VRIJE UNIVERSITEIT
Subfaculteit Psychologie

EDUCATIONAL TECHNOLOGY IN THE NETHERLANDS

A REVIEW FOR UNESCO JOINT STUDIES IN THE FIELD OF EDUCATION, STUDY GROUP 11: "NEW TECHNOLOGIES IN EDUCATION; INFORMATION AND COMMUNICATIONS TECHNOLOGIES AND THEIR IMPACT ON EDUCATION"

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1. Introduction

The Netherlands is a small country, about 36,842 km2. In the schoolyear 1981/1982 there were 21,607 schools for full-time education. Schools and teacher centers are always in relatively close proximity, which means that in the Netherlands little money has to be spent on bridging large communications distances. In the field of audio and audiographic techniques the only media in use are radio and audio tape. The Dutch Telecommunication Corporation (PTT) offers facilities for teleconferencing but these techniques are not currently being used in education. Applications of the computer are being developed just as they are in other countries. The combination of computer and VLP has been applied on experimental basis. Video techniques in Dutch education are restricted to open net television and video tape (in addition to the traditional media such as projection and 16mm film). The construction of a nation wide table network is in progress. On the average eight channels are available, one of which is dedicated to a local station (at least in the urban parts of the Netherlands). As yet no plans have been made for an educational channel.

This review follows the approach that was adopted at the Paris meeting of UNESCO study group 11. Developments in the area of audio techniques, computer applications and video techniques are reported in subsequent sections. The appendix contains a comprehensive outline of the Dutch educational system.

2. Educational Radio

The Dutch broadcasting system is supported by corporations which represent the political parties and religious denominations in Dutch society (conservative, liberal, socialist, catholic, protestant). The

amount of broadcasting time allocated to each corporation is in proportion to the size of its membership.

Educational Radio is produced by the broadcasting corporations. In the schoolyear 1983/1984 app. 131 hours of radio lessons were broadcasted. Table 1 gives an idea of the subjects covered by educational radio.

Table 1. Subjects in 1983/1984 Educational Radio Programme.
Percentage of time allotted to each subject.

Subject	% time
Dutch language	6
English language	14
Arts	14
Science / Social science	16
Health	3
Moral development	23
News	20
Kindergarten subjects	4

The largest proportion of broadcasting time is used for programmes on Moral Education (which includes general educational and pedagogical issues; religious education, subjects concerning minorities in society, and politics and democracy) and for a weekly News Show, followed by Science/Social Science series (which are called "world orientation" series), Arts and English language programmes. The latter are translated from Swedish. In the near future English language will be introduced as a subject in primary education.

Most of the educational radio time is aimed at primary education, except 4.67 hours for kindergarten and 20 hours for secondary education. Most series consist of 4 to 7 programmes, each lasting 10 to 20 minutes, which are broadcasted within a short period of time. Additional material, such as worksheets, teacher and student guides is also available for each of these series. Most series are also available on audio tape. Some series are simultaneously run on radio and t.v. Each week a spe-

cial News Show for children is presented on radio and television.

3. Computer applications

3.1. Introduction

During the past fifteen years, the computer has been introduced in some privileged educational institutes. In most cases this was made possible by grants from the government and semi-governmental agencies. The Netherlands Foundation for Educational Research has supported important pioneering activities. Some universities have done research on the use of computers in tertiary, secondary and primary education. Local boards of private secondary schools in relatively prosperous areas have raised money to buy equipment for use in the classroom. Industry has been quick to realize the potential benefits of instructing employers in the possibilities in using the computer for purposes of administration, communication, information processing and automation of mechanical processes. Finally, the Ministry of Education and Science has installed an impressive number of advisory boards, which are now in the process of advising and publishing reports on education and information technology. A National Center for Education and Information Technology at the Twente University of Technology has been founded to gather, evaluate and distribute all forms of information concerning the application of technology in education.

The government's policy has been presented in the nota "Education and Information Technology", prepared by the Minister of Education and Science and the Ministry of Economic Affairs (September, 1982) and the nota "Informatics Stimulation Plan" (January, 1984). The last paper announced a budget reservation of Dfl. 267.5 million for the period from 1984 until 1989.

This section gives a review of the current use of the computer for instructional purposes (3.2.), for administrative purposes (3.3.), development of artificial intelligence application (3.4.), some miscellaneous issues (3.5.), and the prospects for the near future based on the government's plans (3.6.).

3.2. Computer-based education

3.2.1. Primary and special education

Primary schools are purchasing micro's on a modest scale. The National Educational Exhibition, which was held in Spring 1983, had Education and Information Technology as its main theme. The educational field showed great interest in the new developments which were exhibited. At this moment we do not have a clear view of everything that is going on in the rapidly evolving use of computers in education. The kind of equipment used generally consists of small 8-bit micro's with less than 64K and BASIC as the main language. Teachers have organized themselves in users' societies like Didacom (300 members). This organisation has prepared a BASIC standard with application software which can be used on the Apple, ITT 2020, Pearcom, TRS-80 level II, EALA, Videogenie, LNW, BBC-Micro, D.A.I., Exidy Sorcerer, Aster CT-80, Basis 108, and on micro's using Microsoft-BASIC. The Didacom Handbook contains 122 routines for BASIC programs. Several publishers are developing material for the courseware market. Educaboek offers software on cassette tapes for the Philips P 2000.

In June 1983 a study group of government Inspectors of Education published a report on the state of the art of computer use in education. Of the 9,700 schools for full time primary or special education about 30 had been using computer for more than one year. Table 2 gives an overview of the kinds of applications for which the computer is being used in the 20 schools examined and the number of schools using each kind of application.

The inspectors conclude that the amount of time spent using the computer as an interactive teaching and learning aid, both in primary and special education, is remarkable. The integration of the computer in the regular curriculum is restricted. The relation between the didactics of teaching a particular subject in the classroom and practicing the same subject in an interactive computer-aided learning situation, is not the teachers' first concern. The courseware being used is of simple drill and practice nature. Teachers seldom purchase their own software. Most programmes are exchanged in users' societies or developed by the

Table 2. Kinds of applications of computer use in 20 schools for primary and special education.

Application	Number of schools n = 20
Administrative	14
Text editing	6
Information retrieval	1
C.M.I.	7
C.A.L.	17
Gaming	12
Computer literacy	3
Teacher training	6

teachers themselves. BASIC is the mostly used programming language. Upon obtaining a computer schools usually begin using it for computer assisted learning. After having had some experiences with this medium new applications are sought in the field of administrative support. Schools for special education consider the main function of the computer to be in the field of remedial assistance. Introducing the computer into any school situation entails an enormous investment in time for whoever's takes the initiative, often the headmaster. Teachers receive their training through magazines and manuals. They exchange experiences in users' societies.

The inspectors summarize that (1) the first experiences in the use of the computer in primary education usually result from personal interests and hobbies, especially of the headmaster; (2) the diversity of hardware and software is enormous and causes serious problems especially for compatibility; (3) computer aided learning is the form of use most frequently encountered; (4) the government should take measures to improve the quality of software and to reduce compatibility problems; (5) BASIC will probably become the only programming language in education; (6) the costs/effectiveness ratio is still unfavourable for most schools in primary education; (7) there is a tremendous lack of teacher training

facilities; (8) the use of computers in education is still in development: teachers are still looking for better hardware and courseware.

Several research projects have been carried out in primary and special education. Some important studies will be briefly mentioned.

Special education. With the help of the University of Leiden and the Delft University of Technology a school for secondary special education in Rotterdam has developed a program for mentally retarded children to help them to learn to count money and to check bills in a supermarket. This project is part of the government's stimulation plans for primary and special education.

Computer managed instruction. Since 1978 the University of Leiden and the City of The Hague are sponsoring a project on computer managed instruction at a primary school in a deprived area in the city of The Hague. the project has two purposes: (a) to design a model for progress evaluation in educational practice; (b) to optimize individual progress decisions by CMI. The use of the computer is supposed to support the process of individualisation in primary education. The project started with elementary arithmetic. The entire curriculum was divided into 38 blocks, each containing three to six objectives. For each block several tasks were developed, consisting of instruction and practice. Each task ends with a formative test. Within a block the tasks are hierarchically organized in three levels of increasing explanatory power. The system produces summaries per session, per period (e.g. a week), per student. The system has been developed on a PDP 11/10 minicomputer with 6 CRT terminals and 1 Silent 700 typewriter (for the teacher). The software is written in RT-11 Multi user BASIC.

Logo. The Nijmegen Catholic University has started research on the use of Logo by primary school children. The project has moved away from the university and has received some support from industry. Currently, summer camps are organized and a Logo lab has been installed in the public library of the city of Nijmegen.

Computer Assisted Instruction. Since 1969 the Foundation for Educational Research and the Vrije Universiteit Amsterdam have conducted a study into the use of the computer in primary education, mainly for remedial purpose. One of the premises of the project was that the computer can be of substantial help in primary education but should not replace the teacher. As a consequence the software does not offer new materials to the pupils. On the contrary, the programs are explicitly designed to practice basic arithmetic and language skills which have previously been instructed by the teacher. The software is generally written following a suggestion by a teacher, and provides training for those parts of the subject matter, which are notoriously difficult. Twelve schools in the city of Amsterdam participate in the project. Four schools are situated in areas with considerable social problems (housing, unemployment, high percentage of foreigners). Each school has a terminal which is connected with the central minicomputer (a PDP 11/55) in the laboratory via a dial-up line. The teachers are free to choose their own way of integrating the computer in their classroom activities. In some cases the terminal is located in the classroom, in others it is placed in the library. In this case the computer is available for use by different classes. Software and equipment can easily be operated by the children.

One of the purposes of the project was to make an inventory of the ways in which the computer is used in the classroom. Three distinct forms could be described: (1) Remedial, in which the teacher selects programs for a restricted number of children with difficulties. (2) Complementary in which all pupils made the same exercises individually. They can be used as a test and/or as an exercise to increase the comprehension of subject matter already taught. (3) Enrichment, in which pupils, after finishing their tasks are free to choose their own games.

Evaluation of the achievements by computer assisted practice led the researchers to conclude that learning by computer does not result in significantly higher performance levels than comparable paper-and-pencil work. However, both teachers and pupils report considerable effects on motivation (children are highly motivated to work at the terminal, even though they may make frequent errors), and on concentration (pupils work

with concentration, even when they are known to be easily disturbed especially when other activities are going on in the classroom). These findings seem to be in congruence with results reported in the United States (White, 1983).

The project is part of the government's plans for further research and development. Extension of the number of participating schools is expected but also the transfer of programs from the central PDP 11 to micro's which belong to a family of microprocessors (all supported by a Faculty of Computer Science project at the Vrije Universiteit) is about to be realized. This transfer makes an enormous dissemination of software possible.

3.2.2. Secondary and higher education

Apart from administrative applications (see 3.3.2.) in secondary and higher education the computer is frequently used for courses in computer literacy and computer science. The latter courses are intended for students who will have to deal with computers in their future vocations.

Computer literacy. One of the first initiatives in the early seventies was the service offered by the Center for Research in Mathematics Education at the University of Utrecht to secondary schools to process punch cards. The students had to send their batch jobs (written in BASIC or ECOL) to the center which processed them within a couple of days. However, this turn around time was discouraging to most students and teachers. Some schools purchased a new or secondhand terminal (sometimes a noisy teletype typewriter), other schools (especially private schools) were able to buy their own computer systems. At the moment the ECC (a) processes batch jobs on punch cards, (b) offers a terminal network on which students can program in Pascal, BASIC and ECOL, (c) offers an ECOL processing system for micro's, and (d) offers educational system software for 16-bits micro's with the UNIX operating system.

The Government's 100 Schools Project has given an upswing to the

general interest in the use of computers in education. The Dutch Ministry of Education has started a project in 102 secondary schools comparable with the French 10000 Micro's Project which began on September 1, 1983 and will last till September 1, 1988. The purpose of the project is stated in terms of computer literacy: "To develop knowledge and skills every citizen needs to cope with information systems which are part of daily life". Each school has received eight microcomputers (of two types either): Philips P2000 or Aster CT-80 (both manufactured in Holland). The Dutch Foundation for Curriculum Development is developing a course in computer literacy for students aged 4-16. The emphasis lies on the kind of questions and problems with which information technology confronts us and with the kind of methods computer scientists use in attempting to reach solutions. During the course the students should interactively explore fundamental matters, related to their own world. They should be introduced to both applications such as automatization of money transfer, booking systems etc., and designing algorithms themselves and writing simple programs. The course will be an integration of four parts: (1) introduction in the use of information systems, (2) automatic data processing, (3) applications of information technology, (4) impact of information technology on society. At the moment we only have anecdotical reports about the first experiences during the computer literacy courses. The equipment arrived some months after (the start of the schoolyear had begun and caused considerable troubles in the beginning. Due to teething problems the first schoolyear didn't offer the teachers a real chance to develop a regular computer literacy course. The Foundation for Educational Research has ordered the Twente Technical University to carry out a study as to (1) which place computer literacy should be given within the curriculum; (2) which practical measures have to be taken (time scheduling, classroom management); (3) the way in which additional materials are being used; (4) the degree to which certain groups of teachers and students are involved in the computer literacy experiment, esp. those who are not really interested in mathematics. Aside from this, the debate on the position of computer literacy in the curriculum continues. Some favor the position to integrate the course in the mathematics curriculum. As mathematics teachers are generally capable and most involved in computer science, the

responsibility for the new subject can safely be put in their hands. On the other hand, a course on computer literacy which is closely connected to mathematics may easily raise the mathofobia which prevents further learning and which seems to occur more frequently with girls than with boys. Moreover, the students should see the impact of information technology both in positive and a negative sense on those parts of culture and society which are not generally associated with mathematics. The final word in this argument has not as yet been said.

Computer science. The activities which started in the seventies in a few schools on their own initiative are now being generally introduced in new curricula. In Higher Technical Training computer science has become a part of the mathematics course in the first year's curriculum. In the 1982/1983 four schools have started an experimental fifth year (after the normal four year period) to educate computer technicians. Senior economic and administrative training schools introduced computer science in the curriculum last year (1982/1983). Also in the apprenticeship system, some small scale projects in economic and administrative training (ECABO) and in technical training (with government support) have been developed.

At the moment 5-15% of the courses given at Higher Vocational Training Colleges are on computer Science. Agricultural Colleges and Library Colleges have included some form of computer science in their curriculum. Several Vocational Training Colleges (a.o. technical training, nautical training, economic and administrative training) have jointly created a Foundation for Computer Management and Support. This foundation is the official owner of the computer equipment used in these colleges and supports both hardware and software in the affiliated colleges. This joint venture has led to considerable reductions in costs and has made an important step towards the realization of an effective educational network of computer services. The Foundation advices individual colleges on the purchase of new hardware and software. All of these colleges use computers from the same manufacturer, the Prime series with the Prime operating system although they are now in the process of changing from this operating system to another, namely the Unix operating system.

After a preparatory phase of about 18 years, in the 1981/1982 term four computer science departments were originated at universities in different regions throughout the country. Six hundred freshmen entered the study of computer science. Apart from this development computer science or artificial intelligence has been a regular course in mathematics and sciences education, as well as in some economy and social sciences departments.

3.3. Administrative applications

3.3.1. Primary and special education

Most computer applications in the area of administrative support, including computer managed instruction, are being developed by users' societies, educational publishers, university research projects and the Central Institute for Test Development. These types of applications are less frequently used than applications in the field of computer based learning. As noted by the Government Inspectors teachers first use the computer in the classroom situation for computer aided learning (esp. drill and practice). After having had gained some experience with this new possibilities attract their attention. The educational publishers sell packages for small scale administrative purposes in primary and special education.

3.3.2. Secondary and higher education

Testservice CITO. In cooperation with the organization of catholic secondary schools OMO the Central Institute for Test Development is designing a testservice system which can be used by teachers who have their own microcomputer. The system consists of a scoring system and an item storage system. Teachers have the opportunity to carry out advanced test manipulation activities like efficient storage, reproduction and modification of items, composition of tests, summarizing and analyz-

ing results, administering grades.

Pascal. The Foundation "Pascal" (the name bears no relation to the well-known programming language) develops software packages for administrative purposes in educational settings. The PASCET system, developed with government support, constructs time tables for schools in which students can choose different combinations of courses. The HAPPACK system is used for student administration, the PASCOUNT system for bookkeeping and the PASCORE system for processing of multiple choice tests.

At the University level several projects deal with Individualized Study Systems in which the computer administers tests and gives advices on continuation of the course. Apart from this computer assistance, advanced students serve as counselors or proctors to guide their younger colleagues.

During 1973-1976 the Department of Psychological Research Methods and Techniques at the University of Leiden developed a computer based statistics program, LEISTAT, which covers subjects from hypothesis testing to covariance analysis. The program is in use at the Psychology Departments of the Universities of Utrecht and Nijmegen. The program provides for progress evaluation, individual compensatory exercises, and summative evaluation. Information presentation and processing are supposed to be taken care of by the teacher, resp. the student. The program is problem-oriented. The student requests an exercise, tries to solve the problem, and asks for a new problem or for additional information (two levels of explication).

3.4. Artificial Intelligence

Artificial Intelligence is currently being applied in several experimental educational settings, initiated by university research projects. Progress in the field of speech technology at the Institute of Perception Research (I.P.O.) in Eindhoven has led to the development of products which can be incorporated in educational programmes. One of the applications is a "speaking reading" pen which interprets the bar-

code under a word and produces the appropriate sound output. This pen could be used by children suffering from reading difficulties caused by a supposed slow information processing speed. Simultaneous visual and audio presentation of words and sentences may enhance their reading speed.

At the University of Nijmegen a Dutch language interface is being developed for I.C.A.I. systems; systems in which natural language processing will play an important role.
Several research project deal with expert systems and computer coaching. Some of these systems are already in use in medical training colleges.

At the Faculty of Medicine, University of Limburg, a simulation program, CARDIO, was designed to present a laboratory simulation in which the student can use an unlimited number of subjects and can register physiological parameters. The program is based on a model of the cardiovascular system, containing about 40 mathematical equations. Parameters can be recorded. Different clinical pictures can be simulated by assigning certain values to a number of parameters.

Other research projects are being undertaken in the field of thermodynamics.

At the University of Amsterdam a system has been developed encompassing a realm of knowledge about thermodynamics to be used as the expert part of a computer coach which itself consists of three other systems: a diagnostics experts, a tutor expert and an expert on man-machine interaction. The diagnostician will use the frame of repair theory to trace student errors back to omissions in their knowledge systems. At the same university another team is working on a spelling expert which produces correctly written words on basis of audio or phoneme input.

At the Free University in Amsterdam a computer coach was developed to guide students when searching for information in a data base. The coach determines the strategy preferred by the student and tries to work systematically towards the goal of the task. The coach has now been made available to the public in a vocational quidance information centre in which a database with job descriptions is used as a source of information.

Two other projects are closely connected to the artificial intelligence approach. At the Centre for Mathematics and Informatics in Am-

sterdam a programming language with the provisional name of "B" (written in "C") has been developed for use by non-skilled programmers such as salesmen or students from secondary or even primary education. The language has structuring facilities which are comparable to Pascal and is supposed to be as easy to learn and use as Basic. At the Free University in Amsterdam an experimental programming language for children, P.I.P.O., has been constructed, mainly for research purposes. Eleven and twelve year old children learned to use the language to solve simple mathematical problems.

3.5. Other issues on education and information technology

3.5.1. Educational computer applications in industry

Large scale applications of the computer for educational purposes can be found in all large companies, esp. the computer manufacturers. Authoring systems are used (sometimes developed) to write courses which can be followed with minimal teacher support by large as well as very small groups of trainees. This results in a greater flexibility and a reduction in costs. The first computer aided courses were developed for system analysts and programmers (the subjects covered were: operating systems, Basic, structured programming, file management, etc.). Gradually new courses were added for e.g. computer aided design, organization and management, etc. Nowadays introduction of the personal and office computer is being achieved by 'way of' computer aided courses for large numbers of users. VLP-techniques are occassionally integrated into the course.

3.5.2. Teacher training

The Dutch government stresses the importance of adequate training of teachers in primary and secondary education who wish to use the computer for computer aided learning or computer awareness courses (see 3.5.4.). At the moment training facilities are offered by teacher training colleges and by users' societies. The courses have a limited

scope and do not surpass the level of first practical experience and simple programming in Basic. The Ministry of Education and Science has selected ten teacher training colleges to start regular courses for students. These colleges have been equipped with appropriate hardware. The lecturers themselves are to be trained by the Twente Technical University and the Free University in Amsterdam. The colleges involved will, in addition to their normal tasks, serve as local information centres for schools in the neighbourhood. The available facilities are still rather primitive. New initiatives are announced by the Government.

3.5.3. Hardware and compatibility

In the Netherlands the educational hardware situation can be characterized as being quite chaotic. All kinds of equipment are being used, ranging from the 8-bit 16K micro's to full fledged mini's. By and large most educational programs are written in one of the unnumerable dialects of BASIC. The chances for compatibility are therefore minimal. Several initiatives are being undertaken to end this deplorable situation. Two of them will be mentioned briefly.

(1) Philips and the educational publisher Educaboek have started a delivery system in which software for the Philips P2000 is distributed by the open Viditel system (the Dutch equivalent of Videotex). Due to a donation program by a number of Dutch banks and the 100 Schools project (see 3.2.2.) the P2000 can be considered to be one of the most widely used micro's in primary and secondary education. However, its capacity is limited (less than 64 K) and BASIC is the only admissable language.

(2) Some University Departments (Free University in Amsterdam, Utrecht University, Leiden University) have elaborated on a plan, which was included in the government's policy, to develop an educational computer network for software (e.g. educational publishers), teacher training colleges, research institutes, clearinghouses, The National Centre for Education and Information Technology at the Twente Technical University, and last but not least the schools. The computer configurations at each of these locations are to be connected by the open telecommunication network. The solution to the problem of compatibility will be

found by only permitting one operating system, namely Unix, and by using cross compilers to transfer code from a source machine to a target machine. A substantial contribution to this network will come from the Amsterdam Compiler Kit, a set of cross-compilers developed by the Department of Computer Science at the Free University in Amsterdam. This Kit consists of a number of front-end compilers which translate several types of source code (Pascal, C) to an intermediate code. A number of back-end compilers is capable of translating this intermediate code into a form which can be used on a target machine with one of a number of specific microprocessors (e.g. 650Z, Z80, 8088, M68000) and operating systems (e.q. CP/M, Newdos, MS/DOS).

The realization of such a computer network should eliminate a lot of the compatability problems which now exist.

4.6. Government's policy: "Education as the key to the future of society".

The Dutch Government has recently announced a comprehensive programme on education and information technology of which a summary now follows.

"Education plays a key role in preparing people for changes in society. It is beyond doubt that the introduction of information technology will cause great changes. Both the demand from the labour market and the functioning of people in society, their personal development require training in which serious thought is given to information technology. The preparation of education for information technology thus serves two purposes:

- to make "citizens" familiar with information technology (e.g. "burgerinformatica").
- to create "human capital" for the benefit of strengthening the market sector, as well as for the benefit of better and appropriate functioning of social services.

The latter also holds for all levels and all sectors of education but with the accent on vocational training. Now and in the future the labour market will require people with different forms of knowledge of

computer science. Many existing occupations are changing and new occupations are being created. By increasing both the supply of computer science specialists and the knowledge present in all types of occupations for the society of tomorow, a better connection between education and the labour market will have to be realized. In order to increase the effectiveness of education and policy specific indications will have to be received from industry, the labour market in general and the (re)industrialization policy so that this connection can be gradually realized. The approach to execution of policies outlined herewith offers such possibilities. The hereby disclosed plan provides a substantial contribution to the strengthening of the market sector by attuning to the needs of education and industry. The plan offers industry possibilities for software development whilst at the same time an important market for hardware will arise.

The government is striving to teach all students about and with the possibilities of the computer within the next 5 to 10 years for their future occupations, for their participation in society and for their personal development. Everyone will need a general knowledge of information systems. Many will have to learn computer science, one for further study, the other as preparation for a job, because the use of computers (in general: programmable components and systems) is becoming of more importance, for many education will possibly become more varied and more efficient if the computer is used as a tool, for example, for simulation. some groups of students will profit from computer assisted instruction. Hereby one can think of students in special education and in situations in which children have been deprived of normal development. We want to bring the present practical experience and the emoting policies together to include them in a policy which will be characterized by an unorthodox and innovative approach for education, that by 1988, will try to have created a situation in the field of education in which educational institutions, school and advisory centres, industry and other institutions concerned with training and forming, will be capable of taking care of the remaining educational needs.

The steps to be taken for education are grouped in five clusters.

These clusters are named below, and the budget for 1984-1988 is given between brackets for each cluster. The amounts mentioned do not imply a definite division between the clusters but give an indication of the financial limitations for the proposed plans of action.

I. The national and partly regional infrastructure for software development and distribution (40 mln.). Measures in this cluster are aimed at the realization of an educational network and several supporting measures with regard to regional support of software development, approval, and distribution of software. The aim is to improve the quality of the software and provide incentive for further developments on a voluntary basis.

II. Education-sector policy, excluding refresher courses for teachers (172,5 mln.), covering:

II.1. Primary and special education.

This cluster is primarily directed at long term measures. The aim is not to achieve wide spread applications of information technology in primary education: rather a strategy in depth.

II.2. The first phase of secondary education.

Building on existing projects, such as the 100 schools project and the regional projects (which have still to be started) on "burgerinformatica" (see above) "burgerinformatica" will eventually become a separate subject within the first phase of secundary education: this is a strategy in breadth.

II.3. The second phase of Secundary General Education.

In the second phase of secundary general education computerscience will be offered as an optional subject whereas the use of the computer as a tool withing all subjects will be encouraged.

II.4. Junior (preparatory vocational subjects in 3rd and 4th schoolyear) and Senior Vocational Training.

Vocational training, and in particular technical vocational training, will receive high priority. The subjects offered will include both specialized computer science, strongly application directed

computer science appreciation within many forms of education, education about and with programmable systems and with the computer as a tool for, for example, simulation, looking up data, etc.

II.5. Higher Vocational Training.

The existing programmes within technical and administrative higher vocational training will be further developed. In a short period of time the question of obtaining adequate hardware will be dealth with.

Within the many forms of education where, up to now, no attention has been paid to information technology, computerscience, appretiation courses will be given.

II.6. Stimulation of computer use within agricultural education.

Computer applications are in full development in agricultural and horticultural education. These courses shall rapidly receive more attention.

III. Refreshers courses, Guidance, Reschooling and Raising the Standards Expertise (30 mln.).

Refresher courses, in the widest sense (including raising the standards of expertise, guidance, comprehension, etc.) will be given high priority. Both regular (re-)schooling institutes and -when cost effective- irregular forms of education will be enlisted.

IV. Initial training of teachers, including hardware for (re-)schooling (15 mln.).

With a view to the long term, all future teachers should acquire a basic knowledge in the are of information technology.

V. Educational Research (10 mln.)

Given the priority for education and information technology the supporting research including policy evaluation must be considered unsatisfactory at this moment. Specific attention shall be given to research on applications of informational technology in special

education.

The policy with respect to university education is not directly considered in this nota, but indirectly via the measures required for research. Furthermore, the services provided by university calculation centers, also considered in the context of research, are of great interest to education.

It is of utmost importance that, expertise and facilities from outside regular education (companies in hardware and software sectors, educational publishers, institutes for irregular computerscience education, user's clubs, Teleac, Centers for Micro-Electronics, etc.) be used as much as possible and appropriate. Private companies will be encouraged when and where this is possible. Finally, this nota reflects the choice of two possibilities. Firstly, to stimulate and provoke all sorts of private, local and regional initiatives by means of a good infrastructure, by incentives and by example. Secondly, to improve the quality and applicability at a higher level and by exchanging data and experience."

4. Educational television

Can Televisions Teach? This question has never really been answered, any more than the questions "Can Books Teach?" or "Can Teachers Teach?", as the Editor of the Times Educational Supplement concluded after a conference on educational television in June, 1978. In a well written review of the activities of the Netherlands Educational Broadcasting Foundation (N.O.T.) Van Zon (1977) describes the fourteen years of Educational Television in the Netherlands. In 1963/1964 the first twenty programs were transmitted. The experimental period lasted two years as part of a research project that was supposed to shed light on the conditions of learning through instructional television in the Dutch educational system. This study, however, resulted in rather vague and global conclusions. The number of programs had increased from twenty to 226 by 1970/1971 and in 1977 117 programs had been written for secondary

education, 203 for primary education, and 26 for nursery schools. In 1977 the following subjects were covered: geography, biology, history, English language, mathematics, vocational guidance, and social studies. By law, the Dutch broadcasting companies have to use 30% of the time spent on educational television (145 hours) on programs which concern subjects stimulating children to form their own opinions including religion and politics (10% for socialist and liberal opinions, 10% for catholic and 10% for protestant opinions). As far as secondary education is concerned there has been a gradual change in the selected audience from the higher to the lower grades (in particular in junior vocational trainings). The programs are watched by an average of 15% of the schools, 80% of which are recorded on tape. 30% of the secondary schools never use educational television. For primary education a slight decrease in interest has been observed during the years. Each program is used by an average of 16% of the schools. The biology series are recorded as having received the highest rates (50%), the human values series the lowest (1%). In May 1977, primary-school teachers were interviewed about instructional television. The question concerning the affiliation between classroom activities and educational television showed that 13% of the teachers interviewed could integrate the majority of the programs offered into their daily lessons while 41% could only accomplish this with a fraction of the programs. 45% welcomed the opportunity to vary their teaching-learning process by including television programs in their curriculum. The conclusion seems warranted that most teachers do not consider instruction television as part of their classroom situation. It is an important contribution to education but not indisposable. Van Zon (1977) regrets this development because television programs should give teachers the opportunity to change the context within which subjects are taught by trying to relate the subject matter to today's society. It's this society for which schools are trying to prepare the children.

The question whether open net television can be used for educational purposes should be answered affirmatively although 15 years experience has revealed this medium's restrictions, two of which follow. (a) Two way communication between the teachers and the student is impossible. The student has to remain in a passive observing position and can

not interrupt the course of the program by raising questions. (b) The teacher has no opportunity to influence the content or flow of the educational program. If one also considers the wide divergence in the methods of thinking and working between the educational authorities and the broadcasting companies, (at least in the Netherlands) it is obvious that school television will probably remain in its current background position.

These remarks have been based on the experiences with educational television in the usual school system. One can't compare this with the situation in which the television in the only source of information replacing the teacher. Many adults benefit from an increasing number of television lectures on various subjects. People suscribe to the courses given by the Dutch Television Academy using their textbooks and other instructional material. Especially in this period of increasing unemployment the social significance of this form of education at a distance is becoming more and more important.

5. Distance Education: Open University

The Open University has recently designed a strategy for the integration of media in distance education. The choice of media has been based on the following three factors: (1) Analysis of the functions the media have to serve in the teaching process. (2) Finding the optimal combination of medium and teaching functions. The most important criteria are: (a) presence of the medium at the student's home, (b) costs of purchasing the medium by the student and by the Open University, (c) the degree to which the medium allows future changes of the learning materials, (d) the degree to which the medium admits exchange of materials with other universities. (3) Analysis of the existing media on the market. The Open University expects the following media to be present in 1987: (a) At the student's home: audio tape deck, TV, telephone, video recorder, programmable pocket calculator. (b) To be acquired by special groups of students for use in the Open University courses: video recorder, microcomputer, Viditel, teletext. (c) Only to be used in a study center: large computers, VLP, retrieval systems for literature search.

(4) Also optically readable records will be used. The order of introduction of media: (1) immediately: optically readable records, teletext, audio tape; (2) after some technical and organizational preparations: TV, computer as computing tool, Viditel; (3) in the long run: video tape, computer based learning, and VLP.

Based on these considerations the Open University has decided to integrate media in education in the following order of preference: written materials, audiovisual materials, computer (software), personal contact.

6. References

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