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USE OF COMPUTERS IN FINNISH SCHOOLS

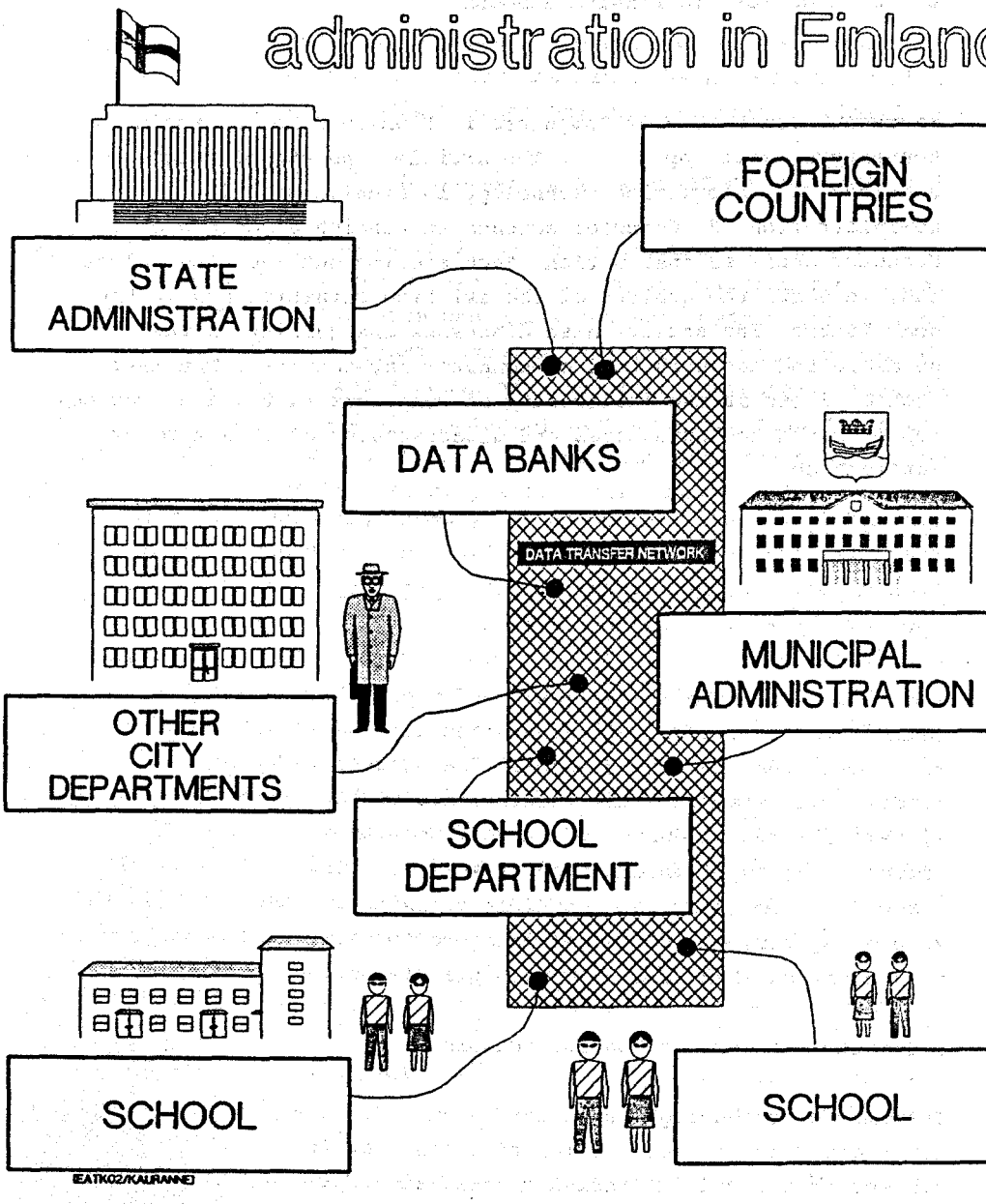
Kauranne, Jouko. Use of Computers in Finnish Schools. Koulu ja Menneisyys xxvii, pp. . The article consists of three sections: 1. Information technology in Finnish school administration, 2. Computer science in Finnish schools and 3. Computer assisted instruction. Each section outlines the volume and, in part, the quality of the existing situation and in the near future. The article also discusses the quality of the hardware and the structure of computer laboratories. The last section looks at the feasibility of computers in teaching various subjects and the advantages and disadvantages of this kind of instruction.

Finland is a small, technologically developed country. It is essential for small countries to keep up with today's rapid technological advances. The computer company NOKIA LTD is one of the best-known in Finnish information technology: their microcomputers are used not only for economic and administrative purposes but also in many Finnish schools. It is generally acknowledged in Finland that expertise and international competitiveness in information technology are becoming increasingly important for the future. The need to master information technology is not solely the concern of high-tech experts but of all citizens. The Finnish school system aims at offering comprehensive and senior high school instruction in the basics of computer science as an independent subject called 'information technology', and instruction in the use of microcomputers for the study of a variety of subjects.

The uses of information technology in Finnish schools can be classified under three headings:

1 Information technology in Finnish school administration
2 Computer science in Finnish schools
3 Computer assisted instruction

Data processing in school administration in Finland



1 Information technology in Finnish school administration

Microcomputers and software are used by many municipal education offices and by school administration. This use is expanding and is likely to cover the entire country within 5 years.

1.1. Information technology in education offices

The operational target for the Helsinki school system includes the computerization of pupil information systems, the curriculum application system, the budgeting and economic planning system, the bookkeeping system, the personnel management systems, the material management databank, the schools space planning system and electronic mail and text planning. Apart from this, the education office has data communications with the city and state administration systems and data registers, and even with foreign data banks.

1.2. Information technology in the administration of individual schools

The target for schools includes the computerization of the administration system maintaining the data on pupils, teachers and facilities, and the financial administration system. The school type determines the requirements of the administration system. The schools have communications with the education office's a) pupil information system, b) curriculum application system, c) budgeting and economic planning systems, d) book-keeping system, e) personnel management system, f) material management databank and g) space planning system of schools.

2 Computer science in Finnish schools

Information technology is taught as an independent subject in upper comprehensive and senior high schools. It is the newest subject introduced in Finnish schools and lacks the traditions

that other subjects have. The course content and the teaching methods are still in the development stage.

2.1. Computer science in upper comprehensive schools

The pupils in upper comprehensive schools who receive instruction in computer science are from 13 to 15 years of age (grades 7 to 9). In grade 7 the instruction is common to all pupils and comprises no more than 6 to 10 lessons. Computer science is taught during study and vocational orientation lessons. The purpose of computer science education is to introduce pupils to the use of the computer equipment and software available at their school. Because of the time limitation, the programs studied are mainly word processing. The aim is to give pupils an understanding of the importance of information technology in modern society.

In grades 8 and 9, computer science is an optional subject. In both grades, pupils attend 1 to 2 lessons a week. The entire syllabus thus consists thus of 1 to 4 lessons a week, depending on the pupil's interest. In Helsinki the only option is between 2 and 4 lessons a week. The aim is to teach pupils to understand practical applications of computer science in modern society and to prepare them to use computers, to offer positive cognitive and practical experiences, to stimulate pupils to acquire and maintain knowledge and skills independently, to teach them to see both the potential and the limitations of information technology, and to take a general look at its socio-historical role.

The content of the subject comprises six subsectors (courses):

- the basics of computer science
- the computer as a means of expression
- data management and transfer
- programming
- automation
- computer operation

The subject is so new that in comprehensive schools in Helsinki, Finland's capital, computer science was taught for the first time in grade 9 in 1988-1989, and the last two parts of the course were postponed till later years.

2.2. Computer science in senior high schools

In senior high schools, computer science has been an optional subject for pupils from 16 to 18 years of age (grades 1 to 3) since 1982. The syllabus comprises two courses: the basics of computer science and programming. The basics course aims to give a general idea of the uses and potential of information technology and of the features and applications of the most central tool programs. The programming course aims to give pupils an understanding of the operation of a computer, to teach systematic and disciplined programming techniques, to provide practice in making new programs and to teach pupils to see the importance of team work in developing programs.

The computer science syllabus is being revised to take account of the experience acquired in comprehensive schools, but it will continue to be optional. There will be an introductory course, a computer science workshop course and school-specific optional courses. The aim is to expand and complement pupils' basic understanding of the uses and importance of information technology in society, to improve pupils' ability to cooperate, to carry out systematic independent long-term projects and to evaluate their own work, to encourage interdisciplinary integration and to develop the schools' working methods, to give pupils the ability to utilize information technology in senior high school studies and to improve pupils' ability to use computer equipment and software.

The aim of the optional computer science courses is to expand pupils' awareness of the applications of information technology and their view of its potential and limitations, to introduce the basics of computer science, to improve pupils' capacity to form

integrated wholes in data processing and to stimulate the independent acquisition of knowledge and skills.

The introductory course is for those who have not studied computer science in comprehensive school. During the workshop course, the pupils apply computer technology to a project closely connected with one or more senior high school subjects. The school determines whether the optional courses deal with programming, database construction, information systems, graphic design, computer operation or data structures, etc.

2.3. Choices made by pupils in Finland in 1988-1989

In upper comprehensive grades 8 and 9, computer science has become a popular subject. In Helsinki, for example, approximately two thirds of all pupils chose the computer science option. The subject was more popular with boys than with girls but, nevertheless, more than 50% of the girls chose computer science. In senior high schools it was not so popular, perhaps partly because computer science knowledge and skills are not yet tested by the matriculation examination.

2.4 Pre-requisites for successful computer instruction in Finnish schools

2.4.1. Hardware and software

All upper comprehensive and senior high schools have microcomputers and software for the instruction of computer science. The general aim is to have one microcomputer for every two pupils, in a separate computer science classroom. In Helsinki all municipal upper comprehensive and senior high schools have a computer science classroom with eight microcomputers for pupils and one for the teacher, with two printers and a local area network (LAN). Through the network the pupils have access to common files and programs on the teacher's machine, and they can

print either text or spreadsheets and color graphics through the printers connected to the teacher's machine.

The schools' software consists of tool programs and programming languages. The tool programs comprise word processing, drawing, spreadsheet and cardfile programs. In comprehensive schools the programming language is Logo and in senior high schools Pascal.

2.4.2. Teacher training

In upper comprehensive and senior high schools, computer science is taught primarily by teachers of mathematics, physics and chemistry. An additional training course of 6 weeks is provided for upper comprehensive teachers and of 2 weeks for senior high teachers. Not all of them have a university degree in computer science, but many have been engaged in active study during their summer holidays.

3 Computer assisted instruction

Microcomputers, programs and public databases are being turned into teaching and learning tools in a variety of subjects in lower and upper comprehensive schools and in senior high schools.

Using computers as tools offers an opportunity to utilize and develop new teaching methods, for example, to apply more pupil-centered working methods and to increase problem-centered instruction. As an interactive tool, computers make it possible to use other audiovisual equipment and material more fully and efficiently than before. Computers facilitate routine work and make it possible to handle large amounts of data. When a pupil has to use information technology as a tool in a real situation he acquires experience necessary to function as a member of our modern society. By providing an opportunity to apply information technology in their studies, the school system fulfils its responsibility to give pupils knowledge and skills required in later years.

The current level of hardware and software purchases and teache training is not yet sufficient for starting more extensive systematic computer assisted teaching in comprehensive and seni high schools, with the exception of a few experimental projects The introduction of extensive computer assisted instruction wou require suitable hardware, software and teacher training.

Curriculum development and reform work will have to integrate information technology into the instruction in all schools subjects.

Finnish pupils and teachers have described the advantages of computer assisted instruction in the following ways:

- there is more peace and quiet for classwork
- it is easier to differentiate work and to study at your own pace
- teacher-pupil relationships become more intimate in the less formal teaching situation
- shy and slow pupils enjoy working on a machine
- arts and music programs allow scope for creativity

Some of the disadvantages they listed were:

- the computer may become an end in itself
- your eyes get tired if you work on the machine for prolonged periods
- there is a risk that poor programs make your thinking mechanical

In 1978 a Finn, Risto Hamari, studied attitudes towards computer among teachers and pupils in the city of Kotka. There was a clea difference in attitudes between pupils and teachers. The older teachers were clearly willing to leave the subject to younger people, saying: "It's no longer any concern of mine."

3.1. Data communications

More and more, information will be electrically stored. Data communications and the use of databases is therefore an important element in the information technology syllabus of comprehensive and senior high schools.

Independent acquisition of information is on the increase in schools. For this reason, databases play an important role in other subjects besides information technology. Familiarity with data communications and the use of databases is part of the general education of members of the modern information society. In teaching, data communications may contribute towards breaking down cultural barriers. The schools' own and external databases will also play an important role in teachers' preparation work .

3.2. Usability of computers in various subjects

Information technology can be applied in various subjects, and the aim is to make multiple use of tool programs - word processing, drawing, spreadsheet and cardfile programs - in teaching. The word processing program is particularly well suited to writing talks and study reports, and can be combined with the drawing program to prepare publications such as school newspapers. Cardfile programs can be used to create databases for the various subjects.

In the teaching of Finnish or Swedish and other languages, and especially typing, word processing offers a great deal of scope. Pupils can use it to edit their essays and to use previously stored texts when studying new subject matter.

In studying languages, the multimedia programs provide a wide range of learning methods: the interaction of graphics, text and speech intensifies the learning process.

In physics and chemistry, microcomputers and peripherals can be used to measure regular and steadily accelerating motion, temperatures and radiation.

In commercial subjects, spreadsheet and bookkeeping programs facilitate computations otherwise requiring a lot of routine work. They help pupils become familiar with applications generally used in working environments.

Technical work allows pupils to familiarizes themselves with the latest applications in the field, such as the CAD (Computer Aided Design) and CAM (Computer Aided Manufacturing) programs and the operation of robots.

In mathematics, the teaching can be complemented with function curve drawing programs, and statistics and spreadsheet programs.

In arts and music, the computer opens up new dimensions: computers are particularly good for color composition. During music lessons it is possible to create small-scale compositions.

Computers can be selectively used for teaching other practical and art subjects, too.

It is, in fact, no exaggeration to say that the computer can be used in the instruction of all subjects taught in Finnish schools.

3.3. Efforts to improve computer assisted instruction

As hardware and software resources increase, there will be more and more computer assisted instruction in Finnish schools. The first microcomputers were purchased for schools towards the end of the 1970s. The 1980s have become the decade of personal home computers, and during this period computers have spread into schools, too. We are now living through a period of computer utilization.

By decision of the Ministry of Education at the suggestion of the National Board of Education, there are now 33 ongoing experiments on computer assisted instruction and computer science syllabuses in Finland. Apart from that, there are schools for developing the use of information technology within 17 schools.

These schools for developing information technology are intended to promote the use of computer science in teaching all subjects from the pupil's own starting point. Opportunity for providing computer assisted teaching varies throughout Finland, depending on the hardware and software resources. The owners of the schools guarantee these developing schools a sufficiently wide range of teaching technology for their work.

3.4. Current state of teaching program

Computer assisted instruction (CAI) requires a wide range of tool and teaching programs. It is rather rare, however, for someone to have both teaching and programming expertise. This is why there have not been many CAI programs available closely linked with school curricula. This has directed attention towards the utilization of tool programs, which allow the pupil to study more freely and creatively.

The production of CAI programs is time-consuming. The Finnish State Computer Centre used 1000 man-hours to make one CAI program. With this in mind, it is not surprising that few teachers start to write CAI programs to meet their own teaching requirements. In making teaching programs in the Nordic countries, it has been found that the first screen of the program is particularly important, since it has been shown to be crucial for the pupils' interest in the program. In the near future we are expecting to get an increasing number of teaching programs made according to the so-called supermarket method, which allows pupils to proceed freely according to their own capacity and interest.

3.6. Problems and challenges in computer assisted instruction

The surface area of Finland is fairly large, but the number of people who speak the language is small: there are some 5 millio people in the country. It is not commercially profitable to mak computer programs for small languages. Nor is it profitable to invest major amounts of money in program development unless the programs are marketed abroad. Program translation is therefore important for Finland. There is a need to translate English-language programs into Finnish, for example. The problem with ready-made teaching programs is that the subject matter and subjects vary from country to country, which means that, beside translation, programs require editing.

The utilization of foreign teaching programs is further limited by the fact that some of the subjects taught in our schools have a lot of culture-bound features. On the other hand, foreign teaching programs can sometimes be just right for Finnish conditions, for example, those for foreign languages.

Some challenges for information technology and computer assisted instruction are:

- the effects of information technology on curriculum developmen
- keeping up with the rapid advances in information technology
- efficient information technology training for all subject teachers
- development of the didactics of computer assisted instruction
- efficient application of information technology in school work

Our aim is to get both teachers and pupils to use computers flexibly as aids to achieving the targets outlined in the curriculum.

4 Computer instruction and pedagogics

4.1 Computer instruction linking school education with modern life

Young people see computers all around, e.g. in shops, offices and factories, not to mention computer games in restaurants, on ships and in department stores. Many have home computers with a number of different programs. When pupils in school learn about computers, data banks, microprocessor writing, computing, drawing etc., they feel school takes them close to real life, instead of insisting on the conventional, dry methods of schoolwork.

4.2 Computer instruction increases activity

It is not natural for a child to sit still and listen quietly to what the teacher says. Throughout history, good teachers have aimed at active learning. In the same way as technical work and home economics, computers allow pupils to take initiative, to invent and to test, to look for information, to correct their text and computations, to teach their friends; in a word, to act on their own instead of merely listening.

4.3 Computer teaching increases learning motivation

As stated above, the pupils are allowed to do what they like during computer science lessons. It has been proved that most pupils like computer work. Boys, in particular, are interested in computers and may stay at the keyboard till late night. Learning motivation may increase in other subjects, too, if there is something particularly pleasant about school. It is a happy finding that even the general learning motivation of many pupils increases with this new teaching instrument.

4.4 Computer instruction integrating teaching materials

Computers can be applied in teaching most school subjects, at least from time to time. Access to the general data banks and registers provides additional information in the various subjects. Thus the borders of the subjects are transcended in a natural manner. Instruction becomes integrated, and the pupils' knowledge is no longer limited to the narrow field of a single subject. Their world of knowledge expands and becomes integrated

4.5 Computer instruction and computer-assisted instruction link the school environment with community life

An active computer teacher is not satisfied to teach at school only. He will take his pupils to see how computers are applied i the companies nearby, in specialized computer firms etc. Thus useful links are formed between school and business life, and school is no longer an isolated working environment; it becomes living part of the surrounding community.

In conclusion: I have shown that computer teaching and computer assisted instruction can promote the fundamental pedagogical and educational goals the better, the more teachers understand the potential offered by computers and the more active their approac is.