ABSTRACT for the conference

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Information and communication technologies (ICTs) are key components for innovation in Leonardo projects and teachers are the catalysts who are supposed to transmit new learning content to students through ICTs. Teaching as a profession certainly is entitled to occupy a much more important place in Leonardo projects. In order to promote the inclusion of the pre- and in-service teacher training programmes as integral parts of Hungarian Leonardo projects, here is a brief overview of the role of teacher preparedness, teaching skills and motivation for innovation in the successful dissemination of results of projects of the Leonardo Programme.
CERI (*Centre for Educational Research and Innovation*) of the OECD (*Organisation of Economic Co-operation and Development*) has initiated, between 1999-2001, an international research effort to evaluate the results of the first phases of introducing CT in education. "*Information and Communication Technology (ICT) and the Quality of Learning*", (Venezky and Davis, 2002, Venezky and Kárpáti eds., 2004), a survey that included 96 school based case studies from 21 countries. The objective for the OECD survey was, in contrast to similar international school computing evaluation efforts, was not to identify sites where students' ICT level is good but those where *information technology became an important factor of school culture*., We concluded that staff and parent involvement as well as multiple uses of ICT for communication, information retrieval and collaborative work key factors for successful implementation of new technologies in education. We found that being the "*intellectual centre" of the area* was the mission that inspired management and staff of our model schools to be on the cutting edge of educational reforms to participate in the first large scale ICT projects in the country. Libraries as well as other facilities of our ICT model schools were used by community members - mostly parents and alumni, but also participants of various adult education courses in computing on offer there. These schools were also able to offer ICT in education courses for teachers in their region and soon became the *focal point for pedagogical innovation* of their area.
This research showed that the key factor in the dissemination of achievements of ICT culture is not the level of technical infrastructure or staff / student skills in computing, but the innovative educational repertoire of teachers. *Vocational skills training in the teaching profession* proved to be key for the success of ICT.

Kvilon, 2002, Robers, 2002) Some of the most frequent activities that may be used for a description of teacher ICT competencies:
Teacher – student – expert communication

- Demonstration, visualisation),
- Explanation, motivation
- Debate, co-operation
- Presentation, documentation

Development of skills and abilities

- Presentation of processes and problems in a true to life manner: simulation, modelling
- Usage of digital encyclopaedias, data banks and other learning resources
- Differentiation
    - Talent development
    - Supporting special learning needs of those with a mental and / or physical handicap
- Creation of multicultural learning environments, integration

Digital tools for evaluation and assessment

- Testing and practicing environments
- Production of adapted to learner needs (personalised) task sequences
- Evaluation of information gained and stored in a virtual learning environment (VLE) to make use of data on individual thinking strategies, skill levels, eventual knowledge gaps, talent areas, developmental constraints etc. for better planning and teaching

he *Leonardo Thematic Monitoring Project,* (Attweell et al., 2002) This study showed that the majority of the projects supported by the Leonardo Foundation between 1998-2001 have answered technological needs in the first place, through the development of new software applications and ICT enriched learning environments. Structuring the learning material in easy-to-acquire, motivating modules, planning for individualised assessment and evaluation were barely considered. It was mostly the *cost-effective delivery of content through digital solutions* that project efforts were focused on. The analysois of more than 250 projects showed the *dominance of the programmer over the educator.* The success of a learning process, however, depends on the educational methods employed much more than on the technical level of the learning environment.

According to this study, successful e-Learning applications could be characterised through the following traits:

1. Learning was based on the *constructivist or constructionist paradigm* that makes use of the experiences of the learner in the construction of the content and methodology of education.
2. Learning based on *individual discovery* was central in the process of knowledge acquisition
3. As a result of the learning process, students gained *long lasting and flexible knowledge and skills* and assumed an expandable overview of the teaching content that facilitates individual, life long learning
4. Knowledge gained was *structured into the pre-existing knowledge base* of the learner. Controversies were revealed and discussed through mentoring. Problems were presented to learners not as handicaps for further inquiry but as challenges to be solved.
5. The learning environment and teaching aids supported all three major components of knowledge acquisition: *perception, selection and practice* of information
6. Content was *authentic, open ended and interesting* enough to motivate learners for further knowledge expansion. Resources for this were clearly pointed out.
7. Learning was constructed as an *individualised process,* where the e-Learner could always assume a central position.

8. *Mentoring and facilitation* of the learning process introduced pair and group work situations and contributed to the development of collaborative knowledge construction skills.
9. Learning content was created with the observance of the *cultural environment* of the learner.
10. Methods of *andragogy* (an area of educational research focusing on the special needs as well as skills and experiences of the adult learner) were considered throughout the planning and teaching process.

Teacher training was revealed to be one of the key requirements for achieving the aims listed above. One of the most often quoted recommendations of this research projects makes a clear statement about this:

"Recommendation No. 4:

Projects in eLearning should train the teachers and trainers

Support for teachers has to include the use of new technologies as well as the pedagogical aspects of teaching, training, coaching, moderating etc.

Teaching science, technology, economics, medicine etc. needs a teaching and learning approach that is as close to the "*real world*" as possible. This can only be achieved with appropriately trained teachers competent in their own subject area, trained in the use of modern learning technology and also trained in methodological and didactical processes.

Although all the projects surveyed aim at teaching new skills and abilities, and invest considerable finance and labour in developing innovative learning environments, we found *few examples of pro-active teacher / trainer development* programmes. This was the weakest side of many of the projects we looked at. Learning platforms and digital teaching aids are described at great lengths – mostly in technical terms, with regard to professional content – but it is hard to identify any educational philosophy that the training of future trainers could be based on. Most platforms include interactive components but requirements for mentoring and coaching, monitoring student progress and providing individualised feedback are limited. As most projects are in their preparatory phases, measures to develop a *professional community of trainers* can still be made.

Teachers' training is needed because even at the highest level, *university and college staff members are inexperienced in adult education*. University professors with decades of teaching and research experience turn out to be unsuccessful and frustrated when teaching on-the-job courses. Course design for distance education is a set of skills that should be mastered even for highly qualified staff.

Even those with a natural talent for educating adults will face *technical problems* when cutting-edge technology must be used. For example, video conferencing requires totally different presentation methods than normal lecturing. Special training is required to develop illustrations and devise a suitable structure for such sessions. Technology develops rapidly, so trainers need ongoing updating.

National Agencies should organise informal training events for teachers participating in the Leonardo projects, but the projects themselves also must cater for their own special training needs. (Littig Ed., 2003, pp. 57-58)"

These aims can only be realised through intensive, well-structured pre- and in-service teacher education. (Cf. the report and recommendations by UNESCO on this topic: Kvilon, Euvgnehi ed., 2002) Teacher training was identified as a focal point for future ICT-based educational development also by the European Union by its research task force„*Future Objectives for Education and Training",* 2000-2004 Group

C of this task force, „*ICT in Education"* formulated its suggestions, among which teacher training was on the top of the list.

"Empower educational actors and train for the management of change

Educational actors, students, teachers, trainers, administrators and school directors need to be empowered through inclusive ICT education policies, which address the broad scope of learners and communities.

Teacher education appears as one of the most important arenas for addressing the integration of ICT in education. The ability of teachers to critically reflect on their own practice, and to review what other teachers have done, should be encouraged. Many ICT tools have already been developed with a view to such 'reflective practitioners'. Communities of practice – within or across disciplines - could foster 'learning by doing' and reflection within teacher communities. Training should include examples of educational use within the different subject matters. Teacher training should be largely be done 'in situ' with a view to the specific educational issues and problems that teachers have to face.

Learning in a technology-enhanced environment (e-learning) should not be confused with learning about technology (learning 'e'). Teachers and trainers' initial and in-service education policies must go beyond technical skills and empower all educational actors by developing new competencies to master digital and media literacy and integrate it in daily learning contexts. Modular frameworks for the educational use of ICT and its integration in education could foster a better understanding of the changes in the educational processes and of the educational objectives that ICT can help to better attain or implement.

Students need to acquire technical skills but most importantly they need to become familiar with digital culture and more critically aware of how media and digital technology impact on the way they learn, think, create and express themselves.

Educational actors need to be *trained to cope with change,* uncertainty, innovation and disruptions. The increased complexity of today's schools, classrooms and learning environments suggests the need for understanding educational activities in new ways and for developing new analytical models and practices on how educational activities could be organised.

Problems encountered by decision-makers are of a decreasingly technical nature. They must grapple with financial, regulatory, ethical and political issues such as intellectual property rights and the availability of 'open source' material. They have to cope with privacy issues and with the 'safety' of new devices (protection of minors, health risks) Education and training policies must reach beyond the purely technical, and embrace areas such as media and the digital culture, reflecting the ever-growing role they play in our lives.

When piloting changes brought about by the mainstreaming of ICT into learning and teaching processes, teachers and head masters need to refer more often to clear goals, assessment procedures and evaluation criteria. New avenues need to be explored in setting up the open learning centres for lifelong learning. Management of change therefore requires institutional flexibility and vision, along with promotion of creativity and inventiveness.

Due regard should be given to the rights and obligations of all stakeholders in such areas as freedom of expression, consumer protection, privacy, security, intellectual property rights, open-source solutions and management of Internet addresses and domain names, while also maintaining economic incentives and ensuring trust and confidence for business activities." (EU Directorate for Education and Culture, Educational Division (2003, p. 33)

The new program of the EU, the Integrated Life Long Learning project, will certainly favour applications that take into consideration the suggestions and research findings summarised in this paper and encourage teacher trainers to apply with third generation ICT programmes. First generation projects were PC-based and aimed mostly at the exploitation of potentials of new hardware. Second generation projects developed learning content that utilised hardware for a more efficient content delivery. Third generation projects should finally focus on the dissemination of new pedagogy through innovative hardware and software solution. Thus, the dream about ICT to become the benevolent Trojan horse of education that defeats conservative methodology may finally be realised.

Examples of good practice for all the above listed activities that competent "*e-teachers*" have to master are to be found on the INSIGHT project web page (http://insight.eun.org) of the European Schoolnet (EUN). To quote just one example, the *Republic of Ireland* – a success story not just in economy but also, consequently perhaps, in education. The Irish ICT strategy and results of the realisation of its first phase may offer a wealth of good examples also for teacher education. (Schools IT 2000 – A Policy Framework for the New Millennium. 1998) The major pillar of this strategy is the Irish school network project entitled Technology Integration Initiative (TII, ScoilNet, www.scoilnet.ie) One of its core elements is a comprehensive training programme for the preparation of Irish teachers of all disciplines in public education for the educational use of ICT: the *Teaching Skills Initiative* (TSI, cf.: Attracting, Developing and Retaining Effective Teachers, 2003) Its characteristics:

- 20.000 teachers trained nationally – ICT coordinator certificate for pioneers, discipline based training for all
- At least one teacher per school is trained to be a mentor teacher to further train others
- Special training programmes for different school types – from kindergarten to higher secondary level

Many countries offer courses for beginners and competitions for high end users – but the vast majority, those who have started but not yet excelled are frequently left unnerved by training institutions. Therefore, one of the most successful models for training "medium level" ICT users – practicing teachers with a basic training in computer skills and some experiences in their educational use, the *Teachnet Project* (www.teachnet.ie) may be of special interest for Hungarian course providers. It manifests a revolutionary approach to in-service teacher education because it invites participants to define both the content and the timing of their distant learning course.

Between 2002-2004, 200 learning objects were prepared, all suited to the Irish national curriculum. The authors, practicing teachers themselves, were also obliged to test their products and report on their applicability for different educational settings. As mentioned before, they received both technical and pedagogical support to do so. An interesting finding of this project is, that teachers made extensive use of technical support but did not often turn to the pedagogical expert for help. Evidently, they supposed that their innovative skills were sufficient to make use of ICT in education if technical problems were solved. The analysis of the learning objects developed proved, however, that modern educational paradigms were not always considered, so teachers were encouraged to form knowledge building communities, discuss and test each other's teaching aids and thus provide pedagogical peer support. Several

hundred of these communities is active up till now, two years after the end of the project, and maintains a very useful educational home page open to interested educators.
Another important result of the project was, that intensive involvement in ICT-related pedagogical innovation proved to be an effective means to fight professional burnout, reported by many of the participants at the beginning of the project. Researchers concluded that educators needed both technical and educational support for efficient use of digital technology in teaching practice, but pedagogical help has to come from a group of peers, not necessarily from a single expert or an anonymous helpdesk official.
EPICT (*European Pedagogical ICT Licence*, www.epict.org), a new model for in-service teacher education, proides exactly that. Its aim is to furnish basic ICT skills in connection with current methods that they can effectively upport. This course is based on a blended learning method in groups of 4 or five, that can be formed both on the basis of an institution (staff members of a school) or on a shared professional experience (kindergarden educators, teachers of the same discipline, administrators, school heads, etc.) The course requires PC and internet access and a degree in education. As all tasks and exercises are closely connected to school practice, it is important that all group members were employed in education during the course. Four compulsory and four optional modules have to be learnt. *Knowledge and skills are tested through group based, collaborative tasks realised in the authentic setting of the school of the participants*. Technical and educational support is provided by the *facilitator* assigned to the group, a practicing teacher with high level ICT skills trained to mentor online. Focal points of the course are:

1. The role of ICT in the realisation of new educational paradigms
2. Development of ICT competencies of teachers
3. Planning for computer-supported learning
4. Usage of digital tools, teaching aids and resources
5. Use of ICT in school management and communication

The course has been in use in 12 countries worldwide an is currently been piloted and accredited in Hungary.

Virtual Learning Environments have decades of developmental history. Still, they fail to yield educational results promised by their developers – an impressive improvement in the quality of teaching and learning that would justify investment in their development. Teachers, irrespective of the quality and quantity of infrastructure and training courses offered, are still reluctant to use them [1]. According to case studies in 21 OECD countries ranging from school cultures of Mexico to Finland, those who make optimal use of ICT technology are innovative teachers who have been equally successful in “non-digital” educational innovation [2].

The traditional method of educational software development is based on *parallel monologues* – those of the teacher and learner, expressing their need for a digital learning tool, and those of the software developer and producer, expressing their special viewpoints and interests. Learning materials developed as a result can only be used for traditional, authoritative “*learning dialogues*” [12].

The EU-funded Knowledge Practice Laboratory defines an innovative model for the co-construction of knowledge that educational software development also has to

consider: *trialogical learning.* “Those forms of learning where learners are collaboratively developing, transforming, or creating shared objects of activity (such as conceptual artefacts, practices, products) in a systematic fashion. Trialogical learning concentrates on the interaction through these common objects (or artefacts) of activity, not just between people ("dialogical approach"), or within one’s mind ("monological" approach).” (from www.kp-lab.org, the official Website of KP-Lab: KP-Lab Wiki / Trialogical Glossary) Consequently, the realisation of this learning model needs *communities of practice*. On the one hand, it involves learning in self-regulated student groups (“knowledge building communities”), on the other hand, teachers’ communities that co-develop learning content to support and guide self-regulated student learning also have to be formed [13].

The first development of learning material (databanks for seven disciplines) for Movelex VLE was launched in 1991. By now, its digital content repository contains about 8000 tasks, based in a lexicon of 7000 items. About 300 teachers have been trained, and 100 of them take an active part in the development of the Movelex repository and tools. *One third of those teachers trained became developers and have been involved in this community of practice ever since.* This community building capacity is considered especially important for improving teachers’ educational strategies [15]. As a result of assessment of teachers’ ICT skills, two levels of Movelex facilities are offered: Beginner and Advanced

The CALIBRATE (Calibrating eLearning in Schools) project (October 2005 – March 2008) brings together eight Ministries of Education, (including six MoEs from new member states), to carry out a multi-level project designed to support the collaborative use and exchange of learning resources in schools.
The work builds on the results of three successful IST projects under the European Commission's 5th Framework Programme (CELEBRATE , ITCOLE and VALNET) and is designed to help strengthen the integration of the ICT research effort in an enlarged Europe. The large-scale project involving 17 partners will:

- Develop and ensure take-up of an open source technical architecture to support content exchange/collaboration between MoEs and other owners of educational repositories.
- Develop and ensure take-up of an open source, learning toolbox that supports the collaborative use of learning resources by providing an environment for group centered work and knowledge building activities but which also provides the sort of course building tools found in more conventional Learning Content Management Systems.
- Research and testing of new approaches that can improve semantic interoperability related to the discovery and evaluation of learning resources.
- Validate CALIBRATE project results in up to 100 schools using an advanced validation methodology.

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Note: all web pages were opened on 20 September 2006

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APPENDIX – Teachers' ICT competencies in the U-Teacher Project

Content Area 1: Critical-situational
Educational technology in School innovation
Educational technology and Learning/teaching Processes
Disciplines and ICT
Learning environments and ICT
Collaborating and learning on-line
Evaluation and ICT
Role of ICT in the integration of disabled students
School management and ICT
In-service training and ICT
Special ICT competencies and skills necessary for teachers
Teaching concepts and paradigms to be utilised in an ICT-enriched environment
Content Area 3: Techno-pedagogical
Optimal and minimal school infrastructure for ICT use
Optimal placement of PCs and other equipment in a computer lab for ICT training, in a computer training lab for given disciplines (. E.g. sciences and humanities)
Optimal placement of PCs, other teaching-learning infrastructure and furniture in a classroom used for teaching a variety of disciplines
Content Area 4: Instrumental
Optimal configurations for discipline-based ICT – supported education and for teaching ICT as a discipline
Content Area 5: Self-reflection
Self-assessment methods for teachers in an ICT-enriched environment: digital portfolios, log analysis, evaluation of student use of facilities (e.g. educational portal by teacher, forum for discussion, online mentoring.)
Content Area 6: Collaboration
Initiating, supervising and assessing digital projects
Online mentoring – teacher and student skills and optimal working methods
Using real time electronic communication (chat, web cam, audio broadcast etc.) for interactive, differentiated, situated teaching and learning

Source: Vittorio Midoro, Editor (2005): a Common European Framework for Techers' professional profile in ICT for Education. Ortona:Edizioni Menabo Didactica,