PROMOTING EQUITY THROUGH ICT
RESULTS OF THE
GYPSY EDUCATIONAL COMPUTING PROJECT

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Background for the project: "ICT and the Quality of Learning" (1999-2001)

CERI, the educational research institute of the Organisation of Economic Co-operation and Development (OECD)**,** commissioned an extensive study to investigate if and how information and communication technologies (ICT) resulted in changes in the quality of teaching and learning in public education. **"***ICT and the Quality of Learning" (1999-2001)* involved researchers from 23 member and allied countries. As part of the project, school based case studies were executed that evaluated the functioning of schools incorporating ICT in education, internal and external communication and management.

It turned out that the majority of high level ICT users were well-equipped, innovative schools with high SES students, Altogether 91 cases were documented in 23 countries to verify five *pairs of hypotheses* through 3-6 school studies per country The anthropological / qualitative approach included structured interviews, observation of teaching and extracurricular activities, analysis of students' ICT-related work. Schools were revisited after 6, 12 and 18 months to see how educational change due to the introduction of ICT culture prevailed. (Cf. Venezky and Davis, 2001, Venezky and Kárpáti Eds., 2004)

Some results of this research showed different effects of ICT on education for Hungary – the only Eastern European country participating in the project – and the other OECD countries. The most conspicuous difference was the role of ICT in educational reform movements. One of the pairs of hypotheses investigated during the project intended to reveal how computerisation of schools effected modernisation. Two scenarios were outlined: „Technology is a strong catalyst for educational innovation and improvement, especially when the World Wide Web is involved. The rival hypothesis indicated that innovative schools made the best use of technology, but where true school-wide improvement was found, ICT served only as an additional resource and not as a catalyst. (Venezky and Davis, 2001, 10) In the OECD countries, the first hypothesis proved to be valid. Those schools excelled in ICT-based innovations that had been outstanding in the use of up-to-date educational methods even before computers were ever installed. The summary of findings of this part of the study clearly indicated that infrastructure and student competence did not contribute to the success of the reforms as much as teacher attitudes, motivation and skills. Almost all of the school-based case studies showed that reform-oriented educational institutions with dedicated and highly trained staff to be the first to engage in computer-related educational reforms. These schools were considered cutting-edge, innovative institutions before using ICT and continued to do good work through an effective and intensive use of computer technology in teaching and communication. Infrastructure was helpful and student support often needed but by far not instrumental. Most innovative efforts produced a diffusion pattern characterized by Rogers (1995) as "classic" for educational innovations.

In Hungary, however, results seemed to suggest a different pattern. Here, ICT infrastructure at schools played a decisive role in the initiation of educational reforms. Computer culture proved to be a successful catalyst of educational innovations and actually solicited change. The most popular educational paradigms in our country at the time of the first computerisation campaigns were *constructivism*, *situationism*, and *collaborative learning*. Students who had been considered passive receptors of teacher-generated information for centuries were encouraged to construct their own knowledge and engage in creative, discovery based inquiry in realistic situations in teams. (Halász, 1999, Schooling for Tomorrow, 2001) Hungarian education that had been geared towards instruction in high quality abstract knowledge needed a strong impetus – indeed *a new teaching-learning platform* – to alter classic pedagogical views and methods. We observed a *direct connection between the level of infrastructure and the innovative quality of teaching and learning* in the schools observed for the OECD study. (Kárpáti, 2003b) Though by far not practiced by all schools in Hungary, those institutions that were sufficiently equipped with ICT tools and digital teaching materials turned out to be much more motivated to upgrade their teaching culture than those who were left out of the computerization campaign. Similar results have been recently reported from France. (Pouts-Lajus et al., 2001)

Apparently, in Hungary, computers acted like *Troyan horses* – smuggling an army of new methods within the fortified walls of perhaps the most traditional public sector in Hungary: education. Technology acted as an initiator of the reforms – but was it really a catalyst? Did it significantly contribute to the maintenance of innovative ideas and teaching – learning methods? Providing means is one aspect - another issue is the role of ICT in keeping up high level, innovative education. Here, our results approached those of other OECD countries more closely. Hungarian schools that had been innovative before the introduction of computers – for example, the first bilingual secondary school (www.karinthy.hu) or the first privately owned educational institution (www.akg.hu) – made a better use of the potentials of educational computing. Another group of schools in our sample, however – the tiny village primary school named after the great Hungarian computer scientist, John von Neumann, (www.enjai.sulinet.hu) or another primary school in a small town at a developing industrial area (www.almasi.mako.hu) initiated educational reforms clearly after the introduction of computer technology, inspired by its potentials. Therefore, we could not exclude the role of technology acting as a catalyst for better education although we agreed that a kernel innovation effort had to be present at a school to be successful in making full use of the potentials of ICT. (Kárpáti, 2002b)

The eve of the school computerisation campaign in Hungary, 1990-98, was characterized by massive investments in infrastructure. In the second phase, 1998-2001, the training of teachers was in the focus. Results of the first OECD study outlined above helped policy makers plan the next step of the reform movement: development of educationally valuable content and teaching methods to make best use of infrastructure and teacher competence and providing equal access to ICT culture for those with social, physical or mental handicaps. (Cf. Kárpáti, 2003a for an overview.)

In the third phase of computerization of Hungarian schools, starting in 2002, content development and diffusion of ICT-based teaching methods has become central for national sponsoring efforts. Research on student and teacher competence shows that *ICT skills are not age-specific* – even middle-aged teachers of humanities can be successfully trained for computer use. Training efforts are now geared towards medium and small size schools situated in small towns and villages where educational institutions may act as mediators of Knowledge Society culture also to adult citizens in their neighbourhood.

Extensive studies of small Hungarian village schools indicated, similarly to our OECD project findings, that ICT was perhaps the most effective device for schools situated in socially disadvantaged settlements that needed to make the “tiger’s leap” and overcome decades of underdevelopment through one single investment. Fehér, 2000) No other educational toolkit can so flexibly be adopted to local needs, no other set of information is so easily extendable. During the student and parent surveys of the OECD project and other international evaluation efforts, we also noticed how popular ICT was even among the most disadvantaged youth groups whose parents made huge efforts to facilitate their children’s involvement in a culture they hoped would help them fight poverty and achieve a social status much higher than themselves. (MONITOR, 2000) Therefore, in 2002, researchers suggested increased government support for small and medium size schools in villages and towns with modest cultural facilities to engage in computerization and staff training. It was generally assumed that ICT tools would help develop learning to learn skills and cognitive abilities of children with social handicaps more effectively because of its inherent motivational value.

"Promoting Equity Through ICT in Education", (2002-2005

In the next OECD initiated ICT research effort, coordinated by the Education Division of the organization, *equity* was chosen as one of the key issues to be investigated. In Hungary, sponsored by the Ministry of Education, our research team at Eötvös University, UNESCO Centre for ICT in Education was commissioned to launch our national research project in co-operation with OECD: the *Romani (Gypsy) Education Through ICT Project (2003-2005.*

Our aim was to introduce ICT-based teaching and learning methods in *10 primary schools* in secluded and poverty stricken villages of Northern Hungary, with 60% or more Gypsy student population. We created *ICT-enriched, constructivist learning environments* in 10 primary schools of Borsod County in Northern Hungary and develop teaching programmes for Hungarian Romani (Gypsy) children to overcome their learning handicaps and develop their national culture to its full potential.

Treatment method: ICT-supported teaching and learning in six disciplines

Our major aim was to develop cognitive, communicative-expressive and learning to learn skills and thus prepare students for secondary education and make students and teachers aware of the Gypsy cultural heritage through participation in national and international digital projects and creation of heritage sites and teaching aids. Boys and girls participated in the project with equal enthusiasm and good results. Gender in ICT education was not an issue.

Students of the partner schools were encouraged to work collaboratively on digital projects. We prepared students for secondary vocational and grammar school through individual development. *Information Technology (IT) is a compulsory school discipline* in Hungary. In our experiment, computer supported education focused on fostering information retrieval, processing and presentation skills.

Extracurricular activities were also offered to help increase ICT competence of 93 % of our experimental population: students who did not possess a computer at home. Through the creative use of digital communication media, we invited students and teachers to share Gypsy cultural heritage through home pages and school magazines.

Eight disciplines were selected for **ICT-enriched education**: **Art, Biology, Chemistry, Foreign Languages, Hungarian Language and Literature, History, Mathematics and Physics.** Textbooks for teachers including tried and tested lesson plans, software suggestions for different themes and tasks, as well as a CD-ROM with exemplary student work and teacher presentations, digital teaching aids and tests for immediate use developed for the first OECD project, "ICT and the Quality of Learning" were used here.

A similar volume containing projects especially suited for social inclusion through ICT is being prepared for publication as a continuation of the textbook series entitled "***Promoting Equity Through ICT in Education – Results of the Gypsy ICT Project***". This volume will include lesson plans for Grades 7 and 8 (last grades of the compulsory elementary school in Hungary) for eight school disciplines and focus on developing cognitive abilities, foster learning to learn skills, improve communication skills and thus prepare for secondary education.

Assessment of student achievement

Students were pre-tested at the end of 6th Grade, in May 2003, before experimental teaching had begun in September 2003. Post-tests were administered at the end of both school years (end of 7th

Grade, May 2004 and end of 8th Grade, 2005). Five areas of skills and abilities are assessed with tests developed and standardised for Hungary by the Educational Research Group at the University of Szeged, Department of Education:

1. *General thinking abilities* (Test for Inductive Thinking)

2. *Operational abilities* (Test for Combinative Abilities)

3. *Reading achievement* (Text Comprehension Test)

4. *Self-regulation learning strategies and learning motivation* (Learning Abilities Test)

5. *Affective dimensions of the personality* (Personality Characteristics Test)

Testing involved 120 minutes in total and was evenly distributed between two school days. Results were computed for all students, classes and the whole experimental group. Comparative data were presented from previous study samples representative for Hungary and the given age group. Sub-samples including students from Hungarian schools with similarly low SES were created and compared with participants of the Gypsy ICT experiment.

Results of the pretests

An encouraging result of the pre-test: *all low SES classes included some students that were close to or even slightly above the national average*. There was one class where all students were around the average level of achievement in all the areas tested. Apparently, social handicaps and resulting learning deficiencies were in some cases successfully overcome by efficient teaching methods.

In total, however, results were in all areas below the national average. Students in our experimental schools were poorest in inductive thinking (average test result: 22,89 %) – a fact that hints on poor learning abilities. They performed best in the Combinative Thinking Test (55,23 %) – a collection of tasks requiring manipulation with non-verbal information only. Their dominant learning method was memorisation (58,50 %), self-regulatory ways of knowledge acquisition are less developed. Their level of motivation was average (55 %) Their personality test revealed a lack of emotional stability (31,54 %) but a comparatively high level of task orientation (51,22%).

The charts 1, 2 and 3 below show the performance of our experimental groups (socially handicapped children) in three important areas: *inductive thinking, combinative thinking and reading.*

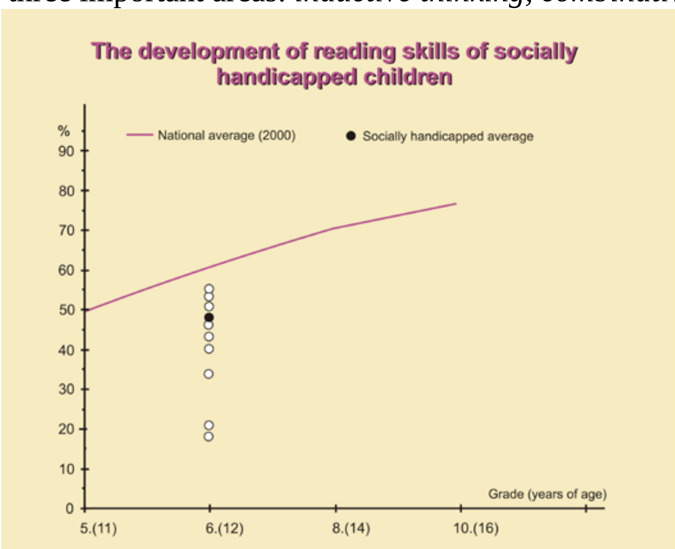

Chart 1

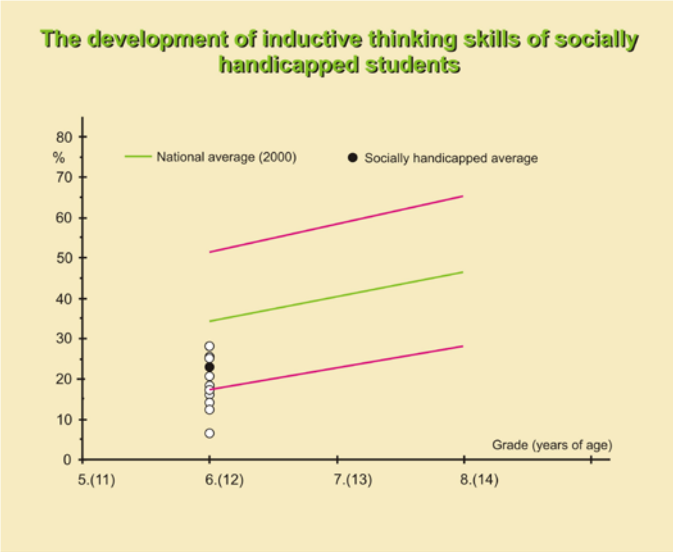

Chart 2

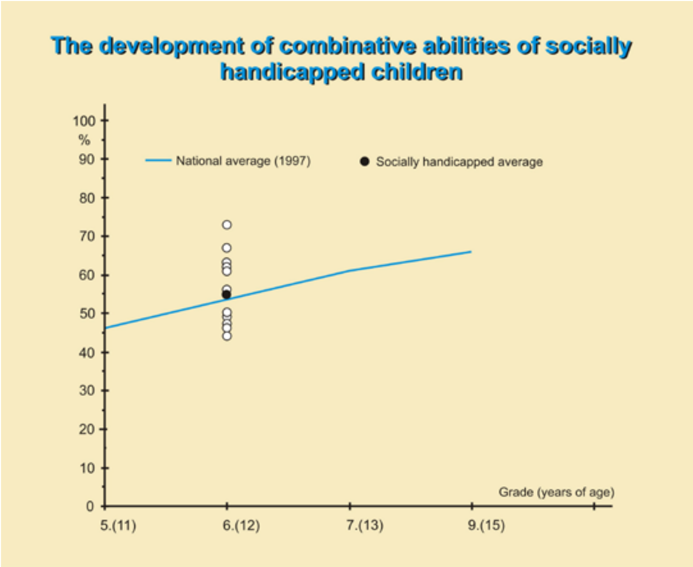

Chart 3

The level of abilities does not, however, explain extremely poor learning results. These students were capable of learning much better and achieve higher marks leading to better average results – necessary for secondary school entrance – as soon as their *learning methods* were improved and their knowledge processing strategies became more diversified through computer-.supported, individualised instruction.

Also, *language skills* were in need of further development. All Romani children speak Hungarian fluently when entering primary school and use their mother tongue (a dialect of the Romani language) only at home, in conversation with elderly relatives. Still, both oral and written comprehension is poor and insufficient for efficient learning. Therefore, we focus our development efforts on teaching how to learn (methods geared towards a better understanding of Mathematics and Science are especially needed) and developing communication skills through digital platforms.

Chart 4 below shows the frequency distribution of thinking skills, combinative skills and reading skills in the pre-test. It is clearly visible how performance in the different areas is distributed in the experimental group before treatment. The curve for inductive thinking is asymmetric to the left (Skewness index: 0.66) More than 35 % of students could only achieve 20 %p in the test. The combinative thinking curve is slightly asymmetric to the right,((Skewness index: - 0.17) with huge differences among the performances of the students. The reading curve is asymmetric to the right,((Skewness index: - 0.50). Here students performed best with 30 % of them achieving 60 %p.

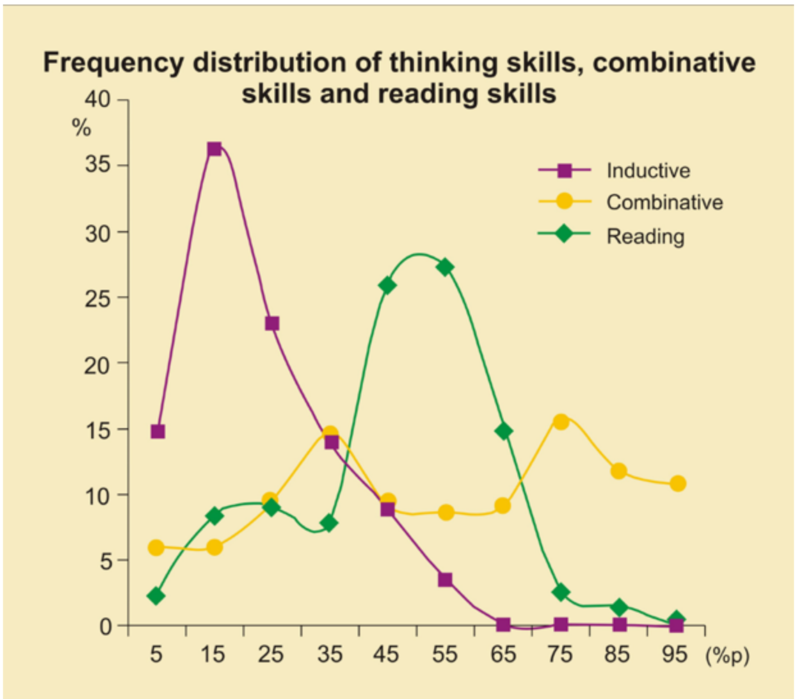

Chart 4

Results of the post tests

The post tests proved that treatment methods resulted in an increase of performance in all areas. ICT enriched education brought the majority of the sample close to and the top 10 5 slightly above the national average in reading and writing skills, cognitive abilities and learning to learn skill. Chart 5 shows the frequency distribution curves of the pre- and post tests in ***inductive thinking***. The shape of the distribution is similar, indicating that there are still some laggards among the students. The curve for inductive thinking is still asymmetric to the left (Skewness index: 0.66) but the level of achievements increased substantially. In the pretest, the best result was 65 %, now it is 95 %.

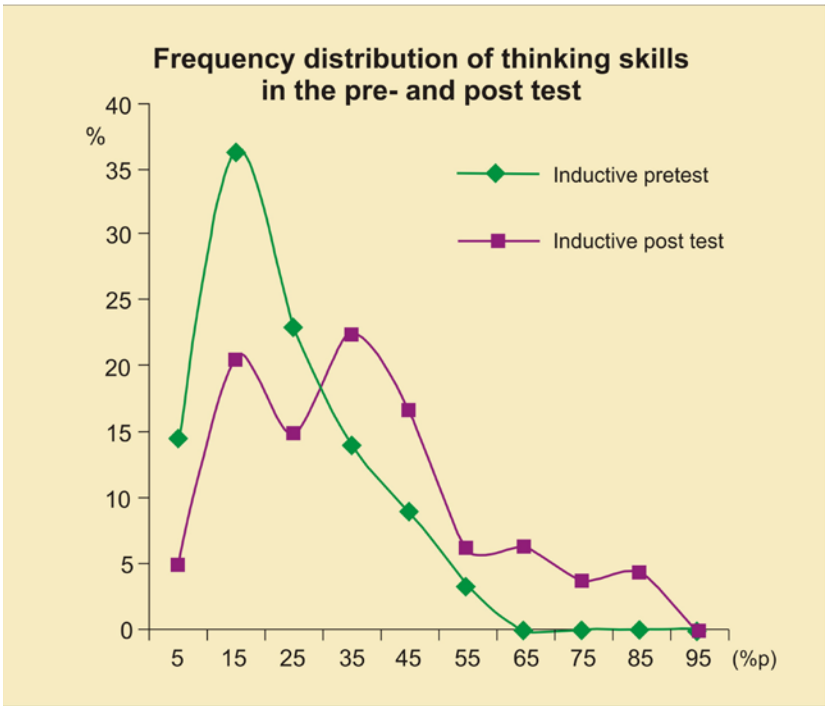

Chart 5

Chart 6 shows the frequency distribution of ***combinative skills*** test results in the pre- and post test. This was the test where students scored best in the pre-test. The combinative thinking curve is more asymmetric to the right,((Skewness index: - 0.51) indicating that students who were medium in the pre-test now scored better and even those who were good developed further.in this area. More students are now to be found in the higher ranges. This result shows that ICT is an efficient tool for cognitive development not just for low achievers but also for better performers.

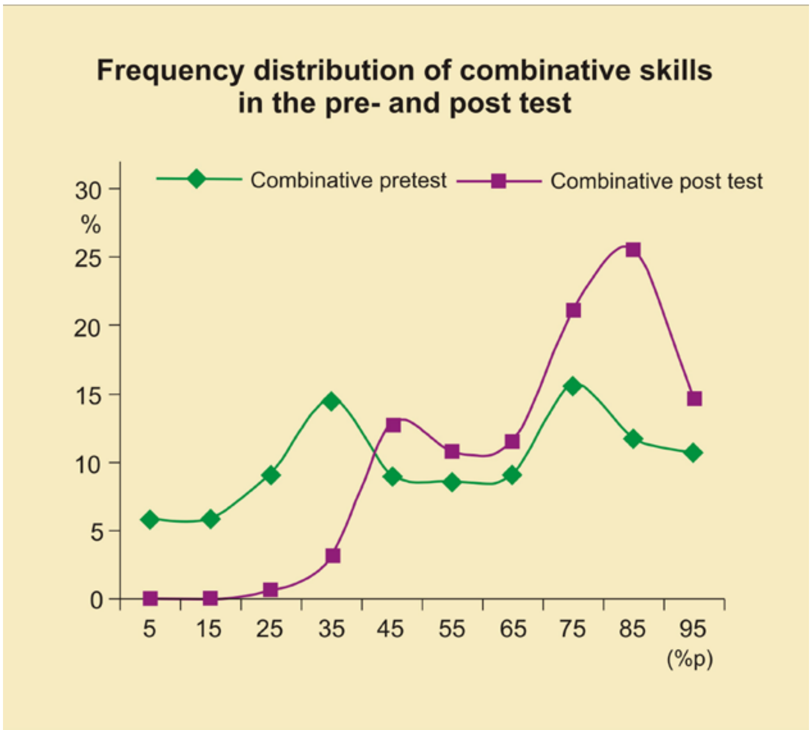

Chart 6

Chart 7 shows the frequency distribution curves of the pre- and post tests in ***reading skills***. The reading curve is in this case more asymmetric to the right,((Skewness index: - 0.58). In the post test, however, much more students belong to good readers 30 % of them achieved 70 %p. This skill is instrumental for further studies, so the result was very welcome among teachers and parents alike.

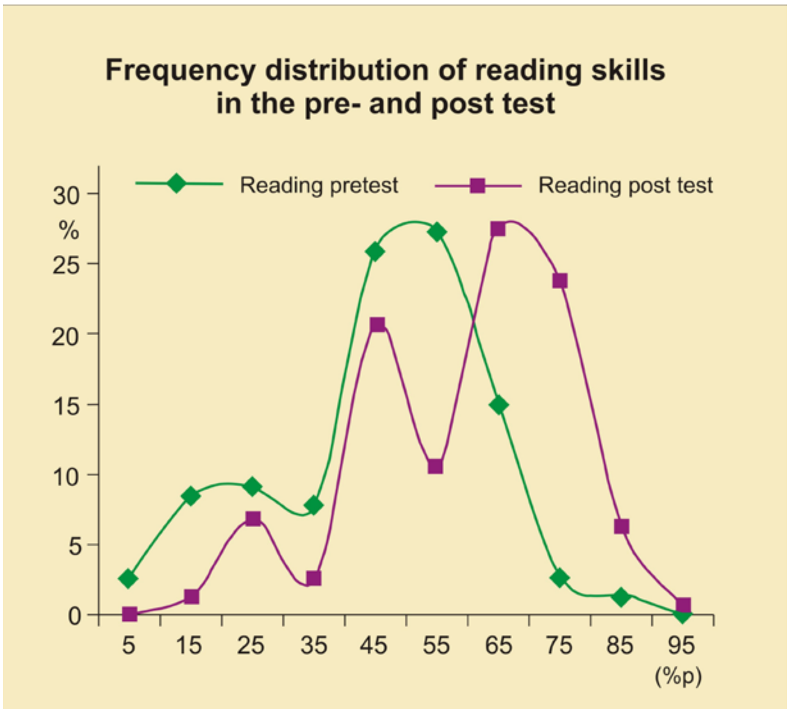

Chart 7

An analysis of the added value of the treatment shows that *improved performance could not be explained by natural growth or any other background variable*. (Cf. Table 1 below.) Outstanding learning results were achieved to a large extent through our educational method: computer-supported, individualised and collaborative instruction in eight disciplines.

Factors explaining school performance, post test, 1th experimental school year

Independent variables	School performance (dependent variable)		
	r	β	r*β (%)
Self-regulated learning	0,410	0,420	18
Inductive thinking	0,584	0,321	19
Parents' educational level	0,368	0,150	6
Combinative abilities	0,561	0,273	15
Reading skills	0,395	0,088	3
Explained variance (R^2)			61 %

Table 1

Mentored innovation – a successful model for teacher training in ICT

Teachers have entered the project with absolutely no ICT knowledge (78 %), a medium level competency (12 %) and a diploma or certificate in ICT (10 %). After the summer course, the majority of novices asked for a supported European Computer Driver's Licence (ECDL) training course and have successfully taken the examination. Parallel with basic technology training, all teachers of the eight selected disciplines attended monthly *mentoring weekends* and learnt how to make more and more use of ICT-supported pedagogical knowledge, as they felt more competent in basic skills. Mentors – practicing teachers themselves with excellent ICT knowledge – supported them in *discipline – based groups* (comprised of teachers of the same discipline from the 10 experimental schools) through frequent e-mailing and virtual collaborative work.

Our experimental schools became ICT knowledge centres for their settlement by the end of the second school year. We train and encourage them to offer basic ICT courses for adults (mainly parents, grandparents and alumni) and help the work of the local administration with computer based clerical and Internet services.

Local teachers who have volunteered to participate in the experiment teach the five school disciplines that form the basis of the treatment. They have formed *discipline based ICT study circles* co-ordinated by *mentors*, members of our research team who are experienced teachers and ICT specialists at the same time. Three of the five mentors are currently working on their PhD dissertation connected to the project, thus they act as participating observers and facilitators at the same time. Study circles meet once a moth for a weekend to discuss problems of ICT use in their discipline, share teaching results, learn and practice new methods or experiment with a new device or teaching aid.

Mentors always presented samples of their own work with ICT (video documentaries, PowerPoint presentations and small programmes (for example, Java applets) they developed for educational use and share student work with their colleagues. They describe in detail, how they prepare for ICT-supported classes, what information resources they use, which tools they find most helpful for the development or adaptation of teaching aids, how much time does it take to prepare for a lesson, and how can student development be best assessed. Thus, local teachers, novices in educational computing, will not only learn methods but also a new working culture presented by an authentic role model: their peer.

School principals unanimously agree that ICT-enriched education may be the chance of a lifetime for their students and support their staff members in their re-training efforts. Still, it is extremely difficult for participating teachers to learn about new educational technology and a new philosophy and practice of teaching at the same time. Several teachers complained about intellectual or emotional overburden but none left the project. In fact, village intellectuals seemed to welcome the chance of adherence to a larger professional community and enjoy the team spirit.

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