditional courses provided in schools, on the one hand, and open and distance learning (ODL) on the other is set to dissolve. Learning and study

centres and workplace training will play an increasingly important role in adult education. The Government aims to support and boost development of ICT-aided education and training that can be used for ODL and other adult education at upper secondary level.

Within the framework of the Adult Education Initiative, large-scale inputs are currently under way. The Government has initiated an educational development project at the national schools for adults, one aim being the development of flexible ICT-supported ODL, and allocated SEK 13 million for this. The objective is for ICT-aided education to permit a broader range of upper secondary courses than most local education providers have the scope to offer, so that the sought-after infrastructure for lifelong learning can be realised outside, as well as within, metropolitan areas.

In its Regional Policy Bill (Govt. Bill 1997/98:62), the Government has recently made proposals regarding the need for further inputs relating to supervisors' training, local study centres and other matters. A flexible system for ODL should afford opportunities for students to choose between several different study environments. Access to local study centres is highly important to a successful introduction of a flexible ODL system for a broad target group. Within the framework of the Adult Education Initiative, numerous study centres have already emerged in Sweden.

In spring 1995 the Government appointed a special Commission for Distance Methods in Education (DUKOM, Dir. 1995:07), which has been engaged in some 100 pilot projects aimed partly at providing documentation for a future strategy for ODL in Sweden. The Commission is to report its proposals in June 1998.

Universities and colleges

One precondition for Sweden's capacity to hold its own as a well-developed nation in the knowledge stakes is for more people to be given the opportunity of higher education. The Government has therefore made the expansion of higher education a priority. In the years 1997-2000, resource inputs in higher education are to correspond to 68,000 new permanent places. The demand for people with skills in natural sciences and technology means that the thrust of expansion in higher technology is in these fields. The business and public sectors' need for well-trained labour is particularly marked in the ICT sector. The Government has therefore laid down as the objective of all universities' and colleges' work the requirement that they respond to this sector's need for trained staff.

Methods in higher education are also changing in courses that do not primarily train people for ICT, and ICT is used as an educational tool in an increasing number of courses. The scope for ODL with the aid of ICT is also growing. Since most people will need ICT literacy in gainful employment, many courses also have sections in which ICT is used as a tool.

Schools can help to play down the complexity of ICT and computers, thereby lowering the threshold for people – notably women – to apply for such courses. This is an important precondition of the capacity of higher education to satisfy the increasing need for ICT specialists.

ICT must be a major feature of teacher training. Since 1 January 1998 the objectives of teaching degrees include imparting to students, as a condition of the award of degrees, an ability to use computers and other ICT aids in their own learning, and to know how these aids can be used in school teaching (Annex 3 to the Higher Education Ordinance [1993:100]). To ensure that newly trained teachers obtain knowledge of ICT, the Government has allotted funds for ICT training for teacher trainers.

In the higher education sector, major technical investments in ICT are also being made. The Swedish university computer network, SUNET, is to be upgraded during the current fiscal year. In addition, the Government and Parliament have decided to offer municipal main libraries and county museums fixed online connection with SUNET and the Internet. Accordingly, public libraries and county museums will gain access to a powerful Internet connection, the cost of which will be borne by the state in the first two years provided that the municipalities meet costs over the ensuing three years. There is also scope for all students to obtain Internet connection from their homes, regardless of where in Sweden they live, on highly advantageous terms. In this context it may also be mentioned that, in its Regional Policy Bill (Govt. Bill 1997/98:62), the

Government proposes the establishment of a special development centre in Härnösand to assist the development of ODL based on modern ICT. The National Agency for Higher Education has been charged with developing an ICT-based research information system.

Future-oriented education for all

Asking questions oneself

Introducing ICT into education does not, as such, change the requirements of critical examination, but ICT calls for new ways of working. Traditionally, teaching has been based on a textbook in which the various sections of the subject are usually presented in an instructive and orderly way. A different arrangement, using the Internet or teaching media, is for pupils to collect data from various sources, thereafter making presentations or reports based on the material they have collected. This kind of method requires discussion of the provenance of the information and evaluation of its correctness and relevance. On the Internet it may be difficult to distinguish truth from falsehood and hearsay, or neutral facts from commercial messages. There is thus a great need for critical analysis.

By collecting material from various sources in this way, the pupil can come to realise that, in many situations, the same thing can be regarded and described in various ways. In various subject areas with a social and arts emphasis it is very common for different – and sometimes widely divergent – views of a particular issue to coexist. If the teaching can thus elucidate several perspectives, it has gained in quality. The pupil gains a more profound grasp of the subject, since the perception gained corresponds better to real-life conflicts and paradoxes. This also gives the pupil a better basis for making personal judgements concerning Internet material that may be of dubious value or opposed to the fundamental democratic values of education and society.

Understanding the implications of various alternatives, as the curriculum prescribes, is a demanding task for teachers and pupils alike. The kind of education in which the pupils themselves seek knowledge does not supersede the teacher's role of providing basic knowledge. Only a person with sound basic knowledge is capable of seeking, selecting, evaluating and compiling relevant information.

An approach of this kind is indeed possible without ICT, but good use of ICT can help to push educational development in the right direction. If this does not happen, there is a danger of ICT in education being reduced to learning with software based on drills and multiple-choice questions. Although in some quarters the use of ICT in schools is regarded as justified by the capacity of such programs or teaching media to make learning more effective, this cannot be the primary purpose. However, it is important to be aware that there is no automatic mechanism whereby investing in ICT in education will, by some simple mechanism, impart to pupils a capacity to examine information critically. It is through purposeful teaching that pupils develop this capacity.

The school in the global community

A modern school responds to knowledge, events and information from all over the world. ICT means that physical distances become irrelevant and the classroom opens up towards the outside world. On the Internet, it is no more expensive or difficult to be on-line with a computer in the USA than with one in one's own home town. ICT gives those who wish and venture to do so every opportunity of transcending boundaries and obtaining information from, or forging contacts in, other countries.

As pupils in more and more countries worldwide gain access to the Internet, it is becoming feasible to arrange joint projects or exchange information between countries. One good way of understanding other countries and cultures may be to work on an assignment in co-operation with pupils in a school abroad. This way of working, which previously required a great deal of patience or was very expensive, is now open to everyone with Internet access. The Government sees the increased internationalisation of education to which ICT can contribute as an important means of promoting development in education.

Curiosity and the joy of learning

The Internet is an ocean of information. No one knows what will turn up with the next click of the mouse. Every new web site is a world in itself, thought out and designed by a unique individual. On the Internet one can find everything – highbrow and lowbrow, new and old – and the only limits are those imposed by one's own imagination and wishes. Teaching aids that utilise the scope afforded by the new technology can stimulate several senses at once.

One basic problem of classic, lecture-oriented teaching is that pupils receive answers to questions that they have never had occasion to formulate. Methods that involve an active quest on the pupils' part can arouse this very curiosity and joy of learning that has hitherto often been lacking.

If ICT is to stimulate pupils, one important requirement is that the technology be subordinated to the teaching. The computer teaching of the past, which was a matter of learning to programme in Basic, often had the opposite effect, making many pupils lose interest and feel that the instruction was pointless.

Instruction and work procedures in education should stimulate a problem-oriented way of teaching in which analysis and processing of various methods of solving problems and action based on these strategies are followed up, examined and evaluated. A work procedure of this kind is promoted by the smaller-scale use in schools of ready-made software for school use that revives old-fashioned teaching methods in electronic form. Instead, teachers' and pupils' own creativeness should be stimulated; this may, for example, be achieved through the Multimedia Bureau of the Swedish Schoolnet, which places at schools' disposal the tools enabling them to create their own multimedia productions.

Correspondingly, schools can use the usual software available on the market for word-processing, calculation, presentation of material and so forth. This approach – using professional tools for school use and to stimulate the pupil's own production – is not self-evident in international contexts. It also presupposes greater know-how on the part of pupils and teachers than it has hitherto been possible to expect. But it is an approach that bolsters the general educational attitude of wishing to promote pupils' own active participation in the learning process, to give them tools for lifelong learning and to prepare them for the world of work.

Language increasingly important

ICT facilitates and supports writing. By using computers with word-processing programs, pupils can work actively on process-oriented writing.

The English language predominates heavily on the Internet. A large share of all development of the Internet, software and computers is taking place in the USA. The positive side of this is that it provides a very strong driving force for pupils to learn English. On the other hand, people without a knowledge of English will be excluded to an ever greater extent from information and contact with their fellow humans in the future.

The Internet provides unique opportunities for communicating in a simple way with pupils in other countries. This communication may take place in foreign languages, thereby affording practice in a real-life context.

Modern word-processing programs can help with spelling as well as checking the user's English grammar. Since dictionaries and thesauruses are available at the click of the mouse, it is simpler to use these aids to writing. Computer-based dictionaries also provide the opportunity of getting the word read aloud with correct pronunciation.

The school environment

School pupils are covered by the Work Environment Act (1977:1160). It is important, on the basis of this statute and of the rapid development of new technology, to make teachers and pupils aware of the requirements that this technology imposes on the work environment, in school as well as in the pupils' future working lives. The National Board of Occupational Safety and Health has compiled information on these requirements. One important element in pupil democracy at school is the pupils' right to participate in safety activities – a right conferred by the Work Environment Act. The pupils' safety representatives have a very important function for themselves and their peers. They learn to take responsibility, and have

genuine scope for influencing their own work environment. It is essential for demands imposed on the ICT environment at schools to be equivalent to those, for example, stipulated for the modern office environment.

Women as well

In public debate, ICT is often said to have been created by and for men. Pioneers in the industry were often inspired by a sheer love of technology as such. Technology was central, and became an end in itself for many. Such notions as applications or user-friendliness were unknown at that time. All experience and various surveys indicate the same conclusion: women are seldom interested in technology for its own sake. They are, on the other hand, interested in its usefulness, or any benefits the technology may afford. Initially, the computer industry was heavily male-dominated and technology-oriented, and this excluded many women.

The proportion of women on computer-oriented courses in higher education has long fallen short of 10%. In the computer industry, women make up a small minority. Jens Pedersen, in his *Information and Communications Technology in Schools, a Research Overview* (in Swedish; National Agency for Education, 1998), shows that research findings on ICT in education to date echo what was previously known about gender and the natural sciences. Girls are interested in seeing context and meaning. They regard technology as a means to this or that end. Boys, on the other hand, more often see technology as having intrinsic value.

Sweden is a knowledge society with ICT as a major driving force. This technology is dominated by men, who thereby have the upper hand. We are in danger of succumbing to a trend whereby men become the winners in the information society.

The powerful influence of ICT on social development is due solely to the advantages it affords. The main thrust of policy must therefore be to give women access to technology on their own terms. Arousing women's interest in the use of computers thus requires more effort than arousing men's. It is therefore also important to work for a massive change in the culture that has previously prevailed in ICT contexts. Only then can ICT attract both sexes on equal terms.

For Sweden to be a successful nation that can hold its own in the competitive international ICT arena, large groups of technicians and engineers capable of developing the technology of tomorrow are needed. The number of people engaged in ICT is rising rapidly. More women are needed in this world, both because society needs all available forces in this sector and because women can help to adapt new technology more to people's real needs and ways of functioning.

For girls to be given better scope for using and learning about ICT, several things are needed. One is that teachers must be aware of the difference in girls' and boys' use of ICT, and work actively to give both sexes the same chance. The teaching must be arranged in such a way as to show girls, too, that ICT is a meaningful tool that helps them, not something justified by its intrinsic value. Finally, access to equipment must be ample and fairly divided, so that the girls are not pushed out by their male "technofreak" classmates.

Class gaps in the information society

The distribution of computers in Swedish homes is very uneven. Far fewer wage-earners than salaried employees and graduates have computers at home. There may be several reasons for this. The latter are, in many cases, better paid, which makes it easier to finance the

purchase of a computer for home use. Moreover, white-collar workers use computers in their jobs on a large scale: this familiarises them with the technology, and also means that they can see the value of being able to carry out certain duties at home. Distance employment using ICT is a way of working that, in practice, includes salaried employees only.

The benefit of having a computer at home that is paid for by the employer is not liable to tax if certain rules are complied with (Act amending the Local Tax Act [1997:770]). The primary precondition is that all employees should be included in the offer. The new rules were introduced to stimulate the use of computers (Govt. Bill 1996/97:173). This will give many more people in various groups a chance of having a computer to use at home than would otherwise have been the case.

The function of schools is to provide an equivalent education for all pupils, regardless of their background and experience. Thus, one important task is to compensate for pupils' disparate capacities. Since knowledge of ICT is a requisite preparation for the future labour market and generally strengthens people's position in society, all pupils must become amply familiar with ICT. This presupposes that every school has good access to computers, and that the teachers are well versed in the educational uses of ICT. An effort to boost ICT in education is therefore well justified.

New paths for democracy

ICT gives democracy new potential. The principle of public access has a tradition of several centuries' standing in Sweden, and is a cornerstone of our democracy. In practice, however, it is mainly the citizens' representatives – especially journalists – who have made use of the opportunity of going to a public authority to read current documents. The public-access principle has been a right that most people have never exercised in person. This may change completely as a result of the Internet, which now offers the technical means of publishing every public document. Using simple search tools, interested citizens can use their own computers at home to retrieve all documents relating to a particular subject, or follow everything that happens in a particular decision-making body.

Such web sites as the Government's "Information Rosenbad", Parliament's home page and Sweden Direct are very popular, and enable far more people than ever before to study the entire documentary basis of decisions, not only the parts that journalists choose to report on.

ICT enables groups that share particular interests and pursue specific issues to conduct Internet discussions and campaigns. It is easy to keep many people informed of what is happening and to co-ordinate activities. This situation is as yet in its infancy, and its full potential cannot yet be assessed.

ICT also changes the parameters of political debate. Using the new technology, people can come together and debate various issues. By convening and discussing matters in different forums, people can help to give depth to democracy and enhance public participation.

ICT affords great scope for participation in active democratic efforts for those who perceive this scope and can use the tools. There is a danger of growing gaps in the knowledge society. People lacking ICT literacy are at a disadvantage. Well-educated groups with a good grasp of the technology are gaining more of an upper hand than before, since they have access to better channels of information and influence.

To offset these disparities, education must provide equal opportunities for all. Preparing pupils for participation in democracy is a primary task of schools, and they must therefore impart to all pupils the requisite ICT literacy.

Nationwide development

ICT brings people closer. No other technology has reduced the importance of distance as ICT has done. On the Internet, increasing distance boosts neither cost nor (appreciably) transmission time, and the latter is all that matters.

ICT requires extensive infrastructure, and the cost of extending this infrastructure rises with the size of the area connected. In sparsely populated areas, Internet connections of varying capacity may therefore cost considerably more than in densely populated areas. "Education for all" means equivalent conditions for pupils in different parts of the country. It is therefore essential to try and even out the cost and speed up the hooking-up of schools to the Internet.

New potential for schools

The 1998 Spring Budget Bill (Govt Bill. 1997/98:150) proposes allocating a total of SEK 1.5 billion over three years for ICT investments in schools. Within this framework, the Government is now presenting proposals for a national programme for ICT in schools aimed at equipping Sweden's schools, and every pupil and teacher, to meet present-day and future challenges. This programme focuses on developing teachers' ICT skills, ensuring their computer access, speeding up schools' Internet connections, giving every pupil a personal e-mail address, improving education for functionally disabled pupils by means of ICT, and continuing to develop both the Swedish and the European Schoolnets.

As we have seen, schools need to expand their use of ICT. The foremost reasons are that:

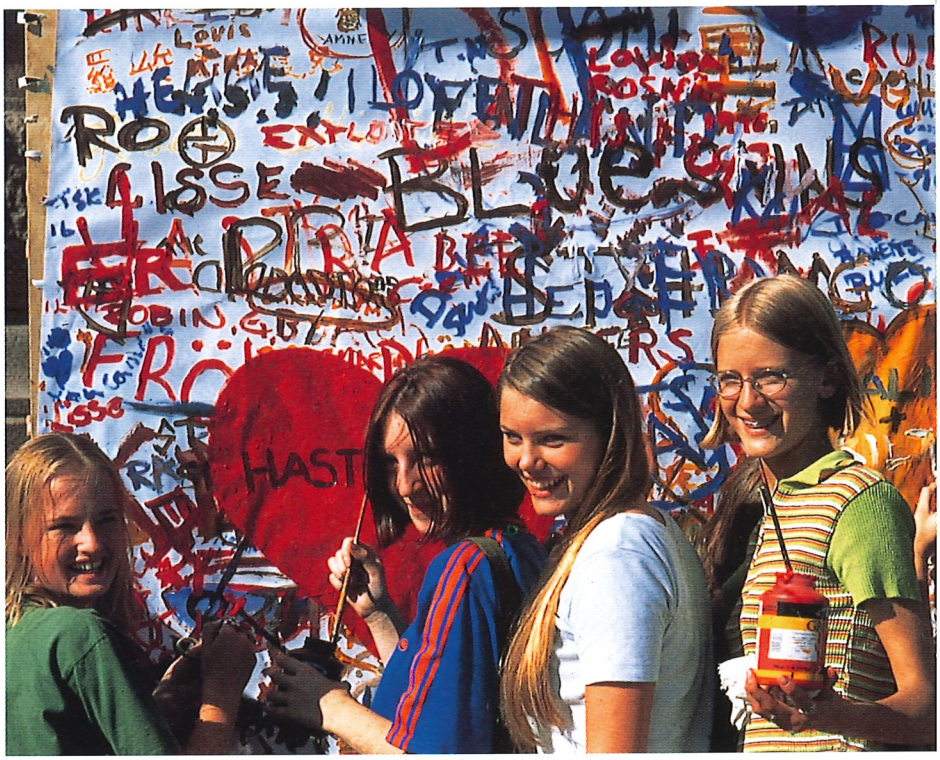
- ICT can help to develop teaching and new roles for pupils and teachers, and to expand the classroom. Teaching can come to entail more pupil activity and reflect a modernised educational approach. ICT generates new scope for understanding complex connections, e.g. through simulation programs in various subject areas. It also affords new scope for communication with society at large. Schools are opening up, and pupils are encouraged to seek information and initiate a dialogue with others.

- ICT almost entirely permeates society and the world of work. Every pupil therefore needs to acquire ICT skills in preparation for adult life.

- Stepping up our ICT efforts is a major issue of equity. Children in various groups in society have widely varying access to ICT, and schools therefore have an essential compensatory function. Through wide-ranging ICT efforts in schools combined with development of teachers' skills, education can offset these disparities. Equivalent education must be a joint endeavour.

- ICT affords new scope for internationalisation of schools. The Internet, for example, gives pupils new chances of getting in touch and comparing notes with pupils in other countries.

TOOLS FOR LEARNING – A NATIONAL PROGRAMME FOR ICT IN SCHOOLS



The Spring Budget Bill 1998 specifies expenditure of up to SEK 340 million and 540m for 1999 and 2001 respectively on, mainly, ICT in education. The national programme for ICT in schools represents a focused endeavour, for a limited period, to develop schools by means of ICT. The purpose is for state inputs to stimulate school governing bodies to invest in ICT development. However, it is these bodies that bear short-term as well as long-term responsibility for funding ICT in schools. The measures specified in this section are to be implemented subject to Parliament's and the Government's decision.

The national programme for ICT in schools covers pre-school, compulsory school, special school, school for Lapps and upper secondary school.

Concerted ICT effort in schools

Partly in order to prepare, plan and implement the national programme for ICT in schools, the Government has appointed a special delegation for the period up to and including the year 2001. Besides representatives of the Ministry of Education and Science, this delegation includes members from the partners that are needed for successful implementation, including the National Agency for Education, the Swedish Association of Local Authorities and the Foundation for Knowledge and Competence Development. The Ministry, with responsibility for school-related issues, is providing the delegation's chairman. A secretariat responsible for operative work is linked to the delegation.

Skills development and computers for teachers

In order for ICT to contribute to educational development, teachers must have ample scope to utilise the new technology. All true change in schools must take place through the teachers, who are and will remain key figures in learning. One substantial part of the national programme for ICT in schools is therefore an offer to teachers and school managers to attend an ICT course aimed primarily at acquainting them with the potential uses of ICT as an educational tool. This offer of skills development is directed at the school governing bodies.

Every teacher and school manager who attends the course and attains its objectives will, for professional use, be given a multimedia computer for home use. This computer should be seen as a stimulus to the teachers, but above all as an essential tool in mastering ICT and exploring its use in teaching. Teachers with their own computers can achieve the familiarity required for using a computer as a professional tool, i.e. for administrative as well as educational purposes.

Teachers the key

Within the framework of the national programme for ICT in schools, teachers are to be offered training with the objectives and content described below. A study-programme syllabus will be drawn up by the Delegation for ICT in Schools.

Aim and purpose

The purpose of the training is to give teachers basic knowledge of ICT as an educational and professional tool. The training will focus on imparting knowledge of and familiarity with the use of ICT in teaching, but also developing the teachers' grasp of how ICT is used in society at large. The training is also aimed at giving teachers knowledge of how to organise their teaching so that both girls and boys perceive ICT as a meaningful aid.

The training is therefore divided into two main parts. One concentrates on giving teachers knowledge of the computer itself as a tool. The other, which is the essence of the training, concerns the use of computers for educational purposes in everyday school work. The training will deal with how, in this context, computers can be used to enable pupils to attain various forms of knowledge.

The intention is that, after the training, teachers will

- be well informed as to how forms and procedures of school work can be developed through the use of computers in teaching;
- be well versed in ways of arranging teaching that enable all pupils, irrespective of gender, to perceive ICT as a meaningful tool;
- know how to develop a plan for the introduction, use and evaluation of ICT in their own teaching;
- possess basic knowledge of how to develop multimedia programs – educational media – for school use;
- be able to use computers as tools of computer communication, in local area networks (LANs) and on the Internet, and of information management, e.g. by utilising the scope afforded by the Schoolnet;
- be familiar with computer construction, functioning and software, and capable of using computer operating systems;
- at a basic level, know how to use common application programs, e.g. for word-processing, graphics, calculation and database management;
- understand the uses of ICT in companies, organisations, education and society, and be capable of engaging in a critical discussion of opportunities and threats in the information society;
- be familiar with legal issues relating to copyright, data security, purchasing and agreements;
- have an understanding of the ethical rules that exist de facto on the Internet, and have reflected over the ethical issues that arise when pupils use the Internet;
- have a grasp of the work-environment requirements entailed by these new technical aids.

Training on the trainee's terms

Training activities will be on a large scale. In the three-year period ahead, an estimated 60,000 teachers at least are expected to be affected by this skills development, i.e. a volume of some 20,000 teachers a year. To make it feasible to train all these teachers, the training should be arranged flexibly, in the form of intensive courses, study circles or seminars, or of ODL. Use of the Internet and e-mail enables part of the training to take place in a virtual classroom.

For implementation of these training inputs, it is essential to engage teachers who are at the leading edge, e.g. teachers who are directing successful educational ICT projects and student teachers who have received ICT training, to teach and lead the study circles. It is also important to make use of knowledge and experience from the projects supported by the Foundation for Knowledge and Competence Development, such as the "Lighthouse" projects.

From many points of view, it is appropriate for more teachers – e.g. a working group – from each school to be trained simultaneously, to obtain the collective inspiration and knowledge to introduce modified ways of working at their school. The training is required to be closely associated with everyday teaching practice, but is to take place outside teaching hours. Each course should – depending on the teachers' prior knowledge – comprise two to four weeks' full-time studies. Since the training can be implemented in various ways and at varying levels of intensity, the training period will vary within the aforesaid framework. The first part of the course will provide skills that many teachers already have. These teachers can proceed straight to the more difficult and complex second part.

Teacher's ICT certificate

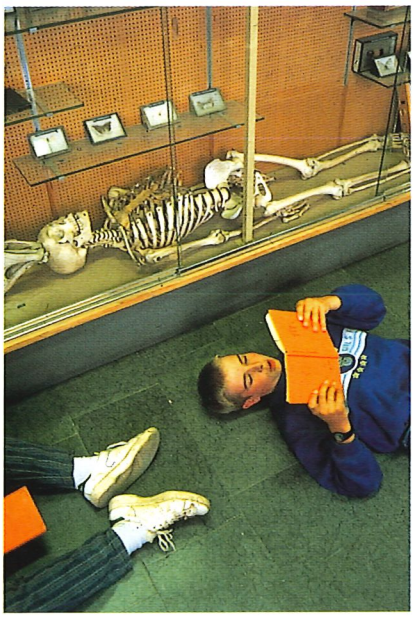
After undergoing the training, the teachers should all show that they have the knowledge of ICT that the courses aim to provide, and that they have acquired a personal perception of how ICT can be used in school work. Teachers who, after the training, fulfil the objectives of the syllabus will receive a Teacher's ICT Certificate, which will perform an important function by substantiating the holder's level of skills and, accordingly, be of value as a qualification.

Organisation for ICT training

The Delegation for ICT in Schools has overall responsibility for inputs to develop teachers' skills. The Delegation is formulating guidelines – based on the Government's decision – as to how the training is carried out, i.e. requirements concerning dimensioning, implementation, arrangement and content. The plan is for the training to be held regionally and adapted to regional conditions. A management group representing teacher-training institutions, regional educational development centres and the municipalities concerned is to serve as co-ordinator of a regional network to include every municipality and, indirectly, each school.

Teachers' computers

To enable the teachers, after training, to make active use of computers as an educational and professional tool, the Government's intention is for every teacher awarded an ICT certificate to obtain the use of a computer. The idea is for the school governing bodies to be offered the computers and then make them available to the teachers, who can then use them at home for professional purposes. Each computer is therefore formally owned by the school's governing body, which bears all future responsibility for it. The governing bodies must thus bear the future costs that these computers may entail.



The Internet in schools

The Internet has become overwhelmingly predominant as a means of communication in the ICT society. On the Internet, information can be retrieved and generated, and it provides scope for co-operation and contact between pupils throughout the world.

The Government will make it possible for every school to be hooked up to the Internet and use it directly in education. Schools' Internet connections will be funded by grants payable to school governing bodies for upgrading of Internet connections. The objective is for every school to go on-line in the near future and for there to be Internet access, in principle, in every classroom.

Build on what we have

According to the National Agency for Education's latest survey, that of autumn 1997, 91% of municipal upper secondary schools and 56% of municipal compulsory schools have an Internet connection of some kind. The state offer should be designed to bring about an optimal boost to the inputs already made. Of those schools that have a fixed connection, many are connected to a municipal network, while others have opted for a direct connection to the Internet through an Internet operator.

The majority of municipalities have adopted ICT strategies that specify plans for extending access to ICT in various activities, including education. State support must be so flexible, and in such a general form, as to be compatible with various strategy options and enable the full benefit to be derived from inputs made to date.

Nature of the grant

The state will not take over from the governing bodies the cost of schools' Internet connections. Instead, the intention is for state funds to be provided for a limited period to hasten a transition to connections of a higher capacity. The grant should be calculated for each school separately, and the level should vary with size, in terms of the number of pupils.

The calculation sets a limit to how much a school's governing body can receive. Each governing body can add connections where they are most useful. In many schools the addition will consist of a high-speed connection, while others will be hooked up to a municipal network. Schools that already have a connection can choose to increase their capacity or install a LAN that reaches into the teaching premises (classrooms). Initially, the aim is for each school to have at least one connection, as follows:

Size of school	Capacity
< 200 pupils	128 kbps
200-500 pupils	512 kbps
> 500 pupils	2 mbps

Application from the school's governing body

Decisions on funds should be a matter for the Delegation for ICT in Schools. The grant for Internet connection is intended to be disbursed to the school's governing body on application. The application should also clarify how the body intends to ensure that the school attains the capacity level specified above. The grant is intended for Internet connections, which may be achieved in various ways – as an extension of the school's LAN or by the school's own Internet connection, direct or via a municipal network. To enable schools to derive maximum benefit from the grant, the Delegation is to negotiate on school-connection pricing with Internet service providers. The school's governing body will receive instructions concerning the requirements for obtaining a grant.

E-mail address for every pupil

E-mail is the most basic and widespread communicative function using modern ICT and the Internet. Having access to e-mail is an important precondition for being able to participate in the ICT society.

The Government intends to offer every pupil and teacher at compulsory and upper secondary school an e-mail address. It considers that special inputs are required to ensure that e-mail access does not vary and depend on local conditions. Having their own e-mail addresses will enable all pupils and teachers to reach one another, and this will make e-mail use consider-

IT and learning

A NEWSLETTER FROM THE KK FOUNDATION ABOUT IT, EDUCATION, PEDAGOGY, AND LEARNING. NR 15/2 October 1998.
THE INTERACTIVE VERSION OF "IT AND LEARNING" IS FOUND ON http://itl.kks.se (http://itl.kks.se/english/)

74% OF ALL TEACHERS READ IT!

You are looking at an issue of "IT and Learning" – the most read Swedish newsletter about information technology and learning. Every second week a new issue is sent to all schools in Sweden, offering our readers a comprehensive summary of the latest news about IT and learning reported in the media. Fifteen minutes every other week is all our teachers need in order to stay updated.
We started publishing the newsletter two years ago and it has been a big success. 74 % of the teachers and 89 % of the headmasters. Nineteen out of twenty readers rate it as good or excellent.

We are convinced that "IT and Learning" has a substantial effect on the development of computer assisted learning and the reforming of the Swedish school system.

David Nordfors, Editor-in-Chief
david.nordfors@kks.se

STOP PRESS

The new government policy on schools

In his statement on government policy, Göran Persson emphasised that Sweden is to be a leading nation of knowledge and that its position in the vanguard of IT countries is to be strengthened. The school is to be developed and modernised. Teachers' working situation and opportunities for development are to be improved. Dyslexic pupils are to be given extra support and everybody in school will have access to Internet and e-mail. The statement on Government policy can be read in its entirety at: http://www.regeringen.se/

TT 6 OCT.

USA: IT improves pupils' results according to teachers

A new national study in USA, commissioned by the American Association of School Administrators, shows that 80 percent of teachers and head teachers interviewed believe that IT has improved their pupils' performance at school. 96 percent of the teachers also believe that IT is an important tool for improving the motivation of pupils to learn.

When asked what evidence there was to support this, 30 percent responded that they had seen improvements in the exam and test answers of their pupils. 42 percent pointed to the fact that pupils had acquired more knowledge. It is more difficult to measure other results. For example, 60 percent responded

In this issue:

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that they had seen an improvement in pupils' motivation to study and 30 percent mentioned fewer discipline problems in classes. Moreover, 86 percent believe that IT is an important tool in strengthening parental involvement in the school.

There is a strong link between access to home computers and performance of pupils. Access to home computers was high amongst "high performing" students, however the opposite was true for those students with the lowest grades.

NEWSWIRE 12 OCT.

Good teachers produce better grades

An American study performed by the Educational Testing Service (ETS) in Princeton shows that computer investment in schools does not automatically lead to better education. The survey covers approximately 14,000 American fourth and eighth year pupils. ETS has tested how the pupils' knowledge of maths is affected when they have computers to use at home as well as at school. It shows, among other things, that good computer programmes together with good competent teachers can have a positive impact on grades. The opposite applies. The study can be accessed at: http://www.ets.org/ research/ pic/

HALLANDS NYHETER 6 OCT.

FROM REAL LIFE

E-contact resulted in school trip to Portugal

Class 8 N1 at Näsbydal school in Täby have had links with a school in Portugal via e-mail since last spring. Now the class are going to visit their friends and for a few days they will have the opportunity to learn more about Portuguese culture, communicate face-to-face with each other and take part in lessons with the Portuguese children. Näsbydal school will receive a return visit from Portugal in November.

LOCAL PAPER, DANDERYD, 6 OCT.

Seventh-graders design home pages for companies

Seventh year pupils at Oxhag school have been working on a multimedia project "Gyllene Oxen" (The Golden Ox) for two years. The aim has been to develop the pupils' IT skills and provide them with opportunities to link up and co-operate with the business community. The major part of the project has been the planning and design of a home page for a company. Businessman, Rune Tennesmed, is satisfied with the final result. " They have worked really hard. This looks as though it's a good foundation for building an Internet home page".

BAROMETERN 30 SEP.

Pupils' rules for the Net.

Pupils at an upper secondary school in Falkenberg have been barred from using the Internet since last spring because the computers had been used for purposes other than learning. A group, where pupils make up the majority, have worked out new rules on how computers should be used and now they've got Internet access once more. "The old rules didn't work, they were too detailed and full of dos and don'ts ", says head teacher Johnny Rydgren.

Slander, harassment, racial agitation, racism, pornography and "abusive" hacking are a few examples of what is banned by the new rules. The reorganisation means every second computer in the study halls is connected to the Internet. Fewer computers are occupied by those using the Internet so there is greater access to computers for other purposes.

HALLANDS NYHETER 29 SEP.

Lord Nelson and D Day

Work is in progress in Portsmouth on linking up state and private schools, universities, libraries and museums in an education project. A special curriculum will be produced to exploit the unique resources of the city as well. A series of different sub-projects based on the city's rich history are planned. Among other things, the allied invasion of France in 1944 was launched from Portsmouth, and interactive teaching media will be produced about the invasion. Pupils are also working on a project about the English naval hero Nelson and the different battles he fought. From this it will be possible to reconstruct and alter the course of history.

THE EXPRESS 26 SEP.

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Archipelago children build island communities

Pupils at Gräsö school are taking part in a project involving pupils in the archipelagos of Finland, Åland and Sweden. Using their computers children will be creating four fictitious island communities in the Baltic. The pupils will work in groups and have the task of populating the island and getting it working. All school subjects are involved in the project. The children learn to make decisions together and at the same time learn about other regions.

UPSALA NYA TIDNING 2 OCT.

Constructing a virtual amusement park

Ferrous Wheel is an interactive Internet project aimed at pupils in compulsory and upper secondary school. The task consists of gradually constructing a merry-go-round for a virtual amusement park over an eight week period. The project was started in September but there is still a chance to join. In April, there will be a new round in the challenge. Further information available at: http:// www.onlineclass.com/ ferrous/ home.html.

ACORN USER NOV/98.

IT AND EDUCATIONAL APPROACHES

Invest in developing educational approaches!

Maria Larson, from the Department of Education at Lund University, has in a 3rd year dissertation examined the goals and implementation of the project "IT for Quality" in schools in Lund. Marie Larsson states that the goal that all teachers and pupils should be able to use computers will probably be reached. However, there is still a long way left to the other major goal: that computers should be used to develop new educational approaches, enhance the quality of teaching and change working methods in the school.

" I think schools should forget about the first goal and concentrate all their resources on developing better pedagogical approaches" says Maria Larsson and goes on to add:

" It is so easy to put the blame on a lack of resources or not having Internet access. But you need ideas to make something out of technology."

SYDSVENSKA DAGBLADET 9 OCT.

Science centre for school educational development

A new pedagogical and technological centre will be built in Jönköping with financial support from the KK Foundation. The aim of the centre called "Ladulåset", is primarily to interest young people in science and technology. It will function as a centre for technological training for lecturers as well university college students. Similar technological centres in Luleå and Södertälje have significantly boosted interest in technology and science courses at upper secondary and academic level.

TT 28 SEP.

Upper secondary courses on the Net

The city of Stockholm and "Kunskapslyftet" (the government programme for boosting adult educational) have started investing resources in web-based teaching. Over the autumn, eight teachers will develop upper secondary courses in Mathematics, Swedish, English, German, Russian, Science and Civics. The courses will then be tested by the pupils in their respective schools and are expected to be available in autumn 1999.

" This will be a resource for teachers, pupils and parents", says the project leader Kersti Hjertqvist. The idea is that there should be an open part with information about what is needed for the different courses. There will also be a part with restricted access where it will be possible for those with passwords to follow the teaching and have meetings with the teachers. Similar projects are in progress in several parts of the country, including Göteborg, Jämtland and Hallsberg.

DAGENS IT 7 OCT.

Elite teachers go "live" on Net video.

The Ministry of Education in England has launched the idea of video filming the best teachers in the

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country "in action" and making the material available on the Internet. The objective is that other teachers will be able to see this and learn. "We want to exploit modern technology to demonstrate tried and tested pedagogical methods", says David Blunkett, The British Minister of Education.

THE SUNDAY TELEGRAPH 4 OCT.

Links worth checking out

The project "Thinklinks" which was started during the 1996/1997 school year is aimed mainly at intermediate levels in the compulsory school. Thinklinks, financed by the KK Foundation, is interactive teaching media on the Internet where children answer questions in a number of areas. To be able to answer the questions they need a knowledge of Geography, Swedish, Mathematics, Civics, English and Religion. At the same time the children also learn to use computers and the Net.

Lars-Erik Åhman is the man behind the project and he says that the response so far has not been that great possibly because relatively few people know about Thinklinks. However, the pupils who have tried Thinklinks think it's good. The address is: http://www.educe.se/

NYA KRISTINEHAMNS-POSTEN 30 SEP.

SCHOOL/SOCIETY

Research safari

Safari, the search engine of The National Agency for Higher Education, will be officially launched in connection with Links98 between Oct. 23-26. Via Safari, the country's universities and university colleges will be able to provide information on their research to the general public, i.e. upper secondary school pupils, journalists, business people and private persons.

The information will be presented in two versions, one with a purely scientific focus with the other taking a more popular view. The project is still in its infancy and Marin Sparr, of the National Agency for Higher Education, thinks that it's difficult to predict Safari's future. If school pupils and others start to express their opinions, this could lead to positive changes. Marin Sparr believes that once researchers feel the public is interested in their work, they will then be more interested in explaining it.

SVENSKA DAGBLADET 13 OCT.

Pupils solve EU-MP's problems

Rudbeck school in Örebro is one of three Swedish upper secondary schools chosen to take part in a project called ParlEUNet. Pupils from eight EU countries are divided into smaller groups using computers, faxes, video conferences, the Internet, books, databases etc., they will solve a problem given them by an EU member of Parliament. The aim of the project is to find out how pupils use different kinds of technology when gathering information and collaborating with others across country borders. This should lead to pedagogical models which would make it much easier to use communications technology in teaching. Links between the countries will help instil in the pupils a feeling of being European citizens as well.

ÖREBRO-KURIREN 8 OCT.

Interest among teachers steers IT investment

Lillhag school is one of the schools in Gävle which has decided to move slowly in their computer expansion programme. A total of 300 pupils share 20 computers, one of these connected to the Internet. Soläng school takes the opposite approach. Pupils there have a computer in each classroom, a computer room and what they call a "Knowledge Square". Gun Hedberg, head of development of compulsory schools in Gävle, does not believe that money is the key factor for determining the progress schools have made in using computers in education.

" The differences are mainly a question of the "computer maturity" of educationalists, the degree of interest shown by school management, teachers and other members of staff."

ÖREBRO-KURIREN 8 OCT.

All Boston schools on-line soon

Boston is the first major school district in USA where every school and library will soon be connect-

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ed to the Internet. The city is planning to install one computer for every four pupils and intends to connect all schools, libraries and municipal centres to the Net before 2001.

EDUCATIONAL TECHNOLOGY NEWS 16 SEP.

CD-ROM to be, or not to be?

CD-ROM technology is expensive and computer software represents just one per cent of total sales of teaching media and profitability is low. Vast amounts of money are invested in developing teaching materials on CD-ROM, despite the fact that many people believe that CD-ROM technology is just a stop-gap before the Internet. Håkan Lewis of the KK Foundation however believes that CD-ROM technology will be the dominant form for another three to five years.

"It is still true that "the band width" is a hundred times greater on a CD-ROM ; you get higher speed and better quality moving pictures ".

SVENSK BOKHANDEL NR 18/98

Part-distance upper secondary

Next autumn upper secondary schools in Nyköping will be able to offer pupils distance learning courses. Right now three pupils at Tessin School are participating in distance learning one day a week. The pupils, who together have a combined travelling time of three hours to school, took the initiative themselves and the school saw this as an opportunity to test distance learning at the same time. The pupils have got their own computers and the municipality pays the telephone costs for a three hour link-up each week.

"We want to offer pupils courses that they want. And today I believe that there is a large group of pupils who would prefer a certain amount of distance learning instead of the traditional upper secondary school approach", says Erik Carlgren, head of child and youth activities in Nyköping.

SÖDERMANLANDS NYHETER 3 OCT

Science centre for children and young people

The society "Kreativt Forum" in Blekinge is in the process of developing a science centre for children and young people called Kreativum. The aim is to develop the interest and knowledge of children and young people in general science and regional development.

DAGENS IT NR 41/98

DEBATE/POLITICS

"School drops behind technology".

More and more teaching media of the "open kind" are appearing, but more could be done. "Today's systems are still basically static" is the view of Karl-Henrik Ohlén, director of studies for the multimedia programme in Tumba. "It is not just the fault of developers, users too have got caught up in an old way of thinking. Now we have a new generation on its way and the school we have to-day is going to have problems dealing with it."

"We take the traditional division of subjects for granted. We look at it in the same way as we look at the school, as if it were an unchanging law of nature. A school is an unbelievably complex system and to believe that you can get results just by putting in two computers is to say the least naïve", says Karl-Henrik Ohlén.

Anita Kollebaum, from the Institute for Computing and Systems Analysis connected to the Royal Institute of Technology (KTH) and the University of Stockholm, points out that technology has developed but not the school.

" Schools must be torn down, the building itself constitutes a restriction."

SVENSK BOKHANDEL NO 18/98

"A major investment in schools is essential"

Public debater, Olle Wästberg, is looking for an enlightened political discussion about information tech-

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nology and how it will be possible to use IT as a means of deepening democracy. Wästberg believes that state regulation is the great threat and he feels that politicians should interfere as little as possible in the development of IT. "Politicians should try to create conditions so that technology will benefit as many people as possible. If Sweden is to be a country with high standards then computers must be an integral part of the large scale investment in schools that we need necessary", writes Wästberg.

YSTADS ALLEHANDA 6 OCT

NEW ARRIVAL ON THE WEB

Site for prospective upper secondary school pupils

Every year pupils in the ninth year are faced with an important decision, which upper secondary school are they going to choose for their studies. It's not that easy to find a suitable school. Now a new Internet service 'Gymnasieguiden' (the Upper Secondary School Guide) is being launched and there it will be possible to browse different courses and access information about the various study programmes. http:// www.gymnasieguiden.com/

UPPSNAPPAT 8 OCT

Complement for TV viewers

Anyone who finds that TV treats the news far too superficially and wishes to delve deeper into a subject can change this by navigating to the Internet address: http://www.megastorier.com.
Here you will find a more penetrating analysis of a number of today's current topics. The service is free.

COMPUTER FÖR ALLA NR 10/-98

Nobel prize-winner

Read more about the literature prize at http:// svenska.gu.se/akademien.html

Further information about the literature prize-winner José Saramago can be found at http:// www.bok.bonnier.se/ww/forfattare/saramago.html

It is possible to read more about the medicine prize on the home page of " The Karolinska Institute's Nobel Committee" http://www.mednobel.ki.se/

Further information available at The Nobel Foundation: http://www.nobel.se/

And if you want to get a greater understanding then you can visit the noble prize-winner database at: http://www.nobel.se/ prize/database.html

25TIMMAR

Using newspapers as teaching material

The aim of the organisation ' Newspapers in School' (TiS) is to stimulate teachers into using daily newspapers more in their teaching. On the TiS home page, there are a lot of tips about school and daily newspapers as well as links to Swedish papers. The address is: http://www.tidningeniskolan.com

ARBETET NYHETERNA 12 OCT.

Surf the Net with the micro

Often we have read about how people in the computerised society of the future will be able to surf using the washing machine, the microwave oven and other domestic electronic appliances. http:// www.pcformat.net/ nyheter/ 1998/ 40/ micro.shtml

UPPSNAPPAT 6 OCT.

4,000 computer terms explained at new Internet service

'PC för ALLA' (PC for Everybody) is launching an interactive computer dictionary on the Internet in collaboration with IDGBooks. Key in the tricky computer term you want to understand and get a quick explanation – in simple Swedish. The service is based on 'Nya dataordboken 97' (The 1997 New Computer Dictionary) by Ulf Lingärde. http:// www.idg.se/ pcforalla/ dataordboken/

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ISSUED BY THE KK FOUNDATION IN CONJUNCTION WITH OBSERVER SVERIGE. 35,000 COPIES ARE DISTRIBUTED TO ALL SCHOOLS IN SWEDEN.

From the KK-projects

Training ethical decision-making

At Fredriksdal school in Lidköping all pupils by means of IT, and through ethical discussions, reflection and guidance develop their ability to think through their views on ethical dilemmas. The objective is to create a new generation of humanists.

Humanism and democratic ideals can't be taken for granted. Young people today would like to see the adult generation getting more involved and start participating in debates and ethical guidance. Pupils in the eighth year can choose an ethical issue they want to research. They write a report based on the following subheadings: facts, arguments for and against, participants in the debate and their own thoughts and views.

As a starting point pupils take a subject area in which they are interested and emotionally involved. The ideal situation would, of course, be to have adequate computer facilities in different parts of the school, but abandoning the traditional computer room would require many more computers. The school has chosen to concentrate the majority of their computers in the school's 'Knowledge Centre'. This unit includes fiction, non-fiction and encyclopaedias, an IT platform with four computers connected to the Internet, a training studio to provide reading and writing practice for pupils with dyslexic problems, and an IT centre with 12 computers for ordinary work. The school also has a small number of computers located close to different teaching areas.

Making "we-fix-it"- technology pupils

Kattegatt upper secondary school in Halmstad has succeeded in getting its pupils to become 'independent problem solvers'. The school wants to stimulate interest in the upper secondary course in transport and vehicle mechanics. Pupils study a few subjects the first year and work on projects. The pupils are genuinely involved and in some cases take a surprising amount of responsibility.

Teaching is conducted in work teams comprising groups of three pupils. The pupils are given the framework for an assignment and know what they need to do to carry it out. They choose the content together with the teacher. By regularly writing notes and descriptions of their work in logbooks, the pupils become aware of how they learn, plan, carry out assignments, and perhaps most importantly evaluate their progress. The pupils become much more interested in the core subjects they are studying and take greater responsibility for their work.

You can't be too clear when giving instructions. The weaker the pupils are, the more precise and defined the tasks and framework have to be. Not all teachers had a clear idea in the beginning about how this integration was to be achieved. Nor were they prepared for the extra work the project/working method involved. It is easy for enthusiastic teachers to rush ahead and forget that their colleagues need more time to find their own role and way of working.

Information about the project must be absolutely clear, and it is essential that everybody involved feels they have something to contribute and gain through the new approach. All teachers must have the opportunity of meeting regularly, preferably once a week, to discuss, plan and evaluate the work they are doing together. It is impossible for those working with IT problem based learning to conduct lessons and take responsibility for the large number of pupils usually found in more traditional forms of teaching. Working in an integrated way in work teams within the framework of 35 hours a week (15 to 20 sixty minute lessons) in school is difficult.

Technology – a popular girls' subject

In Kil, the pedagogical debate has increased pressure on school libraries, particularly over reference books. The upper school there has experienced a quite unexpected and remarkable outcome from a project called 'Technology for Girls'

The attention the girls in the project have attracted has upset the boys so much that at times during the spring, there have been long queues of boys waiting to see the head teacher! They were quite upset about how unfair it was that they didn't have the equivalent, namely technology for boys. The school has noticed when girls get the opportunity of working with technology in "pure" girl groups, their interest in the subject grows.

Multimedia production in groups of poorly motivated low performing pupils has resulted in them quickly learning how to use the technology, and demonstrating great enthusiasm when presenting their work using multimedia. IT has undoubtedly played a very significant role here in stimulating pupils, who would normally find it difficult to start taking initiatives of their own. The pupils take more and more initiative because they see they are getting results. The effects are clearly evident in the newspaper and girl technology projects.

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Catalogue of IT based teaching media

The KK Foundation has compiled a catalogue containing Happroximately 400 IT-based teaching material programmes. The aim of the catalogue is to disseminate information about available products and inspire teachers to use IT based teaching media as a supplement to traditional teaching. The catalogue will be a supplement in the next issue of 'Skolvärlden" (The School World) and Lärarnas Tidning (The Teachers' Magazine). It is also being distributed to all school libraries and head teachers in Sweden. You will also be able pick up a personal copy of the catalogue at the KK Foundation's stand at Links'98.

Take a chance! Take a test!

During Links'98 the KK Foundation, in collaboration with SIFO, (The Swedish Institute of Public Opinion Research), will be giving you the opportunity to test just what kind of teacher you are. Are you one of those that thinks things were better before when there were slates and carbon paper ? Or do you dream of lessons in Cyberspace with no books and no classrooms?. Visit our stand and complete a simple form. The results will then show if you are a teacher of the new millennium and the new IT technology or whether perhaps you need a little help along the way!

You have registered for Links'98, haven't you? The more visitors that come, the more knowledge will be circulated. Why not ring and tell your colleagues at the other schools in your region about Links'98 ?

Further information is available at: www. Links98.org.

Drugs, porno and Neo-Nazism

"Drugs, porno and Neo-Nazism – ethics on the Net' is the title of the KK Foundation's third publication in a series of pamphlets. It focuses on questions about ethics and the Net and considers the ethical questions that arise.

"The fourth publication in the series "School Books are IT" (Skolbok Itiden) is coming out in October and has examples and hints about IT based teaching media and how to use them. The publications can be ordered free of charge from agneta.barle@falun.mail.com, max 5 copies.

Students at Links

Pupils from the behavioural science courses with an IT focus at the University College in Örnsköldsvik will be acting as hosts during Links'98, whilst pupils from Åsö and Thorildsplan upper secondary schools will be helping out with the technology. Just before Links' 98 opens, the station at Älvsjö and the road up to the main entrance of the Stockholm Exhibition Centre will be decorated by students in the "Information and stage design programme" from the University College in Mälardalen.

IT and Learning

Swedish web site: http://itl.kks.se/
English web site: http://itl.kks.se/english/

The newsletter "IT and Learning" is published twice monthly on the Internet. A printed copy of the newsletter is sent to all schools in Sweden.

Subscriptions

Subscribe to the Swedish version of "IT and Learning" at http://itl.kks.se and receive it via email.

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ably more effective, since the value of a communication service rises sharply with an increase in people with access to the service. This input will enable everyone throughout the education sector to obtain access to e-mail and, accordingly, an Internet identity.

Personal mailbox

The offer of a personal e-mail address and mailbox is aimed at all pupils, teachers and school managers. Many pupils do not have a computer of their own, and should therefore be able to access their e-mail from various computers. A web-based e-mail system is a suitable model. Traditional, Internet-based e-mail is retrieved from a central server to the user's own computer. The advantages of a web-based interface is that e-mail can be accessed from different computers and that it lends itself to a central system. Web-based e-mail programs are also easy to learn and use.

Nor does a web-based program require any installation on the computer from which the mail is read, while this is necessary for the use of a traditional e-mail system. This aspect is important, since it simplifies the operation of ICT systems in schools.

With a web-based interface, e-mail management can be separate from a school's other computer systems and Internet connection. Many schools already have their own e-mail systems, and can continue to use them.

Personal responsibility

Everyone who gains access to this e-mail service must study and undertake to obey the rules applying to use of e-mail. It follows from these terms that the user is responsible for all use of the e-mail address, and certain restrictions apply to e-mail use. Anyone who breaks the rules can be excluded from the service for some time.

E-mail address that shows where pupils come from

An e-mail address linked to the pupil's municipality/school shows clearly where (s)he comes from. This means that a positive form of social control automatically also arises on the Internet, which can otherwise be anonymous. The link to a school also has a favourable effect since pupils who in various ways make valuable contributions also thereby represent their school and municipality. The location of a pupil who does not follow the rules, and how people in charge can be reached, is equally evident. This kind of clear link between the pupil's address and the school is important, since it emphasises the pupil's personal responsibility.

Joint operation

The intention is for the National Agency for Education to be responsible for the e-mail service. This means that the service will be run centrally for the whole country. The plan is for the Agency to look after technical service, maintenance and administration. User administration at each school – i.e. arrangement, maintenance and removal of addresses and mailboxes – will be the task of the school governing bodies, which will themselves be responsible for, and able to choose their own ways of arranging, their own administration.

Since pupils cannot change their own particulars, there is a link between e-mail addresses and individual pupils. This link is important as a prerequisite of responsible Internet use. All pupils must be aware that they are responsible for the content of mail sent from their own addresses.

ICT for pupils with functional disabilities

In less than a decade, ICT has entirely revolutionised the educational situation of many children and young people with functional disabilities. According to the National Board of Education for the Physically Disabled (SIH), every pupil with gravely impaired vision now has a computer as a personal and educational aid. The same applies to children with severe motor disabilities. In the 1990s, special schools have emerged as one of the educational environments with the highest computer density.

For pupils with functional disabilities, computer access has (somewhat simplified) entailed a two-stage development. First, pupils gained access to a reading and writing tool that they could manage independently. Now, through the Internet and e-mail, pupils have acquired a source of knowledge and means of communication

that generates entirely new scope for participation and equality. Parallel to these changes, continuous development of software for normal and special teaching is under way.

Teaching aids in sign language for the deaf

Deaf people's sign language is not suited to the printed medium, but requires use of moving images, film and video. Multimedia technology has created entirely new scope for integrating text, images (still and moving) and animated cartoons in one and the same medium.

Today, multimedia productions contain an abundance of high-quality moving images. This creates new scope for developing and producing teaching aids that use sign language as their first language, and in which complex topics can be illustrated with concrete examples that are simultaneously explained in sign language.

The Internet as a teaching aid

The Internet is an increasingly important teaching aid in schools. Obtaining information on the Internet entails particular problems for a pupil with severely impaired vision. Web sites are becoming ever more complex, and their information is displayed in various frames and with graphic features, making it more difficult for Braille-display users. To some extent, corresponding problems exist for people with grave motor disabilities who control their computers with switches.

Today, knowledge exists as to how web sites should be designed to meet the needs of people with various functional disabilities. This knowledge must, with the assistance of disabled people's organisations, be disseminated to major content producers on the Internet.

Dyslexia

There are no short cuts to good literacy skills. A great deal of reading and writing is invariably required. Pupils with major reading and writing difficulties need special ICT-based aids. These may both be intended as support for literacy development and serve as a compensatory support. These aids can consist of specially developed educational media or adaptations of ordinary software. The aids may be such as to encourage pupils to read, write and learn. They aim to help make the laborious task of reading and writing so meaningful as to be worth the pupil's trouble.

Helping pupils with functional disabilities

The Delegation for ICT in Schools will be charged with allocating special funds in this area to support and speed up as far as possible the development of educational media for pupils with functional disabilities.

The Swedish Schoolnet

The Schoolnet is provided by the National Agency for Education, under a government commission of April 1994 that was renewed in June 1996. The purpose of the Schoolnet is, ultimately, to develop ICT use in teaching. The Schoolnet is intended to serve as a guide in this work. It is a web site that provides ample scope for Swedish schools to retrieve information, publish their own material and communicate with schools in Sweden and abroad.

The Schoolnet's web site is very popular. On an ordinary weekday in termtime, there are an average of 40,000 page "hits" – a substantial increase compared with the previous year. This rise may be largely explained by schools' extended Internet access, but also by the fact that some of the Schoolnet's services have become popular outside as well as inside schools.

One important role for the Schoolnet is to serve as a meeting-place. Teachers and pupils can find other Swedish – and foreign – schools engaged in active ICT work. The number of schools reporting their own home page to the Schoolnet directory (Schools on the Net) rose from 700 to nearly 1,400 in 1997. In discussion groups and on notice boards in the Schoolnet, teachers can forge contacts and compare notes. It also has a calendar with details of all current events and activities relating to teaching and ICT.

Informing teachers is one of the Schoolnet's major functions. The aim is to bring conferences, seminars and exhibitions to teachers' attention. Classroom Direct (in Swedish), a magazine that aims to serve as a teacher's guide to using the Internet, is issued quarterly.

The Schoolnet has an e-mail-based newsletter that is distributed to some 2,000 subscribers, for the purpose of disseminating news of ICT in teaching and emphasising new features of the Schoolnet.

The Schoolnet has an important role in the initiation and conduct of projects. Funds are granted for a range of major projects of importance from a national point of view. One example is Music Net, an innovative project with many useful services for teachers and pupils in the sphere of music. Others are Sputnik, which enables pupils to practise journalistic writing, and Planet, which contains activities for younger pupils. New projects are to be started in various subjects, such as mathematics.

A living web site

The Schoolnet has become a living, interactive web site. As with other virtual meeting-places, it is important for it to engage in a dialogue with users, to be highly topical in its coverage and to

Resources of the Schoolnet

• ***National link library. The Link Treasury*** service is a library of links, divided by subject and scrutinised in terms of quality, for schools. One of the biggest obstacles to Internet use in teaching is uncertainty as to which web sites contain reliable information. The links included in the Link Treasury have been examined by librarians and teachers, and the library differs from other Internet guides in being oriented towards schools and containing only scrutinised links. It thus gives many more teachers a chance of using the Internet effectively in their teaching. The Link Treasury is to undergo further development in order to support information retrieval in school work even better.

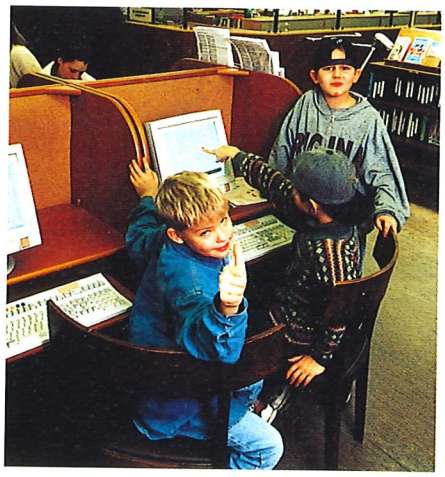
Development of information structures for teaching is continuing: during 1998, the service will be restructured and, with an updated user interface, become simpler to use.

• ***Dictionaries.*** The Swedish Schoolnet contains a virtual dictionary, Lexin, which is a combined monolingual and bilingual dictionary. At present, Lexin contains Swedish-English and Swedish-Finnish parts. Lexin is to be expanded henceforward with more languages and functions.

• ***Resources for multimedia production.*** The main innovation in the Swedish Schoolnet in 1998 is its integration with the Multimedia Bureau, the new web site resulting from the Government's task of producing "a network-based resource centre for ICT-based teaching aids". The aim is to provide a resource centre that supports teachers and pupils in the work of creating their own multimedia products. (For more information on the Multimedia Bureau, see p. 33.)

• ***Information databases.*** The national agreements with major information providers have played a major role in integration and realisation of the usefulness of the Internet in school work. One example is schoolsí access to press archives. From now on, reaching agreements that give schools access to important Internet information services will be a priority task.

• ***Computer course.*** Multimedia Software Scandinavia AB has entered into an agreement with the National Agency for Education entitling the Agency, using the Schoolnet and CD-ROMs, to give teaching staff and pupils in Swedish schools the right to use its ECDL ("European Computer Driving Licence") course package free of charge. This contains every element required to pass the European "driving test". The Schoolnet launch of this course has received a tremendous response in schools: just over a month later, school heads at some 1,000 of the nation's schools had signed agreements on the course with the Agency.



create a sense of community and mutual benefit. The further development of the Schoolnet will proceed along broadly the same lines as hitherto. Great emphasis will also be laid on information inputs and dissemination of good examples in teaching.

The Swedish Schoolnet in a European perspective

The development of the European Schoolnet means that its Swedish counterpart needs modifying to become compatible with other national networks connected to the European one. Parts of the Swedish Schoolnet need translating. Some new pages are to be produced, with a content demanded by foreign network users. Examples of pages that are needed are presentations of Swedish education and of our national resources and specialities.

A European Schoolnet

In December 1996, an official proposal was made by Sweden to its fellow EU members concerning a joint initiative to set up a European Schoolnet in co-operation with the European Commission. This initiative had been preceded by discussions with the Commission and some member states, and received a strong response. This marked the inception of intensive development work for which, up to spring 1998, the work inputs and financing had been largely Swedish.

The European Schoolnet (EUN) comprises national and other school computer networks. It has three main aims: to facilitate co-operation between schools in Europe, to offer a range of educational content or teaching services, and to provide opportunities for teachers to develop their skills. EUN is an Internet-based network of information and services made available free of charge to schools, teachers, pupils and the public. Although certain forums are intended particularly for certain groups, such as teachers or school heads, EUN's openness and the unrestricted and universal access it affords is a fundamental starting point.

Besides the 15 EU member states, the Schoolnet includes Iceland, Norway and Switzerland. In the near future, countries in Central and Eastern Europe will be admitted. Japan, the USA and Canada have shown interest in co-operating with the Schoolnet.

The value of co-operation concerning a joint school computer network lies in educational and cultural, as well as technical, factors. The purpose of a European Schoolnet is to enhance the benefit and value of the content in the national networks, to raise its equality, and to share the costs of services that are benefit to everyone.

The European and intercultural dimensions are also to be strengthened. The hope is that contacts forged between pupils, teachers and researchers in different countries will encourage educational debate and inspire new research and new development and co-operative projects across frontiers. Intensified international co-operation enables understanding between countries to be increased and the foundations of a citizens' Europe laid.

Schoolnet co-operation between schools, researchers in technical and educational fields, and businesses and public authorities in different countries also encourages technological development, research and software development in the European education and ICT sectors.

Mirror of diversity

The "web platform" of the Internet is the hub of the European Schoolnet. EUN's web site also illustrates the basic starting point: that this is a network of other networks, since it provides links to those it contains.

To reflect the linguistic and cultural diversity of Europe, navigation instruments and entry pages on the platform will, as far as possible, be worded in all the relevant languages. The number of language versions of the national contributions and the working languages in everyday co-operative efforts are to be determined by the parties taking part.

So far, the work has been concentrated on creating the web platform and its various parts. Most of the constituent services are still in the process of being established, and will be successively filled with content. Examples of services are the virtual teacher training college for in-service training and professional discussions between teachers, and the virtual schoolhouse with its subject departments for teaching materials and hints, quality-examined links to relevant subject information, principal's office for school managers, school yard for pupils to meet in, etc.

The platform also contains a gallery or notice board for schools seeking partners for their projects and a rendezvous for pupils or teachers looking for pen-friends. For Internet beginners there is a handbook in English providing instructions on the terminology and techniques for finding one's way around the Internet. One department describes examples of schools that have implemented successful projects in some subject using ICT, and also in some cases invites participation. Another part provides information, advice, support and hints on technical matters. Finally, the platform also offers information about the EU and its various educational programmes, and an information and news service on educational issues.

Additional services and products are to be successively developed and added to the platform. Ensuring that the Schoolnet is relevant and up to date requires a strategy based on the users' own involvement in developing the Net. This is being done mainly by the setting-up of various networks or working groups around the EUN. Such working groups are, for example, the network of innovative schools, the technical network, the network surrounding multimedia products and the one relating to successful school projects.

Swedish inputs in 1999-2001

Sweden undertook to develop a web platform for the European Schoolnet by 1 September 1997, and succeeded in doing so. The platform has since been developed further, especially in terms of content and design. Although the work has been directed by the international management committee Sweden, by virtue of having taken the original initiative, has exercised most influence. Experience – considerable by international standards – of the Swedish and Nordic Schoolnets has played a major role in this work. With the agreement on the future management etc of EUN that is being adopted by the parties in June, its European and intergovernmental nature is being accentuated. Accordingly, the Swedish input must have a partially different focus from that during the establishment phase. This development is both desirable and necessary to retain and develop the European nature of this joint project.

The Swedish inputs should, in part, focus on active efforts to strengthen the working groups or networks connected to EUN. Moreover, further Swedish efforts should be made to develop the virtual school building.

Sweden should assume the task of establishing meeting-places on the web platform for exchange teaching posts. There, for example, schools seeking teachers from other countries for brief exchange periods, and teachers themselves, can advertise their exchange wishes, while companies, schools and pupils can arrange trainee positions within the framework of various courses. Sweden should work actively to bring about co-operation with a range of major European museums concerning virtual learning and cultural environments.

Further Schoolnet development

The Delegation for ICT in Schools will be charged with allocating special funds for optimal support and acceleration of development in the Swedish and European Schoolnets alike.

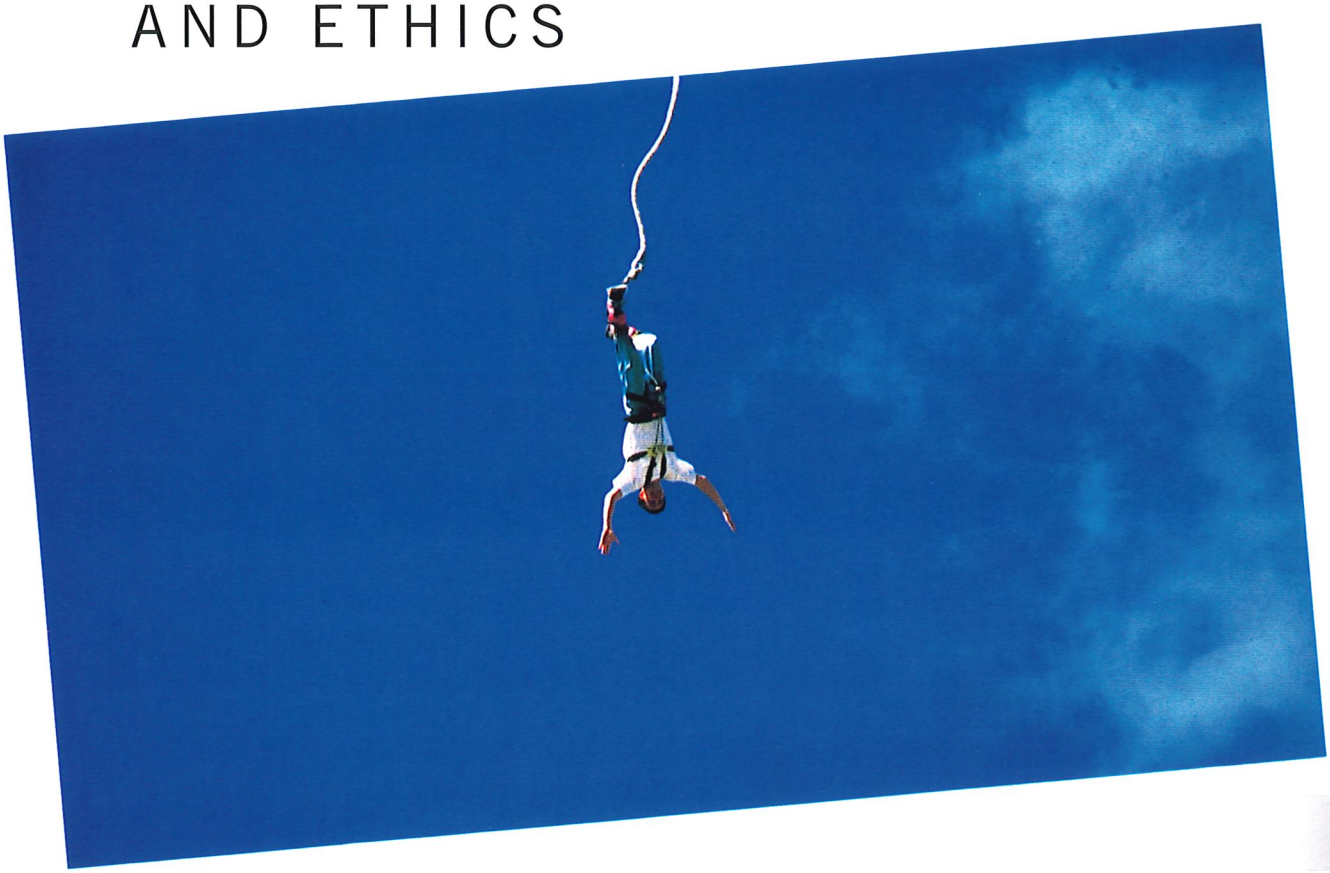
Prize for excellent pedagogical inputs using ICT

The primary motive underlying efforts to boost ICT use in education is to support teaching development. Besides specific support in the form of measures to develop teachers' skills and the hooking-up of schools to the Internet, knowledge transfer between teachers is required. Experience shows that schools and teachers have made varying progress in learning the technology, and above all in really making good use of it in teaching. One important factor in educational development is therefore for schools that made relatively little progress to learn from others. This may take place in many ways. One way is to draw attention to those that have progressed furthest. The intention is therefore to set up a prize for excellent pedagogical inputs using ICT.

This prize will go to a teacher or group of teachers that has made an outstanding contribution to the use of ICT in teaching. Those wishing to enter must document and freely disseminate their methods, teaching aids and results to all other schools, e.g. via the Schoolnet. This will give users more good examples of potential benefit to all.

The award will be managed by the Delegation for ICT in Schools, which will also provide additional information on entry conditions, decide on the composition of the jury, etc.

SCHOOLS, THE INTERNET AND ETHICS



The Internet has made its entry into Swedish education. Over half of all compulsory schools and more than 90 per cent of upper secondary schools have an Internet connection. The Internet is a mass medium of a new type. Anyone can publish information on the Internet that is then accessible worldwide. Accordingly, the Internet is the first mass medium to give everyone wishing to say something a chance of being heard. The effects of this freedom are that all forms of expression created and spread by human beings somewhere in the world can therefore also be found on the Internet. There are novels and poetry; there are lively debates between committed people on all conceivable subjects. The Internet is, at the same time, highly commercial and abounds in advertising and marketing. Unfortunately, frauds and false rumours, pornography, etc are all too common. The Internet also contains drug-glorifying material and bomb-making instructions. Another very serious cause for concern is that racist opinions and Nazi propaganda are disseminated on the Internet.

The Internet is a reflection of our society. We may detest the fact, but such phenomena as narcotics and pornography exist in our society and therefore on the Internet. Expressions of opinion that are punishable in Sweden, such as persecution of ethnic groups, may be permitted in other countries and therefore difficult to stop on the Internet.

In the national curricula for compulsory and upper secondary school, the basic values of education are defined as follows:

"The inviolability of human life, individual freedom and integrity, the equal value of all people, equality between women and men and solidarity with the weak and vulnerable are all values that the school shall represent and impart."

Schools must discuss and take a stance on issues of basic values. Teachers must, in co-operation with pupils, analyse and discuss the content of various kinds of material available on the Internet. Obviously, lecturing pupils on ethics and morality is insufficient. At school, the pupils must be helped to develop a basic ethical approach, an inner compass, that enables them to ask their own questions and form their own opinions on what they see, based on facts and fundamental democratic values. Many parents worry about what they read concerning the Internet, and its becoming accessible in schools. Schools must be prepared for discussions of this kind, and also actively raise the issue with parents, inform them properly about what using the Internet involves, and listen to the parents' views.

Personal responsibility

Section 2.4, on the plan to offer every pupil an e-mail address, contains a line of reasoning on the importance of each address being clearly linked to a specific pupil. This will give the pupils a clear signal that they must take personal responsibility for their Internet conduct. Each must be accountable for the content of messages sent from his or her own address.

The important discussion on morality and personal responsibility can be supplemented by local regulations on the use of ICT systems. These regulations should contain provisions regarding the purpose of school computers and the use that is unacceptable. The regulations should also describe the rules of conduct that exist on the Internet (sometimes termed "net-iquette"), and be clear regarding various types of criminality. A crime is a crime even if it is committed on the Internet. Anyone who commits a crime using the Internet will be held accountable for it in the same manner as if it had been committed elsewhere. Breaking into a computer system or making pirate copies of software is no sport, but a breach of the law that may have grave consequences. Schools may, for example, reach agreements on the regulations applying to use of the Internet.

Filtered Internet connection

Today, filtered Internet connections are available. One argument for using a filter is that there is no reason to give school pupils access to improper material. Through the national programme for ICT in schools and by other means, many schools will obtain high-speed connections that lend themselves to image or film retrieval. A school library does not contain pornographic magazines, so why should schools provide free access to the unsuitable and undesirable content that actually exists on the Internet?

Deciding which pages a filter should screen out is a controversial matter. Material regarded as offensive abroad, where filter lists are usually made, is not always perceived as such in Sweden. One example may be a web page presenting arguments in favour of gay rights. Moreover, use of a filter makes it a challenge for pupils to try and outwit the filter.

Within EU co-operation, Sweden is participating in the task of drawing up an action plan to combat harmful and illegal material on the Internet. This plan is intended to contribute to the setting-up of "hot lines" to which the public can report offensive or illegal material on the Internet; to development of filtration systems permitting undesired material to be screened out; and to enhanced public awareness of the tools and methods available for dealing with such material.

Deciding whether a school should have an open or filtered connection to the Internet should be done locally. Accordingly, every school or municipality must actively adopt a stance on, and formulate a strategy for, how to tackle the issues raised in this section.

INFORMATION AND COMMUNICATIONS TECHNOLOGY IN EDUCATION

ICT is no new phenomenon in Swedish schools. This section contains an overview of its use in education to date, and reports on favourable experience of development work using ICT in teaching.

Various phases in the use of ICT in education

Various phases in the educational use of ICT may be discerned. For a long time, it was difficult to devise a suitable role for computers in education, although many people grasped their vital future role in society.

When computers were introduced into schools, the aim of computer instruction was for pupils to learn programming, using the programming language Basic, in a few hours' teaching. The effect was to convince the pupils that computers were tricky to use, and to put many pupils off them. Unfortunately, the technical orientation that dominated school computer use at the time is still, in fact, common. Personal computers were then still a new and unusual phenomenon. Common computer models in those days, such as the ABC 80, Apple II and Commodore, have now entirely disappeared. Mathematics and technology teachers were often responsible for computer use in schools.

The next stage was the big *Compis (Computer Pal)* project in the early 1980s. Compis was a computer specially adapted for school use, which was developed and distributed in schools in large numbers. One major problem was the shortage of software for this unique computer.

Later, the computer began to be seen as a tool. Teachers of Swedish, mathematics and social studies discovered its usefulness for writing texts and performing calculations. Computer science became a subject at compulsory school. Computer instruction was a means of preparing pupils for the world of work, and took place in special computer rooms.

Now, computers are increasingly often being moved from the computer room to the classroom to serve as an aid to teaching, since the computer can contain various knowledge sources and be connected to the Internet. ICT is now seen not as an end in itself but as a tool in developing education towards increased pupil responsibility and activity. Obviously, ICT in education is also vital as preparation for life in a society in which ICT is omnipresent, especially in the world of work. The new focus of computer use in schools affords more equal opportunities for the sexes.

Risk of mistakes smaller now

Twenty-five years ago, the Internet was a research experiment. Gradually, it came to be used in the academic world, and from 1994 it gained ground very rapidly throughout society. The Internet now has absolute dominance among major networks. The Internet Commission (*The Swedish Part of the Internet*, SOU 1997:18) predicts that the Internet will be the dominant communications network in the future as well.

The Internet is unique in that open standards regulate the form of data and their transmission. Traditionally, each manufacturer has had its own standard for these purposes, and this has impeded communication between computer systems. Internet standards enable a web page or e-mail message to be created and read by programs

from various producers. These standards are emerging in an open process that takes many interests into account. A web page created today can undoubtedly be read in the future, although new web pages will then be of a more advanced design.

The situation in schools in 1997

In 1993, 1995 and 1997, the National Agency for Education surveyed access to computers in schools. Its 1997 report (National Agency for Education, 1998) covers the supply and location of computers and the rate of Internet connection. This survey provides an important basis for identifying schools' requirements in the future. Although international comparisons are difficult to make, the survey indicates that Sweden's position is good in comparison with other countries.

Number of pupils per teaching computer

	1993	1995	1997
Municipal compulsory schools	38	19	13
Independent compulsory schools		12	13
Municipal upper secondary schools	10	8	6
County upper secondary schools	20	10	7
Independent upper secondary schools		6	5
Komvux (municipal adult education)		8	9
Special municipal and county schools	8	6	4
Särvux (special schools for adults)		6	8
Other special schools		4	4
Schools for Lapps		8	4

The above table shows that computers have proliferated at compulsory and upper secondary level alike. In upper secondary schools, however, the pupil-computer ratio is more than twice that in compulsory schools. The supply of computers does not, in principle, depend on whether the governing body is municipal or the school is independent. Disparities between different types of municipality are minor, but there is a slight tendency for metropolitan areas to have fewer computers than other municipalities, especially those in sparsely populated areas. There is a marked trend, especially in compulsory schools, to move computers from special computer rooms to the classrooms. One major reason why this development is lagging behind in upper secondary schools is that computer science still exists as a subject: this requires computer rooms to enable large groups to receive simultaneous instruction. The computers are also, to an increasing extent, connected to LANs.

Teachers per computer

Since 1993, the number of computers for teachers' use has increased. Here, there is a marked disparity between compulsory and upper secondary school: today, computer access is ample for upper-secondary school teachers, while six compulsory-school teachers must still share a single computer.

Number of teachers per computer

	1993	1995	1997
Municipal compulsory schools	27	12	6
Independent compulsory schools		6	4
Municipal upper secondary schools	7	3	2
County upper secondary schools	5	3	1
Independent upper secondary schools		2	1
Komvux (municipal adult education)	9	2	2
Special municipal and county schools	29	15	7
Särvux (special schools for adults)		64	57
Other special schools		5	7
Schools for Lapps		4	4

Internet access

Schools are increasingly hooking up to the Internet. More than half of Sweden's schools had some kind of Internet connection in 1997, which represents a substantial increase since 1995. Upper secondary schools are much more often hooked up to the Internet than compulsory schools.

More than half of upper secondary schools have a fixed Internet connection. The survey does not show connection capacity, and according to the Internet access and service providers (IAPs and ISPs), many of the schools with a fixed connection have a relatively slow one. Excluding upper secondary schools, less than one school in five has a fixed Internet connection. Relatively few schools have an ISDN connection. A modem connection to the Internet is tied to a particular computer, has a low capacity and is relatively sluggish to use.

It is interesting to note that the proportion of

Percentages of schools and computers connected to the Internet

Type of school	1995 Schools connected	1997 Schools connected	1997 Schools with fixed connection	1997 Computers connected
Municipal compulsory schools	17	56	14	31
Independent compulsory schools	20	53	4	49
Municipal upper secondary schools	68	91	71	67
County upper secondary schools	35	74	34	52
Independent upper secondary schools	40	69	25	58
Komvux (municipal adult education)	47	69	50	70
Special schools	3	30	13	25
Särvux (special schools for adults)	14	19	12	24
Other special schools	38	86	43	63
Schools for Lapps	0	100	0	38

computers connected to the Internet is lower than the proportion of schools hooked up. At schools with an Internet connection, many computers lack a connection. Thus, the proportion of computers connected to the Internet is a yardstick of how well the Internet can be used in teaching. Effective use of computers is based on their communication and co-operation capabilities, for which they must install a LAN that is in turn connected to the Internet.

The survey shows that if the aim is to equip all computers in schools with a high-speed Internet connection, major inputs are needed.

Attitudes towards ICT among teachers and pupils

In October 1997, the Foundation for Knowledge and Competence Development presented a survey of 5,000 teachers, pupils and employers on ICT development in education and the world of work. This survey gives a good picture of how pupils and teachers perceive the importance of ICT, and how far they are able to make optimal use of it.

Teachers

No fewer than eight out of ten teachers state that their knowledge of ICT is inadequate. This is a very clear signal that serving teachers regard themselves as in need of supplementary training in the field. The survey findings also show clearly that the great majority of teachers lack knowledge, and this suggests an extensive need of skills development.

On the question of the biggest obstacles to the use of ICT in teaching, 65% of teachers state that their skills are inadequate. This result shows that the great majority of teachers regard themselves as lacking knowledge and that this is a crucial obstacle to the use of ICT in teaching. Limited access to equipment is cited by some 70% as a major problem in or obstacle to using ICT in teaching. Many teachers also mention lack of time or money as a major obstacle.

More than 90% of teachers consider the pupils' ability to use ICT important for their future working lives. It is interesting to note the consensus among teachers on the importance of ICT for pupils' entry into the labour market.

As many as nearly 80% of teachers believe that the teacher's role will change over the next five years, in view of ICT development. A large majority of teachers thus expect a modified teacher role, and this in itself is a sound basis for change. More than 70% of teachers see the change as positive for their own part, while less than a tenth of teachers see it as negative. These results show that, on the whole, the teaching profession welcomes ICT-aided development of school work.

Pupils

A fifth of pupils use computers daily at school, while another 50% use them weekly. Computer

use has thus become a natural feature of school work. However, most pupils – more than 60% – consider their own ICT knowledge inadequate.

As among the teachers, there is a broad consensus among pupils on the importance of ICT literacy in their future employment. Almost all the pupils (some 90%) deem it important to have ample ICT knowledge for their working lives. A majority of pupils, like the teachers themselves, consider that their teachers lack sufficient knowledge of ICT.

Employers

More than half the employers consider ICT literacy important in recruitment. More than two-thirds of companies state that the ICT elements of the company's activities are increasing. Together, these two findings show that ICT literacy has a bearing on every other recruitment, and that the importance of ICT is also increasing rapidly. On the question of the value of ICT literacy in the labour market of the future, 90% of companies state that such literacy is important.

Research findings on the use of ICT in education

The National Agency for Education has initiated a project to monitor the development of ICT use in Swedish education. This project, known as ELOÏS, is directed by Professor Ulla Riis, whom the Foundation for Knowledge and Competence Development has engaged to evaluate its own major inputs to boost ICT in teaching. As part of ELOÏS, Jens Pedersen has carried out an overview of ICT research and development and education. This overview has been published (in Swedish) as *Information and Communications Technology in Education, A Research Overview,* National Agency for Education, 1998.

This publication gives an account of how computer use has changed, from a focus on computer science as such to the utilisation of computers as teaching tools. The degree to which ICT influences education is hard to determine. The technology is dynamic, with constantly new applications, and it enters into and changes the environment in many places and in numerous ways. It is not self-evident that everything ICT makes feasible is good. Pedersen would like to see more discussion of which changes are desirable, and less of the scope ICT affords. The discussion should also include the role of schools in young people's upbringing and their importance in young people's social and emotional development.

According to the report, research does not unequivocally point to a markedly beneficial impact of computer-aided teaching. Nonetheless, the author considers that computers should be used in education. ICT enhances variation in the teaching, makes material more easily accessible and up to date, facilitates communication and writing, and supplements library resources. Although the technology does not fulfil visions of an educational revolution, a general boost to knowledge or rationalisation gains, there is no reason to refrain from using it.

Whether the motivation-generating effects of the interactive nature of ICT depend on its novelty or whether they are lasting is an open question.

The need for educational media

In this communication, the main arguments for ICT use in education are the development of teaching it makes possible and the changes under way in society. ICT has a function as a pedagogical tool and can give teaching new scope. It is therefore important for there to be good ICT-based teaching aids – "educational media" – for use in schools.

The Internet as a teaching aid

The Internet is a communication medium that facilitates contacts between pupils and between schools. It provides access to immense quantities of information (at present, the freely available part of the Internet comprises 300 million web pages). Anyone wishing to know more about a country or region can find an abundance of references. A very large number of newspapers and magazines are also available on the Internet. Various agencies and organisations publish

reports, proposals and statements on the Internet. Accordingly, the Internet can be used as a teaching aid based on reality.

The Multimedia Bureau, a resource centre for personal creativity

The Multimedia Bureau, run by the National Agency for Education, is available on the Internet as part of the Schoolnet, and serves as a source of material, ideas and knowledge. The Bureau is also intended for use as a tool for distance publishing and to facilitate exchange of experience. Its overall aim is to induce teachers and pupils to use new media at school.

The National Agency for Education has been commissioned by the Government to create a resource centre for educational media. Today, this centre is a virtual organisation, with some 20 employees around the country at schools, municipal resource centres, universities and colleges. The outwardly visible part of the centre is the Multimedia Bureau.

The Multimedia Bureau invites users to join seminars, workshops and TV conferences. Ideas and examples are disseminated in several different ways: on the Internet and by means of video films and printed matter.

By using a tool they have developed themselves, the Bureau's employees in various parts of Sweden can co-operate and publish multimedia material at the web site from a distance. The Bureau offers this tool to Swedish schools, in its project hotel, offering various services for project co-operation. This means that schools can easily collaborate on projects and, for example, jointly produce Internet-based teaching aids without mastering the underlying technology.

On the Internet, the Multimedia Bureau comprises three parts:

- ***The Café,*** which is a meeting-place and presentation area for various projects. It has a multimedia publication produced by the Sound and Vision School in Varberg; a "global-local" radio station (Glokalradion) with 20th-century events as its theme, and a project hotel where projects can book space, co-operate and produce their own material. The café also has a CD-ROM circle where one can follow various teachers' ideas and comments on the new teaching aids based on CD-ROMs.

- ***The Archive,*** which contains images and sounds for use in school work. Pupils and teachers can also send in their own material and help to expand the archive.

- ***The Idea Bank,*** where pupils and teachers give courses and compare notes on educational methods and software. There are lesson proposals, project diaries and guides to provide support and inspiration. The Bureau's employees will produce interactive courses on multimedia in schools, and there is also a question box where they answer users' questions.

Promotion of teaching aids by the Foundation for Knowledge and Competence Development

In the years 1996-98, the Foundation is investing SEK 120m in promoting the production of ICT-based teaching aids. It has approved grants for some 70 projects in all subject areas. Several criteria are used to assess teaching-aid projects. First, the content must be important and meet a national need. Secondly, the project must have a view of learning and educational arrangements in line with the national curriculum. Thirdly, the teaching aid should make good use of the scope afforded by ICT. The Foundation also assesses project organisation and budgets.

Co-operation in the OECD

In September 1997, the OECD set up three working groups to stimulate the development of multimedia in the education sector. The function of these three groups is to identify criteria for assessing the quality of multimedia and software and the multimedia market in the education sector; promote partnerships between private and public purchasers; and establish networks for researchers engaged in using multimedia and software as tools in learning processes. Sweden is taking part in the latter two working groups.

Experience of ICT projects in education

The national programme for ICT in schools is of limited duration but has a long-term purpose: to support self-sustaining development. All genuine change in education is a protracted and profound process. The aim of the national programme for ICT in schools is for ICT to serve as an element in educational reform. ICT projects will not result in any real change if they focus on placing a number of computers in schools. Work involving ICT in education has now left the stage at which only certain pioneering schools carry out projects. It is now spreading to every school.

Numerous educational ICT projects have been carried out in schools or entire municipalities. Although the use of ICT in education can be organised in many different ways it is possible, from experience, to identify certain common criteria for successful projects.

The prospects of change are more favourable if there is an expectation of development surrounding the school. If the parents become involved, they serve as supporters and instigators. There are also good reasons for schools to seek collaboration with nearby companies and organisations.

Most of the Swedish municipalities have, in recent years, drawn up overall ICT strategies at local level. Using ICT – for such purposes as boosting economic growth and employment, enhancing municipal efficiency and improving health and social care services and, in particular, schools – is the cornerstone of these strategies. It is essential for the municipalities to incorporate into their overall ICT strategies, and also develop and evaluate, the efforts to boost ICT in education that are now being proposed. To achieve results, support is required at the top management level in each municipality, in the administrative departments in charge and, of course, in school managements. This calls for high-quality leadership in schools. As the person directing and responsible for the school's development, the school manager is crucially important. Successful implementation of change using ICT in education requires a strong commitment on the school management's part.

Successful development is thus based on external support. It is equally important for people working in schools to embrace and support the change. Legitimacy, i.e. all the education stakeholders' acceptance and support of the ICT inputs, is also essential. This requires participants to "own" their projects and be able to influence their content and pace.

When ICT is introduced in teaching, new occupational groups enter the education sector and other groups' functions are changed. Technicians of various kinds are needed for service and maintenance of ICT systems. These may come from outside or be school staff with an interest in technology. In practical work, the boundary between pedagogical and technical duties may be unclear, and this is a challenge to the various occupational groups in schools.

The librarian's role changes when books are no longer the sole source of information in libraries. A librarian is in an excellent position to become an important resource in conjunction with ICT. The Internet contains vast quantities of information, and the difficulty lies in finding interesting, relevant and correct information. Librarians are trained in organising and evaluating knowledge, and this training is excellent for helping to guide pupils on the Internet.

Many pupils have extensive knowledge of ICT and can therefore be an important extra resource in schools. It is a challenge to teachers to use their pupils' knowledge and to stimulate and contribute to the further development of this knowledge. Being able to utilise these pupils' knowledge is also a challenge to schools. The Swedish Association of Local Authorities, the Swedish Teachers' Union and the National Association of Secondary School Teachers have developed a project to train unemployed young people as "tomorrow's school caretakers", to assist in schools' use of ICT. In 1998-99, this project will take the form of an EU project within the framework of Article 6, to be run in co-operation with several county administrative boards around Sweden.

The school as community centre

Many people lack access to a computer. As the Internet grows in importance as a communication medium, those who do not themselves have access to it will be at a disadvantage in terms of information. Most households with Internet access usually have a slow modem connection. With the inputs being implemented by the Government, Sweden's schools will have a very powerful connection that permits new areas of use, such as transmission of video etc. When schools have these opportunities, it would be desirable for them to be utilised for longer hours than the actual school day.

Retrieving valuable information from the Internet requires not only the right equipment, but also knowledge. It is a matter of both achieving the connection and, above all, knowing how to find interesting, relevant and correct information. The Government therefore sees interesting scope for the use of school premises and equipment after the end of the school day. With the right organisation, it should be possible to keep the premises open and let those who are interested use the school equipment and obtain help from others. If the schools are hooked up to the Internet via a municipal network, the high-speed connection can be used outside school hours from other premises connected to the municipal network.

In this context, schools can become a well-equipped resource for Komvux (municipal adult education), the Adult Education Initiative, popular adult education and the activities of associations and societies. Closer collaboration between schools and other institutions, such as employment training and computer centres, is also worth aiming at. Schools can become centres for new networks created in the community.

INTERNATIONAL EXAMPLES OF WORK INVOLVING ICT IN EDUCATION

Internationalisation of society is increasingly important. Many countries have adopted various types of strategy document for the use of ICT in society and education.

Norway

The official plan for ICT use in Norwegian education in 1996-99 formulates the practical aim as follows:

"Norwegian pupils, apprentices, students, teachers and lecturers at compulsory and upper secondary school and in adult and higher education must personally be ICT users, in the sense that they are capable of using ICT to enhance and enrich their own learning, and also of using ICT in their work and leisure."

Norway has a small population. The restricted linguistic area has implications for publishers, the market, capital and skills. It is a matter of good organisation, wide-ranging collaboration and being at least as good at utilising existing organisations and institutions as competing countries.

Many young people have extensive ICT knowledge that they have obtained outside school. Their knowledge may be of various kinds, from the superficial to the very profound. Pupils can be a major resource in schools, and it is a challenge to teachers to make use of the pupils' knowledge and to encourage and assist its further development. The Norwegian ICT plan also emphasises the importance of girls' ICT work.

Educational use of ICT is divided into the following main areas

- ***Using ICT for learning.*** This includes the use of ICT as an aid to learning, e.g. for simulation programs in physics or social sciences, for information retrieval in various databases, and for communication with other pupils using ICT.
- ***Learning for use.*** This part of the programme focuses on the need to learn how to use ICT tools so as to have a good grasp of their use in the school situation and later, in one's working life, regardless of one's main field of work or occupation. In this area, the emphasis is mainly on ordinary user skills, although leading-edge skills are also important.
- ***Technology.*** The technology area is about technical parameters: how to create connections and services, i.e. an infrastructure for ICT. The aim is to create a national infrastructure connecting Norwegian educational institutions to national and international computer networks. These institutions are to be free to choose among providers' competitive bids.
- ***Teacher training.*** Without teachers and other pedagogical staff who are ICT-literate, every ICT venture in schools will be meaningless. Teacher training is so crucial as to be treated as a separate area.

Every year, the programme is translated into practical terms, and in 1998 it contains inputs totalling NOK 30 million in the following areas:

- a research and skills network for ICT in education that is a central resource at Oslo University for ICT in teaching;
- development projects for skills development in compulsory and higher education;
- a guidance centre that exists both on-line and physically, and is directed at teachers and school managers;
- central agreements for purchase of equipment, infrastructure and software, with the costs borne by school governing bodies;
- support for development of ICT-based teaching aids;
- international ICT co-operation, including the European Schoolnet;
- further statistical surveys of ICT standards in education;
- girls and ICT;
- ICT in adult education.

Denmark

In Denmark, an active policy on the use of ICT in education is being pursued. The principal tool is the Sector Net, which involves an investment of DKK 500 million between now and the year 2000. The Sector Net is the computer network for the whole Danish education system, and it is expanding as a result of offers made to educational institutions that are attractive from both the financial and the qualitative point of view. It is based on tried and tested systems adapted to school needs. The purpose of the Sector Net is to enable schools to use the Internet in teaching and administration. The Sector Net is Denmark's largest part of the Internet, with more than 1,000 schools, 10,000 teachers and 100,000 pupils hooked up.

The aim is for the Sector Net to encourage schools to undertake other measures, such as acquiring computers, installing LANs, developing various types of material for teaching, enhancing the teachers' skills and generally modernising and improving their course programmes. With the Sector Net, every school gains access to an open educational network, a closed administrative network and the Internet. The Sector Net also contains a range of tools for internal communication in the form of e-mail, conference systems and a web hotel.

Depending on the infrastructure possessed previously by the schools and municipalities concerned, they can choose various forms of connection to the Sector Net:

- the small-scale model, for schools without a LAN that wish to connect one or a few computers;
- the school or basic model, whereby a school's LAN is connected to the Sector Net;
- the municipal model, whereby a municipal network is hooked up to the Sector Net. This model provides the opportunity of making use of lower local charges for individual school connections;
- indirect connection, whereby a school is hooked up to the Sector Net through a separate service provider.

Schools connected to the Sector Net receive grants to cover the Sector Net charge for the first two years, but pay for their own direct on-line charges for the Sector Net connection. After two years, the school may pay its own charge to the Sector Net, but the education ministry continues to finance Sector Net services and support.

Subordinated to the Danish education ministry is UNI-C, a national skills centre for the use of ICT in education and research. Various central resources, such as the Sector Net, form part of UNI-C. The organisation is developing a range of educational services that are being made available to schools through the Sector Net. UNI-C is largely commission-financed.

Denmark also has a national body, CTU, that is a centre for ODL and technology-aided teaching. The centre runs development projects in its own area.

There is also an organisation, Orfeus, run by the Danish municipalities and county councils, aimed at encouraging the use of ICT in teaching. Orfeus's main function is to produce educational media. To date, Orfeus has produced around 200 sets of teaching material.

Finland

The 1995 "knowledge strategy for education and research", on which policy regarding ICT in teaching is based, identifies education and research as among the crucial factors for developing Finland as an information society. The education system must be adapted to the "on-line society", and open learning environments must be created to assist a change-over from once-for-all education to lifelong learning.

Schools, as providers of general knowledge, have the function of giving every pupil the basic skills that are a precondition for life in the information society, and for further studies – skills in obtaining and managing information, and communication skills. A national objective should be for Finland's vocational know-how in ICT, and in industries that produce information and information services, to be of the highest international class.

When it comes to realising the principle of lifelong learning, the importance of teachers' professional knowledge must not be underestimated. Teacher-training requirements should be raised to correspond to the new demands.

The supply of high-quality domestically produced information products for education and research should be safeguarded. Production of information in electronic form, and the mediation and use of this information, should be boosted in various sectors, especially education, research and administration, and in libraries, information-service bodies and archives.

Infrastructure for national ICT is to be established with the Internet as a model. Schools are regarded as part of the local environment, and schools should be connected to regional networks and join in regional collaboration.

The aims of the knowledge strategy were attained in the years 1995-97 by such means as subsidies for hardware purchases and network formation in educational establishments, universities, libraries, archives and museums; for development of training and research linked to the information society; and for production of content and services for networks. To attain the objectives of the knowledge strategies, special grants totalling FIM 540 million were used.

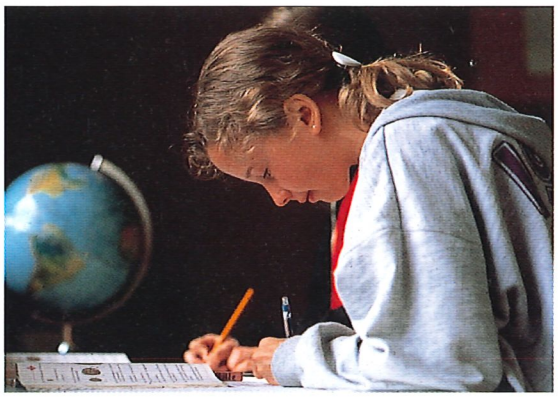
In the 1998 budget, FIM 265m is allocated for funding of information-society projects in culture, schools and higher education. The planned uses of this sum are:

- basic and in-service training of teachers;
- development of teaching methods and learning environments, content production, digitisation, development of computer systems and material purchases for computer networks;
- equipment purchases;
- hardware purchases and expanded training and research for universities and technical colleges;
- calculation services at advanced level, maintenance and development of the FUNET network;
- purchase of equipment for development projects connected with adult education.

United Kingdom

In October 1997, the British Government took an initiative called the National Grid for Learning, and after a consultation period a programme is to be adopted. The programme is to be national and aimed at developing the infrastructure for ICT in schools and enhancing teachers' skills. The initiative is to consist in a network of educational media and teaching materials. All the various institutions, such as schools, libraries and museums, that have educational resources must able to join in the network, so as to create various kinds of educational resources and make them universally available.

The year 1998 has been nominated UK NetYear, to promote awareness of these issues and stimulate the work. The aim is to enhance the quality of education and boost the UK's international competitiveness. UK NetYear is taking place in collaboration between public and private players. Much remains to be done before all schools and other institutions join the network, and activities will therefore begin with a prototype Grid.



The British Government has defined the following targets for ICT in education:

- All schools and institutions for higher education should be connected to the Grid by 2002, so that perhaps 75% of teachers and 50% of pupils then have their own e-mail addresses.
- Every newly qualified teacher should, by 1999, become ICT-literate in order to receive the award of qualified-teacher status.
- By 2002, serving teachers should feel confident, and be competent to teach, using ICT.
- By 2002, most school leavers should have a good understanding of ICT, as specified in the curricula; at the same time, measures for assessing the level of school leavers' competence in ICT should be in place.
- By 2002, the UK must be known as a centre for excellence in the development of networked software content for education and lifelong learning. The UK should then be a world leader in the export of learning services.
- From 2002, the distribution of documents for administration of the education system should largely cease to be paper-based.

To promote the use of ICT in British schools, GBP 100m has been granted for the 1998/99 academic year.

USA

In June 1996, the USA presented a report on technology and education. This declares that basic knowledge of ICT and other technology for improving learning, productivity and performance has become as important to a person's capacity to cope in society as traditional knowledge such as reading, writing and arithmetic. It is therefore a major problem that the technology is not harnessed more in education. Only 4% of schools have a computer for every five pupils, and only 9% of classrooms are hooked up to the Internet. In schools with pupils from low-income homes, there are fewer computers. Research and experience in schools in the vanguard of the digital revolution indicate the immense educational scope afforded by ICT.

President Clinton and Vice President Gore have formulated a Challenge, including a vision of a future in which every pupil becomes ICT-literate. The Challenge is more than just a vision, and defines four objectives:

- Every teacher in the USA is to have the training and support required to help pupils learn with the aid of computers and on-line networks.
- Every pupil and teacher must have access to modern multimedia computers in the classroom.
- Every classroom must be connected to a high-speed network (information superhighway).
- Effective software and on-line education must be an integrated part of every school's resources.

The costs of attaining these objectives are difficult to calculate, but are estimated at between USD 10 and 20 billion a year for five to ten years. During the 1994/95 academic year, schools invested some USD 3bn in education. The conclusion is that the funding must come from various public-sector levels as well as private sources. At national level, the task is to press on and support the states' work. For this purpose, a sum of USD 2bn is to be spent over five years.

The future for pupils, the country's economy and the skills of the future labour force depend on whether this challenge can be met.