

## USING OF THE ICT IN EDUCATION

Matilda DROZDOVÁ\*, Milan DADO\*\*, Pavol PODHRADSKÝ\*\*\*

\*Department of Info-Comm Networks, Faculty of Management Science and Informatics,  
University of Žilina, Univerzitná 1, 010 26 Žilina, tel. 041/513 4334, e-mail: matilda.drozdoва@fri.uniza.sk

\*\*Department of Telecommunications and Multimedia, Faculty of Electrical Engineering, University of Žilina, Univerzitná 1, 010 26  
Žilina, tel. 041/513 2200 e-mail: Milan.Dado@uniza.sk

\*\*\*Department of Telecommunications, Faculty of Electrical Engineering and Information Technology, Slovak University of  
technology in Bratislava, Ilkovičova 3, 812 19 Bratislava, tel. 02/60 291 705, pavol.podhradsky@stuba.sk

### ABSTRACT

*In this article we present the results of the project called “Using of ICT and new generation networks platform in education”, which were carried out within the state program of research and development at the University of Žilina in cooperation with five another Slovak universities. The main goal of the project was to support the complex and effective ICT utilisation in education by means of the e-learning system creation and its implementation in the educational process at the universities. The research in the project was divided to two main parts. The first part was dealing with the structural tasks of e-learning what means new learning methodologies and changes in the educational process. The second part was concentrated to the infrastructural tasks connected with the information & communication technology. The main results of both parts of the solution are described in the article.*

**Keywords:** e-education, e-learning, information and communication technology, ICT in education, Next Generation Networks

### 1. INTRODUCTION

Information & communication technology (ICT) have brought fresh impetus in the society development. We speak about information society or knowledge society. Both these expressions are very deeply connected with education and the area of education has also been part of the whole-society changes. There is very apt of Alan Kay quotation: “A successful technology creates problems that only it can solve”. ICT is successful technology now and the problem brings it in education we have solved with them. ICT can bring revolutionary changes to education, which can be used for new pedagogical purposes alongside the textbooks and blackboards.

But ICT is not the main purpose of changes in education. Information & communication technologies are only the main tools for support of these changes. For this reason our research was divided to the parts of the structural tasks and infrastructural tasks. Structural tasks are connected with the educational process and involved information sources, information processing, organisation and management, and, teaching and learning. Infrastructural tasks include creation of communication networks and its services, application and information processing software development and terminal equipments.

The results of the infrastructural research are implemented at the universities as the e-learning systems accessible trough communication networks. Using of the e-learning systems can bring the changes in the structural tasks. Student have possibility to find electronic process study materials what in many cases leads to the changes in the teaching and learning methods.

We can say that we start the process of changes in education using of ICT.

### 2. NEW EDUCATION DEMAND

University education has been known in Europe for more than 900 years. Its initial common role was to

disseminate the knowledge and venerate God. The industrial revolution had a significant impact on that mission. Therefore, the role of universities started to change in the middle of the 19<sup>th</sup> century. Universities initiated more demand at national preferences following economic and military intentions of each country. Besides the change of the initial role of universities, student mobility became more restricted. This was due to the substitution of common teaching of the Latin language by national languages.

New changes originated from the information & communication technologies twenty years ago. They did not modify the primary mission of universities, which is the knowledge dissemination. ICT affect opportunities for the changing of forms and techniques of teaching. However, the character of universities remains up to this point the same. The process of education is managed through the same methodology, as it was 50 or even 100 years ago. Meanwhile ICT has only replaced former manually or mechanically made activities and has improved the quality and effectiveness of the educational processes.

Information & communication technologies bring new tools to the education process at the universities. Additionally, they also bring new needs for the education of society. In the past when the technologies and knowledge in the world were changing slowly, the active life of people was divided into two parts

- education - preparation for active life and profession,
- utilization of results of education in active life and profession.

This scheme does not work today. The main problem is the speed in the change of knowledge. A period in which knowledge doubled is shorter now. Ten years ago it was approximately within ten years. It is assumed that in next years it will be within some hundreds days, maximally within few years. The only way how to solve the education in such conditions is a broad implementation of continuing education and training

during the whole life of people. Continuing education is not a new kind of education. It has only a different form which is used just in the moment of necessity. Apart from that it is needed to change education processes at universities and not only there. Education in basic and secondary schools has to be changed too. Good preparation of young people for life long learning and continuing education is a big challenge for education systems. Success of society will be strongly influenced by preparation of young generation for this new condition of their life. They must be adaptable enough for fast changes in a knowledge society and knowledge economy.

Education that is predominated nowadays must be changed. Knowledge will be disseminated through ICT tools designed for those who are interested in new knowledge. Students travelling to a place of education will be dramatically replaced by the transmission of information to the students' locations "just in time". Instead of the situation where the student has to adapt his time to the timetable when the information is provided, the information will be accessible to the student when he has time to study. Students will be provided, at their workplace, by tools to access information, by searching tools to find new information, as well as by communication tools in order to contact teachers and other participants of education. Multimedia and other new forms of content presentation can be enable students to absorb information better and faster than when using the traditional form of verbal and written interpretation or graphical notation. On the contrary to the present form of education used in all levels of schools where the student often becomes a passive object of education, dissemination of knowledge via ICT tools will push more responsibility to the student himself/herself.

### 3. TECHNOLOGY IN EDUCATION

Technology in education as the object has been used around for a long time in the form of blackboard, pencil, and recently overheads projector, radio and TV or film. Information & communication technology brings additional new technological possibilities. Besides of traditional media are applied new media through computer, and allow games and simulation, electronic performance support systems, virtual reality, video conferences, IP streaming, etc.

But technological equipments are not used due to use of technology, it has to support teaching and learning process in order to make learning more interesting and better accessible for students. The technology should enhance the quality of lessons and exercises in order to be effective, student friendly and to make possible the ubiquitous learning not only learning in the "stone schools". Therefore it is necessary to combine information & communication technology equipments with educational technology. Educational technology is often associated with the terms instructional technology or learning technology. According to Association for Educational Communications and Technology [1] instructional technology is defined as follow: "the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning,"

The foundation of instructional technology is instructional design that means the systematic development of support tools according to learning needs. Instructional design is used nowadays to creating of the information & communication system for education. Instructional design is the systematic process of developing information & communication systems and it implementing in the educational environment. This process needs specific methods and tools of the solution. We have analysed several systematic approaches and found the best practice solution for changes in education using of the ICT.

## 4. ICT IMPLEMENTATION IN EDUCATION

ICT implementation into educational institutions requires such implementation and application approaches according whom the created systems would not only be presented but also applied to a real educational practice and added value would evidently enhance the quality of education. This was the reason why concurrently with the technical realisation of the system for e-learning, there must be solved the problem of effective using of the e-learning system in educational institutions. It leads to new instructional technology in education and creation of a new model of educational institution. Only according to this outcomes can be ICT support use effectively and brings changes in education.

Application of the three partial system [2] was used as a basic for our implementation methodology. This approach consists in a transposition of general parts of strategy, tactics and activation to the problem solution. According to this approach design and implementation of the e-learning systems was divided into following parts:

- Strategy and goals specification on the ground the e-learning system implementation
- Application of the transformation principles necessary for the implementation
- Realisation of the e-learning system according to the implementation plan

### 4.1. e-Learning strategy and goal specification

When designing a strategy plan it is necessary to respect relation between infrastructural and structural tasks of education that presented two connected layers. One is a socio-economical layer and the other technological.

Following tasks represent the socio-economical part:

- Creation of a new way of teaching and learning, known as a creation of a new technology of education, change of present habits in education by the use of the information & communication technologies etc.
- Creation of conditions for new ways of teaching and learning, for example use of the learning management system – LMS, use of interactive multimedia sources, own or shared, other e-tools supporting education etc.
- Establishment of new organisation and legislation rules enabling changes in education etc.

Technological part represents the creation of technical conditions for a new educational technology application. It has following objectives:

- Creation of services and applications for e-education systems
- Creation of appropriate information-communication networks
- Association of needed attributes of components and devices – terminals, systems for information saving and processing, transfer systems, etc.

Objectives of the implementation of e-education systems are to accomplish essential changes and innovation in education. These e-education systems have not been applied by now from the inevitable necessities of their users but from the possibilities which information-communication technologies provide. Their technical plan and realisation must be in the future in accordance with their use in education, only so they bring desired values to users.

#### 4.2. Transformation principles application

The designed strategy and the strategy plans are not the base for the realisation. Between objectives specified in the strategy and the realisation itself must be another interlink, which is often referred to as tactics which means a preparation of realisation conditions. From the point of the e-education system solution, it means a transformation of the educational process and preparation of other conditions for the realisation of a new process by the use of e-education system.

Application of the transformation principles led to the following solution:

- Analysis of educational environment using SWOT analysis. Problem parts, created in the matrix of strategies, give a scope for further appraisal of proposition and design of a new technology of education.
- To obtain objective evaluation in problem parts, an expert questionnaire was produced. The results of the questionnaire provided us with the basic information about opinions of academia at Slovak universities, primary and secondary schools.
- Pursuant to the resource considerations and possibilities, which provide information-communication technologies, a sample model of a new process for education at universities and life-long educations was created by the method of reengineering.
- The new proposed educational process needs to make radical changes in these three sub-processes of the existing educational process: teaching, testing and design of e-learning material. These sub-processes are the most important factors for the result of the educational process.
- The e-education system implementation enables us to create a new type of educational institution. In this kind of educational institutions, an e-education system will change the form of education. A new educational institution needs a new business model, which leads to creation of a new value chain of educational institution, [3].

- Teachers must have a number of competences, which are more or less described in various documents and have already been a subject of a research. Therefore, this research work realised for this purpose, presents definition of all the competences, which a teacher must have.
- Educational institutions are considered as very specific, because of the character of the main processes. By now they have used the systems of quality management in a small scale. Changes in education and the implementation of e-education systems change the present approach. EFQM quality management system can be the base for the innovation, [4].

## 5. INFORMATION & COMMUNICATION INFRASTRUCTURE REALISATION

The research activities of the team of researchers in the project [5] were focused on the design of the type architectures for the systems of e-learning, e-consulting and e-collaboration for individual educational levels. At the proposal of configuration of particular platforms, we issued from the concept model of integrated networks and NGN, defined by the international standardised institutions ITU-T and ESTI. Our aim was to design a universal global platform for e-learning, e-consulting and e-collaboration work, while the main emphasis was on openness, modularity and flexibility of a designed platform. By its modification, there were consequently suggested complex solutions of the concept and structure of the type architectures of the systems of e-learning, e-consulting and e-collaboration work for various target groups and educational levels from the point of:

- Hardware platforms
- Software platforms
- Dimensioning of individual segments of given type architecture
- Information security.

### 5.1. Global Platform for E-learning on the Base of Converged Technologies and NGN

Present and future development of ICT will be based on new converged technologies and networks which are called as Next Generation Networks at present. The main feature of all modern information and communication technologies and networks can be characterized by:

- High flexibility
- High granularity
- Data rates evolution in access networks towards broadband communication
- Mobile and fixed access connection
- Intelligence in networks and service adaptation and modification.

From ETSI perspective [6] the future development of ICT networks is about:

- A multi-service, multi-protocol, multi-access, IP based network - secure, reliable and trusted
- An enabler for Service Providers to offer
  - Real-time and non real-time communication services

- Between peers or in a client-server configuration
- Nomadicity and Mobility
  - Of both users and devices
  - Intra - and inter-network domains, eventually between fixed and mobile networks
- Regulatory compliance
  - Lawful Intercept, Number portability, Emergency call...

All we are speaking about in this chapter give as new possibilities for utilization new and future technologies for support of education.

**5.2. Architecture of a Global Platform for E-learning**

The global platform of e-learning system is designed in such way that it supports two alternatives of this platform

- Solution based on a direct use of segment of the public ICT infrastructure (terminals and other devices of user area implemented directly into the user area of the public ICT infrastructure segment)
- Solution based on two cooperating segments of the ICT infrastructure:
  - Segment of the non-public ICT infrastructure which contains individual layers of architecture NGN (terminals and other devices of user area are implemented into the user area of the non-public ICT infrastructure segment) together with the other ICT elements and network segments
  - Segment of the public ICT infrastructure whereby the connectivity and interoperability of both segments is secured by the use of access nodes and protocol platforms.

Configuration of the global platform results from the five-layer model of the NGN architecture:

- Users layer – end terminals and other devices accessible for users
- Access layer – provides connectivity of end terminal and devices with the ICT infrastructure
- Transport layer – transfer of information flows (text, picture, audio and data) among individual segments of the ICT infrastructure above the access layer
- Managing layer – management of the ICT infrastructure and management of processes providing services and applications (e-learning is one of the multimedia e-services)
- Application layer – application servers/portals where the individual services and applications provided by the NGN platform are implemented

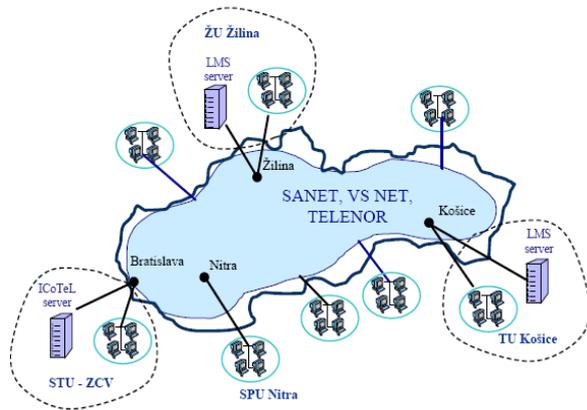
**5.3. Pilot Platform**

For the purpose of testing of Research and Development task output, a national pilot platform for e-learning was designed and realised. Its main segments based on Next Generation Networks are:

- segment platform in a node of the University of Žilina
- segment platform in a node of the Telecommunication Department of Slovak University of Technology in Bratislava
- segment platform in a node of Technical University of Košice

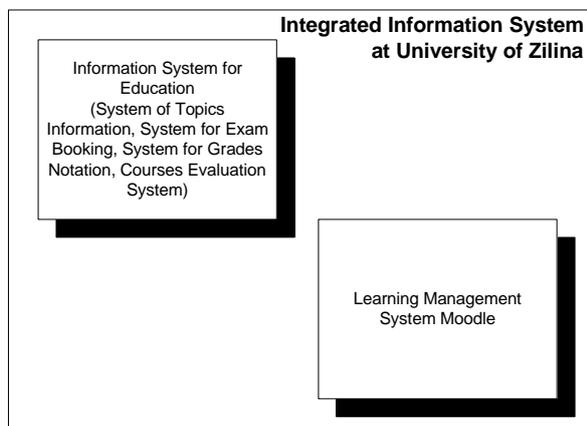
A part of this pilot platform is composed by the platforms for e-learning: chosen group of universities which took part in the process of testing of the pilot courses and the pilot platform.

The network infrastructure on the level of the transport layer is realised on the base of the network SANET (see Fig.1).



**Fig. 1** Pilot platform

The integrated e-education systems supporting e-learning at the University of Zilina can be shown as an example. The integration of LMS Moodle system and Information system for education is its main feature. In the information system are accessible all dates needed as support for administration of education e.g. information about students, study groups, curriculums, students chosen subjects in semester, dates about teachers, study plans, study timetables e.t.c.. The principle of integration is on Fig. 2 and published in [7].



**Fig. 2** Integrated e-Education System Principle

Segment at the University of Zilina was created on the process analyse done with strong collaboration within all actors involved in university education (university

management, faculties management, academic staff represented by experts in ICT and education). The technical solution of the integrated e-education system is on Fig. 3.

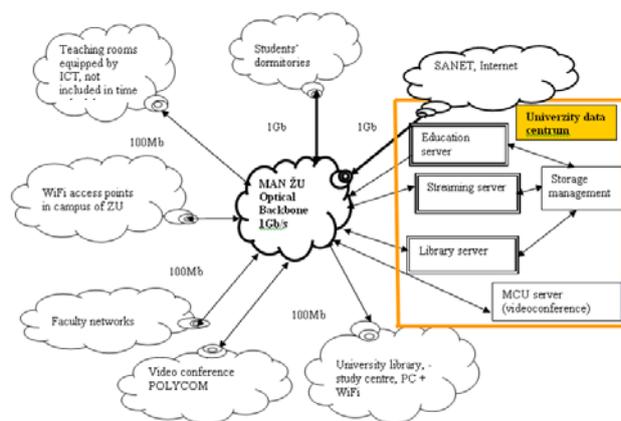


Fig. 3 University of Žilina segment of e-education system

Segments at the University of Technology in Kosice and segment at the Department of Telecommunications Slovak University of Technology are fully described in many separated articles.

## 6. RESULTS

The task of the state program of research and development „Utilisation of ICT technologies and network platforms of the new generation in education“, which was solved by the University of Žilina in cooperation with the cooperation organizations within the State program *Information society building*, was focused on the new generation of convergent networks and NGN (Next Generation Networks) application in e-learning and e-cooperation.

The main objective of this project of research and development was to support the process of complex and effective new generation of information and communication technologies utilisation (convergent technologies and NGN) mainly in the e-learning in all education levels (elementary schools, secondary schools, universities, lifelong education and self-education) on the basis of face to face form, distance form as well as their combination in education (blended learning).

Many recommendations from the project were addressed to the Slovak Ministry of education.

## 7. CONCLUSIONS

In the article was presented approach for effective implementation of ICT in education. New education demand given by strong development of information society has new requirements for forms and content of education. Both main requirements can be carrying out by process analyses and syntheses in the different phases of e-learning system implementation. As a basic for our implementation methodology we applied the three partial system, which consist on a transposition of general parts of strategy, tactics and activation to the problem solution. In case of e-learning creation it goes through a strategy

and goals specification on the ground the e-learning system implementation, application of the transformation principles necessary for the implementation, realisation of the e-learning system according to the implementation plan and e-learning system operation. We consider it as the best approach for development of e-learning system. In this case three pilot platforms were implemented at the universities (STU Bratislava, TU Kosice and University of Zilina).

## ACKNOWLEDGMENTS

The authors would like to thanks all research workers participating in the state program project represented by 11 participating institutions. Special thanks would to give Ministry of education Slovak republic for financing of this research work. It has created possibility to integrate experts from different universities and different field of education and information and communication technologies.

## REFERENCES

- [1] [http://en.wikipedia.org/wiki/Instructional\\_technology](http://en.wikipedia.org/wiki/Instructional_technology)
- [2] Papeš, Z., Research of structural formalisation of management system, VÚEPE Prag, 1976.
- [3] Drozdová, M.: NewBusiness Model of Educational Institutions, *Ekonomie + Management*, 1/2008, ISSN 1212-3609
- [4] Drozdová, M. – Dado, M.: Innovation in Education Involves Quality Systems Implementation at Universities, *ICETA 2007 Proceedings*, Elfa Košice, ISBN 978-80-8086-061-5
- [5] Using of ICT and new generation networks platform in the education, *Research target of the government issue program No 2003 SP 20 028 01 04*, 2006.
- [6] ETSI TISPAN NGN SPECIFICATIONS, <http://www.tech-invite.com/ti-tispan-standards.html>
- [7] Drozdová, M. – Dado, M.: Integrated e-Education System Design, *Current Developments in Technology Assisted Education, Vol.I*, FORMATEX, Badajoz, Spain, 2006, ISBN 84-690-2471-X

Received July 2, 2008, accepted November 28, 2008

## BIOGRAPHIES

**Matilda Drozdová** is associated Professor at the University of Zilina, Faculty of Management Science and Informatics, Department of Information Network. Since 1990, she has been working in the area of communication networks and information services. Currently, her research is oriented to the implementation of information & communication services to the real life. She has worked on several European and national projects

**Milan Dado** is full Professor and head of the Department of Telecommunication at the University of Zilina. He was active in the management of the international projects e.g.

3 projects in TEMPUS program, 4 actions in COST program, 2 projects in LEONARDO DA VINCI program and European University Association project in quality culture in research management. At the present he manages participation in two 6.FP programs and national projects in area of intelligent transportation systems and e-learning. He is active in the technology and knowledge transfer and is involved in the preparation of new activities for the regional innovation strategy.

**Pavol Podhradský** is full Professor at the Department of Telecommunications of the Faculty of Electrical

Engineering and Information Technology, Slovak University of Technology in Bratislava. His research orientation is to Theory of communication systems, Intelligent networks, Network architectures and protocols, Multimedia services, as well as application of ICT in e-learning. He coordinated 4 TEMPUS projects, 5 LEONARDO DA VINCI projects (as coordinator, or local coordinator). He participated in 3 COST projects, 2 state research and development projects (as the deputy head) and several projects focused on lifelong learning. He is active in the implementation of converged network technologies and NGN in the ICT infrastructure.