OECD/CERI ICT PROGRAMME

Hungarian case study No. 3

A Case Study of ICT and School Improvement at the

JOHN VON NEUMANN PRIMARY SCHOOL, ERDPKERTES, HUNGARY

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1. Overview of the present

Picture 1: The library of the school

"Madam: do You want to see a real Database? - the six-year-old girl stares at me with pride and excitement. She is about the show the lady from the big city something she might not even heard

about - a real miracle.

"Come to the library, there sits a big one in the computer! It knows my name and all the books I have ever had - even those I lost!" - she continues and takes me by the hand to the ancient computer on the librarian's desk. Surrounded by children and books, there sits the librarian who, while giving out books, has explained Maria and her peers the basics of database use. In a Hungarian village with high unemployment rates, no significant industry and agriculture, five hundred children are daily given a chance to cross the bridge over the Digital Divide.

In the town of Békéscsaba, every autumn a conference on ICT as a discipline is held that is considered the "in" event for hard core ICT specialists. Many innovation projects and angry appeals to the government were initiated here. Two years ago, pupils of the John von Neumann Primary School were invited to give evidence of their knowledge. For there days, they kept running around with their digital cameras and on the last session they gave a multimedia presentation of what they thought was exciting about this meeting of teachers. The last image shown was a spider's web, covered with ice, a glittering linear structure of astonishing beauty. "We captured this, because it is so nice and no longer there." - the 13-year-old girl, spokeswoman to the team, told the audience. In the paper summarising results of the conference, this moment of silence was considered very important. "I came here to learn how to teach better - but these youngsters taught me the importance of retaining sensitivity in this mechanical world.'" - the rapporteur remarked.

1.1 What has been accomplished?

ErdQkertes is a small village of 4500 inhabitants in the vicinity of the Hungarian capitol, Budapest and the town of Vác. Not close enough to attract well-to-do families looking for a suburban home, but 40 kilometres distance is easy to overcome for a school principal looking for new ideas and opportunities. ICT culture was embraced by Béla Kapuvári, teacher of mathematics and a keen computer user from the Commodore 64 times onward, to give a chance to pupils of the village to reach beyond local sources of information and learn marketable skills. Introduction of ICT to all areas of school life was the catalyst of reforms that turned a small and not particularly well-equipped school a frontrunner of modern pedagogy. Mr. Kapuvári has recently been elected Chair of the Public Education Section of the John von Neumann Computer Society, the central association for Hungarian researchers and practitioners of ICT and official partner of IFIP, the International Association for Information Processing.

The John von Neumann Primary School (to be called Neumann further in the study) is one of the pioneers of educational use of ICT. Main indicators of successful use of ICT:

Ø All teachers successfully completed the *national training courses* in ICT. (30.000 hours of training in 3 years, see Point 2.1) Most successful graduates from this course have become mentor teachers and researchers of ICT culture themselves and soon assumed a leading role in the introduction of ICT on primary level.

Ø *Increased efficiency in teaching* in disciplines utilising ICT based methods have been observed by supervisors.

Ø *Students' basic ICT skills improved* due to optional training in Grades 1-4 and compulsory training in Grades 5-8

Ø *Teachers' ICT skills improved*, almost all became regular computer users. 70 % of them possesses a computer at home.

Ø Good results of *students in ICT competitions*, e.g. Fist Prize in 1999 and 2000 at the

international Internet-based project competition organised by the National Geographic Channel.

Ø *Publications and conference presentations* give evidence of teachers' involvement in ICT-related educational research. Presentations and invited workshops not only at teacher conferences but also at professional meetings of engineers.

Ø Formation of a *Teacher Team* for more effective teaching through ICT - see details in Points 3.1 and 3.2

Ø Formation of a *Student Team* for more effective learning through ICT - fully computerised production of newsletter and yearbook with all work phases done by pupils

Ø High level *study circles* on ICT and Geography (geoinformatics, explanation below in Point 3.1, History, Multimedia Design and Internet Use - absolutely unique for primary school level.

Picture 2: Stall of the school at the INFO exhibition in 1999

1.2 Who profits from the introduction of ICT?

In a high poverty area, all pupils are given a profound education in computer use and thus furnished with a very important skill for further studies and work. More interested children (every fifth of them) take part in different higher level ICT courses and graduate at age 14 with a knowledge in multimedia design and Internet search, Logo programming and Excel use almost equal to that of the average Hungarian secondary school student. Thus, it is pupils who profit most from this programme.

Parents of children soon got carried away with the growing interest in computers. Children convinced even low-income families to purchase a computer and many taught their parents basic ICT skills. Therefore, the *school helps local citizens profit* from computer culture - a realm most of them would never have a chance to enter.

Teachers of Neumann have, with the substantial financial help and moral support of the school management, have all completed a variety of ICT courses useful for their everyday work. Those who teach ICT as a discipline (13 people - a record number in Hungary - have received a computer for

home use from their school. Many other have benefited from the advantageous Computer Loan Scheme developed by the school management and a regional bank outlet. Therefore, staff must also be mentioned among the beneficiaries of the innovations.

1.3 How do the staff, students, and parents view these accomplishments?

Unanimous praise from all concerned. Teachers interviewed expressed their excitement about new initiatives and pride over accomplishments. They praised their principal, Béla Kapuvári, who was instrumental in starting the reforms and spares no effort to safeguard accomplishments.

Many of staff members, however, expressed concerns about the lack of financial, let alone moral support from the Village Council of ErdQkertes. The school suffers severe difficulties because, being the only educational institution in the village, has to admit an increasing number of student population to a building that is already overcrowded. No special support for ICT has ever been given by village authorities. Their mild disapproval has turned a bit more positive only recently when the Village Council administration also started to use computers.

The *pupils* we interviewed - children aged 12-14 - were astonishingly knowledgeable and outspoken about the ICT-focused reforms of their school. They esteem their teachers' ICT competence highly - an opinion not shared by many Hungarian students elsewhere. They are unhappy about crowded classrooms and would prefer to spend much more time with ICT - preferably at every lesson.

Picture 3: Building and environment of the John von Neumann Primary School

2. Overview of the past

2.1 What led to these accomplishments?

Computers appeared at the school in the first wave of the establishments of the Hungarian School Net, in 1996. One of the most important components of the astonishing accomplishments of

Neumann was the *profound re-training of staff* before and parallel with launching the reforms. Between 1996-99, all the 41 staff members of the school underwent at least two ICT courses and spent, *30.000 working hours with training for using ICT in education*. (This astonishing effort meant that teachers of Neumann sat for in-service education on computer use for 732 hours on average). Types of training received varied from high level BA and MA. degree programmes in engineering to practice-oriented in-service courses for teachers.

At start, 13 staff members, novices to the culture, successfully finished a basic computer use course organised on the premises of their school and joined their fellow teachers to continue their studies at different teacher training courses in the field. (Logo Language Programming Course - 14 people, Introduction to Internet Use course - 36 people and a Computer Supported Education course - 10 people) The technician of the school, who is currently employed as systems manager, completed both the basic Windows NT System Manager course and the higher level ICT Systems Design and Management course. Further on, 22 staff members (teachers of practically all disciplines and General Classroom teachers for junior grades) received a Bachelor of Education degree in ICT as a discipline. Thus, this subject could be taught by specialists form Grade 1 through Grade 8.

Picture 4: Teacher preparation area

More experienced computer users chose sophisticated training programmes and later became major agents of change at their school. One person completed the Information Technology and Engineering degree course at a technical college in Budapest, another five received a special engineering degree in Geography and ICT. One person graduated from the Civil University (a distance education course for civic studies). 8 teachers - competent computer users already at the start of the reforms in 1996 - received a Mentor Teacher Certificate in "ICT and Education" at a post graduate course organised by the Hungarian Association of ICT Teachers and became trainers themselves. As the major project of the school required knowledge of Spatial Information technology Systems, all teachers involved in this project underwent courses on ICT in Topography.

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

Initiator of the reform was the school principal, Béla Kapuvári. He initiated that the school is named after John von Neumann, a world-renowned computer scientist of Hungarian origin (called Neumann János in his home country). He was instrumental in all grant applications and managed them to successful completion. He hand-picked his staff on the basis of interest in computer-supported education, established a network of supporting university chairs and industrial companies and ensured that results achieved be presented at regional and national conferences for discussion and adaptation. Important figures in his team are the school librarian, Gábor Beély, the leader of ICT-related study circles in History and Geography, Mónika Némedi, participant in the ICT-enriched teaching of Physics and Mathematics, Mrs. Béláné Kapuváry and all ICT teachers of the school who developed innovative curricula for teaching computer skills for children aged 6-14.

2.3 What barriers were overcome in doing this?

Picture 5: Facade of the school building

The most important barrier to overcome was the lack of reliable, constant financial support. Erd Qkertes is a small settlement and its Village Council has modest financial resources to distribute. Moreover, as indicated before, local authorities were not particularly interested in computer culture and never allocated special funds for its promotion in the village school. Therefore, all projects and training courses had to be financed from grants received as a consequence of writing dozens of lengthy and complicated applications.

Financial barriers are still there, the school has to fight for every penny to be spent on ICT but, due to grant writing skills acquired and professional fame, fundraising efforts are mostly successful.

3. The present

3.1 ***Characteristics of the school***

Picture 6: The school cafeteria

Neumann is a medium size primary level educational institution in Hungary. The number of students is 485 (254 boys and 231 girls) and the total number f staff is 41, all fully employed. The work of the school principal is assisted by two Deputy Principals: one for management affairs and one for educational affairs – a distribution of leadership tasks usual for Hungarian schools. It is a traditional 8-grade primary school where pupils are admitted to Grade 1 at age 6. Junior grades are Grades 1-4 for pupils aged 6-10, senior grades are 5-8 for pupils aged 11-14. *Departments* (groups of teachers teaching the same discipline and acting as a professional community) at the school are as follows:

Ø 13 junior grades teachers: one teacher per class, “general practitioners” who teach all disciplines except fine arts, music and Physical Education)

Ø 9 specialist teachers at the Humanities Department who teach junior and senior grades level fine arts and music and senior grade level Hungarian Language and Literature, History and Foreign Languages (English and German)

Ø Sciences Department: 10 teachers. One librarian, webmaster employed part-time.

Ø 2 teachers for the *physically or mentally handicapped* (with a B. A. degree in Special Education cater for the needs of those requiring speech development and assistance in learning. Pupils with small handicaps (slight hearing or vision impairment, motion disorders and minor mental illnesses) are admitted to this school and offered special healing and skills development activities in after-school hours. (An effort for mainstreaming that is becoming more and more frequent, especially in village schools where children are cut off from special education facilities readily available in

towns and cities.)

Ø A part-time P.E. teacher shares his working time between the two primary schools of the village.

Ø 4 after school care providers (qualified general practitioner and subject specialist teachers who work in the day care centre of the school and do not teach regular classes). This service is provided by al Hungarian primary schools as 65% of mothers are employed full time in rural areas and more than 80% in urban areas. After school care does not only mean a sheltered space for playing and assistance in doing homework but also a range of cultural activities and chances to benefit from the ICT infrastructure and library of the school. In a high poverty area like the one our school is situated in, these services are of high importance to ensure equal opportunities for all students.

Picture 7: Interior of the school lobby

Instruction is organised according to the requirements of the National Core Curriculum that was introduced in 1999. A Local Curriculum based on was elaborated in 1999 to accommodate special features characteristic for the school. Special education programme for slightly disabled children and several ICT-related courses offered for pupils and staff members are unique to this Local Curriculum. The school is a training site for the "ICT in education" certified course for teachers run by the Hungarian Association of ICT Teachers (HAIT). All teachers of this school have completed the course and the most competent ones are now employed by HAIT as instructors.

No compulsory central examinations are administered on primary level in Hungary but there are plans for 2004 to introduce a national Basic Examination for those pupils who do not continue their studies on secondary level. As a preparation for this, local examinations are organised at many Hungarian primary schools at the end of 7th Grade, (age 13) one year before graduating from this level of schooling to help students estimate their achievement and select a suitable secondary school.

(School leaving age: 14, Grade 8.) Local examination subjects include Mathematics, History, Hungarian Language and 2 optional subjects chosen by the student. Tasks are centrally developed and sent to interested schools by the National Institute for Basic Examination. Neumann offers this possibility for pupils as teachers find the diagnostic function of the examinations especially important for socially disadvantaged pupils whose talents often remain hidden and learning problems not revealed. Based on the examination results, teachers may design suitable for individual needs remedial courses for those lagging behind and enrichment programmes for the gifted. ICT provides excellent means for individual instruction.

In comparison to Hungarian primary schools that only possess a computer lab with 12 multimedia PCs on average, Neumann is well equipped although many of their machines are not multimedia computers. The number of WWW-usable PCs is 12, and another 16 PCs are at the disposal of staff and students. Distribution of PCs is laboratory-based: 17 machines are situated in the ICT Lab, one in the library, 17 in the Teachers' Room (a very generous arrangement, that reflects the involvement of staff in computer culture), others are in the offices. and in their discipline-related storage rooms. A few older PCs are even given out to home use. The school is open from early morning, sometimes even from 6 a.m. till 9 p.m. and PCs can be used during the generous opening hours by staff and pupils under their surveillance.

Internet connection is the usual ISDN line (64kBit/sec) provided by the Hungarian School Net free of charge, 24 hours a day. Neumann was among the first primary schools to get connected in 1998. By now, June 2001, almost 60% f Hungarian primary schools are connected to the Internet through the state-provided School Net system. Bandwidth will be doubled in January 2001 but at first only for 300 selected schools out of more than 3000 primary and secondary institutions connected. There is hope that this school will be among the lucky ones enjoying an Internet speed that enables normal classroom use. At present, most downloading tasks are done at off-peak times during the night and ad hoc use of Internet pages during class periods of 45 minutes is very rare.

The school home page (http://www.enjai.sulinet.hu/) is above all a medium for publicity. In order to attract attention of potential co-operation partners, sponsors and educational policy makers, it features all successfully completed projects and plans for future development.

Picture 8: The computer laboratory of the school

Indicators of success for the special programmes and services offered by Neumann are national and local awards and prizes given to teachers and pupils. One of the specialist for disabled children was given the honorary title National Expert – a recognition that entitles her to act as a supervisor to mainstreaming programmes in the country. Eight teachers were elected Supervisor Teacher for ICT use by the local educational authority. Eight teachers take part in National Geographic Channel educational experiment. Video and multimedia materials made by equipment from George Soros Foundation's Jefferson project are distributed nationally. At the Hungarian Ministry of Education and National Geographic Channel: Geography competition, geography teachers of Neumann won the first prize in the last two years. At the Hungarian School Net Conference, 2000, staff members were invited to introduce the school as a model for ICT use in education .

In April 1999, as the only compulsory school in Hungary, Neumann won the little of *Assisted School by Microsoft* that came with professional assistance in the form of consultations and training and several software donations.

Together with the ICT in Education Sub-Committee of the Educational Committee of the Hungarian Academy of Sciences and the ICT teachers' Association, the staff on Neumann took part in the survey about the use level and quality of digital teaching aids.

Accredited (nationally accepted and registered*) teacher training courses developed and taught by the staff* of this school are always booked out (PC and Internet in 55 lessons, Word processing and databases in 65 lessons, computers in education in 85 lessons, Comenius Logo Programme Language in 30 lessons). During the first year of the training, 1999, 104 teachers from the neighbouring schools and kindergartens attended in the courses organised in this school. In 2000 Neumann handed in an application to the Ministry of Education and became a registered in-service training centre from January 2001

Main uses of ICT at this site do not differ from the Hungarian average - the difference *is frequency, regularity, the number of staff and pupils involved* and pedagogical sophistication.:

- Ø Searching for information on Internet
- Ø CD-ROMs used in teaching and extra-curricular activities
- Ø School home page used for communication and teaching
- Ø Multimedia and video material produced by pupils on the life of this school
- Ø Spatial representation and simple CAD programmes used for geometrical drawing and design
- Ø School paper designed, edited and published electronically
- Ø Multimedia presentations at conferences

Picture 9: ICT class in progress

Special uses of ICT include geographical applications of ICT technology - a training area absolutely unique on primary level for this school that has achieved national acclaim. (For a detailed description see Points 3.2 and 3.3) Teachers participate in the project on developing teaching aids and methods for ICT in teaching different disciplines. In the school year of 2000-2001, research areas included Mathematics, Physics and Foreign Languages. In 2001-2002, areas covered will be Art and Art History, Chemistry and Biology.

On 20 September 1996, at the headquarters of Siemens, the school entered into a contract with institutions of higher education, firms and organisations to provide the professional and financial support necessary for the realisation of the most ambitious plan of the school: the ATOM (*Basic*

Geoinformatical Methodology of Instruction) Project Besides acquiring basic knowledge about computers, pupils learn about the basics of *geoinformatics* and digitisation in the multimedia and cartography study circles. After graduation, Neumann offers vocational courses on topographical measurement and simple CAD applications for those who do not continue their studies in a secondary school. In-service courses for teachers are also being offered on teaching geoinformatics on primary and secondary level.

3.2 Use of ICT by specialist teachers

This school has a very large number of teachers (13 in all) who obtained a second BA degree in ICT as a discipline to supplement their first degree in another area. Thus, many of them unite their two areas of work: they teach ICT skills in relation to Biology, History or even Visual Arts, using both specialised ICT classes and their discipline-based classes. A synergy of qualification and interests is created through this arrangement and applications of ICT are much more regular and profound as observed in average Hungarian schools.

For example, teachers of mathematics and ICT - among them, Mrs. Béla Kapuvári - regularly use data processing software packages, graph and chart drawing programmes, Excel tools and geometrical representation devices. Mónika Némedi, teacher of history, geography and ICT regularly gives Internet search tasks on normal lessons and teaches the use of spatial representation devices in the circle of Geography. This latter project is called *ATOM* and enjoys the support of major Hungarian universities and engineering colleges as well as companies. They provide both financial and in-kind support (training, free lease of equipment, donation of software, admittance to professional conferences, consultation with staff, etc.) to ensure that spatial representation is learnt on primary level, in line with the Piagetian development pattern of spatial abilities of children.

3.3 Use of ICT by non-specialist teachers

As mentioned before, teachers of Neumann participate in the project that develops and tests ICT-enriched curricula for different disciplines. *ICT-enriched curriculum* developed for Grade: 7 in Mathematics and Physics. Both courses have successfully been implemented. Programmes for other disciplines re being developed and teachers elected Supervisor Teacher for ICT use by the local educational authority often give presentations on how to use ICT for teaching primary school disciplines.

The *National Geographic Channel* (NGC) has been issuing yearly competitions for primary and secondary school students on about global environmental issues. After winning the first prize two years in a row, the management of Neumann was asked by the National Geographic Society to take part in the creation of an educational database. This new resource will contain NGC films (also distributed on video) and hints on their possible educational uses. Topics grouped under school disciplines will be related to film excerpts to facilitate the work of teachers looking for subject-specific information. Staff of Neumann - above all, teachers of Biology and Geography, take part in the development of the database (80 hours of film analysed and coded in 2000) and also in the trial of their use during lessons, along with supplementary Internet sites and CD-ROMs (for example, World Atlas and Encarta).

Sándor Pantali, art teacher, regularly uses *CD-ROMs and Internet sites of museums* for presentations on art history and teaches the use of simple *graphic software* packages. Pupils are very keen on learning desktop publishing and are skilful in producing their own communication organs. As he mainly deals with files containing a large amount of images, he finds his work rewarding but very time-consuming as downloading through the always busy School Net network is not easy. He is

looking forward to obtaining a projector that will enhance the quality of his presentations. He finds it extremely important for enjoyable art classes to use digital material and emphasises the significance of "viewing" many big museums of the world in a classroom of a small Hungarian village.

The school librarian, Gábor Beély, one of the key figures in the computerisation of the school, was invited join the researcher team of the *Institue for Strategic Research of the Foundation for the Third Millennium*. His area of research is the role of ICT in the life of small villages, the Telehouse Movement and the role of library as Knowledge Centre for the school and community. An important project he co-ordinates if the *Knowledge Corridor* - a project to unite library-based and school-based resources to create a common database for the town of Fót and the villages of Kerepestarcsa, Veresegyház and ErdQkertes.

Gábor Beély has only been working in public education for 5 years but has accomplished a lot in the field of extending ICT use in the school library. He co-authored with Béla Kapuvári the chapter on "*The School of the Future*" in the Big Future Book, published by the Institute for Strategic Research in 1999. In this, they emphasise the importance of ICT culture for constructive, individualised studies and equal access to information for students living and studying in small settlements. He presumes that the major role of the librarian is to act as a *gatekeeper and broker of information*, accessing, filtering, processing and communicating information to his young customers. He elaborated on this topic in a recently published study on school libraries in the digital age and developed the KINCSTÁR Project to realise his plans. (The word means TREASURY in Hungarian and is an abbreviation of communication, information retrieval and learning in a library environment. He is editor of INCO, an on-line magazine (http://www.inco.hu/)

3.4 ***Use of ICT for internal communication***

All internal communication is computer-based. Everyone must submit learning plans as a file and be informed of new projects from the school home page. (http://www.enjai.hu/)

Teachers involved in national projects regularly use e-mail for work and have no problem attaching or opening documents and images. They regularly contribute to project web sites submitting and correcting lesson plans. Members of our team have repeatedly worked together with teachers from Neumann and have found them quick and reliable e-mail partners. Teachers who were invited by the Hungarian Association of ICT Teachers to do on-line software assessment had no problems accessing the site and interactively fill out and send in data sheets.

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

Almost all the *training programmes* has been (and still are) paid by the school so that staff enrolled does not have any expenses. Many of the basic courses were held on the school premises for ease of access. All teachers who have a BEd in ICT received *a computer from the school, free of charge, for unlimited home use*. They also receive the *ICT supplement* - a fee added to their salary each month, granted by the Ministry of Education for teachers who have acquired and are using ICT in their teaching job.

The school management is constantly applying for *grants* to pay those who do extra work for the spread of ICT culture. Participation at *conferences* - that are also enjoyable social events for village schoolteachers who unfortunately lack chances for frequent encounters with colleagues - are encouraged and very often paid for by the school.

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

This school has a unique approach to teaching ICT. Between Grade 1-4, pupils may have an optional ICT class of 45 minutes per week, from Grade 5 all pupils are obliged to learn ICT skills once a week during a double class (90 minutes). Principals are entitled to increase the number f classes in any discipline, if they find it necessary, but they have to provide the financial means required paying for extra teacher time. According to requirements of the Hungarian National Curriculum, ICT has to be taught as a compulsory discipline for students aged 13-18 in one weekly period (45 minutes). The problem with this arrangement is that students start their "official" training in ICT at age 13 - at an age by which they will have had very different prior experiences with computers. The task of teachers is extremely difficult: they have to provide differentiated training for a group of absolute beginners and seasoned experts.

At Neumann, staff believes that ICT skills must be part of the curriculum - at least as an option - right from the start. Pupils who have no computer access at home will unanimously select this option and are thus adequately trained to learn together with those who have a computer at their disposal. From Grade 5, all pupils must learn ICT skills and thus have 2 years more training than average Hungarian primary school children. Differences in access time between home computer owners and non-owners may certainly result in differences of skill development but this difference will not prevent less advantaged kids from successful completion of basic requirements of the National Curriculum. ICT knowledge of pupils is very high for a primary school. Teachers frequently give on site presentations for colleagues on word processing, database use, creation of graphs and tables that are normally taught at secondary level.

Picture 10: Group work: demonstration of project results

Building a team spirit - this is one of the most important additional benefits of developing ICT skills.

Many teachers remarked that pair and group work are an especially effective methods for computer-based tasks. It teaches task management skills, evolves team spirit and is in line with the Net Generation idea of collective ICT use. Task sharing and discussion of results through e-mail and real-time, person-to-person communication, assembly of project components and presentation of results are skills of high importance for the world of work. ICT acts as a catalyst for all these skills and thus promotes learning new working methods while also acquiring new teaching content.

3.7 Computer use by students and their parents at home

40 % of students have a computer at home and can be considered regular users. As most Hungarian families who possess a PC will use it as a family device, we might presume that about 40% of parents have some ICT knowledge - but in ErdQkertes it is not the case. Many parents who are not users themselves will make extra efforts to invest in a PC to promote their children's studies. Home use by children focuses on games as only about 10% of the machines have an Internet access. Parents reported that their children prefer to do their homework with a word processor rather than by hand and even enjoy doing maths tasks on their PC.

4. Projection to the future

4.1 How likely is it that these accomplishments will remain?

Teachers got used to ICT culture and would feel deprived when Internet access was limited or computer use restricted. When we asked what would happen if ICT-related innovations were abolished, many of our respondents immediately exclaimed that such an event were utterly impossible. Younger staff members declared they would leave the school and carry on with their innovative work elsewhere. Evidently, teachers consider ICT culture an extremely important feature of their school.

In the highly unlikely case that the present principal will not be re-elected or chooses to resign, there are several competent colleagues who would be able - if unwilling - to take his place. This is not a one-man innovation, a reform forced on staff by a charismatic leader. Mr. Kapuvári has excellent leadership skills that helped him create a reform-friendly environment and ensure the efficient transition from traditional to computer-supported instruction. His staff followed his lead and has become an innovation team that is very likely to go on working in the present direction for decades to come.

Educational work at Neumann is highly esteemed by researchers. Staff members often receive invitations to join projects or give expert opinion on policy papers for the Ministry of Education. These invitations provide an additional impetus to carry on with reforms.

Picture 11: Computer-assisted History lesson

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

This model is excellent for village schools that opt for a strong emphasis of ICT culture. There are two important aspects of this model:

Ø *Educational aspect*: development and adaptation of innovative curricula and teaching methods for the inclusion of ICT in different disciplines: the school as a *hothouse for educational innovations*

Ø *Cultural aspect*: serving the community to diffuse ICT culture in different strata of local society: the school as *tele-cottage*

Here a few words about the Tele-Cottage Movement is in place. (A bilingual - Hungarian and English - web site on the topic: http://www.telehaz.hu)/ In Hungary, the movement to provide small settlements with ICT centres has been highly successful. There are more than 500 Tele-Cottages operating in villages all around the country. Furnished with a few Internet-connected computers, printers and scanners and manned mostly by young volunteers under the guidance of the local ICT teacher employed part time, these centres provide excellent service to a more or less computer-illiterate agricultural community. Access to databases, electronic submission of forms, making on-line purchases, processing of information and helping with school tasks - all these services are readily available at these modest cottages - sometimes only rooms situated on the ground floor of a house of culture.

Picture 12: Girls at the Internet circle

School in villages can be turned into such centres of ICT culture if the model of Neumann is followed. This school has expanded and serves now as an in-service training site for teachers. Its library is planned to be converted into a multimedia resource and information site. Staff offers a variety of computer circles for children in after-school hours with a participation of kids from neighbouring villages.

4.3 What resources are required for maintenance?

Another computer lab for discipline-based ICT lessons, upgrade for software and equipment, legal regulation for the ICT System Manager (at present, a teacher cannot be employed as such, because wages to be allocated are below the salary level of teachers.) and a regular sum for maintenance built in the budget of the school are requirements necessary for the reforms to survive all over Hungary. Neumann is no exception: staff and management articulated exactly these needs. As one of the students pointed out: "Teachers are OK but gadgets could be better."

Grant writing (and winning) seems to be the only way out as members of the Village Council does not seem to be willing to raise finances necessary for basic ICT needs. Peculiarly, their children frequent the primary school of a neighbouring village - thus they do not have a regular, first hand experience of results of teaching at Neumann. They do not seem to care, either - the nationally renowned primary school that makes ErdQkertes a household name among researchers and practitioners of ICT is not adequately recognised by leaders of its own village. *Plans for the future*, however, are ambitious.

- Knowledge Centre for neighbouring civil organisations
- Assuming functions of a Tele-Cottage (c. f. description above in Pint 4.2)
- Educational Information Centre for about 80 schools and kindergartens in the counties of Pest

and Nográd

Ø Logistics centre of the local cable television (Intranet network as the basis on-line democracy; starting local cable television for information)

Ø Regional Geoinformatical Centre of Instruction for adults

Ø Organizing courses for regional officials in self-government and for collaborators of Land offices on the National Cadastral Programme

Ø Providing services in agrarian informatics (cooperation with farmer's associations)

Ø Satisfying the demands for instruction in computers of the inhabitants(basic instruction, Internet courses)

Ø Becoming a centre of examination (as a member of the Neumann János Computer Science Society)

Ø Becoming a regional site for distance learning and examination as a member of the Knowledge Corridor project.

Grant applications for all these activities are already being processed and there is hope that some of the ambitious plans will actually become reality.

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.

Neumann (before it even took the name of the world-renowned scientist) was one of the average village schools in the country. When its principal envisioned the new mission for the school - to help village children *overcome the "geographical divide*" keep pace with cutting edge ICT technology and become well-trained members of the information society, innovation projects emerged and the whole teaching and learning climate of the school soon changed. ICT was a very strong catalyst of educational improvements. Soon all functions of the school became dependent on the new culture. As one teacher remarked, "You were made aware of the school's mission and accomplishments - they were overwhelming. You could contribute and benefit or leave." Nobody left - and by now, every staff members have found his or her role in the innovation process.

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.

As a modification for the second hypothesis, we may propose that the diffusion of ICT follows a different pattern from other innovations and, at least in Hungary, there are *several ICT diffusion patterns observable*. In Neumann, *profound training of staff immediately preceded and also ran parallel with the arrival of computers*. Teachers knew what to expect from the new educational technology, were able to formulate their wishes for both hardware and software and became competent computer users BEFORE they actually encountered the problem of ICT skill development

in their classroom. In many Hu8ngarian schools, computers came first - and a reluctant and uneasy staff encountered the dual problem of learning how to use and learning to teach with. At Neumann, ICT culture spread at a very high speed - in many other Hungarian schools, lack of proper training impeded innovations.

A small group of enthusiasts and a large crowd staring at them suspiciously - this is how introduction of ICT usually starts when teacher training does not precede computerisation. At Neumann, the whole staff has been working together as a team of innovators right from the start. Everyone was allowed to select suitable training courses, given a chance to use things learnt, even become research project participant or teacher trainer if he or she felt like that. This image may sound idyllic but it is close to the truth - with a few conflicts of interest and problems due to shortage of PCs, the diffusion of ICT culture followed a peaceful and swift course.

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.

Neumann provides a clear evidence for the first hypothesis. There are many wealthy town and city schools much better equipped than this very moderately financed village school that have incomparably poorer results in ICT competence of students. At this school, major investments were made to ensure high level training for staff members. The effect: large-scale, high level use in all educational areas, successful projects and satisfied students. An evidence to solve policy dilemmas centring around whether to invest in computers or teacher training if a choice has to be made: in Erd Qkertes, *average equipment coupled with high teacher competence produces outstanding educational results*.

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 is a variant to the first hypothesis that can be verified with data from the Neumann study. *ICT use may actually increase learning performance of high poverty students*. Both in the teacher, parent and student interviews we found evidence for ICT being a very effective agent for helping high poverty students increase their academic performance. ICT use creates opportunities for a high quality oral presentation or written task for those whose linguistic competence is low. (A feature characteristic for high poverty students.) Access to information is *made more democratic through access to free information* resources on the web.

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.

Low achievers *experience success* with tailored to their competence level ICT-based learning materials. This was perhaps the most important observation made by teachers at Neumann. Slower students or those requiring more explanation and drill exercises find educational CD-ROMs with *edutainment features* both enjoyable and useful. Especially smaller children like "playing" with them

as manipulation buttons, task features and reward (praising by name, appearance of a cute little animal or a pleasant sound) resembles the world of computer games. Teachers report amazingly good results with low achievers who practised with digital tutorials. Also students find ICT tools motivating.

There are, however, *dangers to Internet use* observed by teachers at Neumann. Slow ISDN connectivity resulting in hours spent downloading "fancier" web pages make information retrieval a tedious business. If the teacher does not pre-filter information and provide guidance, novices to Internet publishing culture are soon mislead, even deceived. Learning to use the Internet is the topic of a successful special course and its experiences will be included in normal ICT curricula as well.

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

Size and composition of the research team: five researchers participate in this study. Three of them have had no previous acquaintance with the school, one of them, Péter Fehér has visited its open presentations several times during his studies on small settlements and ICT culture. One of them, Csaba Varga, Director of Institue for Strategic Research of the Foundation for the Third Millennium, has been in working relations with the school. (The school librarian is member of his research team on the importance of ICT use in small settlements.)

Amount of time spent at the school: 4 days, not including special presentations.

Amounts and types of data collected:

For the purposes of the study, the following data collection methods were employed:

- *Interviews* with teachers and school administration (8 interviews made)
- *Interviews* with parents and students (7 interviews made)
- *On-site observations* of classes (15 lessons observed)
- *Observation of written and visual communication* of the school (analysis of school home page, 3 home pages of students, 3 home pages of teachers related to special disciplines), school magazine and yearbook, publications on the school (including video film.)
- *Analysis of digital teaching aids developed by staff*
- *Questionnaires of ICT use* given to all staff members, 75 % replied
- *Critical reading of project applications and reports by staff members* for grants donated by the school and by foundations.

Appendix B: Tabular data from the Teacher ICT Practices Survey. Use of computers by teachers and students-based on the Teacher ICT Use Questionnaires (Neumann)

Activity	Teachers who do it (%)	Students who do it (%)
Teaching	65	0
Word processing	85	50

Correspondence (e-mail)	45	35
Chatting	0	10
Downloading files	60	35
Browsing	60	35
Playing games	5	60
Programming	25	60
Administration	65	0