

OECD/CERI ICT PROGRAMME

## Hungarian case study No. 5

A Case Study of ICT and School Improvement at the

### JANOS BERZE NAGY SECONDARY VOCATIONAL AND GRAMMAR SCHOOL, GYÖNGYÖS, HUNGARY

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## 1. Overview of the present

Picture 1: The school building



### 1.1 What has been accomplished?

Before describing the achievements of the János Berze-Nagy Secondary Grammar School in Gyöngyös, Hungary (to be called Berze Nagy in this survey) we give a brief overview of some relevant aspects of Hungarian ICT culture. According to a recent survey conducted by Róbert Tardos and his public opinion survey team, ([1]), 1.6 million Hungarians - 19 % of the adult population of our 10-million country - possesses a computer. It means that 24 %, almost one fourth of our households was furnished with the token of information society at the eve of the third millennium - a 9 % growth in one year. The number of "Netizens" - computer-savvy, regular users who employ their computer both for work and leisure, is far less than the number of those who own a machine. A recent study by Szilárd Molnár, member of the Hungarian

Information Society Trends Research Center ([2], home page: <http://www.ittk.hu/>) indicates that only 1-3 % of the adult population of our country can be considered thoroughly computer-literate. The number of Internet subscribers almost doubled within the last year. (It grew from 62 .000 in January 1999 to 110.000 in January 2000. [3]) The biggest supplier, partially state-owned MATÁV (Hungarian Telephone Company) totaled a 77 % increase of Internet subscribers by the end of 1999.) Most homes with Internet access use a modem, although ISDN access is becoming increasingly popular - the number of sites so connected grew 90 % last year.) The growth rate of PC purchases is, however, not that encouraging an estimated 4 % per year.

The computerisation of Hungarian schools, a major national investment co-ordinated by the School Net Office of the Hungarian Ministry of Education, was backed also by international grants. PHARE, EU-Socrates Project, the British Know How Fund and the World Bank were the major sponsors of projects. Far beyond the purchase of up-to-date technology, these projects resulted, for example, in a profound modernisation of vocational education and the development of a range of distance education centres all around the country. Private funding was also important - primarily the George Soros Foundation-Budapest that excellently allocated and monitored grants that reached about 600 schools in all and more than 5000 teachers.

The most intensive phase of hardware development occurred *between 1995 and 1997, when the World Bank and PHARE launched their big ICT projects in the country.* ([4]) The Hungarian Schoolnet Project (<http://www.sulinet.hu/>) could build a firm foundation: hundreds of secondary schools that already had an expertise in using ICT both for education and intra- or extra-school communication purposes. Expensive *infrastructure* in permanent need of upgrading and maintenance is the eternal source of complaint of those who consider ICT an unnecessary expenditure for schools that scarcely scrape by their budget anyway. Hungarian schools are moderately equipped. In 1995, we ranked 17 out of 23 countries assessed. In an international survey done by the educational institute of OECD, CERI. (Cf. Education at a Glance, 1998) In primary schools (compulsory, 8 grades, oldest students' age range: 6 - 14) there were 43 students per computer, whereas in Canada, Great Britain and Australia 5 students shared a PC at school. Between 1997-1999, however, the Ministry of Education initiated a massive computerization movement. This 3 billion HUF (cca 500.000 USD) was allocated, to connect *all secondary schools*, (about 700 in number), *30 % of primary schools* (400 in all) *and one educational institute per county* (22 in all) to the Internet. By the end of 1999, the ambitious plan has been accomplished. Although funds for upgrading, maintenance and the employment of local system operators are extremely scarce, traditional Hungarian ingenuity (a virtue that led our students to victory in the first three *Olympic Games in Information Technology* [5]) led to a more or less acceptable learning environment in hundreds of schools. Fights for improvement of facilities and working conditions started instantly: in 1998, the *Association of Teachers of ICT* was founded. With more than 800 members, this association is a major promoter of innovation and research. (<http://www.isze.hu/>)

Members of our Schoolnet ("Sulinet", an acronym using the kid name for school) receive free, 24-hour Internet connection (mostly ISDN), a computer laboratory with up to 20 PCs and a server, a software and printed manual package called Internet Starter's Kit. The Schoolnet Office employs part-time a large group of subject specialist teachers who created a weekly updated, authentic content-rich and therefore increasingly popular web site: <http://www.sulinet.hu/> features columns for all compulsory school disciplines. Content ranges from learning games to translated articles from professional journals, lesson plans, teaching resources and links to both scientifically and educationally reliable web sites.

Picture 2: Complab1) Computer laboratory



1 . Table: Student /computer ratio per school type, June 2000 (Source: unpublished research report by Éva Tót, National Institute for Educational Research)

School type	Average number of computers	Average number. of students per PC	Avr. Number of stud. per Internet-connected PC
<b>Primary school</b>	15.67	30.11	37.49
<b>Secondary grammar school</b>	38.66	17.72	23.64
<b>Secondary vocational school</b>	61.14	13.98	21.74
<b>Vocational training school</b>	52.96	28.92	37.55
<b>TOTAL</b>	<b>32.95</b>	<b>24.20</b>	<b>21.73</b>

Berze-Nagy was one of the first schools in the country to take part in the large national computerisation projects. The school's ICT facilities were organised to support the "School of the Information Age" model and facilitate personalised acquisition of knowledge. The library was furnished with a set of computers, an electronic catalogue was created and a rich collection of digital information resources made available to students. Staff was trained in educational computing and started using the resources in the teaching of a range of disciplines. Computer circles for students were organised to supplement regular, compulsory ICT studies.

The school soon became *a regional, then a national centre for ICT in education* with presentations and visits organised for staff members of secondary schools. The principal started teaching at training courses of Eötvös University and Károly Esterházy Teacher Training College. Staff members presented about their experiences at national conferences. The Berze Nagy model for using ICT in education found its way to the Hungarian teaching public.

ICT became a challenge for teachers at Berze Nagy and their use resulted in a *paradigm shift in education*. The emphasis was transferred from traditional knowledge transmission to the development of the abilities to deal with information, formation of communicative and social competencies and the generation of positive attitudes towards the changes. In the following table a few important elements of this shift in emphasis are summarised in an essay on ICT at schools by Bertalan Komenczi, former Principal and initiator of the reforms related to the introduction of ICT at Berze-Nagy::

<b>Education in the industrial society</b>	<b>Education in the information society</b>
Teaching data, rules, ready-made solutions	Formation of abilities, competencies, expertise and attitudes

Transfer of closed, definitive knowledge	Formation of the attitude that learning is a lifelong process
The source of knowledge is the school and the teacher	Integration of information elements coming from different sources and perspectives
Teaching in the frame of classes	Learning, in smaller, frequently heterogeneous groups
Domination of instruction by teachers	Students accumulate the skills individually in an inspiring learning environment

The most important achievement of the school is that it has managed to transform its learning culture from the model characteristic for the industrial society to the model characteristic for the information society.

### 1.1 Who profits from the introduction of ICT?

The *library* equipped with PCs has become the main information and media centre for the students where the Gutenberg-galaxy and the Neumann-universe have completed each other, thus helping the work of both student and teacher. Gutenberg-galaxy means the written or printed cultural heritage of humanity. Neumann-universe is the world of digitally encoded and electronically stored information.

Through Internet connections, opportunities of those who use our library have grown substantially. Teachers and students make regular use of the text and image databases available online, assisted in their search by the librarian who has received profound training in electronic library management.

Picture 3: The school library



The use of the *computer laboratory* has also changed substantially since the 1980s when the first computers were installed. Programming became a secondary issue, user training comes first. The PCs are also available after lessons for students and teachers when they can practice at the chosen pace or work on different topics. They are assisted by the systems manager and the ICT teachers who volunteer to supervise extracurricular use and give advice.

The *intranet system* of the school is being continuously filled with materials related to different disciplines and has become an important forum for knowledge sharing.. The general and full availability makes it possible that the students learn and practice the necessary users' skills and knowledge for the future use of information technology in life.

Students at Berze Nagy learn two *languages* in small groups formed according to abilities and knowledge, having 3, 4 or 5 foreign language classes per week. Native teachers help the high-level language teaching. Course books used have ICT support in the form of CD-ROMs and web pages. (E.g. Hotline, Streetwise,

WOW; Deutschmobil, Deutsch Aktiv Neu, etc.) To make teaching more effective and alive, video films and audio tapes are also used. In 2000, 32 % of the 172 graduates have passed the state language examination - a good result bearing in mind that this is the strictest language exam available in Hungary.

Since 1990 the school has been taking part in the *exchange programmes* offered by international organisation of the AFS. They have received students from Australia, Canada, Finland, Denmark, Belgium, America and Thailand. Selected students spent 3-6 months in Austria, Belgium, Germany, and the USA. Berze Nagy is in permanent partnership with schools from Asti, in Italy and Cirencester (Kingshill School), in England. With these schools, common events, staff and student exchanges are on the agenda every year. These exchanges and partnerships are organised and followed up through e-mail correspondence.

## 1.2 *How do the staff, students, and parents view these accomplishments?*

A basic concern for schools today in Hungary is to adapt as early as possible to the challenges of our era. Parents are deeply convinced that computer skills will play an important role in the careers of their children. At Berze Nagy, staff keeps discussing how ICT could be made a more important part of school culture. In teacher and management interviews it was repeatedly emphasized that the traditional educational system progressively loses its prerogative that it is the only representative of knowledge transfer. Reference was made to Lewis J. Perelman's much disputed book "School's Out" tries to convince the American taxpayers that the new information media and the system of public education are incompatible and therefore, in the interest of healthy economic growth, the latter should simply be scrapped. [6]

Picture 4: The staff of the school



Teachers most active in the involvement of parents in the diffusion of ICT culture quoted Seymour Papert, who in his newly published book emphasises the importance of the *learning-at-home culture* as compared to the poor effectiveness of the school-style learning. He discusses how parents could effectively promote the computerised home-learning of their children. [7] Most teachers believe that the new advances upgrade the teacher's profession. They hope that the value of good teachers and good schools will increase exactly because of the challenges of our era. Instant access to data and information doesn't mean that knowledge will be acquired automatically - *the filtering of information and knowledge management* will be important teacher responsibilities.

Those researchers who dreamed about and realised the technology of the information age, from Bush to Tim Berners-Lee, possessed great intellects and deep mental abilities. The Internet and the web have been created by the co-operation of knowledge workers in university circles who were engaged in basic research. To use the world wide collective knowledge system intelligently, one has to have excellent intellectual prerogatives. [8] These skills cannot be acquired by simply sitting in front of the computer and surfing the Internet. The philosopher Jürgen Mittelstrass states a profound truth when he writes:

"The information superhighway actually presupposes that the mind is independent and has an ability to judge. It doesn't create it....and that is possibly our problem." [9]

Everybody needs an “a priori” inner web: his or her personal neural net. This is essentially a hypermedia system that makes us suitable to take advantage of the indefinite possibilities of the outer web. The teacher may be the master craftsman who determines what the minimal contents necessary for an effective inner web should be and how they should be utilised. The school is the place where all this can happen with the right timing and in the appropriate sequence.

*ICT teachers* emphasise that the trend is that the machines will accommodate to the humans. [10] It will be much more important to have a well-rounded education and to know the lingua franca of the information age, the English language. Another factor which makes the teacher indispensable is an increasing demand for an assembly of properties: curiosity, motivation, openness, sensitivity, inner stability and a determinedly positive value system. In order for the student to acquire such properties, the teacher can do a lot. Through the study of multimedia programs and adaptive teaching software I gained a strong appreciation of the value of a good teacher. He produces a superb multimedia presentation. He associates high-level interactivity to the visual and auditory elements, creating a teaching program accommodated to the cognitive capabilities of the students. He applies a large amount of continuously updated software, and in addition, he demonstrates societal values and gives personal examples. He praises, encourages, consoles and if it is necessary, gives penalty for inappropriate use.

For *parents*, the most significant benefit of ICT culture is that it develops the ability for independent knowledge acquisition in children. They will be able to upgrade their knowledge and develop their skills throughout their entire lifetime almost irrespective of the local culture they are embedded in. For parents living in smaller towns and villages, this aspect is of crucial importance. They feel that their children will not be handicapped by living far away from libraries, museums and other information resources if they learn to use the Internet properly.

The spread of computers, however, raises many questions. There is widespread concern among both teachers and parents about the effective use of new technology. Our respondents emphasized that *dehumanisation of the learning environment* must be avoided, the role of the educator retained and personalised instruction provided with the help of mixing traditional methods with computer-supported teaching techniques.

Picture 5: Girls in the computer lab



For *students*, ICT use is more of a challenge than a problem. They would like to have more access and better equipment, however they are aware of the accomplishments of the school management in this area. Home page design by students is rare, e mailing is frequent. They enjoy having Internet-related homework and gladly participate in fantasy or adventure games requiring co-operation of players through the Internet. Their favourite sites include youth subculture web pages mostly related to music styles, sport pages and information

portals with chat possibilities.

## 2 Overview of the past

### 2.1 What led to these accomplishments?

In the case of Berze Nagy, we feel inclined to take this topic literally and briefly outline the history of the grammar school, one of the oldest ones in Hungary. The school home page gives a vivid description of how it was founded in the times of the Turkish occupation, in 1634. The Jesuit provincial sent for two priests who were acknowledged teachers and scientists to establish the grammar school and start teaching according to the principles of the Jesuit Order. The Jesuits - with small forced intervals - ran the school till 1773, till the dissolution of their order. From 1776 - at the request of the town authority - the Franciscan order took over the school and taught here for 122 years. By the end of the 19<sup>th</sup> century the order could no longer finance the continuously increasing institution and thus it was given over to the State. The six-form grammar school was expanded and a more scholarly, eighth-form institution was created.

The new - and presently visible - building of the grammar school was given over to use in September of 1899. It was a landmark building of modern school architecture of the age. At the international educational exhibition in London, 1908, Miksa Rausher, the Hungarian architect was awarded a gold medal for the functionalism of the floor plan and up-to-date furnishing. :

“The Town Council of Gyöngyös, with its generosity by accepting to pay off the instalments of the huge loan resulting from this monumental building, went to its utmost limits. The building of the two-storey palace of the grammar school is the highest embodiment of enthusiasm for the rising of standards for general education” (Gyula Wlassics, Minister of Education and Religion on the inauguration of the new building of the grammar school)

The teachers and the students of this school have always been characterised by openness and sensitivity to the new initiatives. The teachers played important roles in the cultural and spiritual life of the town and in the geographical studies of Gyöngyös and the Mátra Hills region. The teachers of the state grammar school published the first calendar of Gyöngyös in 1909. The intellectual contribution of the school to the preservation and development of the cultural life of the town has been important through the centuries, and it ensured a central position to our institution in the life of the town.

Picture 6: The neighbouring museum



Being the "intellectual centre" of the area is a mission that inspired management and staff of Berze Nagy to be on the cutting edge of educational reforms to participate in the first large scale ICT projects in the country.

With the help of funds of the George Soros Foundation, the first computer lab was furnished in 1996. When the Hungarian School Net began its operations in 1998, Berze Nagy was among the first secondary schools to be connected to the Internet through an ISDN connection and given another set of PCs. In that same year, Microsoft has selected the school to be a Microsoft Model School and give demonstrations about new educational applications. Substantial donations of equipment and software accompanied the nomination.

## **2.2 Who initiated the ideas, who shepherded them to completion?**

The school's principal in the first phase of establishing ICT culture in Hungarian schools, 1996-1999, Bertalan Komenczi is one of the top experts in educational computing. He initiated the establishment of the library as knowledge centre, concluded an agreement with Microsoft to make his school a Microsoft Model School, took part in the George Soros Foundation projects related to Internet use (I\*Earn, Jefferson, cf: <http://www.soros.hu/>). His Deputy Principal, Péter Czinder, who is the head of the school today, an ICT specialist himself, was partner in his efforts.

Several teachers are involved in ICT-related innovations, but one of the youngest staff members, Miklós Kiss, teacher of Mathematics and Physics is especially active in co-ordinating research and innovation in this area.

## **2.3 What barriers were overcome in doing this?**

"The providers of information technology promise quick, easy and, in addition, enjoyable and pleasant learning. However, the question arises whether the attractive, colourful pictures and film presentations are more of a hindrance than a help for intellectual concentration, by stimulating automatic encoding and superficiality. Doesn't the information, which can be produced so easily by using the new knowledge media, cause more trouble and insecurity than benefits and expected improvements? Is the rapid computerisation and the widespread technologisation of the teaching/learning environment desirable at all? Can the new media fit into the socio-cultural system of the teaching environment, an environment which developed in a traditional, evolutionary way? How credible is the promise of easy learning, promoted through the marketing efforts of the information industry? Whenever a new media appears, the hope is raised that there will be a substantial improvement in the quality of teaching and that the cultural level of the public will rapidly increase. Until now, this hope has never been realised. [11]" (Bertalan Komenczi: E-learning. English language manuscript. 2000)

So far, in the first four case studies from Hungary, we described financial factors as hindrances for easier diffusion of ICT culture. The same is true here as well, but moral and educational aspects of ICT use also kept coming up. The first phase of enthusiasm for computers seems to have gone and now teachers of Berze Nagy face "the age of realism": they have to make ICT a normal part of the educational and communication process. When talking with staff and external experts who promote the use of ICT in this school, the following ideas and authors were mentioned:

In the eyes of sceptics, the current enthusiasm for computers is the triumph of hope over experience or worse, it reflects a persistent infatuation with technological fixes for deeply rooted social problems..." -asks the American Paul Starr in the introduction to his study.. [12] In the midst of the euphoria regarding the educational utilisation of computers, it will be beneficial if we also learn about emerging doubts and reservations. In his book Theodore Roszak states, that he does not expect much from the new technology. According to him, the introduction of computers in schools has been promoted mainly by the computer and software industries and made possible by simple human gullibility.

"The computer has entered the schools on a wave of commercial opportunism. One would be hard-pressed to find another time when a single industry was able to intrude its interest so aggressively upon the schools of the nation – and to find such enthusiastic receptivity ( or timid surrender) on the part of educators.".....For the most part, the schools (or mainly trend-conscious administrators and anxious parents, less so teachers) have responded with the promptness and gullibility of well-trained consumers to the commercial pressure of the computer industry. [13]



Roszak is worried about the confusion arising from the misunderstanding of the capabilities of computers and the overestimation of the possibilities of computer technology. This is exactly what teachers at Berze Nagy want to avoid.

Clifford Stoll, an American astrophysicist and computer security expert, was one of those who expressed a critical opinion about the Internet and the utilisation of computers in schools. [\[14\]](#) According to him, it is not worthwhile to waste limited financial means on expensive technologies that have a dubious effectiveness. Teachers need smaller classes, greater parental support and a higher appreciation from society, instead of computers integrated with networks. Stoll doesn't believe that knowledge can be easily and playfully achieved by using information instruments.

"I personally am unsure whether computers belong in classrooms. But I am *certain* computers will not do very much to make learning better. None of the innovations in the past 50 years ... from filmstrips to videos ... has proven to be as important as a damn good teacher. That seems so obvious to me: a good teacher and a motivated student. Between them they *don't* need a computer. It's not essential." [\[15\]](#)

This dilemma is constantly on the agenda at Berze Nagy: when resources are scarce, how could they be optimally utilised? Is it really the purchase of new machines that will increase the efficiency of education?

Neil Postman, Professor of the Media and Communication Chair of New York University also believes, as indicated in his new book, that computers do not mean real help, either in the fulfilment of the real purposes of schools, or in the solution of the serious problems in public education. He states: "Schools are not now and have never been chiefly about getting information to children." [\[16\]](#) However, in a lecture for information specialists, he expressed himself in the following manner: "The computer is, in a sense, a magnificent toy that distracts us from facing what we most needed to confront - spiritual emptiness, knowledge of ourselves, usable conceptions of the past and future.... True, it is only a machine but a machine designed to manipulate and generate information. That is what computers do, and therefore they have an agenda and an unmistakable message. The message is that through more and more information, more conveniently packaged, more swiftly delivered, we will find solutions to our problems...." [\[17\]](#)

According to Joseph Weizenbaum, Computer Science Professor of Massachusetts Institute of Technology, children should first learn their own language and acquire basic literacy and numeracy skills. "to be able to express their thoughts clearly that others can understand and to think critically" Computers do not have to do much about all this. At Berze Nagy, teachers feel more profound research is needed to prove if and to what extent computers can be used in improving learning results in different disciplines.

All these considerations show that *the diffusion of ICT culture should be a process of discussion* of goals, clarification of priorities, distribution of scarce resources in a way that is satisfactory for both the promoters and the sceptics of ICT culture. The most important barrier in ICT development seems to be lack of information and misinformation. Researchers and educational policy makers have to be more active in popularising advances in this area to convince those teachers who have well-founded worries that their "traditional" values and teaching style may be harmonised with new technology.

## 3 The present

### 3.1 Characteristics of the school

"Education should provide value ideas, ideas that make life and the world comprehensible for the students. During the course of teaching we have to strive to provide the latest knowledge and to develop skills appropriate to the requirements of our age.

Each student should be helped to reach the maximum of his/her own potentialities - in pace according to his/her age and preconditions.

We have to respect the student's personality, dignity and rights.

Our fundamental aim is to have graduates who know their ways round the 21<sup>st</sup> century, who are capable of happiness and success.

The Educational programme of the school begins with these words that clearly show the staff's commitment to moral education and development of human values. Berze Nagy is a secondary grammar school offering ICT as a discipline and also as an optional area of study for all students. There are two types of secondary school programme available here: the 4-form, traditional for Hungary arrangement for students aged 14-18 and the 8-form, new type of secondary grammar school programme for students aged 11-18. Both training types end with a final examination called baccalaureate. ICT is an elective discipline for this final examination. Those students who select this option have 3 lessons a week in their last 2 years at school to prepare for the exam.

Teaching staff consists of 51 members and the student population is 700. The ICT infrastructure of the school is good. There are 58 multimedia computers connected to the Internet and 12 other computers that are used for administration and preparation of learning materials. 56 computers are distributed in classrooms, 2 are in the ICT room, 4 machines are at the disposal of teachers in the staff room and 5 are located in offices of management and administration. 3 PCs are in the library that is used as a knowledge centre and external classroom for the teaching of different disciplines. The four-forms educational system contains student groups or classes of general and special interests.

Among the most important aims and objectives of education in the Educational Programme of the school, the followings are included:

- Developing communication skills in both native and foreign languages
- Teaching information technology and media culture
- Developing skills to live a of healthy life style and environmentally conscious behaviour
- Learning the techniques of self organisation, discipline and assertion of group interests;
- Developing sense of duty and responsibility

The school offers special classes for those interested in ICT with accelerated number of mathematics, ICT and English language classes. Future computer specialists from the whole region of Gyöngyös frequent this training programme. The school also offers vocational training courses in the form of post-secondary education and have correspondence courses in their adult teaching section.

The library equipped with PCs has become the main information and media centre for the students where the *Gutenberg-galaxy* and the *Neumann-universe* have completed each other, thus helping the work of both student and teacher. Gutenberg-galaxy means the written or printed cultural heritage of humanity. Neumann-universe is the world of digitally encoded and electronically stored information. With the help of the Internet and other, traditional library facilities our students can work on common projects together with students from other countries. Through exchanging data, results and opinions, they can not only learn but acquire skills of communication and techniques of building new types of relations. PCs in the classrooms are available after lessons for students and teachers. They can practice at the chosen pace or work on different topics.

Picture 7: Audio-visual equipment in a classroom



### 3.2 *Use of ICT by specialist teachers*

Specialist teachers, as in other institutions, are instrumental in the diffusion of ICT culture. Apart from teaching ICT in normal and accelerated classes, they organise study circles for programming and multimedia design, cater for the school home page ([www.berze-nagy.sulinet.hu](http://www.berze-nagy.sulinet.hu)) and assist colleagues voluntarily with CD and Internet use problems.

### 3.3 *Use of ICT by non-specialist teachers*

In order to describe the way non-specialists have been encouraged to use ICT technology in this school, let us quote the former principal and initiator of this culture, Bertalan Komenczi.

"Bill Gates thinks that the greatest promise of computers is that the user, following his/her own specific interests, can enhance his/her knowledge as far as he/she is willing to do. A student can become familiar with selected subjects through preferred channels and can reach any level of sophistication. Since everybody learns most effectively according to their own methods, computer learning programs are designed more and more in ways that they can be accommodated to individual learning preferences.

Computers of the future will be able to assess the cognitive style of the student and to adjust the learning program according to this. In such a way the student will be able to recognise his own learning preferences which may mean priceless help in the development of his own learning methods. The user of the computer will establish a personal relationship with the program, which will pay attention to what the student is interested in, what he already knows and has learned about a subject. The program serves as a personal help, assistant, or smart agent and finds the contents which are available on the Net and which presumably will be interesting to the user.

It is particularly useful that the students, with the help of computers, will be able to assess their own level of knowledge at any time without risks. Control and measurement, integrated into the learning process, become positive. Errors will not be associated with guilty feelings or reprimands, but with the simple necessity to clear up misunderstandings. If a process is not successful, the computer will propose that the student seeks help from the teacher. This system enables the student to assess his real knowledge, helps learning and makes it easier for the teacher to give appropriate help.

In a well-functioning educational environment, *all computers are networked*. The curricular material and a large portion of the exercises are kept on the school server and with the help of the teaching software the students can pursue their studies on their own. The system keeps track of the student's progress, thus the teachers and the parents connected to the database via the network from home can keep informed about their status at any time. The students frequently work in smaller groups, with the computer as the central focal

point, and exchange experiences. Often teaching is theme- oriented instead of subject-oriented. The teacher gives lectures less frequently, therefore he has more time for individual instruction. He helps those that have a need for it, guides discussions for small groups or between groups, provides guidance and motivates the children.(Bertalan Komenczi: E-learning. English manuscript, 2000 [18])

At Berze Nagy, similar arrangement of infrastructure is observable and the same, advanced applications are supported. Non-specialist teachers are encouraged to develop their *discipline-based home pages* (some of them are linked to the school home page and can be seen at <http://www.berze-nagy.sulinet.hu/>). Especially the teachers of Mathematics, Science, Chemistry, Physics, History and Foreign Languages make use of *educational software*. Downloading *material from the Internet* and using it in an Intranet environment is also common among the 15 % of teachers who belong to the "avant garde" of computer culture in this school.

Picture 8. Working in the computer laboratory



*On-line assessment*, however, is still rare in Hungary. Several large databases containing tens of thousands of reliable and valid test items are being elaborated but not yet open to public use. Software products contain an assessment element but this is in most cases not suited to the needs of the Hungarian national curriculum. Thus, teachers at Berze Nagy - many of whom would be interested in trying out a test bank to develop responsive assessment instruments - still use ICT basically for searching for and presenting learning content.

In order to compare data about teacher competence in the use of basic applications, here are data about the Hungarian average. (Survey by Éva Tót, 2000)

*Can You use a PC? (% of respondents per profession)*

	Primary school principals	Secondary school principals	Primary school teachers	Secondary school teachers	Berze Nagy
No, and I do not plan to learn it	2,2	1,6	3,6	2,1	0
No, but I plan to learn it	18,2	7,8	18,3	9,1	5
I am learning it now	9,5	7,8	6,3	3,7	3
I am a beginner, often need help	23,4	23,4	25,5	20,2	15
I am an intermediate level user	27,7	27,3	29,1	40,3	45
I am an experienced user	12,4	19,5	13,0	18,3	25
Yes, it is part of my professional work (= ICT teacher)	5,8	9,4	2,6	4,9	5
Other	-	0,8	,5	0,2	0
No answer	0,7	2,3	0,9	1,2	2

Osszesen	100,0	100,0	100,0	100,0	100,0
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### 3.4 *Use of ICT for internal communication*

The school is quite large but it is situated in one building. Teachers meet regularly and students may also settle most affairs through personal encounter. Thus, *internal communication is mainly verbal* and e-mail correspondence is only used for discussing a very complicated homework, organising a project or making an announcement involving a group of teachers or students who are known to be on e-mail every day. Written circulation of information among teachers is still much more frequent. There is no staff e-mail list and other internal mailing lists are organised in case a project needs regular correspondence of a group..

Picture 9: Teacher's room



This situation will change from 1 September 2001 when most school related statistics regularly required by the Ministry of Education would have to be handed in through the Internet. Management and staff members as well as administrators involved in the process will have to get used to regular production and submission of electronic documents. Filling out on-line, interactive data sheets may not be an easy task, as most sheets received so far on paper are complicated or require further clarifications. Still, e-business in education will certainly result in the spread of e-mail communication culture. At berze nagy, the infrastructure is given and staff is trained to face the challenge.

*External communication* through the Internet is smooth. Staff members who participate in different national projects or organise international exchanges find it easy and reliable to use the mail server of the school. Internet-based student competitions are also frequented and no mailing problems of attachments are reported to have occurred.

### 3.5 *Incentives used for spreading ICT culture*

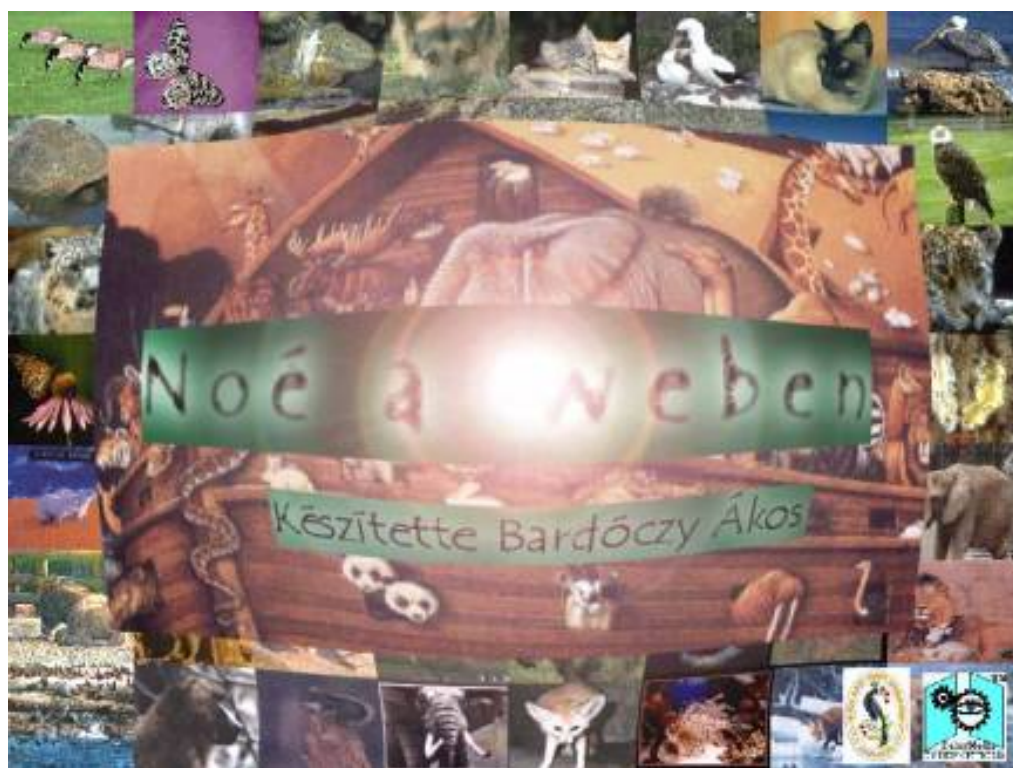
No special incentives are being used but *innovative work is supported*. Teachers interested in participating in ICT projects are given leave of absence for training, travel grants and paid substitutes by the school. (These privileges are far from general and reflect the positive attitude of the management towards this culture.)

Students who do maintenance jobs will be granted more computer use time, more storage space for web pages - the usual barter arrangement for Hungarian schools.

### 3.6 *Level of computer use by students*

15.800 students from 20 Hungarian schools completed a detailed questionnaire about their computer-related attitudes and practices in a survey done by Balázs Török, member of the research team of Éva Tót at the National Institute for Educational Research, Budapest..(<http://www.oi.hu/>) One tenth of the sample was also interviewed orally. Students are eagerly interested in computer culture - boys more than girls, but younger boys more than older ones. Playing games is a "boy thing" in Hungary, too - girls prefer chat groups. Being a hacker used to be fashionable - not so much anymore. Nowadays, being an Internet-based entrepreneur proves to be just as exciting and even more rewarding, at least financially. (Systems operators at schools often reported that one-time hackers turned out to be their best assistants once they got bored of and abandoned hacking.) Organising leisure time through Internet databases is a regular activity, too.

Picture 10: A home page designed by a student



*Home page design* is an adolescent art form - most national competitions receive thousands of entries. (See results of the latest one, the educational portal design contest at <http://www.verseny2001.hu/>. An interesting student home page (the front page of which is included here as Picture 10 is to be seen at <http://www.berze-nagy.sulinet.hu/noe/tartalom.htm>. The home page of the school band that is also a site for alternative youth culture with interesting texts, good graphic art and useful links is to be found at <http://www.berze-nagy.sulinet.hu/delirium/index.htm>)

Picture 11: Language Lesson



Picture 12: Presentation by a teacher in class



Doing homework with the help of the computer is normal for Hungarian secondary grammar school students but more than 50 % of those studying in vocational schools also search the Net and process their text and data regularly. When asked about the content and methods of ICT education, students are extremely critical. They consider history of PCs - an introductory part of all ICT curricula in Hungary, as many Hungarian scholars took a decisive part in the development of computers - is found boring. Programming, another major part of school-based ICT studies, is considered irrelevant as languages change so rapidly and would like to have more, user-oriented training.

For a comparison, here are some data on student use and attitudes towards computers from a survey by Éva Tót (2000):

*Secondary School Students' Use of Computers (% , multiple responses possible)*

	School based tasks	Word processing	Games	E-mails	Internet search	other	Total
<b>BOYS N= 248</b>							
Average %	10,8	11,3	38,9	8,0	16,1	14,9	100,0
<b>GIRLS N=162</b>							
Average %	15,5	19,4	27,3	20,1	11,3	6,3	100,0

We did not survey attitudes and interviewed those students who volunteered to speak about computer culture. Thus, we base our assumptions on the positive attitudes of students at Berze Nagy on teacher reports. Girls seem to be much more positive towards computer culture than the sample in the survey. Total disinterest is rare to find. Teachers presume that more girls will choose the answer that connects computer culture to easier work because they are generally more diligent and task-oriented than boys. Normally, both sexes find word processing an easy way to write an essay and multiple use of texts stored in the computer a big advantage. *Boys and girls seem to be equally capable* of doing the tasks required by their teachers at the ICT lessons or at other classes where ICT is used for teaching a different discipline.

*Secondary School Students' Attitudes Towards Computers (%)*

Opinion	Boys	Girls
I am not interested in PCs	9,1	21,4
Computers make my work easier	18,7	32,2
Computers are useful for a lot of things apart from work	69,1	43,0
Other	2,8	2,5
No reply	0,2	0,7
Total	100,0	100,0

In comparison with these results, students at Berze Nagy seem to be better than average computer users in all areas indicated. Homework requiring *Internet search* is quite standard in higher grades. All students can have an e-mail address and storage space on the school server and more than half can be considered regular e-mailers. *Computer programming* is taught from Grade 1 through Grade 4 and is considered a highly esteemed free time activity among students.

### 3.7 Computer use by students and their parents at home

For comparison, here are data about Hungarian students' computer access at home (Éva Tót, 2000) Note that secondary grammar school students come mostly from the upper two third of middle class families that are likely to make investments in the future of their children.

*Computer access at home by secondary grammar school students*

	Percentage of students (%)
No computer at home	22,9
PC used together with (a) family member(s)	44,6
Own PC	32,5
Total	100

No data about home use have been collected apart from the possession of computer. 40 % of students and 60 % of staff members has a PC in the household. With students, almost the same number can be considered a regular out-of-school user. With teachers, the situation may be less favourable as many of them purchase a PC for their children to use.

Picture 13: Facade of the school





## 4 Projection to the future

### 4.1 *How likely is it that these accomplishments will remain?*

When Péter Czinder, the present Principal took office in 1999, he had different objectives as well as the maintenance of the high ICT profile of the school. Some of these objectives he considered more important than the continuation of massive investment in hardware. *Moral education*, elevation of character of students and the development of a culture of free time among students seems to be his priorities.

These goals require a lot of effort but ICT innovations will still survive. Two teachers participated in the "ICT - supported teaching" Project of Eötvös University in 2000-2001 and two other staff members indicated interest for 2001-2002. Internet-based international projects will be continued and student and staff exchange with partner schools abroad are also on the agenda. All these require the use of ICT as a tool and medium for communication and guarantee the survival of achievements.

### 4.2 *How easily could they be extended to other schools?*

The most important element of the innovations at this school is, according to our estimation, the *library as knowledge centre*. This model is complete with floor plan, furniture design, arrangement of computers, software to be used for building databases, Internet search, cataloguing etc. Also, rules and regulations of use have been elaborated, modified and optimised to meet students' needs and ensure safe and efficient functioning. Thus, the "library model" is ready for inspection: it is being presented at national conferences. It attracts a large number of professional visitors and will certainly be adapted by many schools that have the same commitment (and can ensure financial means) to turn their old storehouse of books into a vivid space for ICT-supported learning.

Picture 14: The coat of arms of the school



#### 4.3 What resources are required for maintenance?

Here is an overview of ICT development funding sources for Hungarian schools (data from the study of Éva Tót, 2000):

*Allocation of sources of costs for ICT development (%)*

Source	Total sample	Primary schools	Secondary grammar schools	Secondary vocational schools	Vocational training schools.
Local educational authority	17,4	23,32	15,5	5,3	7,6
Owner of school (if private)	2,0	2,0	2,3	1,6	2,7
Hungarian grants	9,0	8,0	9,5	11,8	11,2
Hungarian School Net Fund	18,8	14,6	27,8	19,7	18,6
International grants (World Bank, Phare)	2,7	0,2	2,6	7,8	6,2
School budget	21,5	25,1	17,1	19,0	22,0
Sponsors	16,7	14,5	16,3	20,5	16,7
International projects	0,6	0,38	0,22	1,3	0,6
Other sources	8,6	8,32	6,5	10,4	8,6

The local educational authority is not interested in funding ICT maintenance and upgrade as a regular extra-budgetary item. Resources are scarce and the school does not seem to be one of preferred sites for subsidy. The School Net Fund gives grants to new entrants to the system mostly. Berze Nagy has no substantial local sponsor for ICT development and can spend on these costs less than the average percentage for "school budget" indicated on the table above.

The biggest problem has been and will remain to be the cost of *repair and replacement* of old parts or whole PCs. Government regulations are needed to settle this issue as the future of ICT culture in this country cannot depend on the schools' ability to find sponsors to ensure normal functioning.

There are not enough computers for all the applications teachers are ready and able to do. Classrooms should be equipped with at least one PC and a projector - a vast expense that may only be covered from grants. (A major grant application for projector purchase is due to be issued but only one projector per school will be financed for successful applicants.)

## 5 Main hypotheses

1. *Technology is a strong catalyst for educational innovation and improvement, especially when the World Wide Web is involved. The rival hypothesis is that where true school-wide improvement is found, technology served only as an additional resource and not as a catalyst, that the forces that drove the improvements also drove the application of technology to specific educational problems.*

The first hypothesis holds with a small correction. *ICT used to be the catalyst for innovations but when the pace of development got slower, innovation did not stop - it only sought other channels.* Berze Nagy is a lively, innovative learning community where educational innovation is a standard feature of existence. At present, it is moral education and the emphasis on cultivating minds not just teaching facts is in the focus of attention - with ICT still there, still active as a catalyst but not an aim in itself any more.

2. *The diffusion of the innovation/improvement (and therefore of ICT) followed the traditional diffusion pattern for innovations, as outlined by Rogers (1995). The rival hypothesis is that technology functions differently from traditional innovations and that therefore different diffusion patterns occur.*

ICT technology seems to have a *different diffusion pattern* from other educational innovations. Paul Starr, a specialist in American education, divides the use of computers in schools into three evolutionary phases: [19] The first phase occurred between the early seventies and the early 1980s. Computers were primarily used to *teach programming* and for simpler computer-assisted instruction (CAI). This was a heroic age, made up of a subculture of devoted teachers and enthusiastic students far from the mainstream of education. This phase occurred in Hungary almost at the same time and resulted in magnificent results of students at international competitions. Only a small group was targeted - the very best of a cohort - thus computer culture was considered elitist and unapproachable for the "masses" of students and all teachers except for the Information Technology specialist. Berze Nagy was among the first schools to embrace this culture.

The second phase started in the early 1980s with the appearance of the *personal computer* that had graphic user interface and turnkey software programmes. In schools, computers were located in laboratories. *Computing as a subject appeared in the curriculum*, and students could learn the basic skills of operating computers. More and more teachers became aware of the hidden possibilities offered by computers regarding major subjects and in the administration of teacher's work. Students and parents exerted pressure to expand computer use in schools. In Hungary, this was the phase when massive computerisation of schools started to happen with the first international projects. Berze Nagy was among the front runners.

Presently, the third phase is being experienced all over the world, with the main driving forces being the appearance of *multimedia computers* and the explosive growth of the Internet and the World Wide Web. During this process the computers have become instruments of paramount importance. Currently, computers are omnipresent, i.e. available for everybody. The computer has been transformed from a segregated periphery into a ubiquitous presence, with its easy accessibility, and its presence as the main organising and communicative element of the learning environment in the modern school. Berze Nagy has contributed with the scheme of scattered computer placement and the idea of the library as knowledge centre to the "democratisation movement" of computers.

These three phases together can be considered a pattern of diffusion of computer culture. Unlike any other innovation, it is bound to technology and can be accelerated or made slower by political decisions. Schools alone are unable to transform their learning environment but if basic infrastructure is granted, their role becomes crucial in the success or failure of diffusion.

3. *Successful implementation of ICT depends mostly upon staff competence in the integration of ICT into instruction and learning. This hypothesis assumes that teachers mediate ICT applications when they are successful, and that ICT's academic value relates positively to teacher competence. The rival hypothesis is that the school technological infrastructure and student ICT competence rather than staff competence determine ICT implementation outcomes.*

As indicated in the other Hungarian case studies, the quality of ICT culture *at the time of study - at the beginning of the third millennium* - seems to be influenced by the quality of teaching much more than the level of infrastructure or student competence. Here again, a pattern of change can be observed that is peculiar to ICT as an educational medium. In the eighties, when machines were far from user friendly, infrastructure and student competence seemed to be much more important than teacher competence. Teachers were amazed at what a computer can do and were often unable to install an educational CD-ROM without the help of a student. At this time, no real computer-supported teaching was observable - there were experiments that broke the virgin soil of CAL. In the late nineties, however, when PCs and multimedia software meant to be used by babies became a standard feature, teachers were no more overwhelmed by difficulties of handling a computer. Gradually, as they became more confident, they also had more and more time to evaluate software content, reflect on pedagogical effects and do substantial planning for ICT use.

At Berze Nagy, ICT skills of students are developed by a series of non-specialist teachers. *They rely on student skills for support but not for basic guidance.* They are able to make up for the inadequacy of infrastructure through using traditional media along with ICT-based ones. Thus, by the start of the third phase of educational computing, teachers have become the most important agents of change - as the first hypothesis indicates.

4. *Gaps in academic performance between high and low poverty students will not increase when all students have equal access to ICT. The rival hypothesis is that equal access to ICT will lead to more advantaged students increasing the performance gap with disadvantaged (high poverty) students.*

There are no real high poverty students at Berze Nagy, therefore observations in this respect cannot be made.

5. *Successful implementation of ICT will lead to the same or higher academic standards in spite of the low quality of many ICT materials. Academic standards are a function of teacher and school expectations and not of the standards of textbooks, ICT materials, and the like. The alternative hypothesis is that ICT use will lead to a lowering of academic standards as students spend more time on marginally beneficial searches and in browsing poor quality Web and courseware content.*

ICT is not yet used to an extent that would affect the academic level of any Hungarian school. Still, teachers at Berze Nagy - the same way as their colleagues in the other schools we visited - found it important to emphasise the need for rich in content, reliable *educational portals and an impartial educational software assessment site to guide inexperienced teachers in their choices.*

## **Appendix A : Methodology; description of the amounts and types of data collected**

*Size and composition of the research team:* Among the two educational researchers, one has been the former principal of the school who is now studying for his PhD in ICT and Education. The team included a subject specialist who observed lessons in science subjects where most ICT applications are utilised.

*Amount of time spent at the school:* 4 days

*Amounts and types of data collected:*

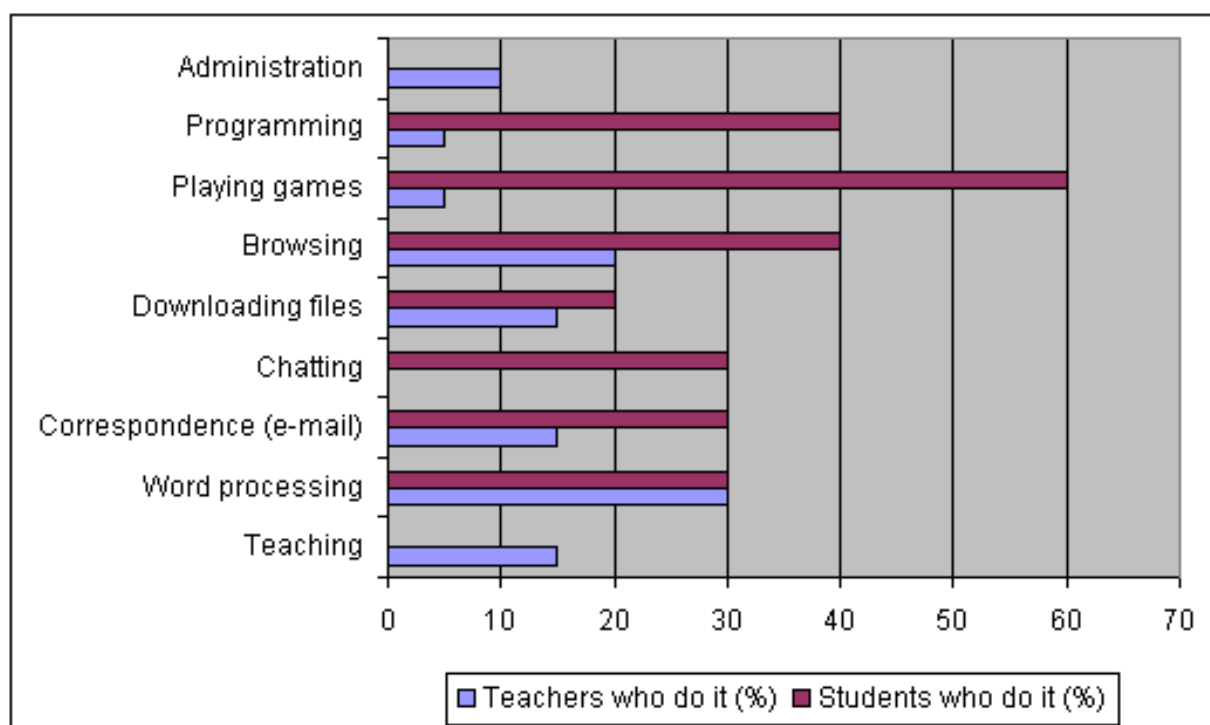
- *Interviews with teachers and school administration (8 interviews executed)*
- *Interviews with parents and students (10 interviews executed)*

- *On-site observations* of classes (12 lessons observed)
- *Observation of written and visual communication* of the school (analysis of school home page, 5 home pages of students, 5 home pages of teachers related to special disciplines)
- *Analysis of digital teaching aids developed by staff*
- *Questionnaires of ICT use* given to all staff members, 85 % replied
- *Critical reading of project applications and reports by staff members* for grants donated by the school and by foundations.
- *Observation of student work* done with the help of computers (papers, presentations, tests, creative work, computer programmes etc.)

## Appendix B: Use of computers by teachers and students-based on the Teacher ICT Use Questionnaires

(Berze-Nagy)

Activity	Teachers who do it (%)	Students who do it (%)
Teaching	15	0
Word processing	30	30
Correspondence (e-mail)	15	30
Chatting	0	30
Downloading files	15	20
Browsing	20	40
Playing games	5	60
Programming	5	40
Administration	10	0



[1] A survey on computer usage was completed by the Hungarian public opinion poll agency Szonda Ipsos and the GfK Market Research Agency in spring 2000. Results were published in several daily papers, our quotes are from Magyar Hírlap, 18 June 2000.

[2] The Information Society Trends Research Centre (Hungarian name: Információs Társadalom- és Trendkutató Központ, abbreviation: ITTK) is a UNESCO-supported institute at the Budapest University of Technology, headed by László Z. Karvalits.

[3] Source: Hungarian Home Statistics 1999. Report published by the Central Buro for Statistics, Budapest.

[4] By the end of 1997, in the 901 Hungarian secondary schools there were 4975 independent and 12420 networked computers with 1906 of them connected to the Internet. There were 1.5 computer laboratories per secondary school in average and one per school had an Internet access.

[5] In all the Student Olympic Games in Computer Science in the 1980s, Hungarians ranked among the first 5, winning gold medals in the first three of the games. With very little opportunities for out-of-school practice, Hungarian students won because they were almost totally platform-independent. Machintosh or IBM, they were able to compete in any of the environments the same way as they had to benefit from any opportunity to get computer access at home. Flexible and creative, Hungarian youngsters easily adopted to the machines offered by the organizers and could concentrate in the task while their competitors were still busy getting used to the new facilities.

[6] Lewis J. Perelman: School's Out. Hyperlearning. The New Technology, and the End of Education William Morrow and Co.

[7] Seymour Papert: The Connected Family. Atlanta, 1996, Longstreet Publishing.

[8] "Um eine gute Frage zu stellen, muss man schon viel Wissen!" / Prof J. Weizenbaum/ In: Der Mensch im Datennetz.Tv-film, Bayerische Rundfunk 1996, R: Wolfgang.Hedinger

[9] Informations Highway setzt eigentlich den selbständigen, urteilsstarken Verspand voraus. Er bildet ihn nicht.....Und das ist möglicherweise unser Problem." In: Internet.Das Netz der Netze. TV- film, WDR , Martin Schneider

[11] Thomas Edison in 1913 imagined, that the spread of moving pictures would soon make most, if not all books unnecessary. Herbert Hoover, as the Minister of Finance in 1926, predicted in the inauguration of the first radio transmitter that the enmeshing stations in America would disseminate the proper and selective use of language. David Sarnoff, the technical director of RCA in 1939, thought that high quality TV games would improve general taste throughout the country

[12] Paul Starr, "Computing Our Way to Educational Reform," The American Prospect no. 27 (July-August 1996): 50-60. On-line: <http://epn.org/prospect/27/27star.html>).

[13] Theodor Roszak : The Cult of Information. University of California Press, 1994.

[14] Stoll,Clifford: Silicon Snake Oil. Second Thoughts on the Information Highway. N.Y.,1995, Doubleday.

[15] Clifford Stoll: Prophet, unplugged. Published by David Plotnikoff, Mercury News Staff Writer: Friday, April 21, 1995. Online: <http://spyglass.sjmercury.com/archives/stoll.htm>

[16] Postman,Neil:The end of Education, New York, 1995, Alfred A. Knopf.Inc, 63. P

[17] Informing Ourselves to Death. Speech , given at a meeting of the German Informatics Society on October 11, 1990, in Stuttgart. Online: <http://www.cs.umass.edu/~ehaugjsja/tech/postman/informing.html>

[18] This manuscript was prepared for a series of presentations in an EU-funded in-service training course for an international group of headmasters and senior teachers in 2000.

[19] Paul Starr, "Computing Our Way to Educational Reform," The American Prospect no. 27 (July-August 1996): 50-60. Online: <http://epn.org/prospect/27/27star.html>).