United Nations
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UNESCO Institute
for Information Technologies
in Education

UNESCO Moscow Office
for Armenia, Azerbaijan, Belarus,
the Republic of Moldova and the Russian Federation

ICT in Teacher Education:

Policy, Open Educational Resources and Partnership

Proceedings

IITE - 2010

15-16 November • St. Petersburg • Russia

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The book of Proceedings includes the papers presented at the International Conference "ICT in Teacher Education: Policy, Open Educational Resources and Partnership" held on 15–16 November 2010 in St. Petersburg, Russia, by the UNESCO Institute for Information Technologies in Education and the UNESCO Moscow Office in cooperation with the Herzen State Pedagogical University of Russia, St. Petersburg State University of Aerospace Instrumentation, State University of Information Technologies, Mechanics and Optics, and with support of CISCO.

The authors of the papers are responsible for the choice and presentation of the facts contained in this book and for the opinions expressed therein, which are not necessarily those of UNESCO.

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Foreword

The UNESCO Institute for Information Technologies in Education (IITE) was established by the General Conference of UNESCO in 1997 as the Organization's unique focal point for the promotion of information and communication technologies (ICT) in education. Since then the Institute's prime objective has been to assist UNESCO Member States in support to policy making and national capacity building in regard to the effective ICT integration into educational systems and teaching processes. The Institute endeavors to narrow the digital knowledge divide through enabling access to information, fostering scientific research, sharing educational practices and facilitating self-education, in order to provide equal access to life-long learning for all and to ensure social inclusion of vulnerable groups of population.

The International Conference IITE-2010 "ICT in Teacher Education: Policy, Open Educational Resources and Partnership" was organized by the UNESCO IITE and the UNESCO Moscow Office in close cooperation with the Herzen State Pedagogical University of Russia, St. Petersburg State University of Aerospace Instrumentation, State University of Information Technologies, Mechanics and Optics, and with support of CISCO. The Conference took place on 15–16 November 2010 in St. Petersburg, Russian Federation. Over 120 participants from more than 20 countries attended the event. It became an intellectual platform for open dialogue between policy makers, teachers, practitioners, experts from public and private sectors, and representatives of educational, scientific and professional institutions and organizations.

The Conference pursued the following major goals: to introduce and disseminate the best practices in ICT application in teachers education, discuss the main problems in ICT use in education, determine the next steps to be made to build the united informational and educational environment for ICT-based teachers' education and professional development of the new generation of teachers in the Knowledge Society. The quality of teachers, their professional improvement and training continue to be central to the provision of quality education. Application of ICT, e-Learning and m-Learning, global informational and educational resources should contribute to the improvement of the current situation in education.

The Conference covered the topics related to the main dimensions of the UNESCO IITE activities: policy advocacy, research, capacity development, knowledge sharing and partnership.

The implementation of strategies and programmes aimed at ICT penetration in teacher training is an important step towards the networked Knowledge Society. Special attention was devoted to the integration of e-Learning into training process, application of digital tools, and development of teacher competences with the use of ICT.

Stronger collaboration was called for between IITE, UNESCO Chairs and UNESCO Associated Schools. The participants shared their visions of the opportunities of establishing a fully-fledged network of UNESCO Chairs and recommended to intensify cooperation on the issues of ICT use and distant education.

The potential of application of emerging technologies in education was debated by the representatives of leading IT companies. The key trends and prospects of future partnership between IT companies and UNESCO IITE were outlined. The parties agreed to work together on the projects oriented to the introduction of innovative technologies into educational settings.

One of the Conference sessions was devoted to open educational resources (OER) and open education practices. The importance of OER – teaching and learning materials provided for non-commercial purposes openly and free of charge – has been frequently emphasized by UNESCO.

The Conference Resolution summarized the Conference outcomes. It contains key recommendations on improvement of teachers' training and development of ICT application in education, IT-literacy and OER dissemination, partnerships between IITE, leading IT companies, UNESCO ASPnet Schools and UNESCO Chairs working on distance learning and ICT in education.

I would like to express my gratitude to the participants and sponsors of the International Conference IITE-2010 for their contribution. UNESCO recognizes education as a fundamental human right. In the rapidly developing world basic prerequisites for the Knowledge Society are the freedom of expression, quality education with the use of modern technologies, open access to information and respect for cultural and linguistic diversity. I believe that the Conference gave a new impetus to UNESCO IITE efforts in fostering ICT-enhanced learning.

Dendev Badarch
UNESCO IITE Director a.i.

PLENARY SESSION I

Teacher Development Policies and Programmes Integrating ICT and ODL

Digital Natives in a Knowledge Society: New Challenges for Education and for Teachers

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Knowledge, education and learning are strongly linked with society and its evolution. One cannot teach or learn nowadays the same way as a century ago. More particularly, the quick and deep changes brought by ICT (Information and Communication Technologies) have a strong influence on knowledge, teaching, learning. But pupils themselves are changing and evolving decade after decade. And education must permanently adapt to the new generations of pupils. In terms of information, communication, computers, and technology, youngsters have new abilities, new approaches, new concepts. Certainly education has to take this into account, particularly at a time when pupils seem to be more competent than teachers in technological abilities! But the new generation of today and tomorrow cannot be described only through technology. We have to take into account other parameters.

Let us remember that there were many evolutions in the past generations. Just after the World Wars, the 'baby-boom' generation was the generation of fun, consumption, and social achievement, in the context of reconstruction and economical development. Everyone was intended to find a place in society. Of course, all expectations and hopes were not met! Then came what some people call the 'generation X' (1960–1989), which lived between the decline of the colonial Empires and the Fall of the Berlin Wall. This generation was confronted to the economical crisis and the increase in unemployment. Deep moral transformations occurred. It is also a generation for which individualism was developing. The balance between professional life and private life became more and more important. And of course it was the generation of the technological revolution (the 'TV generation').

The generation of today is often called the 'generation Y'. It is the generation of digital natives. Digital activity is like a mother tongue for them. We

consider it mostly as the generation of the technological acceleration, of the Internet and its networks. But we must have in mind that this generation has many other features, which are important. It is the generation of massive unemployment, the generation marked by globalization. The moral transformations of the sixties are now accepted and integrated by the majority. The 'generation Y' did not know the World without AIDS. The issues of ecological awareness, of the future of the planet are among strong concerns for them. It is also the generation of growing independence and a certain future insecurity. And the ephemeral has become the major concept. The 'generation Y' has now reached the adult age, and they start being employed. This brings huge changes in companies: a new relationship to hierarchy, to time constraints, to processes, to control; a new vision of task sharing; distance working; multitasking, etc. And this generation has a strong need to give a meaning to what they do.

In terms of technology, the 'generation Y' has a lot of new and impressive competences. Plenty of them have a kind of intuitive mastery of informatics and computers, of electronic devices, of mobile equipment. They don't need to read the user manual, and they don't ask for lessons how to use a computer (only teachers ask for such courses!). The way they play videogames and electronic games from their early childhood, the way they write 'sms' involve specific abilities. This generation is the generation of 'Web 2.0': interactivity, community, communication, collaboration. This gives them a new vision of time and space: I can communicate with any person, at any time, in any place, I can access lots of information. Permanent accessibility to people is now considered as normal. Immediacy and mobility are two keywords of this generation. They are used to a multiplicity of communication modes, they are permanently connected, even over-connected, in a kind of digital hyperactivity. Multitasking makes it difficult for them to concentrate on one activity for a long time.

Digital natives are facing three major challenges: new knowledge, networks, collective intelligence.

New knowledge

No longer traditional and well-established knowledge is enough to understand the world and to address the major problems of our societies. Basic knowledge of the 'generation Y' cannot be reduced to 'read, write, count', knowledge cannot be reduced to the addition of traditional school subjects. There is a tremendous accumulation of knowledge, and knowledge is getting more complex. For instance, a French philosopher, Edgar Morin, in his book *Seven Complex Lessons in Education for the Future* proposed seven new forms of knowledge to be taught in order to meet the needs of our century:

1. Detecting error and illusion: teach the weaknesses of knowledge – what is human knowledge?

2. The principles of pertinent knowledge: consider the objects of knowledge in their context, in their complexity, in their whole.
3. Teaching the human condition: the unity and the complexity of human nature.
4. Earth identity: teach the history of the planetary era, teach the solidarity between all parts of the world.
5. Confronting uncertainties: teach the uncertainties in physics, biology, history, etc.
6. Understanding each other: teach mutual understanding between human beings; and teach what misunderstanding is.
7. Ethics for the human genre: teach the ethics of humanity preparing citizens of the world.

In addition to this more transverse and complex approach of knowledge, the new generation has to face the fact that school knowledge is no longer the only one, that school is not the only place to access knowledge. Social knowledge as informal knowledge is more and more important. And knowledge is linked with competences. Jacques Delors in his *Learning: the Treasure Within* proposed four 'pillars' for education:

- Learning to know
- Learning to do
- Learning to live together
- Learning to be

One often speaks about the 'Information society' or the 'digital society'. Actually, UNESCO proposes to speak about 'knowledge societies', in order to take into account the human dimension of the new trends and context. And in a knowledge society, knowledge has become an economical good that one can buy, sell, store, exchange, etc. For digital natives, knowledge is not exactly what it was for the previous generations!

Networks

We were traditionally used to hierarchical and pyramidal structures in our organizations and in our way of behaving. Societies, companies, and institutions have hierarchical organizational charts; information can be traditionally found through catalogues, directories, tables of content, alphabetical lists, etc. In such organizations, there is usually only one way to access a person or to access information. But ICT, and particularly the Internet, bring a totally different organization, which leads to new ways of processing and thinking. Networks are everywhere! A network can be defined as a set of points (pieces of information, persons, web pages, etc.) linked by edges or

segments (direct access, 'click' of the mouse, connection, etc.). In a network, we find totally different hierarchies. One can access a point through different ways, one can access directly people one could access before only according to the traditional hierarchy; one can permanently enrich the network by new points and new connections. 'Network thinking' is now common, and this is a new challenge for digital natives. Networks are constantly enriching (for instance, moving from the 'Web 1.0' to the 'Web 2.0', and so on). Thinking in terms of networks changes profoundly the vision of the world, the vision of human relationships. Almost everyone is now a member of many networks. 'Cloud computing', one of the recent developments in informatics, has clearly been made possible by networks.

Collective intelligence

We were mainly thinking in terms of individual competences, individual intelligence, individual memory, individual achievement, etc. Networking and collaboration by the means of ICT now make new ways of co-operating possible and develop new concepts at a collective level. Collective intelligence is the major one. Collective intelligence is not only gathering of individual intelligences in a group. It involves a kind of 'added value', a form of intelligence which cannot be reached at the individual level. Just as a simple example, think of what ants can do. Individually, they seem to be very limited animals. But collectively, they become able to achieve very complex and difficult tasks, such as regulating the temperature of their anthill, finding the shortest way from one point to a distant one, carrying heavy loads, etc. And they don't do it according to a hierarchical organization. Each of them, through pheromone exchanges with the environment, enters a kind of communication which makes such complex activities possible. One can imagine that networking may enable human beings to such collective abilities, going much further than the traditional task sharing. The networked society needs and reinforces the collective intelligence. The 'generation Y', the digital natives, are invited to take part in this collective intelligence. ICT make it possible to move towards a global network of collective intelligence. This is a great challenge!

Under such challenges, learning in the digital society takes new forms and opens new ways. Learning in the global network of collective intelligence is not learning traditional knowledge by the means of traditional pedagogy. Since knowledge is not any longer only in schools, in textbooks, in the teacher's hands, digital natives – the 'generation Y' – will have to acquire both academic and social knowledge, and to be able to manage the complementarity of such knowledge. They will have to acquire not only knowledge, but also skills, abilities, competences, mixing the acquisition of formal and non-formal skills. They will have to learn all their life long, since knowledge is evolving so rapidly that no one can acquire for the rest of his/her life all necessary knowledge and competences. Lifelong

learning requires a basic competence: to be able to learn! One of the main challenges at school is to learn how to learn. Learning occurs not only in schools, sitting in a classroom with a teacher. Many new forms of learning are now offered: distance learning, e-Learning, blended learning, etc. Being able to learn at a distance, being able to learn through e-Learning is not so obvious, even if one can think that digital natives will be more ready for such learning. It is also a task for schools to prepare pupils for e-Learning. Some years ago, distance education was mainly intended for those who cannot attend a school for different reasons. But now, distance learning is necessary for all. Everyone has to be able to work at a distance, to learn at a distance.

Technology is now available for new forms of learning. But a huge effort must be made concerning pedagogy. The gap between technology and pedagogy is increasing. The tendency of school systems is just to add new technologies to traditional pedagogy, to adapt traditional courses to some new technological tools, avoiding renewal of the pedagogy, avoiding integration of ICT into education (Interactive electronic blackboards – or whiteboards – are an interesting example: they put new technologies in the classroom without disturbing the traditional pedagogy, the traditional relationship between the teacher and the pupils). Research and innovation must address and ask pedagogy: how can ICT help enriching pedagogy, changing pedagogy; how can pedagogy really take all the benefits from new technologies.

Learning in a digital society brings new challenges to schools, and since pupils will now be digital natives, schools must address these challenges. But schools are not really prepared, not really ready for digital education! Generally speaking, schools are not connected to networks. The Internet is mostly out of schools, not inside! Nowadays, digital natives use computers, ICT, the Internet mostly out of school. Moreover, there is no evidence that one learns better through ICT. Of course, we all know lots of excellent examples of successes in teaching with computers, with ICT, we all know successful experiments. We know that innovative situations, innovative resources, and innovative tools give good results and develop the pupils' motivation. But fundamentally, can we prove that pupils are studying better, that ICT are really improving learning? The 'pedagogical model' of schools does not fit with ICT: the traditional school pedagogy is mainly based on transmissive learning, on non-constructivist methods, on individual learning, individual intelligence. In opposite, ICT offer the opportunity of constructivist approaches, collaborative work, collective intelligence, and collective achievement. Schools neglect the real practices of digital youngsters. Do we know exactly what they are doing, sometimes several hours per day, with their computers? Which competences, which abilities are they practicing? Which knowledge and which competences do they access daily through their computers? How schools can take this into

account? How can schools integrate the actual practice and new competences of digital natives? This is one more challenge for schools in the digital age!

Schools must adapt pedagogy to the new pupils and to the new digital tools and resources, new knowledge, new context of networks and of collective intelligence. Schools have to transform their pedagogy, to enrich pedagogy according to the new knowledge, to the networked society, to the collaborative and collective needs of pupils. New technologies are not only to be integrated in the school: they give the opportunity for a real enrichment of pedagogy. Schools have to admit and acknowledge that they are not the only learning place. They have to integrate the new forms of knowledge, the complexity of knowledge, and the new forms of competences. They have to integrate the collective dimension. They have to integrate the world of networks. For instance, when we see how quickly and widely social networks (Facebook, Twitter, etc.) are developing, we must seriously ask the question whether schools should take this into account, integrate such social networks, experiment how one can learn through social networks. And schools have to mix presence and distance, to manage time and space for learning, to prepare pupils for lifelong e-Learning.

Schools can no longer be simply the place where learned and skillful teachers deliver their knowledge to pupils. Schools have to refocus on their fundamental missions and core values: school is the main operator of the public service of education, and therefore has to carry on and put in action the values of a public service. The school is the place for equity in access to knowledge, the place for access to knowledge for all, the place for equal chances for all pupils. Even if the school is no longer the main place for knowledge acquisition, the school is the place for the mediatization of knowledge. And knowledge acquired by different means needs to be stabilized, made coherent with a wider set of knowledge, needs to be institutionalized; this is the role of schools. The school is also the place for the socialization of children, the place to prepare the integration of each pupil in society, the place to develop citizenship. In a networked society, the school should be the central place for networking. This implies that schools themselves are networked and participate in the global networks. The school should become more collective: developing collective behavior, collective abilities, collective work, and collective intelligence. The school can be the place for the construction of a collective intelligence, in which each pupil is involved. And the school is the main entry point to lifelong learning: it has to prepare pupils for learning all their life long, to be able to learn.

Teachers are main actors of schools. They are not only knowledge transmitters, but also actors of changes in schools. Teachers have new roles, teaching is becoming a new profession! Digital native pupils will change schools!

Digital natives bring new challenges for teachers. Let us quote eight of those new challenges for teachers:

1. Teachers have to take into account the digital native generation. They have to understand the new characteristics of the 'generation Y', to be aware of their new abilities, and to respect their new relationship to knowledge.

2. Teachers have to take into account the new forms of knowledge and competences, and the missions of schools. They must be aware that knowledge is not only a list of items in a curriculum: it has complex and transverse components. They must have the knowledge to address the main questions of the next century. They must be aware of the core missions of schools in the society and of the values school has to transmit.

3. Teachers must work in networks, take part in networks, consider that their role is to develop human networks for learning. Being part of a network, being able to behave in a network, to take benefit from networking demand teachers themselves experience such networked activities.

4. Teachers must work in the framework of collective intelligence and prepare pupils for collective intelligence. This means that teachers themselves must act collectively, take part in collective missions, experience collective learning, collective intelligence, develop collaborative activities. Schools now need 'collectively intelligent teachers'.

5. Teachers have to be 'e-teachers'. This means not only to be able to use digital technologies, tools and resources, but also to change the pedagogy, to integrate ICT as technologies and, more important, as tools for pedagogical enrichment.

6. Teachers have to be 'blended teachers', mixing digital activities and non-digital ones, mixing presence and distance, dealing with time and space and all the possibilities offered by ICT in the management of time and space (distance and presence, synchronic and non-synchronic).

7. Teachers have to be 'LLL-teachers'. This means that they have to prepare their pupils for lifelong learning, mainly by making them learning how to learn, making them able to learn all their life long. This implies that teachers themselves are involved in lifelong learning. Teachers have to be lifelong learners.

8. Teachers have to be actors of the changing school in a learning society. They cannot just wait for the reforms elaborated by policy makers! They must contribute to decision making, they must be aware of their political role in the educational policy.

ICT in education are not only new tools bringing evolution and changes. They raise new fundamental paradigms, new fundamental concepts, which

change profoundly our societies, which change knowledge and access to knowledge. The digital natives will bring this new context, whatever the schools do or not. This is a new challenge for schools and for teachers. Digital natives are not only new pupils, a kind of new step in the humankind, they are the main actors of the new digital society, the new citizens of the knowledge society.

UNESCO Teacher Development Policies and Programmes Including ICT

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Nowadays the mankind is living in the conditions of transition to the Knowledge Society in which namely the knowledge will play the crucial role as a main resource of sustainable development. So, most of the current economic and social forces of the human society are mobilized around knowledge intensive fields, including education in which, despite the ubiquitous ICT intrusion, the human factor priority becomes the main feature, as only a human being is the principal carrier, generator and user of knowledge.

The dynamics of the Knowledge Society development depends on many factors, but one of the critical ones is the level of teachers competencies and their professionalism, because Teacher (to a very wide extent) is the main provider of general literacy and culture, as well as of knowledge and skills related to the key competencies of the Knowledge Society. So, one of the UNESCO major goals is to provide the global leadership on teachers, their status, professional training, management and administration and key policy issues. UNESCO teacher development policies and programmes including ICT applications are implemented in the framework of UNESCO global leadership on teachers through the initiatives on the following issues:

- Training and Management;
- Policies and Quality Assurance;
- Status and Working Conditions;
- Gender;
- HIV and AIDS;
- Advocacy;
- ICT.

The UNESCO/ILO Recommendations concerning the status of teachers provide the framework for UNESCO's support. As a good example of the region-oriented approach and activity we can consider the Teacher Training Initiative for Sub-Saharan Africa (TTISSA) a core initiative addressing key issues in the African context (see http://www.unesco.org/en/ttissa/).

At the same time, the quality of teachers and their continuing professional education and training is one of the educational key factors and remains central to the achievement of quality education. However today, the number and quality of teachers, teaching practice and teacher education are facing serious systemic challenges across the world. This is confirmed by the Education for All Global Monitoring Reports, which argue that the Education for All goals are at risk[1]. Despite the remarkable investments on teacher training and professional development, several problems related to the activities still remain acute. It is clear, that the situation must be improved at the time when the world needs an estimated 9.1 million new teachers to reach internationally agreed education targets by 2015. UNESCO believes that these challenges can be addressed through a holistic, systemic approach to education and teacher development systems in ways that also incorporate the enabling role of ICT. UNESCO facilitates and supports initiatives related to the integration of ICT in teacher education by supporting existing teacher development communities of practice, multi-stakeholder partnerships, capacity building of policy makers and the development of international standards on ICT competencies for teachers. One of the good examples of successful projects based on UNESCO initiatives for a large-scale teacher training is the Avicenna Virtual Campus in the Mediterranean, Africa and Iraq (http://avicenna.unesco.org) that currently is ready for extension to the Caucasus region of the Russian Federation and its neighbor countries. The development and implementation of UNESCO's Open Educational Resources (OER) initiatives and programmes (http://www.unesco.org/webworld/en/oer) including the creation of the Global Courseware Digital Library (GCDL) is very important both for teachers professional growth and improvement of quality education.

To increase the efficiency of the initiatives and programmes, UNESCO works on a permanent basis with its strategic partners from public and private sectors. For example, ICDE (International Council for Open and Distance Education – http://www.icde.org/) and EDEN (European Distance and E-Learning Network – http://www.eden-online.org/eden.php) have established relationship with UNESCO on a broader partnership basis. A mutual partnership document was signed by UNESCO and Nokia to use mobile technologies to further implement Education for All goals. The

[1] See: http://unesdoc.unesco.org/images/0015/001547/154743e.pdf; http://unesdoc.unesco.org/images/0017/001776/177683e.pdf; http://unesdoc.unesco.org/images/0018/001866/186606E.pdf

second part of the agreement concerns teachers. It will promote the use of mobile technologies to support training and capacity building, as well as the management of educational institutions, particularly in gathering data on staff, pupils and school facilities[1]. Microsoft, Cisco, Intel and ISTE are the main strategic partners of UNESCO on the initiative related to ICT teacher competencies "ICT-CFT" – ICT Competence Framework for Teachers[2]. APPLE became UNESCO's partner in the GCDL project.

UNESCO's significant tools in the area of information support for teachers are publications and education-information resources. The examples of the publications are as follows:

- "Regional guidelines on teacher development for pedagogy-technology integrations". This document is primarily intended for teachers and teacher educators in the Asia-Pacific region to help them integrate ICT with pedagogy in teacher education.
- "Teacher education guidelines: using open and distance learning". The guidelines set forth in this document are intended to be used by education officers in the Ministries of Education and teacher training institutions oriented to expanding teacher education through open and distance learning.
- "Internet in education: support materials for educators". This set of support materials is destined to educators who ensure teaching and learning through Internet resources and facilities either in traditional or distance forms.

To find samples of UNESCO's useful Internet resources, it is good to refer to the ICT in Education section[3] which rearranges information on ICT in education including teacher training, and to Teacher Education section which contains interesting web-pages on ICT application in teacher training (http://www.unesco.org/new/index.php?id=36943).

Other relevant resources are:

- Education (http://www.unesco.org/en/education);
- Themes (http://www.unesco.org/en/education/themes-ed);
- Education for All International Coordination (http://www.unesco.org/en/efa/);

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[1] See: http://www.unesco.org/new/en/media-services/single-view/news/unesco_and_nokia_sign_partnership_to_ use_mobile_ technologies_to_further_goals_of_education_for_all/

[2] See: http://portal.unesco.org/ci/en/ev.php-URL_ID=22997&URL_DO=DO_TOPIC&URL_SECTION=201.html

[3] See: http://portal.unesco.org/ci/en/ev.php-URL_ID=2929&URL_DO=DO_TOPIC&URL_SECTION=201.html

- Worldwide (http://www.unesco.org/en/education/worldwide/);
- UNESCO Institutes and Centres for Education (http://www.unesco.org/en/education/institutes-and-centres/);
- Networks and Communities (http://www.unesco.org/en/education/networks-and-communities/).

The UNESCO Bangkok Office website provides helpful materials about the use of ICT in education in the Asia-Pacific region and worldwide (http://www.unescobkk.org/education/ict). And of course we kindly welcome you to the UNESCO Institute for Information Technologies in Education (IITE) portal (http://iite.unesco.org).

As we discussed, ICT competencies are the general base for creation and development of all other key competencies of the Knowledge Society. This issue fully applies to teachers. That is why UNESCO initiated activity on the development of the UNESCO ICT Competency Framework for Teachers (ICT-CFT), which was mentioned earlier. The first stage of this work was implemented a few years ago and its main output was the elaboration of ICT Competency Standards for Teachers (ICT-CST) and corresponded resources providing the guidelines for preparing teachers to play the essential role in producing technology-capable students. The three corresponded brochures were published in several languages as well: "Competency Standards Modules", "Implementation Guidelines", and "Policy Framework"[4]. The second stage currently being implemented jointly with UNESCO strategic ICT partners (Microsoft, Cisco, Intel and ISTE) "Alignment and Deployment" is connected with the creation of the Skills Matrix for Teachers and elaboration of the corresponded syllabi and examinations requirements. The third stage is supposed to be related to the adaptation, localization, extension, application, and, possibly, certification processes.

UNESCO IITE, as the only UNESCO institution specializing exclusively in the field of ICT in education, participates in most of the initiatives, programmes and projects mentioned above. The main directions of the UNESCO IITE activities are policy and advocacy, research and capacity development, information service and knowledge management which are carried out in close cooperation with other UNESCO structures as well as in partnership with private ICT companies, classic, pedagogic and technical universities, public bodies, international and national organizations. The core activity of UNESCO IITE is to strengthen the capacity of educational workers in Member States through the implementation of education programmes and training courses of their professional development based on ICT

[4] See, accordingly: http://portal.unesco.org/ci/en/ev.php-URL_ID=25731&URL_DO=DO_TOPIC&URL_SECTION=201.html; http://portal.unesco.org/ci/en/ev.php-URL_ID=25734&URL_DO=DO_TOPIC&URL_SECTION=201.html; http://portal.unesco.org/ci/en/ev.php-URL_ID=25733&URL_DO=DO_TOPIC&URL_SECTION=201.html

application. Teachers (in a wide meaning of this term) obviously constitute the main target group of this kind of activity. The examples of the IITE projects directly oriented to teachers are described below.

"Teachers of the Arctic" project

In 2010 with the intention to support the teachers' capacity development in UNESCO Member States on ICT use in education, IITE started a flagship project "Teachers of the Arctic". The overall goal of the project is to improve the education system through modernization and support of teachers who work in the circumpolar region conditions. The project is aimed at fostering the capacity development of the Arctic region teachers through adequate teacher training and application of ICT, open, distance and mobile learning technologies and making high quality basic education more accessible for indigenous ethnic communities of the Arctic. IITE launched the project in August 2010 in close cooperation with the Ministry of Education of the Republic of Sakha (Yakutia), Russia. At the project launching conference, 100 participants and experts from five countries revised the current practices of teacher training and shared the effective approaches of using ICT in education, assessed learning achievements, impacts and progress and pointed out the needs and challenges of the teachers and schools in the Arctic region.

International Advanced Training Course/Master Programme "ICT and Teachers Professional Development"

As it is planned, under the coordination of IITE, a consortium of leading CIS pedagogical and IT universities will be established to develop and run the International Advanced Training Course/ Master Programme "ICT and HRD in Education" for pre-service and in-service teachers. IITE has provided a feasibility study on establishing the mentioned International Master Programme, as well as developed the concept and the project proposals. This ongoing project has been supported by a number of Member States. Now the first Programme Working Group meeting and training workshop are being prepared.

"Avicenna Virtual Campus-II" project

The EC/UNESCO Avicenna Virtual Campus (AVC) project was dedicated to accelerating the adoption and best use of ICT-assisted Open Distance Learning (ODL) in Member States. The project aims at establishing adequate local infrastructures and transferring best practice and professional know-how within the target universities. The objectives of the Avicenna project are:

- to accelerate the adoption and setting-up of e-Learning centres in each partner country;

- to equip the Avicenna Knowledge Centres and network them via the Internet;
- to train the staff of the Centres (administrative, pedagogical and IT officers);
- to train teachers to produce e-Learning multimedia courses which shall be used in the Internet network and Intranet satellite;
- to develop courses on a wide array of disciplines;
- to define the norms and procedures for quality control and assurance;
- to set up an Open Virtual Library of multimedia e-Learning courses in English, Arabic, French and other languages;
- to provide e-Learning sessions for teachers and students.

In the framework of this project, IITE was invited to the feasibility study mission to Vladikavkaz in September 2010 and to AVC workshop in Ankara in December 2010 in order to expand the Avicenna Virtual Campus project to the North Caucasian region of Russia and its neighbor countries (Armenia, Azerbaijan). Later several Universities of Belarus, Moldova and Ukraine expressed their interest to participate in AVC-II. There was a strong request for IITE from the UNESCO Science Sector and CIS partners to coordinate the AVC-II project development and implementation once the funding had been secured. The Project proposal for AVC-II is being currently finalized by UNESCO/SC and IITE.

Participation in UNESCO Working Group on ICT in Education

The IITE representatives are involved in the UNESCO activity on elaboration, assessment and revision of "ICT-CFT" model mentioned above.

Partnership with ICT industry, Universities, international and national public and professional bodies

Currently IITE is outlining the cooperation domains, preparing MOUs and creating the project proposals with ICT international and national brands (Microsoft, HP, Cisco, Intel, BitMedia, Oracle, IBM, LANIT Academy of Networking, IT-Academy, Informika, Galaktika, Kaspersky Laboratory, etc.) as well as with international and national professional associations. The main fields of cooperation are:

- Development and implementation of joint training courses including those for teachers;
- Joint creation of content for e-Learning/distant education including the specialized one for teachers and trainers;

- Development and exchange of OER including the special ones for teachers and trainers;
- Establishment of joint training centres in Russia and CIS including those for teachers;
- Participation in international and national educational and scientific-research projects and programmes;
- Joint analytical reports and publications.

Besides, a number of teachers-oriented initiatives, events and projects are planned by IITE in the framework of its main directions of activity in the areas of research and consultancy, policy and advocacy, capacity development and OER, conferences and workshops organization, publications and support of the IITE information-educational portal.

UNESCO IITE welcomes proposals for collaboration in teacher education with the application of ICT.

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Teacher Development Policies and Programmes

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The objective of this paper is to review the current situation on teacher development in five countries (Armenia, Azerbaijan, Belarus, the Republic of Moldova and the Russian Federation). The main tasks are: to briefly outline the assignment; to summarize some pre-primary, primary and secondary education statistics from the five countries to be involved in the study; to provide a brief review of general policy directions in teacher development; and to review a questionnaire to be distributed to the five countries and a report they will be asked to provide.

The assignment

Five countries (Armenia, Azerbaijan, Belarus, the Republic of Moldova and the Russian Federation) will be asked to provide information for a review of teacher development policies and experiences. The review will

be designed to suggest policies and strategic actions for teacher recruitment, development and retention, use of ICT in teacher education, open and distance learning strategies. An initial review will be prepared based upon the questionnaires submitted to the UNESCO Moscow Office in early December 2010, and the written review – by the end of December 2010. An initial report will be prepared in January 2011 and the final report – in early February 2011.

Overview of data from the five countries

Recent UNESCO data from the five counties to be involved in the study is presented in my report and I will highlight the following points :

- Pre-primary entry age is consistent among each of the five countries at 3 years old with a duration of 3 or 4 years. There is a wide variation in enrollment as would be expected. Gross and net enrollment increased in all the countries between 1999 and 2008 with Belarus having the best results. Gross enrollment is still quite low in Armenia and Azerbaijan. The majority of teaching staff are trained in the three countries reporting. Pupil/teacher ratio is appropriately low.

- Regarding primary education: entry age is 6 or 7 with duration of 4 years in most countries. Enrollment data was not available for Armenia and the Russian Federation. Gross enrollment and net enrollment are relatively high in the countries reporting. Net enrollment was lower in 2008 in the Republic of Moldova. All teachers have been trained in the two countries reporting. Pupil/teacher ratios are low by international standards (30 to 35 pupils per teacher).

- In secondary education entry age is 10 or 11 with a consistent duration of 7 years. In most countries gross enrollment is higher in lower secondary education than in both lower and upper secondary as would be expected, with Azerbaijan being exception. No data is available on percent of teaching staff trained. Pupil/teacher ratio is quite low (international standard 20 to 25 for secondary education). Upper secondary graduation rate is low in the Republic of Moldova and in the Russian Federation.

The overview of the situation on teachers includes: school age population, teacher needs to 2015, absolute change in teacher stock, average annual growth rate needed, and projected total teacher need in 2015:

- Teacher recruitment needs: varied from 5,289 in Armenia to 258,141 in the Russian Federation. (Teacher need is calculated on the current stock of teachers today, added to the flow of additional teachers needed to replace those who leave the profession (attrition) in addition to the additional teachers needed to meet the demand of an

increasing pupil population, while maintaining current standards of pupil/teacher ratios.)

- Absolute change in teacher stock is mixed in the five countries. (The total change in stock is defined as the difference between the base year and the stock to be reached in 2015.)
- Average annual growth needed. (It is calculated as a geometric growth rate for the period between the year with the latest data available and 2015.)
- Total teacher recruitment need is based on a 5% attrition rate.

Issues in teacher development

Opinions on the key issues regarding teacher development vary somewhat, but there is general agreement on the three presented by Professor Bob Moon in 2007. They are:

- Teacher supply and retention;
- Teacher education reform;
- Supporting innovations in pre-service and continuing education.

Among these innovations are:

- Development of standards and competencies for teachers and head teachers as well as institutional standards. In many instances these standards are tied to pay scales and/or rewards;
- Strengthening of open and distance learning as the need for teachers increases;
- Training teachers in more active, child-centered teaching approaches;
- Placing more emphasis on formative classroom assessment and providing feedback to individual students.

The OECD has expressed a number of concerns about the status of teacher development. They include:

Concerns about the attractiveness of teaching as a career:

- Concerns about maintaining an adequate supply of good quality teachers, especially in high-demand subject areas;
- Long-term trends in the composition of the teaching workforce, e.g. fewer 'high achievers' and fewer males;
- Concerns about the image and status of teaching, and teachers often feel that their work is undervalued;
- Teachers' relative salaries are declining in most countries.

Concerns about developing teachers' knowledge and skills:

- Almost all countries report concerns about 'qualitative' shortfalls: whether enough teachers have the knowledge and skills to meet school needs;
- There are major concerns about the limited connections between teacher education, teachers' professional development, and school needs;
- Many countries lack systemic induction programmes for beginning teachers.

Concerns about recruiting, selecting and employing teachers:

- There are concerns in most countries about the inequitable distribution of teachers among schools, and whether students in disadvantaged areas have the quality teachers that they need;
- Schools often have little direct involvement in teacher appointments;
- Some countries have a large oversupply of qualified teachers, which raises other policy challenges.

Concerns about retaining effective teachers in schools:

- Some countries experience high rates of teacher attrition, especially among new teachers;
- Teachers express concerns about the effects of heavy workloads, stress and poor working environments on job satisfaction and teaching effectiveness;
- There are only limited means in most countries to recognize and reward teachers' work;
- Processes for responding to ineffective teaching are often cumbersome and slow.

Innovative programmes

The examples of innovative programmes include:

- A programme in England, where schools are provided funding to recruit untrained teachers as long as they provide an education and training programme for them;
- A school-based training programme using ICT and distance education for teachers being implemented in the U.S. state of California;
- A classroom activity-based distance education programme for teachers in South Africa. The activities were designed to copy the concept and style of teaching to be used in the classroom. The use of mobile

communications systems such as handheld computers and mobile phones to develop teaching skills in Egypt and South Africa.

Policy implications

Some of the policy implications of these and other experiences would include the following:

- Making the diverse needs of students a component of teacher preparation;
- Simplifying and facilitating hiring practices for teachers targeting hard-to-staff schools;
- Encouraging new teachers to participate in induction and mentoring programmes;
- Encouraging learning communities among teachers and students in schools;
- Professional development programmes centered upon standards of teaching and better pay for improved student achievement;
- Incentives to attract a more diverse teacher force in areas of teacher shortage.

The European Commission has prepared recommendations on teacher development policy that include a set of principles for teacher competencies and qualifications. They are:

– All teachers must graduate from a higher education institution;

– Vocational teachers must be highly qualified in their professional area;

– Teacher education should be provided in all levels of higher education bachelor, masters and doctorate programmes;

– Research and evidence-based teaching practices should be promoted.

Other recommendations include viewing teaching as a continuum involving initial teacher education and continuing professional development by:

– providing sufficiently resourced lifelong learning opportunities for teachers in both subject-based and pedagogical areas; and

– interdisciplinary and collaborative approaches in teacher education.

As well as encouraging mobility of teachers by:

– promoting mobility projects for teachers;

– ensuring teachers have experience with European cooperation so that they value cultural diversity;

- providing opportunities to study other European languages during initial and continuing teacher development;
- transparency of teacher qualifications within Europe for mutual recognition and mobility of teachers; and
- encouraging partnerships between stakeholders and higher education institutions.

Recommendations from the OECD include:

Making teaching an attractive career choice by:

- Improving the image and status of teaching;
- Improving teaching's salary competitiveness;
- Improving employment conditions;
- Capitalizing on an oversupply of teachers.

Making reward mechanisms more flexible improving entrance conditions for new teachers by:

- Developing teacher profiles;
- Viewing teacher development as a continuum;
- Making teacher education more flexible and responsive;
- Accrediting teacher education programmes;
- Integrating professional development throughout the career.

Recruiting, selecting and employing teachers through:

- Using more flexible forms of employment;
- Providing schools with more responsibility for teacher personnel management;
- Meeting short-term staffing needs;
- Improving information flows and the monitoring of the teacher labor market.

Retaining effective teachers in schools by:

- Evaluating and rewarding effective teaching;
- Providing more opportunities for career variety and diversification;
- Improving leadership and school climate;
- Improving working conditions.

ICT in teacher development

In a policy paper regarding ICT and teacher development the European Trade Union Committee for Education in 2008 noted a lack of computer skills among youth and adults of the EU and emphasized the importance of ICT in education.

With regard to policy implications of ICT for teacher development, a guiding philosophy for integrating ICT into teaching was suggested by the former UNESCO Assistant Director-General for Education.

It involves:

Avoiding bias toward technology and realizing technology will never replace the teacher:

- Interaction will remain critical for education;
- Technology must be integrated with pedagogy;
- Exposing hollow or loose thinking about technology;
- Evidence-based policy making must be encouraged, that considers national or location based ICT applications in education. For example, ICT may not be practical in communities with no electricity.

Taking a broader view of ICT that involves people and social systems:

- ICT mean much more than the Internet and the Internet will not render obsolete all preceding technologies. Technology always involves people and their social systems;
- Various forms of ICT (books, films, radio, television, programmed learning) should be designed and applied.

Seeking a balance between better teaching and better learning:

- Technology should be used to create a good learning environment for the student, not simply to enhance the skills of the teacher. "It is more effective to concentrate on improving access to learning, improving its quality and decreasing its cost";
- Students can learn many ICT skills on their own with minimal help from teachers. Learning pedagogical skills for using ICT for improving teaching is more important for teachers than concentrating on technical skills.

For policy makers and institutional heads developing leadership in using technology for educational purposes is essential to support effective ICT use by teachers. Therefore a priority has to be given to teacher training and professional development in the use of ICT.

Information collection on teacher development policies and programmes

The purpose of the paper is to provide some background to lead into our request for assistance from the five countries – Armenia, Azerbaijan, Belarus, the Republic of Moldova, and the Russian Federation, in preparing a report on teacher development in the region with special attention to ICT and open and distance learning.

The first section on the questionnaire asks if there is a teacher development policy in the country that supports certain types of teacher training, and if so, what level of priority it has – low, medium or high priority.

The approaches include:

1. Early childhood education;
2. Child friendly learning techniques;
3. Child friendly learning environments;

As well as:

4. Formative classroom assessment;
5. Summative classroom assessment;
6. Open or distance learning;
7. ICT in primary education;
8. ICT in secondary education;
9. In-service training for pre-primary teachers;
10. In-service training for primary teachers;
11. In-service training for secondary teachers;
12. In-service training for pre-primary school heads;
13. In-service training for primary school heads;
14. In-service training for secondary school heads;
15. Other.

A request is made in section 2 to describe the teacher development activities or programmes currently underway. This includes the name of the activity, its objectives, target group or groups, duration (from year start to year finish), sponsoring agencies.

Basic data on schools, students and teachers from 2005 to 2009 in government schools is requested in section 3 of the questionnaire. This example is

for pre-primary schools – the number of teachers that have been provided with pre- and in-service training in these schools.

The level of importance of various types of teacher education for pre-primary, primary and secondary teachers should be identified in section 4. This section also asks for the types of training being provided for pre-primary, primary and secondary teachers. The final section asks for information on institutions providing training for pre-primary, primary and secondary teachers. This includes the name of the institutions, number of instructors, type of training provided (in-service, pre-service or both) and number of teacher trained between 2005 and 2009.

We are requesting that the questionnaire be complete by 8 December 2010 (three weeks). We are also requesting that each of the five countries prepare a report on teacher development. The report would have five sections:

1. The Country Context and Challenges for National Development;
2. The Public and Private School System;
3. Teacher Development Policies and Programmes;
4. ICT and Distance Learning Strategies for Teaching and Teacher Development;
5. Critical Issues for Future Development of Teachers.

The first chapter outlines the country context and challenges. Demographic, political, economic and social challenges over the last 20 years should be summarized. Development priorities of the country should be outlined and the way education is to support these development priorities should be given.

In the second chapter the structure of the education system and the number of students and teachers in both public and private schools should be presented. Public and private support for education and trends in public education financing should be described. The role of parents and communities in school decision making, their attitude toward teachers, and the role and power of teacher unions should be described.

In section 3 political, social and economic challenges that are having an impact on schools and teachers should be described. This would include highlighting population and labor market trends.

Teacher development policies that are currently designed to address the country's social and economic challenges should be outlined. The systems for teacher employment and selection by schools, teacher evaluation, promotion, retirement and dismissal should be described.

Also in section 3 pre-service and in-service training programmes for teachers at pre-primary, primary and secondary education levels should be

described. This would include number and types of institutions, number of faculty, facilities and equipment provision. Current teacher development programmes that are underway should be summarized. This would include main objectives, target groups, implementing agencies, and progress made.

In section four, the level of ICT usage in schools at each level (i.e. audio/visual aids, radio, TV, computers, Internet connectivity) will be described, as well as the current types of training provided to teachers in the use of ICT in schools and the types of additional training that should be provided if possible. It would be proposed to describe any distance learning programmes for training of teachers currently underway. This would include type of programme, target group, number of faculty/trainers, delivery systems, and number of trainees over the last five years.

In the last section the major teacher development policy concerns to be addressed in the near future will be identified. The most critical areas for improvement in teacher development in one of the countries will be described. Any initiatives underway or proposed for retaining effective teachers should be outlined. The most realistic and effective improvements to be made for improved teacher development in the future should be offered. It should also be identified what role UNESCO can play in supporting these improvements.

Features of Development of the Information and Education Environment in the Republic of Belarus

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In the XXI century information and communication technologies have become a key factor that determines social development. The informatization of public administration, economic and social sphere, public and personal life of people is the necessary condition, the fulfillment of which makes it possible for any country to claim a decent position in the modern information civilization. The success on this path depends primarily on the national intellectual potential, the effectiveness of the national education system and its ability to adequately meet modern challenges of our information age.

Today, our national education system is carrying out a focused and time-phased modernization, preserving all the best that has been amassed over decades.

The main objective of this work is to achieve improvements in quality of education and provision of its accessibility by means of introduction of new educational technologies and the optimal functioning of educational institutions.

The main instrument of effective modernization of the national education system consists in the large-scale introduction of information and communication technologies into the educational practice, development of already existing educational approaches and models on this basis, and generation of new ones.

The above mentioned priorities are outlined in the Programme 'Complex Informatization of the Education System in the Republic of Belarus 2007-2010' (ratified by Order № 265 of the Council of Ministers of the Republic of Belarus on 1 March 2007), which is set to end this year. The Programme coordinator is the Ministry of Education of the Republic of Belarus.

The Programme objective consists in improving of education quality by means of creation of a modern information and education environment and wide use of information and communication technologies in educational practice.

The Programme is being realized in the following directions:

- Development and introduction of national information and education resources, electronic means of education and branch automated education management systems;
- Integration of educational institutions and state educational authorities into a unified branch information environment;
- Provision of educational institutions and state educational authorities with computing equipment, office mechanization facilities and software;
- Development of systems of training, further training and retraining of specialists of the education system in the area of information and communication technologies;
- Regulatory support of the education informatization;
- Scientific and teaching-methodological support of the education informatisation.

The total expenditures for the Programme implementation out of financing sources measured in 2006 USD are 35,700,000.

The details of the specific results of the 'Complex Informatization of the Education System in the Republic of Belarus 2007–2010' Programme realization are:

1. Development and introduction of national information and education resources

The 'Complex Informatization of the Education System in the Republic of Belarus 2007–2010' Programme brings to the forefront comprehensive questions of education informatization concerning the development of information and education resources. National information and education resources should be of help for all participants of the educational process in the Republic of Belarus.

According to the Programme, the total amount of finance allocated to the development of electronic learning-methodological complexes for institutions of higher education is $1,194,000.

2. Integration of educational institutions into a unified information environment

The strategic objective of education informatization consists in creation of a common education space.

In the education system there is a number of nets that provide educational institutions with access to the Internet. First of all, it is the UNIBEL net of the Ministry of Education and the net of the 'Centre of Information Resources and Communications' of a BSU branch. BASNET, the net of the National Academy of Sciences of Belarus, is the headmost scientific computer net in the Republic of Belarus.

Educational institutions connected to these nets get high-quality and low-priced Internet services as well as high-speed access to national information and education resources. The use of distant education is now gathering pace. Nearly all institutions of higher education are involved in this work; steps are being taken to introduce elements of distant education into general education schools.

Today, in the Republic of Belarus there are four institutions of higher education where it is possible to get higher education distantly:

- the Belarusian State University of Informatics and Radioelectronics;
- the Belarus State Economic University;
- the Belarusian National Technical University;
- the Academy of Public Administration under the aegis of the President of the Republic of Belarus.

Supporting this form of education in general, the Ministry of Education of the Republic of Belarus does not aim at speeding up processes in this direction, stressing the questions of the quality of educational services.

3. Providing educational institutions and state educational authorities with computing equipment, office mechanization facilities and software

In the framework of the Programme implementation, 1213 computer classrooms, 3443 hardware complexes, 1056 projection equipment sets, 8133 packages of license system and application software were supplied to secondary schools.

While in preceding years the acquisition of made-up software was the priority, recently the emphasis has been placed on in-house development of new software with the focus being put on development of programme-methodological complexes that represent a set of educational software, specifically organized digital training material and methodological materials on their application.

4. Development of systems of training, further training and retraining of specialists on ICT in education

The recognition of the importance of ICT use in education conforms with the attention paid to ICT training of teachers.

In this direction the Programme activities included:

- training of regional IT-tutors (846 tutors were trained versus 800 planned);
- further training of computer science teachers (1508 got further training, which is three times more than planned);
- development of training materials for further training of education specialists;
- development of the system in the field of ICT (5 new sets of training materials were developed);
- organizing and carrying out of testing for specialists of the education system as qualified users of information technologies (3831 specialists passed the testing versus 3000 planned).

It seems appropriate that every teacher claiming for the highest qualification category should have a certificate of the qualified IT user.

5. Scientific and teaching-methodological support of the education informatization

As a part of the Programme, a number of steps for scientific and teaching-methodological support of processes of education informatization were taken. In 2009–2010 the SMI 'National Institute of Education' prepared 178 breadboard models of electronic components of the new generation teaching-methodological complexes.

We also should note the high performance of the Belarusian pupils in international Olympiads and academic competitions. During the last four years (2006–2009) 14 of 16 participants of international Olympiads became medalists – among them 6 gold, 6 silver and 2 bronze medalists.

Tasks of education informatization in the Republic of Belarus (2010–2015)

In conclusion, we may state that over the last years a certain education infrastructure based on information and communication technologies has been developed in the Republic of Belarus. Educational institutions were provided with computer equipment, multimedia and communication equipment, electronic means of learning, that were purchased out of the funds of the republican and local budgets or own funds of educational institutions. It means that we can talk about the beginning of quality changes in the education process.

The implementation of the Programme the 'Strategy of the Information Society Development in the Republic of Belarus until 2015' (№ 1174), ratified by the Council of Ministers of the Republic of Belarus on 9 August 2010, will become a new stage of education system informatisation. The social significance of the Programme consists in the fact that for the first time the full range of questions and problems that the modern information society sets for the education system is specified. Activities in the informatization area will be focused on strengthening the national education capacity in application of ICT for education development.

For 2011–2015 activities on the informatization of education in some directions under the framework of subprogrammmes are planned, among which we should highlight the subprogramme 'Electronic Education and Development of Human Capital'. In the field of the electronic education and human capital development, the priority tasks will consist in creating of national system of electronic education resources in key branches of learning, updating of the infrastructure that provides access to these resources and international education resources, preparing the citizens for the life in the information society. This refers to the large-scale introduction and use of electronic means of education in all educational disciplines. The developed means of education should be fully integrated into a unified information and education environment.

Thus, the use of ICT is not a goal in itself but a means of achievement of new education quality. This implies the completion of the global pedagogical task – creation of new information and education environment providing that students not only adopt the past experience, but also learn future technologies.

We set the task of integrating the national system of electronic education resources and the network infrastructure of the education system into a unified branch information environment of the education system of the Republic of Belarus.

Teacher Capacity Building for ICT in Education in Korea

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Teacher competency indicators

Two types of teacher competency indicators for ICT in education were developed in 1999–2002 and 2004. The first indicator, the ICT Skill Standard for Teacher (ISST), focused on teacher computer literacy and information processing based on the teaching career, while the second indicator focused on teacher use of ICT for education based on career and subject.

The Ministry of Education, Science and Technology (MEST) established the ISST in the late 1990s to facilitate teacher skills of ICT literacy and information processing. ISST was developed for both the certification system of teachers' abilities in ICT and teacher training. For certification, the ISST-based assessment instrument was developed for the teacher, ICT master teacher, vice-principal, and principal levels. The government supported the ISST certification system for 10% of all teachers annually. The ISST certification system played an important role in motivating teachers to improve their ICT skills. The government offered incentives to applicants with ISST certificates in teacher recruitment. Several Metropolitan and Provincial Offices of Education (MPOEs) also provided incentives to promotion and transfer candidates.

The specifications of ISST include category, area, and standard details for teacher, ICT master teacher, deputy head, and the school CEO. Table 1 summarizes the classification and areas of ISST. The standards are focused more on a teacher's ability to use information technology to solve problems rather than simple ICT literacy.

In addition to ISST, research on the development of teacher's ICT competency based on teaching career and subject was conducted in 2004. This teacher competency was developed based on the teacher's work area such as teaching and learning, guidance, management, and professional development. However, the standard was not implemented nationwide.

Teachers are considered to be important agents of ICT in education, as they are the final decision makers who select what kinds of ICT to use and how to do that. In this respect, Korea's government has provided teacher training for both ICT literacy and integration purposes since the late 1980s.

At the early stages of introduction of ICT in education, ICT education in the sense of computer literacy is at the primary focus, rather than ICT in education (i.e. curriculum integration). This was the case for Korea in 1988–1995. Topics of computer education generally include hardware and software programmes such as programming programmes, operating systems, word processors, spreadsheets, presentation programmes, etc.

Table 1

A Summary of the ICT Skill Standard for Teacher (ISST)

Category	Area
Information gathering	Identify location, access, and read Gather and evaluate Store and Manage
Information analysis and processing	Produce, edit, and word-process materials Process and analyze spreadsheet materials Produce and edit multimedia materials Produce and edit presentation materials Use and manage the NEIS system
Information transfer and exchange	Present and transfer Communication and exchange
Information ethics and security	Understanding the information society Prevent distribution of harmful materials Protect intellectual property Manage personal information Keep netiquette

Source: Song, Kim, Kim, Ban, & Ryu (2003). The Development and Implementation of Measurement Tools for Evaluating Teachers' ICT Use for Their Teaching. KERIS Research Report. KERIS 2003-27.

In particular, the Computer Assisted Instruction (CAI) was included in teacher training at that time, but many limitations for integration into classroom teaching were reported, because CAI did not fit into school teaching methods. Accordingly, several authoring tools such as New Korea Net, GREAT, and GREAT II were developed to support teachers in their development of teaching materials (Son, 2009). Regional offices of education implemented teacher training to facilitate the effective use of these tools. The arrival of 32-bit PCs, Windows OS, and the Internet supplies in 1995 was followed by teacher training for development of multimedia materials and Internet, and the number of teachers participating in training programmes radically increased.

Teacher training

Beginning from 1996, teacher training was conducted within the Second Master Plan for ICT in Education and had a stronger focus on technology integration. Teacher training at this phase was divided into general courses for classroom teachers and special courses for training-of-trainers and inspectors. Teacher training was focused on the development of multimedia materials and the introductory level of integration. The first phase of ICT teacher training covered over 25% of teachers per year. At that time training had limitations for teachers' ICT integration into both their pedagogy and curriculum (Son, 2009).

Provision of ICT infrastructure to schools was completed in 2000, teachers got computers and Internet connection, each classroom was equipped with a projector, thus teachers had to use computers in teaching. Therefore, in 2001–2005, teacher training was oriented to ICT integration into curriculum rather than ICT literacy. Training programmes included mandatory and optional courses. The mandatory ICT training delivered by the regional offices of education provided official training credits upon completion. This training involved 33% of teachers per year. Optional ICT training programmes offered by schools for at least 15 hours per year included various topics based on the individual schools training needs with no official training credits.

Table 2

Teacher Training for ICT in Education since 1988

Period	ICT infrastructure and training policy	Training topics	No. of Trainees
1988–1995	• Master Plan I • 1988, PCs (XT), 1995, 32-bit PCs	• ICT literacy • Teacher ability to develop multimedia materials and use the Internet	260,000

1996–2000	• Master Plan II • 2000, Teacher computers with Internet connection and a projector per classroom in primary and secondary schools • 1997, 1st phase of ICT teacher training for over 25% of teachers annually	• Teacher ability to use and produce educational content and materials	340,000
2001–2005	• Master Plan II • 2001, 2nd phase of ICT teacher training for over 33% of teachers annually (mandatory course) • Also, voluntary courses (15 hrs. per year)	• 2001, 2nd phase of ICT teacher training • Training focus shifted from ICT literacy to ICT integration	580,000
Since 2006	• Master Plan III • Training based on teacher career stages • Continuously facilitating teachers' integration of ICT into schools	• Teaching with emerging technology such as Web 2.0, IPTV, etc.	In progress

Source: MEST & KERIS (2007). White Paper

Since 2006 teacher training for ICT in education within the National Master Plan III has entered the mature stage focused on u-learning and the knowledge society. The ROK government built the teacher training framework for ICT in education based on teacher career stages, from induction to retirement so that teachers and supervisors could know what training programmes were needed for each stage. School CEOs have played a critical role in ICT in education within each school. In addition to ICT literacy, training programmes for school CEOs included supervision for ICT in education, ICT-applied school management, building a learning community through a school website, and case studies of ICT in education. As a result, 33% of school CEOs received annual ICT training during the period between 2001 and 2008.

Cutting-edge technologies continuously evolve, thus the ROK government designed training programmes for integration of emerging technologies such as the Establishment of schools of the 21st century (Web 2.0), IPTV, etc., which at all times help teachers to integrate ICT into teaching practice. Since its development in 2008, the National Teacher Training Information Service (NTTS) system helps teachers find appropriate information on teacher training, conduct self-assessments of teacher competency, and offers information on the current status of teacher training programmes.

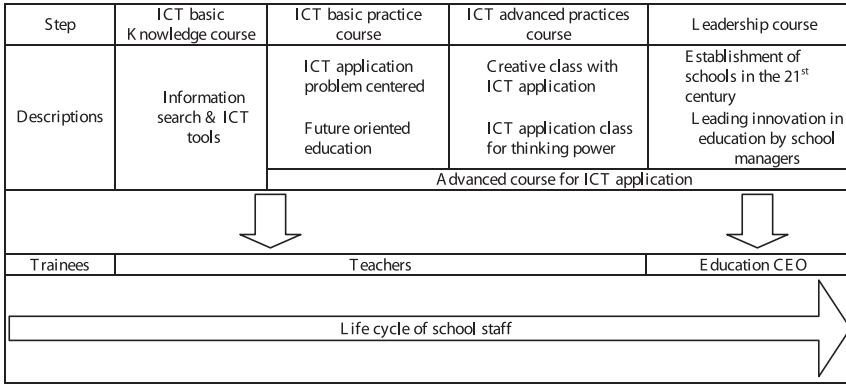

Figure 1. ICT Teacher Training Map by Career
Source: MEST & KERIS (2007). White Paper

Three main agencies – MEST, Korea Education and Research Information Service (KERIS), and 16 MPOEs – contribute to ICT teacher training in the Republic of Korea, each playing its role in this process. MEST elaborates ICT master plans, including a wide spectrum of teacher competency development such as teacher training, teacher competitions, standards development, etc. Final decisions and support for teacher training are the responsibility of MEST. Based on MEST master plans and budgets, KERIS plans, implements, monitors and evaluates teacher training programmes. KERIS has developed teacher-training programmes (e.g. Creative Lesson Planning and Teaching 21st Century Learners) and customized external programmes (e.g. Microsoft and Intel programmes). In addition, KERIS implemented T-T-T (Training-The-Trainers) sessions for all developed and customized training programmes.

This is the cascading approach that can effectively diffuse training programmes to a number of trainees in a short time. KERIS activity focuses on master teachers and pilot sessions. All training programmes are implemented by designated MPOEs. Generally, MPOEs customize training programmes to suit their own training needs. Due to the fact that MPOEs are able to make the final decision with respect to the training budget, they build annual operation plans for the training programmes.

Conclusion

Several factors encourage successful teacher training for ICT in education in the Republic of Korea.

First, teacher training is implemented on the basis of the national ICT in education master plan. Master plans generally include comprehensive plans such as content development and ICT infrastructure; therefore, the

topics of teacher training programmes are in line with these priorities and support national initiatives. This approach contributes to the effectiveness of teacher training. The cases of several countries demonstrate the gap between teacher training topics and national status of ICT readiness. Thus, teachers are frustrated if they cannot apply the knowledge they acquired during the training to their classroom activities due to lack of infrastructure and content.

Second, the comprehensive framework of teacher training associated with teacher career stages provides a sense of complete integration of such competency into career development. This can facilitate continuous sustainability for teacher training over time.

Third, training focuses have changed with account of new training needs. Trial and error is unavoidable, yet not everything can be learned from these lessons. Initial teacher training prior to 2001 indicated some trial and error in terms of training needs. Teachers quickly familiarized themselves with ICT and requested various types of training. To satisfy teacher training needs, teacher training in the Republic of Korea was developed by KERIS or customized by external programmes. Teacher training has also been developed more in pursuit of emerging needs and cutting-edge technology.

Lastly, the implementation mechanism is also a success factor to effectively diffuse training programmes. This can also monitor the quality of teacher training from three different perspectives.

For future teacher training, the definition of new teacher roles and competencies for ICT in education should be considered. In view of the fact that teacher expertise becomes more and more important, ICT in education should continuously facilitate teacher expertise in teaching and learning. Additional training for school CEOs and administrators is needed as they play a key role in the decision-making process for future education.

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Teacher Education in the Global Campus

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Europe very clearly recognizes the role of the universities in building the Europe of Knowledge. The main aim is to improve "the performance and international attractiveness of Europe's higher education institutions and raise the overall quality of all levels of education and training in the EU, combining both excellence and equity, by promoting student mobility and trainees' mobility, and improve the employment situation of young people" (http://ec.europa.eu/europe2020). The EU policy in education has three main objectives (OJ of the European Communities, 2002):

- improving quality and effectiveness of education and training systems;
- facilitating access to all to education and training systems;
- opening up education and training systems to the wider world.

Another important measure is to open up universities to the outside world and increase their international attractiveness, thus preparing them to a broader international competition, especially with the American universities which attract the best talents from all over the world.

New technology advances

The technology environment related to higher education is changing very fast, especially with the advent of the Web 2.0 technologies and cloud computing. The global education movement gave rise to Open Educational Resources (OER), which demonstrate great potential to overcome demographic, economic, and geographic educational boundaries and to promote lifelong learning and personalised learning. According to UNESCO, the term OER refers to open provision of educational resources, enabled by ICT, for consultation, use and adaptation by a community of users for non-commercial purposes (D'Antoni, 2006). The definition of OER is: "digitised materials offered freely and openly for educators, students and self-learners to use and reuse for teaching, learning and research" (OECD, 2007). According to OECD, there are more than 3000 open access courses (opencourseware) currently available from over 300 universities worldwide. For instance:

- MIT OpenCourseWare (http://ocw.mit.edu) is the most popular example of institutional OER model – they published on the Web about 1800 courses which are made available to educators and learners worldwide at no cost;

- OpenLearn initiative (http://openlearn.open.ac.uk/) launched by the UK Open University to make a selection of their materials available for free use by anyone and to build communities of learners and educators around the content using a range of tools and strategies;

- OpenCourseWare Consortium (http://www.ocwconsortium.org/) – a collaboration of hundreds of universities and associated organizations from around the world creating open educational content using a shared model.

Open textbooks are a special case of OER (Frydenberg and Matkin, 2007). The cost of textbooks in higher education is usually paid directly by the students and their parents, and now it is a substantial part of the total and rapidly increasing cost of higher education. A model of e-book based on the new technologies emerges: dynamic, interactive, regularly updated (including by users), localized, customized, remixed, etc. Open courses available on the web can also be a centre of communities of students and teachers. These books and communities could be employed for teacher professional development in ways not possible or not easily attainable with static texts. Open textbooks, as well as OER movement, are very important instruments to bridge the educational gap in the developing countries. The recent OER developments are related to open repositories of research publications, e.g. – DSpace at MIT (http://dspace.mit.edu/), DSpace of the TENCompetence project (http://www.tencompetence.org) and Sofia University (http://research.uni-sofia.bg/), Open Research Online of the UK Open University (http://oro.open.ac.uk/), TeLearn (http://telearn.noe-kaleidoscope.org/), etc. The DSpace at MIT Thesis Collection, for instance, contains more than 20 000 items. Open access is critical to ensure fast and reliable access to EU-funded research results, in order to drive innovation, advance scientific discovery and support the development of a strong knowledge based economy (http://cordis.europa.eu/fp7/ict/istag/). EU researchers, businesses and citizens can have free and open access to EU-funded research papers through OpenAIRE – Open Access Infrastructure for Research in Europe (http://www.openaire.eu/). OpenAIRE will provide a network of open repositories providing free online access to knowledge produced by scientists receiving grants from the Seventh Framework Programme (FP7) and European Research Council (ERC). Such research e-infrastructures will open new avenues for research, education and innovation in Europe.

The e-infrastructure (cyberinfrastructure) is a combination of hardware, software, services, personnel and organization, which provides a wide range of services for the global research communities, such as: high performance computation services; data, information and knowledge management services; observation, management and fabrication services; interfaces and visualization services; collaboration service (Atkins et al.,

2003). Such infrastructure would enable research communities and projects to rely on effective application-specific, but interoperable, knowledge environments for research and education. New types of scientific organizations and supporting environments are emerging, e.g 'laboratories without walls': colaboratory, grid community, e-science community, and virtual community. It is needed to "enable, encourage, and accelerate this grass-roots revolution in ways that maximize common benefits, minimize redundant and ineffective investments, and avoid increasing barriers to interdisciplinary research" (Atkins et al., 2003). The term e-infrastructure refers to a new research environment in which all researchers – whether working in the context of their home institutions or on national or multinational scientific initiatives – have shared access to unique or distributed scientific facilities (including data, instruments, computing and communications), regardless of their type and location in the world (http://cordis.europa.eu/fp7/ict/e-infrastructure/). Increasingly, new types of scientific organizations and supporting environments for science based on research communities are emerging and they can serve individuals, teams and organizations in ways that revolutionize the research practice. The e-infrastructure could be a platform for co-investments building new partnerships by universities and industry and thus – catalyze new organizational forms for knowledge creation and education in the digital age (Atkins et al., 2003). E-infrastructure and virtual organizations are enabling new form of learning: learning through interactive visualizations and simulations (NSF, 2007).

There are many examples of implementation of e-infrastructure projects, such as:

- The Enabling Grids for E-sciencE – EGEE (http://www.eu-egee.org/) – project is funded by the EC and aims to build on recent advances in grid technology and develop a service grid infrastructure which is available to scientists 24 hours a day. EGEE is the largest multi-disciplinary grid infrastructure in the world, which brings together more than 140 institutions to produce a reliable and scalable computing resource available to the European and global research community. At present, it consists of approximately 300 sites in 50 countries and gives its 10 000 users access to 80 000 CPU cores around-the-clock;

- NanoHUB.org was created by the NSF-funded Network for Computational Nanotechnology – NCN (http://nanohub.org). NCN is a network of universities with a vision to pioneer the development of nanotechnology from science to manufacturing through innovative theory, exploratory simulation, and novel cyberinfrastructure. Many students, staff, and faculty are developing the nanoHUB science gateway while making use of it in their own research and education. NanoHUB.org is designed to be a resource to the entire nanotechnology discovery

and learning community. Computation and software is a cross-cutting theme that connects computer scientists and applied mathematicians to problem-driven scientists and engineers, to address large scale problems and develop community codes for nanotechnology.

The vision of Europe is that by 2030 a scientific e-infrastructure that supports seamless access, use, re-use, and trust of data will exist (http://cordis.europa.eu/fp7/ict/e-infrastructure/). The e-infrastructure allows the virtual research labs to become 'real' – the researchers with different backgrounds could conduct global experiments remotely in real time and collaborate on the same set of data from different perspectives.

The model of Global Research Library (GRL) is also emerging (www.grl2020.net). The fast development of the Web 2.0 technologies, OER and e-infrastructure are driving changes in the library model as well. Several best practice cases are reported, e.g. in the area of Nanotechnology, Earth Sciences, High Energy Physics. The GRL of the future should be multi-ethnic, multicultural and multi-lingual; a collaborative and global environment, which emphasizes the ethical issues surrounding data; purposefully inclusive, attending to different cultures. Building pan-European e-libraries is among the main priorities of the EC. Europeana (http://www.europeana.eu) is one of the current projects.

Current and emerging university models

The university, as a centre of teaching and research, is a genuinely European invention and the existence of the university was inspired by and confined to European cultural, economic, and political dominance for a long period of time (UNESCO, 2003). Through the centuries, the universities have changed considerably and they have also remained the central European institutions of reason, knowledge, criticism and learning (Van Vught, 2007).

A virtual university (virtual campus) can be seen as "a metaphor for the electronic, teaching, learning and research environment created by the convergence of several relatively new technologies including, but not restricted to, the Internet, World Wide Web, computer mediated communication" (Van Dusen, 1997). The notion of 'campus' reflects the American traditions in higher education. Turner states: "As a kind of city in microcosm, it (the campus) has been shaped by the desire to create an ideal community, and has often been a vehicle for expressing the utopian social vision of the American imagination. Above all, the campus reveals the power that a physical environment can possess as the embodiment of an institution's character" (Turner, 1995). Although many universities are not 'campus universities', they might afford building their virtual campuses. In this respect it would be more appropriate to use the term 'virtual campus'.

Apart from competition between universities, a clear need for cooperation between them is of great importance. Many universities use the partnership as a means of entry into the global e-learning market and to penetrate in less economically advanced countries (Bates, 2001). The partner institutions from less economically developed country bring adaptation to local culture, language benefits, local or national accreditation, sharing costs and risks, and access to neighbouring markets or markets with similar language and culture. Many countries have announced national virtual university initiatives of various kinds (D'Antoni, 2006). Some of these initiatives are intended to extend and enhance local provision, while others are targeted at international markets.

The OECD Global Student Mobility 2025 Report foresees that the demand for international education will increase from 1.8 million international students in 2000 to 7.2 million international students in 2025, which presents enormous opportunities and new challenges for all universities (OECD, 2007). In nowadays knowledge intensive society, research universities, which are key institutions for social and economic development, are becoming more international in focus. A subset of research universities reflects a new phenomenon, defined as the Emerging Global Model (EGM) of the 21st century research university (Mohrman, Ma and Baker, 2008). The emphasis here is on the international nature of a small group of institutions that represent the leading edge of higher education's embrace of the forces of globalization. EGM universities are engaged in worldwide competition for students, faculty, staff, and funding and they operate in an environment in which traditional political, linguistic, and access boundaries are increasingly losing their traditional roles. Some call the EGM a 'super research university' to emphasize the worldwide perspective and the high scholarly output of this subset of research universities (Baker, 2007). The heart of the EGM is an expansion of the older functions of teaching, research, and service into an organization that can best be described as a knowledge conglomerate (Baker, 2007). The professors in an EGM university have multiple responsibilities – they are expected not only to conduct research, but also to teach graduate and undergraduate students, to provide service to their universities, and to use their knowledge for the benefit of local and national communities. In both developed and developing countries new relationship ('triple-helix') among higher education, industry, and government tend to be established and the third mission of the universities has been defined – to serve to the society (Etzkowitz, 2002). The governments support research universities to collaborate with businesses to develop the economy.

Accreditation of the cross-border education is among the biggest issues in the globalization of education, e.g. how one can ensure that institutions will receive equal treatment from the various accrediting bodies. It has been identified that there is a certain risk of commercialisation of quality

assurance practices on an international scale. Some valuable guidelines for quality assurance of trans-border education are provided by OECD and UNESCO (OECD, 2007; UNESCO, 2003).

The Global Campus Model

The Global Campus Model (GCM) is based on the advanced ICT and incorporates the main characteristics of the EGM and the features of the Research, Entrepreneurial, Electronic and Virtual University models (Nikolov, 2009). The GCM is intrinsically global, since ICT provide natural means to cross the borders. The GCM fits most to one of the following models of virtual universities, identified by Middlehurst (Middlehurst, 2006), namely "an evolution of an existing institution, with a unit or arm offering virtual education", or "a consortium of partners constituted to develop and/or offer virtual education". The cases of "a newly created institution operating as a virtual university" and "a commercial enterprise offering online education" could fit in case of alliance of universities and other strategic partnerships.

The GCM adopts the assumption that the "current educational reform is driven by three major factors – asynchronous space and time, responsive environments, and virtual reconstruction" (McClintock, 1992) and, instead of having "a unit or arm offering virtual education", the GCM follows the model of Virtual Campus as a virtual reconstruction of the existing campuses and 'bricks and mortal' buildings, i.e. to "redesign and reconfigure the human experience of existing physical spaces without having to make physical, structural changes in buildings". Thus, virtual spaces would complement the physical spaces when designing an effective, student centered learning environment. A virtual campus will be a virtual learning environment that integrates not only a variety of software tools, but also all the physical tools that can be found in physical campus. We adopt also that the concept of learning spaces is one of the main features of the future learning (Punie and Cabrera, 2006). The 'place-making' is an appropriate metaphor for designing cyberspace, because "the virtual places will include socio-cultural and perceptual qualities, enriching them to the point where they may approach – perhaps even surpass – comparable physical settings" (Kalay, 2004). In such a way even non-campus universities could build their virtual campuses and make the campus education not only a good American tradition (Turner, 1995), but also a world standard for global higher education. Refering to this tradition, the "Educating by Design" principle (Strange and Banning, 2001) could be applied by transforming it to a virtual campus design principle. Strange and Banning provide a comprehensive model for creating student-friendly and learning-supportive campus environments and discuss four conditions for successful learning: promoting safety and inclusion, encouraging participation and involvement, building a community of learners and designing

for education with campus assessment (Strange and Banning, 2001). They focus on many complexities of campus settings and how they contribute to student success and the quality of learning experiences. The institutional virtual campus could evolve into a global virtual campus comprising all university branches and partner institutions. A (global) virtual campus would be enourmously opened towards other stakeholders and users and provide virtual places where they could meet, cooperate, communicate, share information and knowledge. In order to meet this challenge, a GCM University could transform towards a University 2.0 model (Nikolov, 2009), incorporating the OER strategy, and use new tools for authoring, reading and collaborating on the emerging e-Books platforms (Koychev, Nikolov and Dicheva, 2009). The university could also benefit from the movement of creation of e-libraries.

As virtual organizations, they will also incorporate a new form of learning: learning through interactive visualizations and simulations (NSF, 2007). The GCM universities are developing partnerships and they would have an opportunity to jointly build a (global) virtual campus and e-infrastructure in order to do e-science. One of the measures for global reach of a university is the percentage of foreign students, PhDs and postdocs. The GCM University could promote virtual mobility schemes, e.g by following the Virtual Erasmus model, which complements the existing Erasmus exchange programmes (Op De Beeck, 2005). The virtual Erasmus can be used to prepare and follow-up the physical mobility or/and take courses at the home university while staying abroad. In addition, it embeds "networked e-learning (in transnational collaboration of teachers and students) as an integrated part in mainstream higher education, aiming at transferability, scalability and sustainability: joint programme and course development, joint learning activities as virtual integrated elements of blended learning, 'following' (e.g. elective) courses abroad in a virtual mode" (Op De Beeck, 2005). These models could be further extended towards a combined Virtual/Physical Recrutement Model since the GCM universities are "adopting worldwide recruitment strategies fo students, faculty, and administrators" (Mohrman, Ma and Baker, 2008). The model of virtual mobility would be very useful for developing countries in their efforts to reduce the brain-drain and turn it into a brain-gain status and thus contribute to their home countries' national growth and helping to reduce the rising 'knowledge gap' between them and the developed countries. In order to fulfill this mission, the GCM universities should closely cooperate with international non-governmental organizations and multi-governmental organizations, such as UNESCO.

The GCM universities should be increasingly more research intensive and able to apply scientific methods in disciplines outside the sciences in order to fulfill their third mission, i.e. for solving problems of global importance of the society as well as to have strong orientation towards regional

development and innovation, especially SMEs. We adopt the framework of actions for strengthening and extending the university research provided by Weiler (Weiler, Guri-Rosenblit and Sawyerr, 2006), however they would be powered by the new GCM e-infrastructure.

The GCM is also "an expansion of the older functions of teaching, research, and service into an organization that can best be described as a knowledge conglomerate" (Nikolov, 2009). Being a kind of "knowledge intensive enterprise", a GCM university needs an effective knowledge management strategy and this becomes one of its main characteristics. The knowledge management emerged as a result of the development of ICT and the changes in the organizations' structure, functions and management practices all over the world. The globalization of educational markets and the global competition put the focus on effective management of intangible assets as a way for universities to achieve competitive advantages since the knowledge is the essential asset of them. The professors in a GCM university will face fast increasing global competition, especially with the development of the mixed virtual/physical mode of mobility and recruitment. They will have multiple responsibilities, i.e. not only to conduct publishable research, but also to teach graduate and undergraduate students, to provide service to their universities, and to use their knowledge for the benefit of global, local and national communities. The use of ICT demands new skills and additional time for effective usage. The GCM universities will need future generations of research scientists and engineers (Nikolov, 2009; NSF, 2007) which are able to use tools and services of the e-infrastructure and apply new methods to observe and acquire data, to manipulate it, and to penetrate into new interdisciplinary areas of research. 'Entrepreneurial' is considered as a characteristic of the whole GCM university systems, i.e. the entire universities and their internal departments, research centres, faculties, and schools. This means that a GCM university should actively seek "to innovate in how it goes about its business" and "substantial shift in organizational character in order to better perform in the future". Such university should also "understand the commercial value of knowledge" and make capitalization of research findings one of its primary features (Clark, 1998).

Establishment of science parks, incubators and growing innovative businesses could be considered as another good American tradition which started with Stanford Research Park (1951) and the Cornell Business and Technology Park (1952). However, the GCM universities could use the power of the e-infrastructure and go towards building virtual organizations of such type as well (NSF, 2007). A GCM university could adopt most of the characteristics of the Innovation University Model, e.g. to become a leading actor in the field of continuing education and development services provided for working life and to increase intangible capital both inside the universities and through them in society (Markkula and Lappalainen,

2008). All this will shift relationships among universities and government, business, and society. Successful organizations (universities or enterprises) within the future e-Learning market will adopt a learner (customer) oriented paradigm (Geiger, 2004).

The so-called 'cloud computing' concept emerged. It stands for: open information content, software, and services; service orientation and delivery; server and storage virtualization; standardization of computing across the Internet (Katz, 2008). On the way to a knowledge society in a dynamic ICT environment, the universities should catalyse a process of deep institutional change. One of the major challenges facing the universities in the next decade is to reinvent themselves as information organizations. Unsworth emphasizes that the "universities are, at their core, organizations that cultivate knowledge, seeking both to create knowledge and to preserve and convey knowledge, but they are remarkably inefficient and therefore ineffective in the way that they leverage their own information resources to advance that core activity" (Unsworth, 2008). The model of University 2.0 is a framework for universities to adapt to the social computing phenomena and to the networked information economy. University 2.0 can be described as a research and entrepreneurial university, which integrates Web 2.0 technologies and applications in all university activities, including ones with all knowledge intensive stakeholders. A basic concept in bridging the university and society is Community of Practice (CoP), which is defined as "groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (Wenger, McDermott and Snyder, 2003).

The GCM university organizational structure will follow the University 2.0 characteristics and will resemble the vision for 'Cloudy Academy' (Katz, 2008). A GCM university could also become a virtual organization (VO). A VO is "a group of individuals whose members and resources may be dispersed geographically and institutionally, yet who function as a coherent unit through the use of e-infrastructure" (Cummings et al., 2008; Nikolov, 2009). Such VOs are for instance EGEE and nanoHUB.org. VOs include a broad range of operational options, e.g they can be formal or informal, planned or unplanned, transient or long lived.

Teacher education in the Global Campus – some case studies

The teachers are among the main actors that are involved in the process of school re-engineering and the corresponding educational change. According to Fullan, continuous development of all teachers and the school reform are interrelated (Fullan, 1991). He states that the educational change "…involves learning to do something new, and interaction is

the primary basis for social learning. New meanings, new behaviors, new skills and new beliefs depend significantly on whether teachers are working as isolated individuals or are exchanging ideas, support and positive feelings about their work". Teachers must know the most current research and practice which can be used effectively to match particular teaching procedures to children with particular needs. Friedman has compiled a Web 2.0 Schools teachers oriented electronic book, which contains expertise and experience papers of a number of leading-edge Web 2.0 in education practitioners (Freedman, 2006). He says: "The web is, and always has been, an exciting place for education in terms of the possibilities it offers for research and collaboration. Now, it is even more exciting, with the appearance and development of new tools which have become collectively known as 'Web 2.0'".

We can define the Web 2.0 Schools as schools that use predominately Web 2.0 based educational applications and services in their educational activities (Nikolov, 2007; Nikolov and Nikolova, 2008). The Web 2.0 virtual learning environments provide opportunities for students, teachers, parents and other stakeholders to contribute to creating useful and 24/7 available educational resources. Students can produce a new resource or edit existing ones for other students while they are learning themselves. Even the well-known PC applications, such as word processors and spreadsheets, come to a new life in the Web 2.0 world. A lot of Web 2.0 School oriented portals providing access to web services and content for educational purposes are emerging, such as: Schoolforge (http://www.schoolforge.org.uk), Edu 2.0 (http://www.edu20.org/), Change Agency (http://www.ed421.com/), Shambles: Education Project Asia (http://www.shambles.net/), Web 2.0 for the Classroom Teacher (http://www.kn.pacbell.com/wired/fil/pages/listweb20s. html), etc.

A Web Assignment Database (http://wad.fmi.uni-sofia.bg/wad/) was created in the frames of the multinational European project 'Innovative Didactics via Web Based Learning – IDWBL'. This is a database which provides opportunities for building a community of teachers. It helps them to communicate and to develop and retrieve web-based assignments for teaching and learning in several subject areas. Teachers and learners who are registered as users have access to a whole range of functionalities, such as: adapting assignments, allocating assignments to students, creating products, giving and receiving feedback on assignments developed by colleagues and rating learner's products.

A digital repository for teacher education is being developed under the Share.TEC Project (http://sharetec.it.fmi.uni-sofia.bg/). Share.TEC stands for 'Sharing Digital Resources in the Teaching Education Community' (http://www.share-tec.eu/). It provides access to the partners' own content and to other teacher education repositories. Share.TEC is developing

an online platform which will help practitioners across Europe search for, learn about and exchange resources of various kinds, and will support the sharing of experience about the use of those resources. The system is primarily designed for teacher educators and for teachers engaged in preservice education and continuous professional development. Share.TEC is devoted to fostering a stronger digital culture in the teacher education field and to supporting the development of a Europe-wide perspective among those working in and with the teacher education community. The intended users of the system will be teacher educators, teachers engaged in self-guided learning, and developers and publishers of digital resources. Share.TEC will be adaptive to the needs of the users and will take into account their professional profiles through an ontology-based approach designed to capture individual differences.

The TENCompetence project (http://www.tencompetence.org/) aims at supporting individuals, groups and organizations in Europe in lifelong competence development by establishing an appropriate technical and organizational infrastructure, using open source standards-based, sustainable and innovative technology. The freely available infrastructure will support the creation and management of networks of individuals, teams and organizations in Europe who are actively involved in the various occupations and domains of knowledge. These 'learning networks' will support the lifelong competency development of the participants from the basic levels of proficiency up to the highest levels of excellence. The network consists of learners, educational institutes, libraries, publishers, domain specific vendors, employers, associations, and all others who deliver services or products in the specific field. A pilot experiment for lifelong competence development in ICT-enhanced (soft) skills based on the methodology derived in this project and the training strategy developed under the project Innovative Teacher – I*Teach (http://i-teach.fmi.uni-sofia.bg/), has been carried out (Kovatcheva, Nikolova and Stefanova, 2010; Nikolova et al., 2009). A virtual community model for school teachers and experts was developed under the I*Teach project. The project aimed at providing a means to support teachers in their daily work and professional development in building new knowledge and skills and to motivate and help them to collaborate, share and reuse educational resources. The project supported creation of a virtual community of teachers and experts, development of a methodology handbook, creating digital repositories and establishment of virtual training centers. Such centers were created in five countries, including Bulgaria (Miranowicz et al., 2007).

An example of applying some innovative instructional strategy in a web based learning environment created in the frames of the project WebLabs is given (Mor et al., 2004; Sendova et al., 2004). The WebLabs provides an opportunity for enhancing the scientist in the learner. The students are involved in an international research project. They develop an

understanding of mathematics as a science in which formulating hypotheses, carrying out experiments, solving open problems is its essence. The students are partners in a research process and can influence both the development of the computer environment and the design of the educational activities. They can communicate with each other, with teachers and researchers both locally and globally. The teachers are considered as facilitators in a discovery process. They acquired specific social experience and were stimulated to build valuable personal skills such as: ability to generate and verbalize ideas; to present their results according to a concrete standard; to share their experience by means of electronic communication; to discuss their work and work in a team; to be (self) critical to the work published in the virtual environment. The existing e-infrastructure for e-science provides new opportunities for schools to get access to a great number of virtual labs and learn through interactive visualizations and simulations.

The Sofia University internal project named Elica (http://www.elica.net/) has received a substantial international recognition among educators in mathematics. One of the achievements of this project is that an international virtual network of its users has been established (Boytchev et al., 2009). Elica has been used for in-service teacher training for more than 6 years now and a virtual community of teachers using Elica in their educational practice has been established. Being a general-purpose system, Elica can be used as a development platform for virtual worlds implemented through intuitive and interactive virtual reality. Several courses at Sofia University are based on Elica and they are for students which will become teachers in mathematics and computer science. Being in touch with the system that is used to implement classroom software is an important factor, because several applications are already a part of the IT textbooks for 6th and 7th grades. Nowadays Elica is used in several national and international projects. Within the next year a dozen of new applications is supposed to appear. Additionally it will be possible to collect a more significant feedback from teachers and students.

Conclusion

The emergence of GCM universities and the Web 2.0 Schools is a worldwide phenomenon. The educators should work on a large scale of lifelong learning activities for building new competency of teachers, students and all citizens of the information society. The technologies are ever changing and the new generations of Web are to appear – Web 3.0, Web 4.0, etc. They are connected with the growth of the intelligence of the Web. The integration of the Web technologies with the global e-infrastructure in the academic world is an emerging trend. Having in mind the trend of integration of all existing forms of education, we may expect the ultimate result be that the whole world would become a Global Campus in the next few decades.

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PLENARY SESSION II

Emerging Technologies and ICT Competencies of Teachers

Supporting Teacher Development of Competencies in the Use of Learning Technologies

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Teachers who wish to update and upgrade their teaching and learning designs using new learning technologies have some difficult issues to confront. Whether they are working in schools, colleges, or universities, the incorporation of new technologies into their teaching requires them to learn about a very different approach to teaching and learning, and develop new digital materials and online activities ahead of the start of the course. This is complex design and development work that has to be done on top of the delivery of their current teaching. Some institutions recognize this and allow staff significant time to develop their ideas, skills, and designs. Very few allow adequate time. However, the expectations of teaching staff keep expanding: that they should learn to be ahead of their 'digital native' students, should build 21st century skills into the curriculum even though they have not been trained themselves, and should develop wholly new ways of conducting teaching and learning. It is an impossible task, and it is time we recognize that teachers deserve far more help with the development of digital learning.

This paper starts from the premise that only teachers have the knowledge, experience, and appropriate context for developing digital learning methods. They are with students all the time, they see how they react to teaching, and what they produce as a result. Teachers are best placed to know what students need if they are to master the concepts and cognitive skills of formal learning. The act of teaching provides the fieldwork that needs to be carried out to test, re-design, and re-test the new methods being developed. Effective use of learning technology will not come about unless teachers are at the helm of innovation. It will not come from software companies, or systems developers. It can only come from those who have committed themselves to enabling students to learn, and will seek out whatever method it takes to help them.

We can make a very good case for giving teachers sufficient time and professional development to achieve the skills and new thinking needed, and

there are many initiatives currently in play to do that. But the time and the training will never really meet the need, especially as the rapid development of the technology means that they will always need updating. With that in mind, a new project is exploring a different approach: creating tools for teachers – 'power tools', that will enhance their ability to innovate, and enable them to explore, experiment, test, and share their ideas as a professional community. The project is the 'Learning Design Support Environment for teachers and lecturers' (LDSE). Historically, tools have provided the major engine of human development, so perhaps a tool for teachers will make the critical difference to changing what they do with their students.

The next sections outline what teachers need, why collaboration is important, and the main principles of what it takes to provide a learning design support environment for teachers.

Teachers' needs

If teachers are to have sufficient time to develop their skills and ideas, they will need to have the committed support of their institution, as the students themselves recognize: "Faculties should have innovation funds to support academics in developing new ways of using ICT" (NUS 2010).

In higher education there is scarcely enough attention to professional development in teaching and learning to meet quality standards. Teachers in post-compulsory education have no compulsory professional training, as schoolteachers typically do, yet they are expected to embrace significant changes in the way they carry out their professional duties, and build considerable knowledge of how to use TEL, with little time and with minimal training or resources (Armstrong et al., 2005; Britain, 2004; JISC, 2004; Laurillard and Masterman, 2009).

Teachers also need to be aware of their students' capabilities and needs in ICT, recognizing that they are adept in the digital skills of networking and browsing, though not necessarily in the exploitation of these skills for educational purposes: "students are appropriating technologies to meet their own personal, individual needs – mixing… ICT tools and resources, with official course or institutional tools and resources" (Conole, de Laat, Dillon and Darby, 2006).

Students' facility with a range of ICT tools and environments creates an exciting opportunity for teachers to be able to build on these skills, for educational purposes. Pedagogies associated with social constructivism have become a common focus for many teachers who wish to innovate, and design more student-oriented active learning environments, and now they have students who are capable of finding their way around an online discussion group, able to exchange ideas and drafts, and negotiate a shared solution to a problem posed. This is computer supported collaborative

learning (CSCL) enabled and even facilitated by the structure of an online environment. It depends on the students having some skill and confidence in their use of ICT, but it also takes them beyond what they would normally use it for, in an intellectually challenging way. But it depends upon a teacher who is not only oriented towards a social constructivist approach to teaching, but who also understands how to exploit digital technologies to support it.

For this to be possible, teachers need high quality professional development. This is what makes the difference, at the institutional level: "… in institutions where student engagement and educational gains are found to be high, one finds a higher than average investment in resources… such as faculty development" (Gibbs, 2010).

Teachers have to learn about the optimal ways of using digital technologies, and also where not to use them. And because the digital world is in constant flux, in both the type and the availability of technologies, they have to keep learning, and re-learning, how best to use them. There may be good faculty development courses and workshops, and good central support provided by specialists in learning technology units, but the requirement for support of this kind is almost impossible to meet in an affordable way, precisely because the curriculum for teacher development keeps changing. We cannot, therefore, expect that a faculty development course, valuable though it may be, will remain valid for very long. For teacher development, as for students, they need to learn how to learn. All the principles of good teaching apply as much to teacher professional development as they do to student learning. In particular, the pedagogies of social constructivism, social learning, and collaborative learning, all apply. It will be as important for teachers to learn from each other as it is to be taught by experts on a faculty development course: "…faculty members recognize… that peer interactions and collegiality are significant in helping them learn new innovations and strategies" (Nicolle, 2008).

Teachers know they need to learn from each other, and in the context of innovation in teaching and learning, they certainly value the experience of their peers more than the pronouncements of experts. It is important to know why a design idea is valuable, and to know the extent to which it succeeded. Only their peers can tell them this. It is not an assurance that educational researchers can give, or software development companies, or digital environment providers.

Teachers need to be able to take responsibility for their own learning, just as we argue that students do. They need the institutional support, the information about their students, the time to develop their ideas, and the means to collaborate. In this way they will be able to become creative innovators in teaching and learning, building on each others' work, developing and experimenting with the new and adapted pedagogies appropriate for

digital technologies, in essence, acting like scientists building new knowledge. No other profession is in a position to do it for them, nor to do it as well as they can.

Teachers do not easily collaborate on the design of teaching. It is an activity that is usually individual, unless there is a specific plan to do team teaching. Designs for lesson plans, or for academic sessions, are often not articulated or recorded in a way that can be communicated to others, except in quite general terms. This means that collaboration on teaching designs, or sharing ideas about teaching, is not necessarily a normal part of the teaching process in any educational sector, least of all in higher education. The next section discusses an approach to providing teachers with the means to collaborate more easily, and thereby build a community of practice that can learn about and develop new forms of pedagogy.

Supporting the design of teaching with ICT

There are several different approaches to supporting teacher development in ICT, which we can broadly characterize as training (faculty development courses and workshops), guidance (learning technology experts), online resources (open educational resources for content, digital repositories), digital tools (toolkits, authoring tools, virtual learning environments) and communities (peer groups working together in online spaces to exchange ideas and information). In this paper the focus is on a particular type of digital tool, a 'Learning Design Support Environment' that takes the teacher through an open design process, in a scaffolded and supportive way.

We take the common aims of all these efforts to introduce learning technologies as being to:

- improve the quality and effectiveness of student learning;
- achieve this by making better use of learning technologies, through promoting collaboration across the academic teaching community.

Each approach has its own strengths and weaknesses. Courses and expert guidance are highly valued, but are labour intensive for both teachers and experts, so tend to be short, or a one-off, which means the knowledge is not always kept up to date, or is not linked to the timing of the practice. Online open resources are valuable as a stimulus, and for adoption and reuse within a teaching session, but are not easily customized and adapted to local needs. Digital tools are highly adaptable but can be time-consuming to learn and implement, or they are simple to use but offer only structure, and put the onus of the design on the teacher. Online communities enable contributors to create value for each other, but require greater time commitment to a teaching community than many academics and teachers can prioritize.

An alternative approach is to develop an online interactive tool that attempts to address as many of these issues as possible:

- Not labour intensive but supportive of normal working;
- Open but also customizable;
- Flexible and scaffolded, providing a structure for designing learning technologies;
- Community collaboration that offers value commensurate with time spent.

An online collaborative environment of this kind, to scaffold teachers' engagement with technology-enhanced learning, should provide a framework for a 'community of innovation' in which teachers participate both as learners and researchers in the development of new pedagogies (Laurillard and Masterman, 2009).

A critical issue for the development of such a community is to decide on the 'unit of exchange' – if teachers are to build on each others' work, and exchange ideas about teaching and learning, what exactly do they exchange? To date the exchange has usually been either descriptions of what they do, or complete digital resources in the 'runnable' form of videos, diagrams, simulations, or learning activity sequences, but so far few representations have succeeded in capturing the essence of a good piece of teaching (Falconer and Littlejohn, 2007). The Open Educational Resources (OER) community has expanded recently with an increase in funding to extend the capacity and availability of courseware used in higher and further education (Liyosh and Kumar, 2007; Laurillard, 2008), which has led to new community sites built around repositories such as MERLOT and OpenLearn (Conole, 2010). This emergent community is important because it creates the opportunity for the exchange of teaching ideas. However, although it meets some of the criteria listed above, it does not typically provide customizable resources, mainly because the content of the teaching and the structure of the pedagogic design are inseparable. It cannot therefore easily support and scaffold thinking about the pedagogic design process – the user takes on the resource and embeds it in their teaching, or not. Only an open tool or environment is fully customizable to the user's context.

An alternative approach is to separate content and structure in a 'pedagogical pattern', which, like other patterns, focuses on form and makes the particular subject matter content incidental. The requirements for a learning design support environment that enables the academic community to collaborate on improving the use of learning technologies will be able to use pedagogical patterns to:

- Import existing patterns of good teaching developed by their peers;

- Search for OER content resources to populate the patterns;
- Adapt the pattern to their own context for testing with their students;
- Use this model of a learning design to test its pedagogical and logistical properties;
- Publish the improved design to the community, both as a generic pattern and as an instantiated specific pattern.

The value to students is that it should become easier for teachers to see how best to adapt conventional designs to digital versions, but in a supported environment that builds on what others have done before them, and that enables them to see the likely benefits and disbenefits of moving to new technology. To illustrate these ideas in detail, the next section illustrates the evolution of a pedagogical pattern from a content-specific instance, to a generic pattern, and then to a new content-specific instance, showing how teachers might share and collaborate on teaching designs using this form of exchange. The later section shows how the LDSE project is implementing this approach.

Pedagogical patterns: form and content

A pedagogical pattern develops most naturally from a specific teaching-learning context, in which the teacher is thinking creatively about the difficult aspects of the topic, their students' likely needs for support in thinking about it, and their own past experience of teaching it. It is at this moment that the teacher is likely to be most creative in exploring new approaches. This is the point at which they record notes on how the session should develop, and what they will get student to do. Having run it, they may of course find that all does not go to plan, they respond creatively to the situation, discover something that works better, and can then revise their design in the light of experience. This is the kind of design that might then be valuable to pass to others, and an example is summarized in the first panel of Fig. 1.

The particular content instance will be of value to other teachers of that topic, of course, but the more general value of a good teaching idea will be lost to other teachers, who from an intellectual development point of view, are actually doing something very similar with their own students, albeit in a very different content area. The exchange of good teaching ideas does not happen easily when someone else's content is figural, but if the content-specific elements are removed, as in the second panel of Fig. 1, then it is easier to see how their own topic might fit into the same teaching idea, which could then migrate across subject boundaries to the very different content instance shown in the final panel of Fig. 1.

Tutorial: ***Using a search engine***	Tutorial: …	Tutorial: ***The water cycle***
Learning Outcome: A clear understanding of the role of the critical factors in the system	Learning Outcome: A clear understanding of the role of the critical factors in the system	Learning Outcome: A clear understanding of the role of the critical factors in the system
Summary: through preparing their own **account** of ***using a search engine***, to demonstrate the role of the critical factors, using *the Library guidelines*; presenting it to their group; defending it against questions and comments; and revising their **account** in the light of the tutor's summary of the discussion	Summary: through preparing their own … of … to demonstrate the role of the critical factors, using …; presenting it to their group; defending it against questions and comments; and revising their … in the light of the tutor's summary of the discussion	Summary: through preparing their own **animation** of ***the water cycle***, to demonstrate the role of the critical factors, using *the OER cycle animation*; presenting it to their group; defending it against questions and comments; and revising their **animation** in the light of the tutor's summary of the discussion

Figure 1. A pedagogical pattern for a tutorial on 'using a search engine' has been abstracted as a generic pattern by removing the content-specific parts, leaving the pedagogic form which is the essence of the teaching design. The generic pattern has then been reinstituted with the content-specific elements appropriate for a tutorial on 'the water cycle'

The second teacher in this example has made use of an OER repository to find a good animated diagram of the water cycle for the students to make use of, slotting it into that part of the pattern that requires them to use some pre-existing information source. Because this is a scientific system it is appropriate to ask them to do more than simply supply an account of it, but to do the more challenging task of creating their own animation, taking advantage of the students' digital skills with creating PowerPoint animations.

One advantage of this structured but customizable representation of a learning design is that the recipient of the pattern, on experimenting with it in their own context, can express their adaptation of it in a clear and specific way. Suppose the second teacher has decided that the latter part of the pattern needs a more challenging task for the students, e.g. they might prefer their students to work together on a more public presentation of their understanding, and so redesigns the final sentence to read "and collaborating to produce a better animation to post on their website". This could be seen as an improved version of the pattern, which can be sent

to the open patterns library website in both specific and generic forms, and which also generates new animations that could be posted to the OER repository alongside the original animated diagram – three outputs from the adoption-adaptation process.

A fully-described pedagogical pattern elaborates the summary illustrated above by structuring the teaching toward a learning outcome by means of a sequence of learning activities, each timed, leading to a specified form of assessment (or contribution towards an assessment), a note of the tools or resources needed, and the designer's reflection on its effectiveness (Laurillard and Ljubojevic in press). This sequence of adopt-adapt-test-redesign-publish enables the teacher to learn by doing, to experiment, share and collaborate on innovating in pedagogy. Such collaboration, having a focus on the shareable form of the pedagogy, with slots for the content elements, should create a demand for resources to fill those slots – i.e. a natural community willing to use OER and digital repositories, and capable also of contributing further resources. If the LDSE pedagogical pattern exchange works, then it will act as an engine of innovation for that community. It is currently being evaluated, for report later in 2011[1].

A prototype for a Learning Design Support Environment

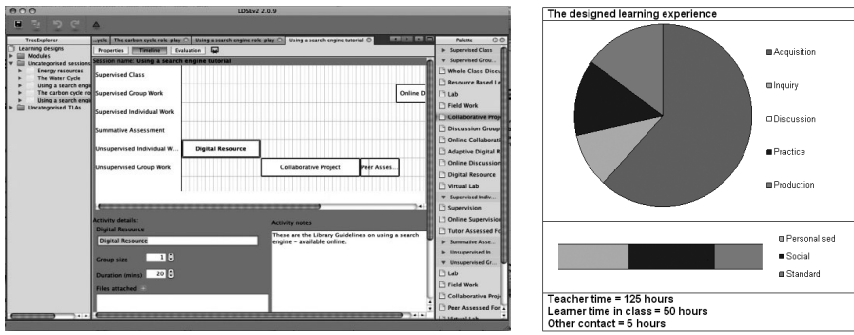
The exchange of pedagogical patterns is an important part of the support that teachers need, but does not cover all the issues listed in section 3 above. It provides open and customizable design ideas, and the means for the academic community to collaborate in a way that should offer value commensurate with the time they spend, but it does not itself scaffold or structure the complex processes involved in designing a module or session as part of a course. To go from the curriculum outline to the delivery of a module, or to be able to think through the pedagogical and logistical consequences of moving to online education, the LDSE needs to offer a more elaborated system of support. Essentially, it has to provide a kind of 'microworld' for learning design. Microworlds, originally conceived by Seymour Papert for enabling students to learn about science, are understood as "…computational environments embedding a coherent set of scientific concepts and relations designed so that with an appropriate set of tasks and pedagogy, students can engage in exploration and construction activity rich in the generation of meaning… [the] structure included the semantics and rules of the language, as well as the graphical representations of the concepts and relations of the domain characterizing the microworld" (Healy and Kynigos, 2010).

[1] To view the current patterns, experiment with them, and contribute further patterns, please see the website tinyurl.com/ldsepatterns.

The 'scientific concepts' in this case are the current ideas in the research literature about the alignment of the different components of a learning design – aims, outcomes, methods and assessment – the concepts of what constitute outcomes of learning, the types of teaching methodologies, such as social constructivism, collaborative learning, the range of learning technologies and their pedagogical characteristics, etc. These concepts and the relations between them have to be represented in the LDSE in the form of an ontology, so that as the user builds a learning design in the system, it is able to advise and offer contextualized help, or relevant examples of existing learning designs. The 'students' in this case are the lecturers using the LDSE, and the construction activity is the design of a course, module or session.

The key feature of the students' activities enabled by such media was the ability to make constructions and change and extend the rules and relationships of the microworld itself. The highly editable nature of these media and their executable representations providing immediate and epistemologically succinct feedback… permitted exploration, bricolage and construction: a kind of learning, which characterizes the constructionist perspective of Papert et al. (Healy and Kynigos, 2010, p. 64).

In line with this, in the LDSE the user creates a design either by importing it or by constructing it, by defining aims and learning outcomes, and by dragging different types of teaching methods onto a timeline, to specify the sequence of teaching and learning activities to be carried out in a session – the graphical expression of a pedagogical pattern. The relationship between the teaching methods chosen and the resulting learning experience, can be explored by the user in the form of graphical feedback showing the likely effects of their learning design. An example of this is shown in Fig. 2, where the sequence of types of learning activity and their duration



(a) (b)

Figure 2. (a) the LDSE timeline with different types of teaching method defining the sequence and duration of learning activities, where the highlighted activity can be annotated in the fields below; (b) the calculation of proportion of learning experience this design results in, given the properties defined for each teaching method

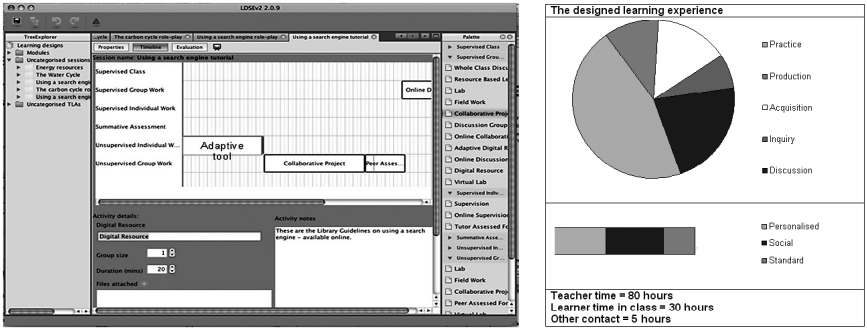
defined on the timeline has been interpreted in terms of the proportions of learning experience they are likely to result in.

This direct and succinct feedback on the learning design enables the teacher to reflect and redesign, perhaps with advice from the system, but always allowing the user to retain control over the definitions, and to contribute to their personal ontology, and collection of learning designs: "… an important feature of microworlds has always been that they should evolve as the learner explores its territory, adding to the initial model by building new objects and new relationships using the given tools… the microworld grows along with the knowledge of its users... It is in this growth that we can locate the essence of constructionism" (Healy and Kynigos, 2010).

The LDSE conforms to this requirement because the main concepts, such as teaching methods, have properties defined by the system, e.g. the type of learning afforded (through acquisition, inquiry, discussion, practice, or production), or the appropriate group size, etc. Each teaching method, such as lecture, tutorial, online discussion group, interactive model, etc. has a properties palette, which the user can access and change, according to their own context. This change creates the user's personal ontology.

Experimentation with the design, and especially with the conversion from conventional to digital technologies, is supported when the user tries changing from a 'digital resource', as in Fig. 2, which might be a web document, or animated diagram, to an 'adaptive tool', such as a microworld, or simulation, or interactive tool, as in Fig. 3.

Here the nature of the learning experience is likely to change, because instead of simply reading a web resource, or looking at a diagram, the students are engaged in the experimentation and testing of their ideas,



(a) (b)

Figure 3. (a) the timeline with the digital resource replaced by an adaptive tool; (b) the calculation of proportion of learning experience this design results in, with a much higher proportion of learning through practice afforded by the adaptive tool

afforded by an adaptive tool that gives them feedback on their actions. Insofar as we want to make the case for learning technologies in terms of the more active forms of learning they afford, such as practice, discussion, inquiry and collaboration, this type of microworld enables the teacher to test out the implications of these ideas, to 'learn by doing', just as we argue our students should do.

There is not the space here to outline the full system structure, but these examples illustrate the approach, and show how it can be possible to give teachers a collaborative and adaptive experience of learning about the design of teaching, and the implications of introducing new technologies.

Summary

- Teachers need to 'learn by doing', become a network;
- Give them tools to design and share new teaching;
- Use pedagogical patterns to exchange good ideas;
- Use OER to populate the well-designed pattern;
- Improve the use of ICT in teaching and learning.

https://sites.google.com/a/lkl.ac.uk/ldse/Home

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Towards Global Education: the Need for the 21st Century Literacies

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UNESCO World Conference of Higher Education in 2009 concluded, among other things, that "Higher education institutions, through their core functions (research, teaching and service to the community) carried out in the context of institutional autonomy and academic freedom, should increase their interdisciplinary focus and promote critical thinking and active citizenship". Furthermore, "International cooperation in higher education should be based on solidarity and mutual respect and the promotion of humanistic values and intercultural dialogue".

Educators have committed to these objectives clearly as observed by Elise Boulding already in 1988: "The objective is to create a peaceful, interdependent world which would be a good place for people to live. No one society can impose a universal order acceptable to all other societies. The creation of species identity that will encompass cultural diversity is a major challenge" (Boulding, 1988).

However, the technology-push global thinking is dominated by economic technocracy and does not reflect enough the nature of multicultural world. One example of the current global innovation network of leading universities in the case of Nokia is given in Appendix 1.One way of approaching the problems of global university education is to construct a taxonomy or staircase of different tiers. Figure 1 is constructed from the analysis of Edward Guiliano, President and CEO, New York Institute of Technology (2009):

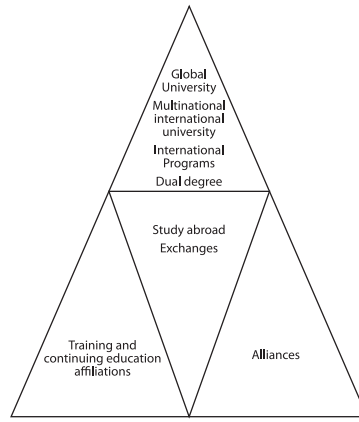

Figure 1. Toward a Taxonomy of Global Academic Programmes

In Guiliano's approach the lowest tier is composed of non-credit-bearing affiliations including conferences, training programmes, and extended education-type offerings. These are very close to friendship alliances which include co-operation agreements and memos of understanding for research, and student as well as faculty exchanges.

The next levels would be composed of studies abroad and exchange programmes. These programmes mean studying or living abroad with another faculty of the same university in another country. In general, full degrees cannot be earned at these sites, but courses and study at them fulfill requirements for degrees at the home campus. Dual degree programmes leverage strengths of each university and campus. Students study both curricula and attend both locations. Another type of international programmes is a degree or credit-bearing certificate programmes for foreigners.

A multinational university or international university means degree-granting branch campuses, generally staffed by faculty not affiliated with home campus, autonomous or semi-autonomous administration and governance extending to the curriculum. Degrees carry name of home institution, but usually with a separate designation.

The highest level in Guiliano's tiers is global university. For him this means one degree, one curriculum offered by a university at one or more global locations, characteristics include exchange of faculty and students, and virtual or distance-learning classrooms. This New York Institute of Technology model includes "some degree of practical 'glocalization', but a true outward-looking global university with one set of standards and outcomes worldwide, one administration, and where students, faculty and ideas freely flow without borders, evolving global understandings and new 'globalized' content over time" (Guiliano, 2009).

In a way this approach is very close to our own model of Global University System (GUS) which we have developed at UNESCO Chair in Global e-Learning at the University of Tampere, Finland. The Global University System (Utsumi, et al., 2003) is a free (volunteer-based, multi-sponsored) grassroots initiative to widen access to higher education and vocational education and training, and to help participating institutions to meet local needs in ways that are locally-appropriate and globally-informed. The GUS encourages the integration of untapped or poorly-deployed human and technical resources, particularly to facilitate the diffusion worldwide of low-cost means of access to the communication and education resources that the privileged West takes for granted. Since it began in 1999, the GUS has become global. It works in the major regions of the globe with partnerships of higher education and healthcare institutions.

This project has been modeled very much with the inspiration of the best traditions of American thinking: we have believed that the culture

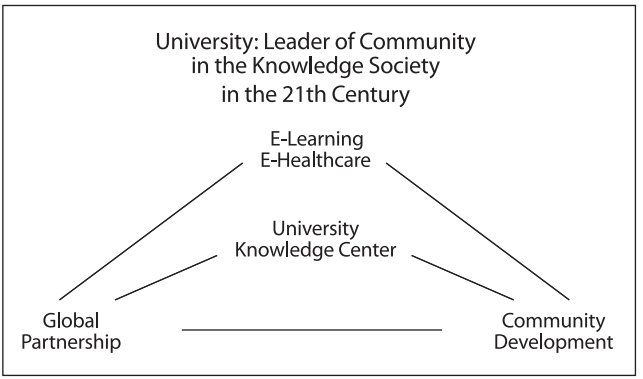

Figure 2. The Mission of the Global University System (GUS)

of America is particularly suited for the creative mind because it has emphasized:

- Extreme freedom of thought;
- Focus on independent thinking;
- Steady immigration of new minds;
- Risk-taking culture with no stigma attached to trying and failing;
- Non-corrupt bureaucracy;
- Financial markets and a venture capital system that are unrivaled at taking new ideas and turning them into global products.

The process of globalization has brought our attention to the complexities of the multicultural world and challenges of the true nature of the emerging global knowledge society. The UNESCO study *Towards Knowledge Societies* (2005) revealed that there is a general agreement on the expression 'knowledge societies', but not on the content of it. We can ask: "Are we endorsing the hegemony of the techno-scientific model in defining legitimate and productive knowledge? Should the term 'Digital Age' be replaced by multicultural world? How do we promote the spirit of knowledge sharing and caring the new humanism?"

These were some of the concerns for me to work with professor José Manuel Pérez Tornero, Autonomous University of Barcelona, for the UNESCO Institute for Information Technologies in Education (IITE) on the publication *Media Literacy and New Humanism* (2010). Under civilisation we mean a specific state of technical development which corresponds to a precise evolution in the manmade environment in which humanity operates, and which is supported by a given set of knowledge, codes, languages, skills and intellectual capacities related precisely to this manmade

environment. These intellectual capacities are known in their broad sense by the name of culture, and we shall call the shift from one state of civilisation to another evolution in the civilising process.

In our view the threshold of the 21st century based on these concepts, can be described as:

a) a technological civilisation based on the digitalisation of information;

b) a media culture organised around the media and their convergence, and that it is subjected to

c) an extremely rapid process of civilising evolution that is only gaining momentum.

The key to this state of affairs must be sought in the fact that during the last few years of the 20th century and early years of the 21st century, digital technologies and the new media (ICT) have come to occupy the epicentre of our lives. They are thus a key factor in this specific civilizing stage.

They are responsible for having constructed the hypertechnological man-made environment in which almost all people and objects have been endowed with a kind of digital interface, so we work, live and interact in a digitally enriched environment, in a kind of digital bubble.

In brief, we can identify some global trends in technology and education. First of all, the world is becoming increasingly multicultural. There is a general confusion of the essence of universalism and uniqueness in the multicultural world. Globalism has brought such quantities as technics, markets, tourism, and information, but universalism deals with values like human rights, liberties, culture, and democracy. Each culture and language is unique. Globalism tends to dominate over the awareness of human values.

In my understanding, we face three kinds of problems. First, we have to try to understand what the learning process of becoming literate is, and what communication competence and media skills mean in the information society. Second, we have to analyze the increasing neo-illiteracy. Third, we should discuss what kind of skills and competences people should have in order to become active citizens now, as compared to the earlier skills of writing and reading.

In an intercultural world communication necessarily mediates different values and cultural behaviors. Great civilizations and cultures have very different patterns of communication and use different senses in a different way. In consequence, if a truly global information society is to be created, more attention should be given to the diversity of cultures and the co-existence of different civilizations and cultures. For the development of our

own language it is necessary to rethink the whole education system, from primary to higher, and understand the links to multiliteracies, multimodality and multimediality.

The study of complexity has brought science closer than ever to art. Knowledge has gone through a cycle from non-specialism to specialism and is now moving back to interdisciplinarity, even transdisciplinarity. Art deals with the sensual world (media as the extension of senses) and the holistic concept of human being. Traditional knowledge has been disciplinary based although increasingly interdisciplinary. In the vocational field, knowledge is also contextual and needs to be created in application – learning by doing. This also reflects local and regional realities. The Western philosophy is characterized by analytical, scientific, objective, rational, and critical thinking, while the Eastern approach is characterized by synthesis, literature and art with a subjective and emotional thinking. One cannot and should not dominate the other. There should be a close dialogue between them. In a sense, many of the basic issues were already discussed in the ancient Greece by Aristotle's Poetics, which is of particular importance to understand the balance between different senses of the human being and the combination of sound, drama, and text like in modern multimedia. Also Aristotle's definition of rhetoric as the faculty of discovering in any given case the available means of persuasion is a relevant approach to analyze the influence of modern media.

In order to learn new technologies and become digitally literate, new forms of learning paths have to be developed utilizing all forms of learning, especially at work and non-formal environments. At the same time, special attention should be given to teacher education in ICT skills and competencies. The period of transition in which we are now living differs from the periods of change of older dominant media. Traditional print and electronic media were introduced within a period of reasonable length, and when we moved to the active use of a new form of communication, we could also have a rough estimation of the economic and social impacts of this transition and train new professionals for the media and support people for the institutions. Now different forms of communication and technologies integrate and converge with such a speed that hardly anyone has the time or ability to assess all of the consequences, real possibilities, or problems.

The use of ICT and digital skills in performing art, craft, and other fields require a team work with special skills. The trend of digitalization does not mean that everything traditional should be rejected. New communicative inventions have always destroyed something valuable, and special attention should be given to the diversity of approaches in the ICT applications. A blended approach is often adopted. The most essential in this new learning environment is the fact that the learner is constantly facing epistemic

conflicts when a problem is presented that needs to be solved but lies outside the learner's current repertoire. Most of the problems of the information society will be of that kind. The learner needs to proceed with self-regulation with an active engagement, which is the learner's response to the conflict. The idea is to adjust and reconstruct thinking to deal with the learning problem at hand.

The cultural dimension in the ICT applications also brings the dimension of feelings and the spirit of sharing and caring to the process. The social dimension requires inclusive policies. In an intercultural world communication necessarily mediates different values and cultural behaviors. Great civilizations and cultures have very different patterns of communication and use different senses in a different way. In consequence, if a truly global information society is to be created, more attention should be given to the diversity of cultures and the co-existence of different civilizations and cultures.

People of the work force face two overlapping challenges. The first is to acquire the skills necessary to enter an increasingly digital job market, and the second is to continually improve those skills, and acquire new ones, as lifelong learning. Many studies suggest that workers around the world may not be keeping pace. It is widely believed, that schools are failing to sustain the pipeline of employees who are adequately prepared to exploit new knowledge and skills.

The first skill in the working life is to define the information problem. It is not possible to look back for an answer from earlier practice since it does not exist. This is followed by identifying information needed in order to complete the task to solve the information problem. There is a wide consensus that all workers should be able to:

- master appropriate tools to gather information;
- understand the context of that information;
- actively shape and distribute information in ways that make it understandable and useful;
- share ideas, opinions, questions and experiences.

People have always learned at work. According to Mr. Mikko Salminen, Nokia Learning Centre Network of Nokia Corporation, the paradigm of learning at corporate setting is rapidly shifting from skills development to capability management. The strong drivers behind the change are the ever increasing need for faster innovation cycles and the ability to support the strategic competency renewal (Salminen, 2005).

The new learning paradigm can be expressed as the 70–20–10 formula of learning:

- 70% of the capability is built through on-the-job development and real life experiences;
- 20% is built through coaching, assessments and increased self-awareness;
- 10% is acquired through structured learning deliveries such as instructor-led-trainings and e-Learning.

The learner will soon realize, that by adapting this formula he/she will make each day a learning day. The need to separately plan the time for learning and work disappears and learning becomes work as usual.

However, this does not mean that we will invest less in learning and development, says Salminen. Basically, the formula is about developing the right mindset for learning rather than making choices between learning events and modes of delivery. There will always be room for skills based competency development, and certain enabling skills will continue to be delivered in a classroom, not to mention highly interactive leadership development, where discussions and networking play a major role. In a similar fashion, e-Learning is here to stay as an easily scalable and cost-efficient delivery channel for theoretical solutions.

As the new working culture emphasizes the importance of lifelong learning, corporations are beginning to provide workers with the means to customize and direct their own learning experiences. There are still several steps to be taken to improve employment opportunities for individuals and expand the innovative capabilities of companies. Everybody in working life and training is becoming more responsible for ensuring the development of the knowledge and skills acquired.

José Manuel Pérez Tornero and myself identified five important dimensions of the new humanism, that in comparison to the old humanism of the Renaissance, needs to be developed now, in the 21st century. If the global communication society has come hand in hand with disproportionate promises and unfulfilled utopias, today it is compulsory to examine and evaluate why this has transpired. It is now imperative to abandon blind trust in technology and to deepen our critical spirit. We need to develop an aware attitude that is capable of weighing positive and negative effects of the changes, and especially that is able to inspire new technical developments that jibe with human beings' aspirations.

To accomplish this, we must first dissolve the axiom of spontaneous technological progress and accept the fact, that when technological alternatives are chosen, progress is only one option among many. The positive development of the media technologies will depend on our ability to take the right decisions and gain cognizance of their potential impact. The global communication society harbours enormous potential, along

with some risks. However, its full, positive realization depends on whether humanity, including each and every one of us, gains in awareness and responsibility.

From our standpoint, today this awareness must be media-related and humanistic. On the one hand, as media-related, its main goal must be to monitor the development of the media and be keenly aware of what it may represent for humanity, for better or for worse. On the other hand, this awareness must drive the values of a new humanism, and it must do so in many senses:

a) In the sense that it must situate the human person at the core of this media civilisation, this new manmade, telecom world around us, just as in the Renaissance the humanists managed to place human beings at the centre of a world which had been organized by theology until then;

b) In the sense that this new awareness must drive the primacy of the critical sense towards technology and thus replace this trusting and rather unselective attitude that prevails today and forces us to unconditionally accept technological innovation. This echoes how the humanists defended a free, critical interpretation of the classical texts and ultimately the autonomy of the intellect and the human person. While Renaissance humanism served as a critical filter of the values of its day by filtering mediaeval culture with classical culture, the new 21st century humanism most foster a critical sense which is alert to the hypertechnologized environment and capable of discerning between what should be kept and what should be revamped;

c) In the sense that while Renaissance humanism helped to 'discover' the sense of self and biography and fostered a new form of individual autonomy compared to the sometimes asphyxiating weight of traditionalist thinking, the new humanism must help to foster a sense of autonomy in a context in which global communication can engender dependence and very subtle forms of intellectual subjugation;

d) In the sense that while Renaissance humanism was characterised by a 'discovery' of new 'worlds', America first and foremost, but also Africa and Asia, giving rise to an 'encounter' – often violent – between cultures and civilisations, the new humanism in the global communication society must prioritize a new sense of respect for multiplicity and cultural diversity and must support media development with the goal of consolidating the new culture of peace;

e) Finally, in the sense that, just like Renaissance humanism, through the new media and humanistic awareness now is the time for us to be capable of reviving the classical idea of the cosmopolitan, universal citizen, with very clear rights and responsibilities, which entail a planet-wide

commitment. We must foster a kind of citizenship that stimulates the idea that individuals view themselves as the bearers of universal rights, as well as responsibilities which are also universal.

Today, media awareness and the new humanism are inseparable. They are the obligatory response to the formation of a technological civilisation and a media culture.

The cultural dimension in the communication and technology applications bring also the dimension of emotions and affection and the spirit of sharing and caring to the process. The social dimensions require inclusive policies. The Internet does not automatically promote social understanding and integration. In an intercultural world communication necessarily mediates different values and cultural behaviours. Great civilizations and cultures have very different patterns of communication and use different senses in a different way. In consequence, if a truly global information society is to be created, more attention should be given to the diversity of cultures and the co-existence of different civilizations and cultures.

Perez Tornero and myself think, that no matter how disperse and diverse it has been, the international media literacy movement has always shared the idea – formulated more or less explicitly – that it is necessary to reach a new media awareness. This media awareness would help us to achieve two key goals: a) ascertain the importance and influence of the media system in our everyday life, and b) develop the competences needed to use the communication technologies bearing human goals and values in mind.

The different aspects of media literacy are related to other fields, such as:

a) critical thinking and an improvement of the capacities of selecting and processing information;

b) the problem-solving capacity;

c) improvements in expressive, communicative and interactive capacities;

d) civic participation and active citizenship.

Today media literacy is one of the major objectives of educational and communication policies, and at the same time, attaining this media literacy is currently a crucial condition for the development of free, democratic societies.

Today, knowledge and skills for international and intercultural interaction are needed in nearly all fields. That is why multicultural studies should be made an integral part not only of general education, but also of adult and vocational education and training. It is essential to consolidate global education in the curricula, teaching and operational cultures of schools and vocational institutes. Instruction must offer tools for finding out the

causes and effects of different phenomena and for drawing conclusions, which at its best leads to growth into active, critical and mediacritical world citizens.

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Appendix 1.

The Open Innovation Network of NOKIA

Modern Areas and Prospects of ICT Use in the General Education of Russia

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The development of education systems in the developed countries at the turn of the centuries was influenced by a number of macro- and microeconomic social factors, most notably, the global informatization process that marked the transition to the post-industrial society with information and knowledge being its main priorities.

The informatization of the education system in the Russian Federation enjoys support and a most active participation of the government. Since 2001, systematic measures have been developed for the informatization of the Russian education system intended to help to overcome the obvious gap in the level of informatization between the domestic education system and the education system of the developed countries. Determined actions aimed at the informatization of the domestic education system were carried out within the framework of the federal target programmes and the branch programmes. Their implementation from 2001 to 2005 resulted

into creation of favourable conditions for the systemic modernization of the education system adequate to the needs of the post-industrial information society. Further systematic informatization of the Russian education system was marked by the implementation of the National Project "Education", the Federal Target Programme for Education Development for 2006–2010 and the Informatization of the Education System project. Since 2006, these programmes and projects have largely contributed to the creation of the common educational information environment:

- schools received a large amount of equipment and were provided with the Internet access (National Project "Education");
- educational portals and websites were developed, new-generation electronic educational resources were created for 12 school subjects, in particular for children suffering health problems, and placed openly on the Federal Centre for Educational Information Resources website (http://fcior.edu.ru/) in the framework of the Federal Target Programme for Education Development;
- the Common Collection of Digital Educational Resources (http://school-collection.edu.ru/) was developed, models for distant learning in professional education and for the Internet-support of the teachers were elaborated; a new impetus was given for the development of educational institutions providing virtual education with the use of distant education technologies (Informatization of the Education System project);
- the Single Window information system was developed to ensure the access to the educational resources (http://window.edu.ru/, Federal Target Programme for Education Development).

The involvement of wide pedagogical community into the testing of learning materials and distant learning at schools can be considered as one of the significant results of the Informatization of the Education System project.

The analysis of social networks and communities revealed that such pedagogical network communities and networks as Open Class (http://www.openclass.ru/), Creative Teachers Network (http://it-n.ru/), Dnevnik.ru (http://dnevnik.ru/), Pedagogic Workers Social Network (http://nsportal.ru/), etc. have currently been developing actively. Therefore, one can conclude that thanks to the endeavours of the government, a common educational information environment has been created and is now at the stage of its development, i.e. there are all conditions for the large-scale practical implementation of ICT in the general education.

At the same time, models and methods for the ICT use in the general education and in the teacher training system have been developed and tested,

which is the case with new modern ICT-based educational technologies that will ensure a higher effectiveness of the educational process at large and the transition from the teaching to the learning model.

Nevertheless, despite the progress made, Russian teachers are still not using ICT in the profession actively enough. The results of the experimental activities carried out in the Herzen State Pedagogical University of Russia showed that PowerPoint or Impress presentations as well as the use of the Internet for the preparation of classes and for the e-mail communication are currently most common among teachers. There is a low demand both for the Common Collection of Digital Educational Resources and the new-generation electronic educational resources located in the Federal Centre for Educational Information Resources. The pedagogical potential of the educational Internet, of the Internet-based professional pedagogical cooperation and organization of the small-group learning is not used enough in the teacher community. Most teachers undervalue the pedagogical possibilities of the Web 2.0 technology. None has the possibility to create author's learning courses based on the new-generation electronic educational resources located in the Federal Centre for Educational Information Resources and enjoy support of the teacher community. The problem of modern ICT-based educational technologies implementation in the general education remains unresolved: the reproductive teaching model still remains priority in the Russian general education which not only makes the effectiveness of the ICT use significantly lower, but also hinders the transition from the teaching to the most promising learning model. So there is an obvious contradiction between the conditions created by the common educational information environment with its big pedagogic potential and its low popularity among most of the Russian teachers. It may be in particular influenced by the fact that according to the statistics, the Russian general education system has about:

- 21% of teachers belonging to the so-called generation Y (Digital Natives, born in 1980 – …). Teachers representing this group actively use ICT in the profession and in future they are expected to more actively cooperate with their colleagues and learners in the Internet to address their professional pedagogical tasks;
- 40% of teachers belonging to the generation X (digital adaptation, born in 1965–1979) who use ICT with big functional limitations, for instance only for the search of information or e-mail communication;
- 33.3% of teachers belonging to the BB generation (Baby Boomers, born in 1945–1964) and therefore having difficulties with the ICT use and resilience to it;
- 5.7% of teachers being older than 65 and also having difficulties and being resistant to the ICT use, and underestimating its possibilities.

As a result, the level of ICT competencies of the teachers representing the second, third and forth groups is lower than the level of ICT competencies of the learners, and this gap will widen in the future. Moreover, already now the conflict is obvious between the learners belonging to the so-called network generation and the classical pedagogy oriented at the classical methods of information and knowledge sharing. A significant rise in the level of ICT competencies of teachers is expected when graduates from pedagogical universities (generation Y) will come to schools and replace the representatives of the BB generation. The implementation of different teacher training models and programmes for each group of teachers might be promising. For instance, periodic teacher training programmes both for modern ICT and their use in the teaching process and for the already existing ones are needed to overcome the limited conservatism of the teachers from the second group (generation X) and to enhance their ICT competence. Wider dissemination of knowledge, in particular through mass-media, about the existing electronic educational resources and their possibilities for the teaching process might be useful to enhance ICT competence of the teachers.

The promising areas of ICT development in the education of Russia and other countries are mobile, ubiquitous, nomadic and mixed types of education based on the mobile communication devices ensuring the access to learning materials at any time and at any place.

Mobile learning (m-Learning) is learning with the use of mobile information technologies everywhere where it is not possible to use standard laptops and other PCs. The technological basis for the ubiquitous learning (u-Learning) is provided by the specialised technologies (such as matrix codes, geolocation, etc.) allowing the learning process in every situation (for instance during journeys or internships) by using the identification information about the surrounding objects. The most significant projects have been implemented in Korea (the KERIS project, http://english.keris.or.kr) and in Canada (Capilano University, http://www.allnationscoast.net/capilano-u.html). In Russia, the UbiPlace project (letopisi.ru/index.php/UbiPlace) is one of the projects implementing the ubiquitous learning model in the country. Nomadic learning is a form of e-Learning where the learners have permanent access to the educational resources through the use of mobile devices by accessing the network and joining the participants of the learning process (teacher – learner, learner – learner) via wireless connection (802.11b/g/n, WiMAX, Bluetooth, mobile telecommunication, etc.) from any part of the world for communication, information exchange, mutual learning. Unlike M-Learning, the participants of the process are supposed to communicate via the P2P (peer-to-peer) network established between their mobile devices, so that a social network is created between the participants of the educational process where they carry out their educational communications. While u-Learning fits well

into the everyday life and becomes a basic necessity just as food, clothing and accommodation do, the nomadic learning ensures the independence of the learning content supply and free access to it, but the model itself does not imply the full integration into the day-to-day life as the u-Learning does.

In the Russian pedagogy, the theory and practice of mobile, ubiquitous and nomadic learning are not well developed, that creates an urging scientific-pedagogical problem when taking into account the big prospects of mobile technologies. The mixed education as an integration of distant and traditional learning models is being implemented in the teacher training system as a support for the traditional on-site training system, as well as in a number of general and higher professional educational institutions of the Russian Federation (distant and online support of the learning process, methodological support of the ICT-based learning process, etc.).

One more promising area of ICT use in education is the development of informal education (mutual learning, learning on demand, learning through the knowledge exchange) and its integration with the formal education as well as development of social education on the basis of social networks and its incorporation into the traditional learning process. The elaboration of individual learning patterns for talented learners, learners having problems in learning, disabled or learners suffering health problems and thus not attending educational institutions should also be given further development. As far as the development of electronic educational resources is concerned, there are big prospects in the creation of online learning games and virtual learning worlds for different subjects and cross-subject ones as well as collectively used learning environments for learning activities in pairs or in small groups.

Despite the huge pedagogical potential of ICT, it is important to pay attention to the risks related to their use in the general education. The risks of ICT use include:

- computer phobia, technostress, overtrust or mistrust of computer data, anxiety during the work with computer;
- Internet addiction, hacking, living in the virtual reality, autisation, transformation of the identity, absorption into computer games (individual, group or role games), poor social intellect;
- degradation of the speech function as an effect of the online communication through the use of a "hybrid of written and spoken language with the use of paralinguistic means";
- deviant (abnormal) behaviour as a result of fashion for ICT;
- irregular daily schedule of the youngsters, impaired vision, problems with the musculoskeletal system, hypodynamia.

The development of the preventive measures system requires additional psychological-pedagogical studies, upgrading and using of active learning methods, social-psychological, psycho-physiological and pedagogical monitoring of the consequences of the ICT use among the learners, enhancement of the ICT culture among the parents, etc.

The ICT use in the general education guided by the more the better principle will not contribute to the real enhancement of the learning effectiveness, and will rather provoke the negative implications listed above. The ICT use will be reasonable and will ensure higher learning effectiveness only if such use meets the concrete needs of the education system and the learning without the use of ICT is impossible or problematic.

In conclusion, it should be noted that the problem of the risk assessment of the ICT use is relevant not only for the Russian education system, but also for the education systems of the countries where ICT are actively used in the general education. The attention of scientists, teachers and general public to the problem is caused by the ongoing informatization of the education system and the rising level of school equipment with ICT which allows access to electronic educational resources, access to the Internet and, accordingly, better information access. Due to its relevance and social importance, the issue of the information security and systematic prediction of risks related to the ICT use requires its further complex development with the involvement of psychologists, teachers, lawyers and sociologists.

Exploiting E-Learning in Future Teachers' Education

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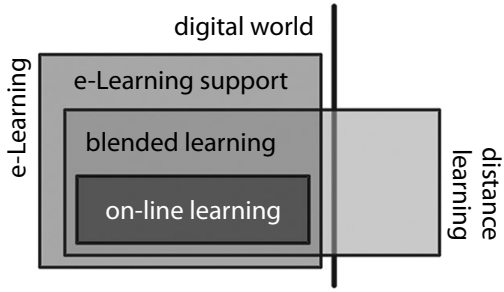
Recently we have frequently been confronted by the question of how e-Learning could be exploited as a productive support in the future teachers' education. The question is highly justified, although quite unrewarding, because it operates with several dim concepts: (a) different people have considerably different interpretations of the term e-Learning, (b) we are not sure what productive support should exactly mean, and (c) many authorities intuitively tend to believe that e-Learning and online learning should not be engaged in future teachers' education at all. Therefore, we decided to tackle these questions in a correct way which would yield new knowledge into the field of future teachers' education and also to the research area of Technology Enhanced Learning (see e.g. Laurillard et al., 2007).



e-Learning support *– essential exploitation of any e-media in order to support the learning process. It may be publishing study materials on the web, using data projector at the lecture, etc;*

blended learning *– a blend of exploiting digital technologies and traditional face to face teaching/learning;*

online learning *– the Internet is the primary channel for communication and presentation. No less than 80% of the learning content reaches the students via the Internet. Personal sessions are exceptional for online courses.*

Figure 1. Relations between different forms of e-Learning, which we will explore

First we felt the need to clarify all those mentioned concepts, and then we proceeded by developing a method which would at least partially allow us to answer our research question in an interesting and valid way. This paper is an abridged report on our method and some of our interesting findings[1]. We believe that this approach presents an interesting way how to introduce certain system into a rather informal issue and could be useful for studying other similar questions as well.

Clarifying essential concepts

If we ask how to make productive use of e-Learning support in future teachers' education, we have to clarify what e-Learning is, what productive support is and how e-Learning fits into teachers' education. We started our research study by more precise characterization of e-Learning. This concept has many different forms, interpretations and approaches, which get different names in different contexts, emerge and sometimes disappear or change their meanings. Let us list some of them: computer assisted learning (CAL); computer-based training (CBT); web-based learning (WBL); web-based training (WBT); blended learning; online learning; open and distance learning (ODL); computer supported collaborative learning (CSCL); learning management systems (LMS), etc. To better structure our task, we decided to consider only three different stages or forms of e-Learning: e-Learning support, blended learning, and online learning. Figure 1 presents their specifications and relations between them.

[1] We are preparing a detailed report on our research to be published soon.

We decided to interpret 'productive support of an approach' in our study as a pedagogical intervention which contributes to attractiveness and efficiency of the learning process, which is modern and appropriate for the 21st century requirements, better corresponding to expectations and needs of the 'digital world'.

Finally, if we wanted to study how e-Learning fits into future teachers' education, we also had to study an additional question: how does it fit into teaching form of the future teachers' education? Therefore, we analyzed our future teachers' study programmes from this perspective and based on the academic classification, we identified five different teaching forms in them: (traditional) lecture; illustrative lecture with interactions; practice; seminar; and workshop[1]. From the footnote it is easy to see that traditional lecture rightly plays only a modest role in the present study programmes of our future teachers, while the most common are illustrative lectures with interactions and practices. On the other hand, we have to admit that the modern form of workshop is represented insufficiently.

How to build a 'metric system' to characterize different teaching forms

The above-mentioned five teaching forms have their traditional definitions in the common academic literature. However, we decided to characterize them differently: we classified each of them from four perspectives – from the perspective of students, lecturers, types of digital technologies, and applied pedagogy. Within each of these perspectives we decided to explore one or several indicators. For example, within the applied pedagogy we studied three different indicators: teaching methods, form of communication and the level of collaboration[2]. Figure 2 illustrates how we visualized perspectives and indicators in a radar chart. Note, that each indicator constitutes one axis. The axes can in fact be considered as independent variables – their values always being qualitative data, either (a) categorical, (b) ordinal, or (c) interval (see e.g. Newby, 2010).

One of the most difficult tasks for us in this research was to identify reasonable values for each variable and how to order them on the axis. Finally, with all three kinds of data we decided to order the values from more traditional in the centre to more modern or recently implemented in the teaching practice at the periphery, see Fig. 2. For example, in the pedagogy perspective

[1] If we classify each activity of our future teachers' study programme into one or two of those five teaching forms, we can observe that (traditional) lecture constitutes 13%, illustrative lecture with interactions – 47%, practice – 53%, seminar – 40% and workshop – 3%. The total of these numbers exceeds 100%, because we have classified several activities as belonging (by different parts) to two different categories.

[2] Unfortunately, presenting more details about academic classification and our own system of indicators for specifying all five teaching forms goes beyond the scope of this paper.

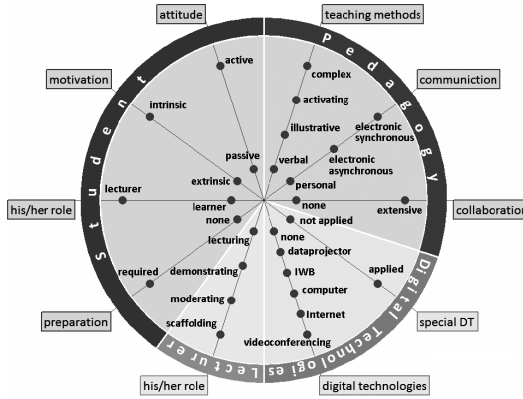


Figure 2. A radar chart of four perspectives and ten indicators to characterize different teaching forms

and its communication indicator, we decided to distinguish three values: personal, electronic asynchronous, and electronic synchronous.

In the next step we used this 'metric system' of perspectives, indicators and their values to visualize each of the five teaching forms from our future teachers' study programmes. We did this as follows (Fig. 3 illustrates the process, watch its upper right part which defines the illustrative lecture with interactions). On each axis (i.e. within each indicator) we indicated either:

- cone characteristic value, for example on the communication axis it is personal;
- ctwo of the values – to denote a set of values or an interval of values, for example on the role of the lecturer axis these are two adjacent values lecturing and demonstrating; on the digital technologies axis two indicated values denote all categories of DT between data projector and the Internet;
- cinterval of characteristic values indicated by one value and a midpoint between that value and another value. For example, on the motivation axis we chose extrinsic and the midpoint between extrinsic and intrinsic. Such interval denotes all levels of motivation which are more extrinsic than intrinsic (all values 'closer' to extrinsic).

Then we connected the indicated values of all adjacent axes: either a point to point (if there is only one value indicated on each of two adjacent axes), or a point to both end points of an interval (if there is one and two values or two and one), or an interval to another interval (if there are two and two values indicated). In such way a closed polygon results for each teaching method, see Fig. 3. It determines the area into which all particular teaching/learning activities of that form should fit.

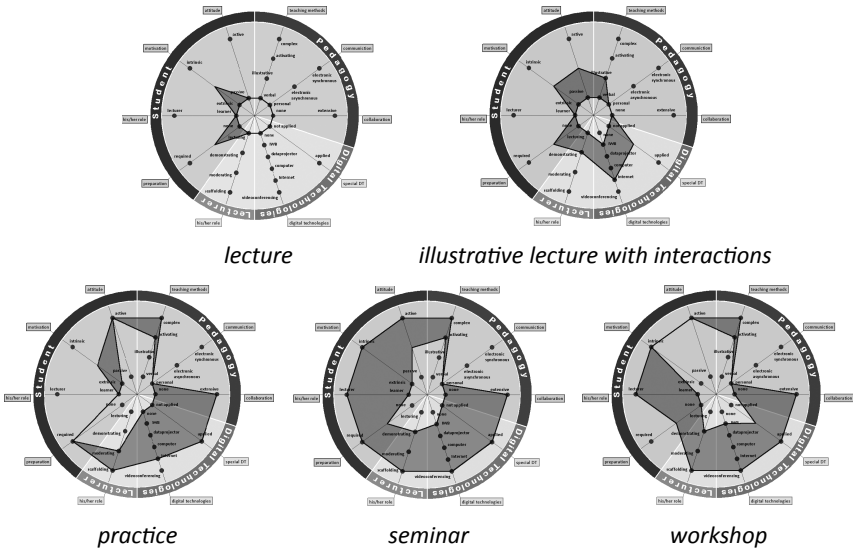


Figure 3. Five different teaching forms presented in our 'metric' system

Using the same system to characterize different e-Learning forms

In the next step we used identical system of four perspectives and ten indicators and visualized each form of e-Learning in exactly the same way, see Fig. 4. And again we can consider the resultant polygon as a visual representation of the certain area – this time the area of opportunities for a variety of implementations of that particular form of e-Learning.

In the left part of Fig. 4 we may notice that e-Learning support gives opportunities also for instructive teaching practices because it comprises 'traditional' values of the indicators as well – except for the value none for the digital technologies indicator. Excluding none for the digital technologies axis is common for all forms of e-Learning, which is quite natural. We can also see, that the area of opportunities offered by the blended learning is the widest of all – from a traditional, instructive paradigm to a constructive paradigm. However, it gives no opportunity to any teaching form, which requires no digital technologies.

If we examine the radar chart for the online learning, we will notice, that it gives no space to any teaching/learning activities, which are solely based on personal form of communication. It also requires more intrinsic than extrinsic motivation, more active than passive attitude, and students' preparation is often necessary. If we examine the indicator of digital technologies, we will find out that the most frequently used are computers, the Internet and videoconferencing. Special digital technologies are mostly not used as far as their operation would usually require personal manipulation by the learners.

e-Learning support *blended learning* *online learning*

Figure 4. Characterizing different forms of e-Learning

Matching different teaching forms against the forms of e-Learning

Finally we used our system of perspectives and indicators to consider which form of e-Learning could be implemented into which teaching form in the following way. We overlaid each form of e-Learning with each teaching form and analyzed the resultant area of opportunities or possible conflicts in some indicators. In this way we got 15 different comparisons. They clearly show that when we want to assess such appropriateness, the decisive roles are played by these indicators: student's attitude, motivation and preparation, then using special DT and communication.

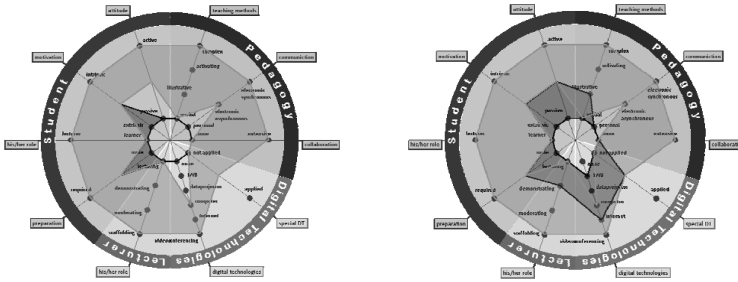


Figure 5. Matching the online form of e-Learning with two forms of lectures

Figure 5 shows how online learning can be exploited in traditional lecture (left) and in illustrative lecture with interactions (right). In the comparison on the left we can observe null match in attitude, communication and digital technologies indicators, and only marginal match in all other indicators. From those conflicts we can conclude that using online learning in traditional lecture is virtually impossible. In the comparison on the right we see that the situation is much better for illustrative lecture with interactions: the only obvious conflict occurs in the communication indicator; marginal matches occur in attitude, motivation, student's role, preparation and collaboration.

Figure 6 illustrates how online learning matches with four less traditional teaching forms (that is, all except traditional lecture). In this visualization,

however, we already hid two original layers and darkened only the intersections of the two areas. In the final part of the paper we will reflect upon how these results can be interpreted.

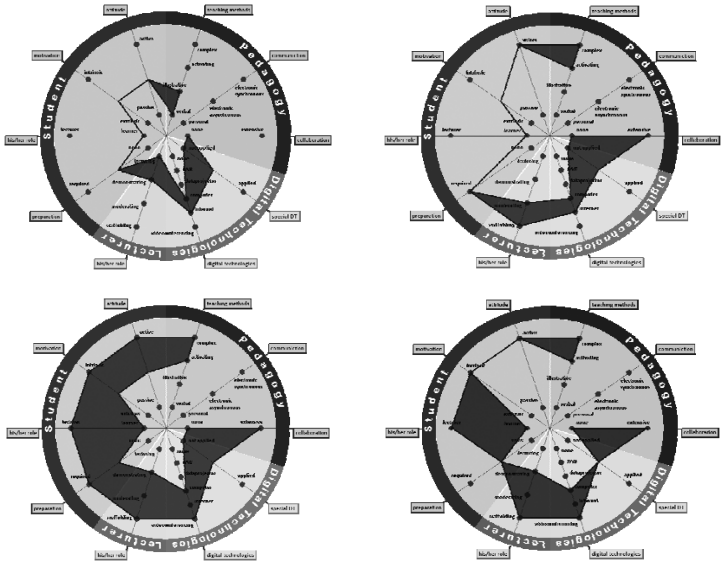


Figure 6. The space of opportunities for the *online* form of e-Learning in illustrative lecture with *interactions* (upper left), *practice* (upper right), *seminar* (lower left) and *workshop* (lower right)

Interesting findings

Let us remind that the polygon characterizing a teaching form can be considered as an area of opportunities for different implementations of that form; the polygon characterizing e-Learning form can be considered as an area of opportunities to exploit this form in the learning process. We believe that the resultant intersection depicts the area of opportunities for exploiting an e-Learning form in a teaching form. If the intersection contains an indicator with an interval of values, more options of integration exist. It may also happen that a certain indicator has null intersection (like communication for online). Strictly speaking, we might conclude that such match is impossible. More productive approach is to take this as an indicator of a problem: we should rather infer that online learning could be implemented in these teaching forms only if we accept the transition of personal communication to electronic (at least in some seminars or other teaching forms). In such way our method helps us identify the indicators with conflicts and gives us opportunity to rethink our study programmes and reflect upon the need of implementing some modifications or improvements in them. Here are some other findings of our research:

- Integrating any form of e-Learning into traditional lecture is not possible. Therefore, we decided to transform all traditional lectures in our future teachers' study programmes into illustrative lecture with interactions;
- Blended learning can be easily integrated into any teaching form (except traditional lecture);
- The most productive match results from applying online learning with seminars (yielding the largest space of opportunities).

Conclusion

When we talk about computers in education, we should not think about a machine having an effect. We should be talking about the opportunity offered us, by this computer presence, to rethink what learning is all about, to rethink education.

(S. Papert, 1987)

We did not expect our research method to give us exact answers to our hazy questions. Instead, we tried to find a valid and transparent way how to transform those questions into a relatively formal system, which would create an opportunity to identify what is typical for the teaching forms and forms of e-Learning; which indicators are suitable for transformations towards certain forms of e-Learning and which are not. Most of all, we have managed to create a research technique which helps us rethink future teachers education.

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Learning and Teaching in a Digital Society with Digital Tools

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This paper details and explains some of the more notable societal changes caused by digital technologies. Different names are employed to describe the major social forces that have shaped society. Whereas the last century has been dominated by industrialization, the last decades are often referred to as the 'information' or 'knowledge society' to the extent that computers and digitalization have changed society in profound ways. In this paper the notion 'digital society' is chosen. This is not contrary to 'knowledge society' but rather since the perspective focuses on emerging technologies, tools and devices that transform society, relations, ways of working and living together. Among these changes is the transformation of the communication through the growth of mobile technologies.

Virtually every device in current use today includes mobile technologies that make it possible to access individuals, institutions and services whenever or wherever needed. Thanks to mobile communication technology, information can be found and work can take place almost everywhere. The focus is increasingly on education and training and more particularly on the ways in which digital and mobile technologies shape learning and educational outcome. Central are the consequences of these technologies, rather than technologies themselves, being agents changing key competences as well as demanding new digital competences. Another side is the effect on knowledge, professional demands and schooling in general.

Digital society

According to A. Hargreaves (2003), "we are living in a defining moment of education history, when the world in which teachers do their work is changing profoundly, and the demographic composition of teachers is turning dramatically", and "teaching is now becoming a young persons profession again". He stresses that the knowledge economy, knowledge society is driven by creativity and ingenuity.

Within the digital society mobile connectivity is seen as one major feature. In the 1990s, as the Internet became commonly available, the growth of desktop and later of laptop computers gave rise to new dimensions of connectivity. These in turn spawned mobile networks and more advanced mobile phones – 'smartphones' – capable of accessing a growing number of Internet services almost anywhere. Devices such as iPhone and iPad (and their equivalents) offer a 'full office' in one's pocket with e-mail, camera,

GPS, books, news networks and almost any 'cloud' (Internet-based) service wanted. The new digital devices and services are increasingly embraced by publishers of books, music, films and, of course, the main news networks. The consequences of consumers turning 'digital' have resulted in dramatically reduced sales of hard copy newspapers, CDs, DVDs, and have prompted publishers to go digital.

Moving from devices to services, or content, we will take a look at 'what is delivered'. If there was nothing in the 'cloud', or on the Internet, the devices would not appear to be revolutionary. But within no more than a few years, use of new features like Facebook (LinkedIn, etc.) and YouTube have become widely spread not only among individuals of all ages, but also among businesses and organizations who make extensive use of these tools in their marketing, strategy and ways of working. Assistant professor of cultural anthropology Michael Wesch looked into the digital world and demonstrated these effects in an impressive presentation in 2008 (http://mediatedcultures.net./mediatedculture.htm).

Internet services have had tremendous effect on postal services, banking, finance, and, as is becoming increasingly clear, on public administration. Today it is common for customers to perform tasks that only a few years ago bank employees typically handled – tasks such as processing bank payments, using automated forms that are not accepted if all boxes are filled in, and the like. Part of the job and responsibility is transformed to individuals. These changes have great effects on the way institutions are staffed and organized, the more so as there are frequently enormous economic and legal implications.

Learning and teaching in the digital society

It should be no surprise that teachers who, like other professionals, are expected to be lifelong learners, must also meet the challenges of digital and mobile technologies. It is not simply a matter of mastering new technology; since the entire traditional paradigm has been up-ended, they must re-examine their profession and redefine their role of the teachers in the learning process. Understanding and mastering technology is the starting point of a process of creating a new school. Inasmuch as information – indeed knowledge itself – is not static, the need for learning must be considered the norm in a constantly changing world of new connectivity and mobility. It is not so much the devices that will be the challenge, but rather the creation of suitable and sustainable pedagogical models that are relevant to the demands of the coming knowledge society. If schools and societies are unable to do so, they will be left behind (Hargreaves, 2003). In fact, this is not simply a hypothesis: it is a demonstrable reality.

Another reality is the retirement of the whole generation of teachers who underpinned national education systems in the 1960s and 1970s. It

happens that their retirement coincides with the growth of the digital society and the recruiting of an entirely new generation of teachers, newcomers who have grown up with this technology. Teaching, once traditional approaches transfer to information ones, is becoming the profession of the young.

The major challenge will be to recruit young people to the profession and make them able to renew education according to needs, including redefining of the teaching profession. It is necessary to define new competency profiles that reflect skills needed in digitalized education. Students must become lifelong learners, being able to handle new devices and tools at whenever available and profitable and serving the purpose. Being innovative and creative, be able to imagine required skills become vital. To some extent, students will more than before experience that skills acquired on graduation may be 'dead on arrival'. Lifelong learning will be an imperative for all professions, and need to be addressed by the education system.

Education institutions must prevent self-destruction, throwing the baby out with the bath water, but rather open up to the real world developments of the digital society – changes must take place while saving vital educational values. M. Wesch's formulation of the challenge is apt: "...the solution is simple. We don't have to tear the walls down... just… begin working with students… answer real and relevant questions… [acknowledging] that we are enveloped in a cloud of ubiquitous digital information where the nature and dynamics of knowledge have shifted". Throughout the world, the number of new devices keeps increasing. In fact, students not only constantly carry devices with them, but also, for all intents and purposes, never turn them off. They are constantly connected to the cloud, for good or for bad. It is remarkable that whereas laptops are in general use, smartphones, iPods and iPads have been generally ignored by educators, despite their potential as learning tools. Teachers can benefit from this technology not only as aids to teaching new skills, but also as means whereby students can navigate both enriching and dangerous environments. It is not only a question of when and how to use different technologies; it is important to decide when they should be shut off. Being aware of benefits and risks is a part of citizenship today.

For this to become reality, teachers need forums, where they can exchange and develop ideas and share practical experiences. In the event, the Internet has both international and national forums. In Norway such a professional teacher portal can be found at www.delogbruk.ning.com ('share and use' see Google translator). Here teachers post ideas, materials, links, YouTube and the like. The portal is also a venue for discussion and debate similar to what is found in real life schools. Learning management systems (LMS) are local solutions for individual schools or groups of schools (local school authorities).

Teachers and students can and will be real publishers – in a more far reaching way than Marshal McLuhan could have foreseen (see Levinson who takes his ideas and their consequences into the digital age in Digital McLuhan: a Guide to the Information Millennium). With tools like YouTube, social media and other cloud publishing possibilities, cultural diversity can be achieved in a powerful and meaningful way. Local and minority languages and cultures, like those of the Arctic, can and should be presented in the cloud, accessible not only to them, but for the world to experience. In the global village these new voices should be welcomed. At a time when identity and understanding of UNESCO four pillars of learning seem more relevant than ever, learning to live together must be considered as a top priority.

Education is and must be contextual in many respects. All nations have their own goals and corresponding curricula and, indeed, the digital society constitutes no challenge to this basic concept. It might turn out to be more crucial now than ever. At the same time, the European Union has defined eight key competencies, among which communication is given priority both in the mother tongue, and foreign languages. Others include digital competence, learning to learn, social and civic competences, initiative and entrepreneurship, and cultural awareness and expression.

From the foregoing, it is evident that technology offers new dimensions to development of cultural awareness and entrepreneurship using opportunities offered by the Internet, or 'cloud' services. Social and civic competences are not complete in isolation from the Internet, by means of which one can learn about benefits and risks, and legal consequences of its use or misuse.

Inadequate education and training related to digital competences may give rise to severe problems for individuals, as well as authorities and society. Part of the challenge is illustrated by the current Wikileaks debate. What is clear is that with proper training and insights, the benefits will be considerable. Digital services will grow considerably creating jobs and opportunities in the future. Traditional services may also depend on digital developments.

Main elements of education challenges

During the latest World Conferences for Computers in Education (WCCE), the education committee of IFIP prepared declarations with recommendations and focus on action: the Stellenbosch Declaration (SD) ICT in Education: Make it Work, 2005 (http://www.ifip-tc3.net/article.php3?id_article=56), and Bento Gonçalves Declaration for Action (BGDA), 2009 (http://www.ifip-tc3.net/IMG/pdf/BGDeclaration.pdf). These documents are based on inputs from the experts participating in the Conferences, and are edited by IFIP members. The Stellenbosch Declaration mapped six

major areas considered beneficial for harnessing of ICT in the service of education:

- Digital Solidarity
- Learners and Lifelong Learning
- Decision-making Strategies
- Networking
- Research
- Teachers

These areas should be addressed at three main levels:

- Societal level
- Learning and teaching level
- Technology and infrastructure level

Four years later the Bento Gonçalves Declaration for Action in a similar setting and process concluded with a model including the following elements (Fig. 1):

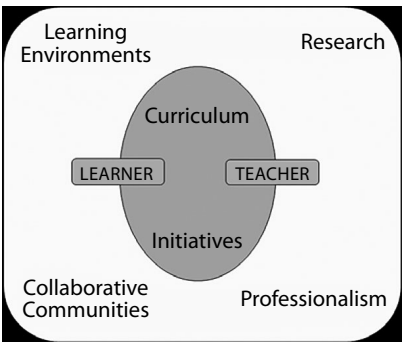

Figure 1. Emerged Themes during the 9th WCCE

While technology is not specifically mentioned in this model, it is the de facto substructure of the concept. Sustainable learning environments, collaborative communities, and research are not feasible in the absence of technology. The same can be said for curriculum, initiatives and competencies of teachers and learners.

For learners BGDA concluded: "We must recognize the fact that young people see ICT as naturally given equipment. If we do not use that as a positive fact, we will lose the new generation". Commenting on teachers – seems to 'forget' the new generation of teachers entering the profession – "Teachers

have to have their own e-Learning experiences before they are able to use it in their own teaching process". It ought to be evident, that laptops or their equivalents must be considered normal teacher equipment to deliver relevant education for the new generation. The 'one laptop per child' initiatives are consistent with the foregoing argument. The curriculum perspective, implicit in the foregoing, includes both informatics and general digital competencies, both of which target learner potential. Needed are clearly defined behavioural objectives in digital literacy that can be fed into relevant courses taught in teacher training instructions. It should also be considered how to support development of learners' creativity.

Professionalism must be seen under the global perspective of mobility of ideas and individuals, and networks as global norm for collaborations between professionals, bringing together education and the knowledge society. Such professionals blend and create new ways of seamless lifelong learning and living. Learning environments with new technologies have different notions like virtual learning environments, personal learning environments, and learning management systems – all supporting or providing more support and individualization for learners. Technology has to be harnessed to support educational needs. Too often technology is focused, rather than content and educational needs. Taking advantage of digital connectivity should encourage a shift in focus from devices to content, what is accessible of 'real world' knowledge and resources. Needed now is therefore research on pedagogy, the content and form of digital literacy and the potential of networking. In addition, strategies to strengthen links between industry and education must be developed and/or reinforced. Finally, collaborative communities must be considered indispensable for the effective harnessing of mobile technology in the service of education.

Conclusion

Future is now. Technology that is new to some people, is well known and even is in the past for others. This statement is certainly valid for the elder generation of teachers compared with the more advanced students living in a blended real and virtual world. Connectedness and instant access to information and institutions (including schools) are building blocks for our future.

A large part of the population is daily 'playing' with the Internet, or cloud services, like Facebook and YouTube. They are utilizing, testing and failing, probing the limits of what works for professional or for everyday purposes. Some have experienced enormous harm; others – individuals and businesses – have found a channel for effective communication. Many users have not learned how to use these tools (or channels) and, to the extent that they have been enrolled in appropriate courses, schools have failed to educate their students. Schools not addressing the challenges of the digital

society have failed even more, considering the duty to prepare students for life in accordance with citizenship of today.

To enable teachers for lifelong learning and develop schools to be learning organizations, they need the described instant connectivity. One strategy that recommends itself is to establish relevant pilot projects, each having a mandate in different fields but with an open profile, so that every school can follow its own line of work. Schools and teachers outside the pilots should be allowed insight and, to some extent, participation. School authorities should facilitate services and follow closely other developments in order to keep in touch with what is happening. Above all, there is a need to maintain critical reflections and accept that, whereas others might be leading in experimentation, warnings to other stakeholders may be necessary to contribute to constructive debates.

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SESSION 1

From Open Educational Resources to Open Educational Practices

Status and Prospects of the Application of Open Educational Resources and Distance Learning Technologies in Armenia

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In the social context the public education is inseparably linked to the formation of the open information society and the enhancement of information culture. Enrichment of the educational system by the features of open social environment motivates fundamental changes of its quality in regard to a greater freedom in the planning instruction. Such system allows each student to design his/her own individual educational trajectory that in the best way corresponds to his/her learning abilities and professional skills [1].

The main factors defining the development of open education on the basis of distance learning technologies are:

- the level of development of the educational system;
- development of information and communication technologies and overall information culture of the society;
- the policy of the governing bodies towards the development of open education and the level of legislation on the use of distance learning technologies;
- development of the legal framework on protection of the author's rights of the programme-makers of open learning materials.

Let's focus on the level of development of these factors in Armenia. The educational system of Armenia is compatible to that of in many developed countries, thanks to well developed educational infrastructure and traditional attitude of the Armenian people to have higher education qualifications. By the level of human resources development, Armenia takes 57th place. There are more than 1450 schools, 22 specialized secondary schools and 81 high schools in the country.

Computerization and Internet penetration

Almost all secondary and tertiary schools have computer classes and are provided by the Internet access, nevertheless the degree of the learners/students' own access to computers and the Internet cannot be considered satisfactory. The Internet penetration and the bandwidth Internet connection are quite low in Armenia, which is of course a significant obstacle to the use of information technology in education. In terms of development of communication infrastructure (including the Internet), Armenia is on 114th position in the world. The WEB-representation in Armenia is also quite weak – 117th position [2].

However, according to the Concept on Development of Information Technologies and Information Society in Armenia, in 2013 the following indicators will be achieved:

- provision of household computers – up to 50%;
- provision of school computers – up to 80–90%;
- access to the Internet community (physical, financial, and linguistic) – up to 70% (versus current 10–14%).

The policy of the governing bodies towards the development of open education and distance learning technologies

The positive trends in the policy of the governing bodies can be traced in the government reports on activities within the Bologna Process since 2001. However, the first real shift in distance education was observed in early 2008. The current provision of higher education, the list of specialties and the guidance on distance learning were adopted by the Ministry of Education and Science in the first half of 2010 [3].

In general, the document is quite comprehensive, though some parts of it, particularly, in regard to the list of unaccepted specialties, terms and procedural rules for the distance learning courses are controversial. Thus, due to the official definition, learning can be considered distance if the total volume of disciplines lectured distantly exceeds 70%. In our view, such provision is quite difficult for the initial stage of distance education, in which Armenia is actually now, and it would be proper to implement the concept of partial distance education [4]. It determines that distance education should start as the traditional one – in the beginning of the academic year, while in many countries the timetable for distance education is not fixed. The list of unaccepted specialties has some which are accepted in other countries as, for example, 'Tourism and New Service Technologies' [5].

Consequently, in order to provide the efficiency of educational process and increase the interest of universities in application of distance learning

technologies, the additional expertise and feasibility analysis of the above mentioned provisions are required.

The basis of the state policy in education is the 'State Programme of Education of the Republic of Armenia for 2008-2015' [6]. The general provisions of the programme in some way touch upon the concept of open education, though the term 'open education' is not explicitly used in the document. The document defines the interrelated goals which should be pursued by the development of education:

- to provide equal access to education at all levels;
- to raise awareness on the value and importance of a personality;
- to enhance the quality of education and ensure its competitiveness on local and international labor markets;
- to ensure the continuous increase in the level of education;
- to broaden the international cooperation.

However, despite the ambitious agenda focusing on the European integration, the application of information technologies, the improvement of the quality of education and achievement of the accessibility by all social groups, regrettably, there is no direct mention of the need to implement the principle of open education, create open educational resources and introduce distance learning technologies. Non-governmental organizations contribute to the field of public education. Not going to details on their activities, it is worth noting that some of NGOs are represented in the Board of the Ministry of Education and Science.

The analysis of the Armenian educational resources in the global network has shown that the work in the field of distance education and open educational resources in the educational institutions of Armenia is at the initial stage. The development is mainly evident in few leading universities and in the educational centres of some Ministries – in the framework of the 'Pan-Armenian Education Programme'. The analysis of the Armenian open educational resources and discussion of their exploitation and prospects of their application with the staff of above mentioned organizations, allowed to identify the following causes:

- low level of information culture development;
- insufficient attention of the state agencies to the development of technologies on distance and open learning resources;
- insufficient administrative and financial support from the management of universities;
- low level of the Internet penetration.

It is worth noting the deficiency of competence of the teaching staff in the field of distance learning technologies and their lack of interest in the use of open technologies, based on complexity of the author's rights protection.

In conclusion, we can argue that in order to promote open education and distance learning technologies in Armenia, it is necessary to implement step by step all activities aimed both at improving information culture of the society, and addressing a number of technological, social, educational, legal and other problems.

In particular it is necessary:

- to take measures to improve all components of the 'information culture' in society and, primarily, in educational institutions;
- to use the media to acquaint the general public with the notion of open educational resources and distance learning technologies, to propagate by examples the positive conception of open education and eliminate the psychological barrier existing in the perception of these technologies;
- to take measures to raise the interest of universities in the introduction of open education and distance learning technologies;
- to increase the commitment of teachers in the creation of open educational resources with the use of information technology;
- to enhance the level of information and communication means;
- to carry out an expert analysis of the rules, regulations, guidelines and other documents regulating the use of distance technology;
- to improve the legal framework of author's right protection in open network systems by integrating new provisions of international practice in the Law of RA on Copyright;
- to intensify international cooperation in the field of open educational resources, including relevant international educational network.

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Open Educational Resources in Lithuania: State-of-the-Art, Challenges and Prospects for Development

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Open educational resources (OER) have been promoted by UNESCO since 2002. Scientists and education institution managers and professionals benefit from the use of OER in their practices, building online communities for OER cooperative development, re-use and integration into lifelong learning (LLL) process. All education institutions address the needs of lifelong learners in both formal and non-formal process of education. Differences mainly occur in how far institutions use information and communication technologies (ICT) in learning and teaching practices and which solutions they choose.

The research aims at identification of the country-based needs and opportunities in promoting and supporting OER development in the context of higher education and LLL.

The objectives of the research are:

- to identify national policy and strategies in terms of application of ICT in education;
- to discuss the notion of OER and the concept of openness, tracing the phenomenon of OER in Lithuania;
- to define the practices in curriculum modernization issues highlighting practices of application of OER in curriculum modernization in higher education institutions;
- to analyse the potential of OER repositories in Lithuania;
- to identify the factors that encourage and sustain OER development in the country, and to provide recommendations for OER development.

The main national political documents have been reviewed, strategies and regulations, as well as programme documents, and current status on the use of ICT at education institutions, including intellectual property rights, access to resources, and quality assurance issues are discussed in the research focusing on OER development. Practices, challenges and prospects are presented in the paper. The factors that prevent wider introduction of OER into educational practices are identified during the research, as well as the factors that sustain OER introduction into educational practices in Lithuania.

Content Provision for Information and Educational Environment in the Republic of Kazakhstan

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The Republic of Kazakhstan is located in Central Asia. By its territory (1 049 150 sq. km.) Kazakhstan takes the 9th place in the world. Its population is 15.56 million; population density – 5,5 pers. per 1 sq. km (http://akorda.kz).

The Internet audience of Kazakhstan is about 4.3 million users (estimates of the company PROFIT Online for January 2010). The tariffs for unlimited access to the Internet in Kazakhstan is around 30–40 USD per month. The speed is up to 1 MB or more per second in Almaty and Astana; in other cities and regions this rate is much lower.

The national policy of Kazakhstan on informatization of education

The integration into the world community and, accordingly, into the global open infocommunication space is something very important for every country, including the Republic of Kazakhstan. The informatization of society was called the most important mechanism for the formation of competitiveness of the national economy in the Message of the President of the Republic of Kazakhstan Nursultan Nazarbayev to the people of Kazakhstan in the 'Strategy of Kazakhstan joining the 50 most competitive countries in the world. Kazakhstan on the threshold of a new breakthrough in its development'.

For the Republic of Kazakhstan the development of Open Educational Resources (OER) has special social significance and relevance:

- many people live in villages and towns far from the administrative and regional centres;
- schools of small towns lack teaching staff and have poor methodological provision of information and learning resources;
- 6032 schools (79,2% of all schools) and 4303 ungraded schools (UGS) (56,4%) are located in rural area;
- according to statistical data, more than 2 million people need annual retraining;
- about 400 thousand people are disabled.

The Republic of Kazakhstan adopted the Law 'On informatization' (2007); 'On Education' (2007); the Programme for Bridging Digital Divide in

2007–2009; Long-Term Strategy 'Kazakhstan-2030'; Strategic Plan for Development of Kazakhstan up to 2020 (2010); JI RK 'Organization of training for distance learning technologies'. As part of the 'Path to Europe' programme, at the II Forum of Bologna in March 2010 Kazakhstan acceded to the Bologna Declaration and became the 47th member-state of the Bologna process. At present, 30 universities of Kazakhstan signed the Great Charter of Universities. Cooperation and integration into the world educational space are the basic guidelines of Kazakhstan's education system.

The draft of the State Programme for the Development of Education until 2020, in which e-Learning is defined as one of the eight major cardinal directions of modernization of education is being widely discussed in RK. The priority objective of the State Programme is to ensure equal access for students and teachers to the best educational resources and technologies. The task is to measure whether the following indicators will be achieved: the proportion of educational organizations that have websites with the necessary training resources (by 2020) – 90%; the share of schools with access to the Republican Inter-University Electronic Library – 100%; the share of institutions of secondary education using the system of e-Learning – 90%.

In accordance with eligibility requirements for educational activity licensing of higher education organizations, approved by the Government of Kazakhstan on 2 June 2007 (№ 452), the provision of educational materials in electronic and magnetic media should be: for institutions – at least 10% of the subjects of the curricula; for academies and conservatories – no less than 15% of the subjects; for universities – not less than 20%.

According to the JI-RK 5.03.010-2006 'Education system of Kazakhstan. Information Resources and Library Fund', information resources of higher education institutions are formalized ideas and knowledge, different data, methods and tools, storage and exchange between sources and consumers of information. Information resources include full text, factual and bibliographic databases with educational purpose (administrative, educational, scientific, educational) in any media, information and search systems, including traditional and electronic library catalogues and files, electronic resources of local access; software tools that ensure the creation, storage and use of educational information dissemination channels; means of communication used for educational purposes.

Current state promotion of OER in Kazakhstan

The creation and distribution of OER in Kazakhstan is carried out by national, state and private companies. The Programme for Bridging Digital Divide in 2007–2009 pointed out the urgent need to eliminate the so-called 'digital divide'. Under this programme, the National Center of Informatization (NCI) developed training manuals, e-multimedia textbooks in Kazakh and Russian languages to teach people computer skills, which are available on

the portal http://www.compobuch.kz, and replicated on CD (more than 500 thousand copies), so that computer literacy of the population may also be tested offline.

Under this programme, the Ministry of Culture and Information made a portal 'Electronic State Library Foundation – Kazakhstan National Electronic Library' (http://www.kazneb.kz), the main purpose of which is to form a national library collection of electronic documents and ensure their accessibility to all categories of users through the Internet. The fund KazNEL includes electronic analogues of printed publications, and independent original electronic publications, which have no analogues recorded on other media.

To form KazNEL, fourty organizations from Kazakhstan and abroad were involved. Among them – 2 national libraries, 15 regional universal scientific libraries, 3 central city library systems, 19 academic libraries. Information resources of KazNEL are open to users of different levels (from a mere user to a system administrator) and are either readable or downloadable.

Higher education of RK is presented by 144 high schools, 9 of them national, 1 international, 32 public, 75 private and 14 joint-stock, 13 non-civil (where more than 630 thousand people are taught). Since 2008, all universities of Kazakhstan passed to the credit system in education, which involves mandatory access of students to information and educational resources. Up to now, 62 civilian universities of the country (47% of the total number of universities) have gained access to educational resources; 43 high schools (33%) have got websites presenting only informational advertising, providing users with general information about the university, its history, structure, specialties, payment terms, etc. Unfortunately, not all high schools today have got actually operating sites. Eleven universities (8%) indicate web-addresses, but links to them do not work; 16 high schools (12%) do not have sites yet. Having analyzed the operating sites of the universities of Kazakhstan, we can conclude that the development of OER in higher professional education is carried out in 3 directions:

1) creation of portals by special institutions of higher education comprising resources which provide access only to their own students and teachers;

2) placing SPA own design on the official portal for free general access;

3) hosting links to the Internet resources with free access to the sites of foreign, domestic and national digital libraries on their portals.

Thirty four universities indicated the availability of additional educational portals that implement distance learning technologies. Among these universities are: D. Serikbaev East Kazakhstan State Technical University (http://www.ektu.kz), Karaganda State Technical University (http://www.kstu.kz), Karaganda State University after E.A. Buketov (http://www.ksu.kz),

Kyzylorda State University after Korkyt Ata (http://www.korkyt.kz), M. Auezov South Kazakhstan State University (http://www.ukgu.kz), etc. Each Institute develops its own database, electronic catalogues and electronic libraries. However, the connection between the portals of the universities is weak; there are only few references to educational resources from other universities, the connection is not secured and does not support automatic replication meta descriptions of primary and secondary information resources between universities and portal of MES RK. In general, the educational resources of schools are closed, accessible only to its students and teachers – free user registration is not available. Username and password are usually granted to students and staff of the deans of universities, the administrators of distance learning systems, etc. The portals of the universities are mainly operating on such platforms as: MOODLE, Prometheus 4.2, eLearning Server 3000, TAMOS University Suite, Platonus.

The country has gained experience in building a network operations center (NOC) 'KazRENA' as a single research and education network of universities and research institutes of Kazakhstan. It started operating in 2003. The network includes 83 research institutes, universities and secondary specialized educational institutions in all regions of the country. The center is organized on the basis of KazNTU named after Satpaev. With technical support from the NATO Science Committee in the framework of 'Partnership for Peace', 'KazRENA' was equipped with modern satellite system equipment that provides high-speed Internet access to technology and WIMAX SHDSL speed from 45 Kbps to 4 Mbps. The center provides interactive, academic exchange and networking on international level.

Currently, the Republican Inter-university Electronic Library (RIEL) (http://lib.kazrena.kz/) is under trial operation. The purpose of the electronic library is to provide access for faculty students, masters and doctoral students to interactive multimedia learning resources, and to combine electronic educational resources institutions of the country into a unified information system. To gain access to educational resources it is necessary to conclude an agreement with RIEL. The executive responsible for the creation of RIEL system is the association of universities.

It is important to develop OER at the level of general secondary education. National Center of Informatization supports the educational portal MOODLE NCI (http://moodle.nci.kz/) developed under the UNESCO project 'Distance education using information and communication technologies (ICT) for secondary schools in remote and vulnerable regions'. The portal MOODLE NCI (http://moodle.nci.kz/) users, having registered, have free access to educational materials on subjects of school education, to perform the task, to pass a trial test, to get methodical assistance. The portal comprises training courses on such school subjects as: the history of Kazakhstan, algebra,

biology, physics, chemistry, Kazakh, Russian and English languages, etc. The courses were elaborated by experienced educators and scientists of the field. The means of control in these training courses include testing, constant communication with tutors via e-mail and online forums. Teachers can discuss their professional problems by means of the forum on the portal, can attach files of any format, can share advice on the preparation of content of the subjects with other teachers of Almaty either offline or online via MOODLE. Multimedia electronic textbooks developed by NCI by order of MES RK are also placed on the portal. Currently, the portal is on a regular basis visited by two thousand registered users from Kazakhstan, as well as from foreign countries: Afghanistan, Australia, Belarus, Latvia, Lithuania, Russia, USA, Ukraine. Multimedia electronic textbooks for grades 1–2, developed by the NCI, are available for teachers, students and their parents at the portal of 'e-government' (http://www.e.gov.kz) in the category Education/Secondary Education/Tutorials. However, the learning process in secondary school has its own laws and principles, due to the age of the children. Even broadband communication lines are not able to transfer and play back rich multimedia materials which are necessary for the school full learning process. Only 34% of the schools have broadband Internet access, so that not all students have the opportunity to study online.

As the majority of Kazakhstan schools, due to their specific geographic location, have no access to the broadband Internet, the creation of case-technology and dissemination of educational resources can be the way out. The Republic has developed a wide roster of domestic electronic textbooks developed by the National Center for Informatization as information and educational environment. The position of the G.K. Nurgaliyeva scientific school is that e-Learning based on the educational environment of electronic textbooks is the projected system-organized infocommunication mediated interaction of subjects of the educational process, which implements the main components of the learning process: motivational-targeted, substantive, operational and activity-estimated scores, provided by transfers of information and communication technologies in educational process. These components represent the main teaching law: the learning process can be efficient only if the student has a positive motivation to study the subject, is aware of learning objectives, independently and thoroughly performs adequate learning goals and learning activities. This activity is controlled by the methods of guaranteeing the achievement of learning objectives by means of adequately assessing the results with the help of pedagogical possibilities of ICT. The subjects of educational process are teachers, pupils and parents. The educational environment of electronic textbooks ensures the inclusion of these subjects in the educational process, the development of their relations as a humanist, creative, optimistic and partnership-oriented cooperation.

Conclusion

The state policy of the Republic of Kazakhstan in the field of information society and education is focused on creation of the national information infrastructure; construction of open communication systems; provision of broad public access to information and educational resources of the global and local networks, which confirms the commitment of Kazakhstan to UNESCO's key principles: lifelong learning and quality education for all.

Kazakh educational organizations with the support of MES RK have worked intensively to ensure access to education and training throughout life, integration into the global educational environment. However, there are several obstacles for OER promotion in Kazakhstan:

- the current legal framework does not fully regulate the development and dissemination of OER; common technical and educational requirements for the procedures of registration and distribution of digital content have not been defined;
- the working mechanisms of motivation and labor incentive regulation have not been identified; educators and teachers developing electronic educational resources are not given ratings of the best developments; the legal aspects – the protection of copyright law – have not been worked out;
- in the Law 'On Education' of 2007, distance learning is not regarded as a form of self-education; in higher education distance learning is implemented as an experiment, so that by now it is not possible to open virtual school for students;
- a number of universities do not provide students with access to the Internet; they do not have their own websites, Intranet and other necessary resources;
- the educational policy of every institution should be adequate to lofty goals of the country and represent the level of engineering and technology. In our view, not 90%, but all organizations of higher education must have their own websites and educational portals;
- the experience of OER development by high schools is characterized by specific features due to the local conditions and different financial possibilities. There is not a single directory of educational sites of RK, which impedes dissemination and promotion;
- high cost of the access to the Internet, lack of broadband communication channels.

In general, rapid development of ICT, public policy in the field of ICT in education can have a positive impact on the prospects for development and increased use of OER in Kazakhstan.

Open Educational Resources in the Republic of Belarus: Current Situation, Problems and Prospects

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The development of technological innovations and ways to provide functioning and progress of the national educational system is defined as a priority area for basic and applied scientific research according to the 'List of Priority Areas for Basic and Applied Scientific Research for 2006–2010 within the Republic of Belarus' that was approved by the Belarusian Council of Ministers pursuant to the resolution № 512 on May 17, 2005.

Within the framework of the programme 'Global Informatization of the Educational System of the Republic of Belarus for 2007-2010' some steps have been taken. To maintain the majority of disciplines the tools for online teaching were developed and then implemented at the educational institutions. Also, more than 600 different types of information resources (first of all, methodological sites on various disciplines and areas of educational institutions' activity) were developed and put on the Internet afterwards.

In accordance with the resolution of the Belarusian Department of Education № 129 dated December 26, 2006, the branch-wise programme 'Online Manual' on the development of online educational resources was established to support the educational system of the Republic of Belarus.

All Belarusian institutions of specialized secondary and higher education currently have access to the Internet. The number of schools with the Internet connection keeps growing rapidly. The fact is that for the last 3 years the percentage of schools having access to the single worldwide network has increased from 56 to 87 percent. However, while talking about the broadband access or, in other words, the technologies that are presently the most efficient and popular, it is really easy to notice the difference – 43 percent in cities and just 9 percent in the countryside.

To get educational content nowadays schools tend to use computers far more than the Internet.

Under these circumstances the authorities of the Republic of Belarus pay special attention to the development of the tools for online teaching and their integration in the educational process.

In the Republic of Belarus, there are currently some proposals made regarding a new social standard statement on providing all students with personal computers and the Internet access (any institution should have at least one room providing the broadband access to the Internet).

The main education information resources of the Republic of Belarus are:

- The Department of Education of the Republic of Belarus – www.minedu.unibel.by;
- The methodological institution 'National Institute of Education' of the Department of Education of the Republic of Belarus (educational portal) – www.adu.by;
- The National Belarusian education Internet portal – www.edu.bu;
- The Republican site on the information retrieval regarding education issues – http://ris.unibel.by;
- The Republican Institute of Vocational Education – www.ripo.unibel.by;
- The Belarusian State University – www.bsu.by.

The site of the Department of Education (www.minedu.unibel.by) containing detailed information on activities of the Department of Education of the Republic of Belarus won a prize at the World Fair of Telecommunications Equipment, Digital Technologies, Software, Means and Systems of Security TIBO-2009 held in Minsk. Products of more than 200 companies located in 12 countries were presented at the World Fair.

Within the framework of the programme 'Global Informatization of the Educational System of the Republic of Belarus for 2007–2010', a national educational portal (www.adu.by) and more than 1300 sites of educational institutions and education authorities were developed. The portal contains detailed information about the system of general secondary education in the Republic of Belarus that includes various workbooks to support different educational levels: preschool education, primary education, secondary education and special education on the following disciplines: the Belarusian language and literature, the Russian language and literature, foreign languages, mathematics, informatics, physics, astronomy, man and the world, social science, world history, Belarusian history, geography, chemistry, fine art, music, career education, drawing, physical culture, preconscription and medical training, principles of personal and social safety. Particularly among the information provided on the site there are curricula for comprehensive institutions and for elective courses, methodological letters of the Department of Education, educational standards, online textbooks (about 200 items), a few open educational resources to support some of the topics learned online and the list of tools for online teaching that is available for educational institutions for free at special foundations of the Department of Education.

The educational portal (www.edu.by) was created as a national multipurpose educational resource with the aim to provide free access to an integral catalogue of Internet-based educational resources, as well as

methodological, standard and reference materials for preschool, secondary, specialized secondary, higher and postgraduate education.

The main purpose of the Republican site on the information retrieval regarding education issues (http://ris.unibel.by) is to provide educationalists, students, pupils and all the Internet users with information resources concerning the Belarusian and international education. The chief aim of this site is to enhance information infrastructure regarding education in the Republic of Belarus.

The search option according to a chosen section is available on that site: the educational system of the Republic of Belarus, education in Russia, international educational resources, international partnership of educational institutions, opportunities to get educated in the Republic of Belarus (for foreigners), reference books (search engines, dictionaries, essays, etc.), information technologies (IT), the Internet and so forth. For example, the section IT contains the supplemental information in Russian and English pursuant to the following subsections: distance learning, open source software, IT used while training (secondary education), IT used while training (higher education, professional education), computer educational programmes (textbooks, programmes, companies, etc.) and so forth. It has become easy to find dozens of up-to-date open educational resources for various educational levels and disciplines.

The site of the Republican Institute of Vocational Education (www.ripo.unibel.by) contains information about the opportunity to get professional education using the Internet, the list of tools for online teaching, elaborated at the Institute, and the list of links pointing to open network information resources and education resources in various disciplines.

There are 54 institutions of higher education in the Republic of Belarus. All of them have their own websites. The following universities have got the best sites:

- Belarusian State University – www.bsu.by;
- Belarusian State University of Informatics and Radio Electronics – www.bsuir.by;
- Belarusian State Economic University – www.bseu.by.

The education resources of the above-mentioned universities are placed mainly on their libraries' sites. Almost all education resources are in Russian, just few of them being in Belarusian. Judging from the links to worldwide open educational resources, it can be concluded that these resources are chiefly in Russian and English.

In the Republic of Belarus there are 204 institutions of specialized secondary education and 54 of them are subordinated to the Department of

Education at that. All of those institutions have Internet access and their own sites. About 90% of 240 institutions of vocational technical training have their own sites and access to the Internet.

In comparison with the sites of institutions of higher education the aforementioned sites contain far less information. The information provided on them includes links to the education resources that were developed for certain specialities. However, web browsing of the resources is allowed only to some categories of students. Links pointed to the sites of institutions of professional education are located on the Republican site on the information retrieval regarding education issues (www.ripo.unibel.by). There is a link pointed to workbooks providing independent advanced training and retraining with further certification.

Distance education is available in the Republic of Belarus in the following institutions:

- Belarusian State University of Informatics and Radio Electronics, the faculty of continuous and distant training;
- Belarusian National Technical University, the International Institute of Distant Learning;
- Administration Academy under the President of the Republic of Belarus, the Institute of State Administration.

The Belarusian State University, Belarusian State Economic University and some other Belarusian institutions of higher education also provide education by correspondence using some technologies of distance learning. There are currently about 2500 students getting education by distance learning in the Republic of Belarus.

There are several reasons for slow development of distance education in the Republic of Belarus: lack of full-fledged normative legal documents, only few experiment participants regarding distance education implementation, lack of educational programmes for socially deprived people, poor activity coordination of institutions of higher education on creation of the educational methodological system, limited possibilities of the Internet, lack of project exchange regarding creation of the educational methodological system among institutions of higher education, lack of independent expertise of the electronic educational methodological system, the usage of just case-technologies in training, lack of the electronic educational methodological system in foreign languages.

In the section 'Online information resources' of the national library of the Republic of Belarus (www.nlb.by) everyone can have a look at the list of databases, view their description and get to know what libraries have access to them. In addition to the databases that are made by the library,

there are databases of leading international producers acquired by the library and databases that are available for everyone in the section.

The online library of the Belarusian State University (www.elib.bsu.by) started functioning on 1 September 2010.

All the content of the online library of the Belarusian State University is subdivided into sections that correspond to organization or structural units of the University, such as faculty, centre, research institute and so forth. Any section may include unlimited number of subsections and ranges. Besides, any range may contain unlimited number of documents. There are various kinds of literature provided at that: teaching aids, workbooks, reference books and academic readings.

While using the tools for online teaching, some issues are needed to be addressed. Firstly, it is enrichment of sites content. There are certain steps taken to provide progress of education informatization while supporting it with educational methodological materials in the Republic of Belarus. For instance, in 2009–2010 within the framework of the branch-wise scientific and technical programme 'Modernization and development of optional education content, its methods and educational tools, as well as training and health improvement of the methodological students studying within the national educational system' ('Education and Heath'), the 'National Institute of Education' prepared 178 models of online components of brand-new educational methodological systems, including: sets of multimedia resources, workbooks, online encyclopedias, virtual labs, online reading books, online tours, packages of interactive computer models, training simulators, testing systems, prototypes demonstrating elements of the educational methodological system to provide teacher's activity and so forth.

The national programme 'Global Informatization of the Educational System of the Republic of Belarus for 2007–2010' provided the development and extensive implementation of about 75 new online programmes for textbooks including online tools for comprehensive schools in the English, Belarusian and Russian languages, informatics, mathematics, physics, chemistry, biology, geography, history, music, the basics of security. All of them should include the presentation part (information course component), exercises improving acquired knowledge, tests that can evaluate students' knowledge impartially. The developed tools for online teaching should have the same format, be easily modified by using the automated system of training management and interrelate with the content of a training process.

Using the prototypical models, the institution 'Main Information Analytical Centre of Belarusian Department of Education' holds open contests to provide the work procurement on development of the tools for online

teaching, textbooks to provide further IT training of specialists in the educational system.

According to the programme 'Global Informatization of the Educational System of the Republic of Belarus for 2007–2010', 31 tools for online teaching were developed and got approval at educational institutions for the last 3 years. Among them are: 'English. Primary school', 'Belarusian. 2–8 grades', 'Russian. 5–10 grades. The visual online package of workbooks in Russian and speech standards providing the methods of application', 'Informatics and information technologies. Information and reference system'.

Educational institutions were provided with 44 thousand duplicated compact discs that had been developed by the tools for online education, 15–30 discs for every school. Creative employees of vocational technical schools also developed 14 tools for online education in various disciplines. Within the framework of the above-mentioned programme 9 electronic educational methodological systems in the natural sciences and the humanities were developed in 2008–2009 (disciplines: 'Physics', 'Programming', 'Philosophy', 'Economics', 'Higher mathematics' and so forth).

The independent methodological examination of the tools for online teaching was made by the National Institute of Education. Besides, the certificate of an expert evaluation was developed, the criteria and indicators of its quality methodological evaluation were determined as well; 9 out of 23 tools for online teaching were approved by the National Institute of Education.

The purpose of the expert evaluation is to find out the place of tools for online education in the current educational system, as well as to determine its use conditions and develop recommendations on its improving, further duplication and implementation. For the tools to get approved for online education, it is essential to confirm the list of educational institutions, to take some steps to provide it with some methodological materials, to make recommendations on use of the tools for online education in the educational process and on users' (teachers') training. Also it is important to provide an opportunity for the tools for online education to be updated in future.

The tools for online education subsidized by the Republic of Belarus are duplicated by the Department of Education for free. There is information on all developed tools for online education available on the sites of those organizations.

There is a flexible, up-to-date and qualitative system of additional education for adults in the Republic of Belarus; 389 educational institutions provide further training and retraining of employees, managers and specialists; more than 550 thousand of employees (about 14% of the total number of

employed population) annually get professional education, further training, in-depth training and retraining.

Since education informatization, wide use of information and communication technologies and the Internet start to influence the educational environment more and more profoundly, it is necessary to review traditional forms and ways of teaching. Under these circumstances, it is reasonable for any teacher pretending to get an upper category to have a certificate that would confirm his/her knowledge in information technologies. The Department of Education gave appropriate assignments to the educational administrations, the Academy of Postgraduate Education and institutes of educational development.

In 2008, a regional network academy of Cisco was set up under BSU. In February 2009, the first teachers/tutors were certified by Cisco in the field of modern information and communication technologies.

Pursuant to the resolution № 1174 dated August 9, 2010, the Belarusian Council of Ministers approved the 'Strategy of Information-Oriented Society's Development in the Republic of Belarus until 2015'. It is planned to develop the national information environment of the Belarusian educational system by 2015. Due to that environment it is easy to provide information cooperation of all subjects involved in the educational system and to develop a national system of online educational resources. All educational institutions will have broadband access to international scientific and educational networks as well as the Internet. On the basis of this strategy, a new state programme of informatization that will replace the programme 'Electronic Belarus' should be developed.

Fostering Open Educational Practices

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Open Educational Resources (OER) are becoming accepted as part of the range of materials that learners and educators can use. However the methods and practices that enable learners, teachers and institutions to best engage with OER are not yet established and may well be more important in enabling change in education systems than the availability of the resources themselves. By looking at the experiences that The Open University in the UK has in direct provision of OER and the broader research carried out by the Open Learning Network (OLnet) initiative several fac-

tors and related practices can be identified that should help encourage openness and engagement with OER.

Experiences from the Open University

The Open University in the UK has direct experience working with OER through OpenLearn, research into the impact of OER through the OLnet initiative, and understanding as an institute of how OER can influence future options. We see OER as having the potential to change the practice of learners, educators and organizations in a profound way. The learner is given choice by OER of ways to learn, either as existing courses make use of the resources or much less formally through individual or group learning around and with the open resources. The practice of learning in this open way does not come naturally to everyone and methods that link together individual experiences need to be developed. For the educator this means thinking through the design and operation of an open approach to education. A key element is the release of resources with a licence that allows change and reuse leading to new forms of course based on paths, guidance and ways to learn. Institutions can evolve by offering the missing elements of support, assessment and accreditation to link the non-formal to the formal. However, there are also more radical options where new practices are needed.

This paper builds on the experience we have had at The Open University in Open Educational Resources. First in OpenLearn where we released content to the world for free. And then in the OLnet initiative which has a research focus that looks much more outside the Open University to find evidence. The Open University has always been open in various ways (McAndrew, 2010) and so there is an interest in new ways to make use of openness. OpenLearn provided an experiment in opening up content that had previously only been available for those paying fees. The evaluation of OpenLearn (McAndrew et al., 2009) found there were several benefits. These included accelerating innovation, establishing collaborations, and attracting new students to the University. In contrast to the inward looking work on OpenLearn, OLnet is considering the developments across all of those involved in OER. For example part of the work has been examining more that 100 reported results from OER project funded by the William and Flora Hewlett Foundation. The Hewlett Foundation has been a major catalyst for the adoption of more open approaches. Analysis of the projects over time shows a move from initial work on the concept of open content, to supporting the open provision of existing content to now work on advocacy and models of use. The concept of resources themselves as the core of openness is gradually being augmented with the concept of Open Educational Practices (OEP), notably through the work of the EU funded Opal project (Ehlers, 2011). In other words, how does the presence of approved and free resources change the operation of individuals and institutions?

Elements of practice

In OLnet our analysis has picked out five factors.

1) **Infrastructure:** the tools that are needed for sharing of content, but also of practice and experiences. Such infrastructure includes the software basis that is becoming well established as free and open systems underlie much of the Internet, but also the infrastructure of legal elements, such as copyright and process models. The models are changing from producer-led such as OpenCourseWare (Carson, 2007) to more open approaches where all may share content. Each approach offers different advantages with the more formal having clearer messages of quality and expectation, while the latter has greater potential for diversity.

2) **Use:** with the greater availability of content there is more opportunity for use and to recognize the way in which OER can act as an attractor for communities of learners. Social spaces can be established on top of content. So even in a move towards greater value in social learning and the gaining of '21st Century Skills' the role of content as a way to bring people together and allow self-directed learning is a great enabler of learning.

3) **Design:** designing for openness both in terms of the content itself, but also the models for use of educational contents. Research has shown (Dimitriadis et al., 2009) that considering designing for use of the content and establishing patterns around free and open content may bring benefits more quickly than embedding the design in the materials.

4) **Adoption:** how to make use of OER as the basis for the practice of institutions and individuals. This places content as only part of the function of learning. To complete the learning experience other elements such as management, support, assessment and accreditation all have roles to play. Content can be seen as part of a disaggregation of each of these components allowing institutions to build revised models around bringing together free content alongside other services. However there can also be more radical models demonstrated by initiative such as P2PU (http://p2pu.org/), OpenSE (http://opense.net/), OpenEd 2.0 (http://www.open-ed.eu/) that are each offering open courses based on open content or rethinking of the value of education and the more personal control summarized as 'Do-It-Yourself University' (Kamenetz, 2010).

5) **Policy:** an increasingly important aspect of OER is the recognition that they have characteristics to support change at many levels, including institutional and national policies. Adjusting the copyright and permissions to content may seem like a minor change. However the use of openness has enabled the crossing of barriers and an easy path for sharing experiences without having to establish all agreements and components.

Contexts

The context provides a further underlying factor. Contextual matters include the country, culture, level, organization and other special aspects of each situation. The OLnet fellowship programme illustrates the way in which OER can both adjust and apply in different contexts. The fellowship programme will support at least 24 fellows over the 3-year period of OLnet. So far 15 fellowships have taken place or are underway. These can be loosely characterized as 'expert fellowships', where the recipient is bringing in their specialist knowledge and being given the space and direction to apply that expertise to OER research and as 'open fellowships', which are more developmental in nature and focussed on solving particular problems using OER.

Each fellow brings their own experiences and situation. Being able to work across these contexts has given an important pointer to how to operate in a more open future. This work has helped us share and reflect on approaches already identified but more importantly we have also been able to bring in new lessons in each case. Examples of contexts that the fellows have brought from different countries and cultures include: in China (http://olnet.org/node/485), to share teaching methods as much as teaching resources and to bring in use of open environments alongside the programme of national courses linked to the use of the open environment of OpenLearn. In Brazil OER (http://slidesha.re/eZLgpa) are being used to support outreach by institutions. In Turkey (http://olnet.org/node/195) – to support the expansion of tertiary education. Working with UNESCO in Russia and CIS (http://olnet.org/node/422) – to help set up a study of the readiness for OER in that part of the world.

Conclusion

The greater spread and availability of Open Educational Resources has given a platform for change and adoption of Open Educational Practices. These require a process of change and development if they are to give the greatest benefit. The evidence that is emerging is that embracing openness can provide many opportunities. The first recognised moves to open content took place approximately 10 years ago with the 10th anniversary of OpenCourseWare about to be marked in 2011 (OCWC Conference). The level of maturity of the field means that there are chances for new innovations but also lessons that should be taken as involvement continues to grow. The five factors outlined above can be treated as the basis for recommendations such as:

1. Infrastructure: an open approach needs to be transportable and so there is no need to develop new systems. Legal problems solved in one context often can be adopted for other contexts.

2. Use: there is greater opportunity in making use of the thousands of free an open resources than in focussing on production

3. Design: focus on the way in which a learner may work with a variety of content rather than specific content.

4. Adoption: content is only part of the answer, the role for support and accreditation remains but there may also be a chance for innovation.

5. Policy: governments often appear to seek the impossible of an expanding education system that costs less. Openness is one of the few approaches that may be able to achieve this aim.

Open approaches continue to develop and it remains clear that there is much to learn from new contexts and systems in this period of change. The role for international bodies such as UNESCO in encouraging awareness of the approaches and developing two way communication can help to improve communication and provide a catalyst to taking up the chances that are available.

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Copyright and OER in Russia

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The concept of open educational resources (OER) has become known in Russia quite recently, nevertheless it is already a matter of discussion. The reason for that lies in the rapid development of information technologies at the turn of the 21st century. First, it has to do with the global Internet computer network that has enabled easier information access for millions of people but at the same time has caused a number of problems, in particular in the area of law. Vadim Monakhov notes that "online e-book shops, video hosting resources that work with the user content (Youtube), search engine giants (Google, Yandex), the Wikipedia online encyclopedia, and social networks (LiveJournal, MySpace, Odnoklassniki, Vkontakte, Moy Mir@Mail.Ru) operating in the same intellectual and spiritual space as libraries are clearly hot on the heels of traditional library systems in terms of information and knowledge access" [1].

For several years already lawmakers from all over the world have been trying to regulate the legal relations created in the Internet by adopting new legal acts or revising and codifying the existing ones. Russia is no exception. The Internet as specific and unique information environment causes conflicts of laws that lawmakers in many cases could not have thought of when adopting this or that law. But law enforcement bodies (above all the courts and public agencies) have to give answers to these questions now. And the most difficult problems of legal regulation typical for the Internet are typical for open educational resources too. In particular, they include the problems related to the regulation of new ways of use of objects protected by copyright and liability for illegal use of such objects in the Internet.

These issues continue to be relevant in the context of the Russian State seeking to build the information society in the framework of the presidential modernization programme. Enhancement and development of the system of national information resources and access to technologies were called a part of transition to the information society in the last century already [2]. Five years earlier, the President of the Russian Federation

called “information resources containing data, information and knowledge stored on special carriers” [3] the first component of the common information space in the Russian Federation. Fifteen years passed since then, but today we still have to deal with a number of legal problems in this area, most of them relating to the copyright law.

Nevertheless, copyright law as a branch setting itself as one of the technically most difficult tasks, namely protection of intellectual property seems to be the primary means of the State influence on legal relations created through development, use and operating of open educational resources.

From the legal point of view, intellectual property is a geographically and time-limited legally allowed monopoly on exclusive rights to use this or that object of intellectual rights (including copyright protected objects). The *monopoly* nature of the intellectual property does not deny the right of the *monopolist*, i.e. copyright holder to use the legally protected work in any way not prohibited by law.

In the law of the Russian Federation ‘On Copyright and Associated Rights’ [4] in its initial revision the use of copyrighted works in the Internet was not mentioned at all. However, as the development of high technologies went ahead, the relations in the Internet became significantly more complicated and in 2004 some amendments were added to the law. In particular, art. 16 of the Law of the Russian Federation ‘On Copyright’ where possible ways to use copyrighted works were listed was amended and the list was added to ‘general public dissemination’ which was primarily intended for the use of works in the Internet and other global telecommunication networks. The following criteria were given for this way of use:

- Every person can get access to the work
- Interactive access mode
- Access to the work is possible from everywhere
- Access to the work is possible at any time
- A person can get access to the work on his or her own choice

In Section IV of the Civil Code of the Russian Federation the lawmakers used the same pattern [5], but excluded the criterion related to the interactive access mode. As we can see, the use of works (be it literature works, multimedia objects, etc.) through their uploading in OER meets all the criteria of general public dissemination mentioned above. Hence the conclusion can be made that the use of copyrighted works in open educational resources in the Internet [6] by the copyright holder does not violate the Russian law on copyright. The wording concerning the use of works through the general public dissemination that appears in the Russian law could be recommended for reception in other countries, in particular, CIS countries, with

the single proviso however that such wording might and should be refined to reflect the specificities of the national legislation. Here, in our view, one should avoid the direct use of the term *open educational resources* in the law. First, such step would make it necessary to include the definition of OER in the law and second, creating the law today we run the risk of getting gaps in the law enforcement tomorrow, especially when we deal with such a dynamic system as the Internet.

As a general rule, the use of works by persons not being their authors, in particular in the way referred to in art. 1270 of the Civil Code of the Russian Federation, implies the pay of royalty fees to the author. The Civil Code also provides the possibility of free (i.e. without author's permission and paying royalty fees) use of works. One of the ways of such free use is set out in art. 1274 of the Civil Code of the Russian Federation. That is free use of works for information, scientific, educational or cultural purposes. This legal pattern is not new since it was transferred almost unchanged [7] to Section IV of the Civil Code of the Russian Federation from the Law of the Russian Federation 'On Copyright'. Alas, it does not mean that art. 1274 of the Civil Code does not cause legal problems. In particular, paragraphs 2–5 of part 1 of the article refer to the use of works for educational purposes through over-the-air and wire transmission or publication in the press but unfortunately give no provision about the use of works through general public dissemination for information, scientific, educational or cultural purposes. Naturally, the use of works through their publication on websites in the Internet that are registered as mass media may be regarded as publication in the press [8], but the share of such registered websites is extremely small.

At the same time, there are already cases of such use of the works in the Internet, and that of on the federal scale. In particular, the website of the Federal Centre for Information and Educational Resources http://fcior.edu.ru/ created with the support of the Ministry of Education and Science of the Russian Federation contains more than 18 000 different information modules intended for reinforcement of learning and knowledge testing. Statistics of this website [9] show that more than 68 000 downloads from this resource were made in September 2010. This resource can be considered as a prove that the State is paying special attention to creation and development of OER in the Internet.

But even the legislation regulating legal relations in the area of education occasionally contains the norms which directly harm the interests of the authors and users of the works. For example, the requirements for candidates for a degree include, among others, publication of the candidate's thesis in at least one leading peer-reviewed journal or publication [10]. The list of such journals and publications is determined by the Higher Attestation Commission of the Ministry of Education and Science of the Russian Federation.

For a publication to be included on the list it has to meet a number of requirements set by the Higher Attestation Commission, including the following: "…Annotations to the articles, keywords and information on the authors should be available in free access in the Internet in Russian and English languages, the full-text versions should be in free access or available for subscribers not later than a year after the publication" [11]. Hence, to apply for the candidate's degree, one has to automatically agree to publish his or her work in the Internet. At the same time the Civil Code of the Russian Federation does not equate the consent of the author to publish his or her work in a periodical with the consent of the author to the general public dissemination of the work [12]. The only possible argument in this situation may be that the publication of a scientific article in the Internet on the journal's website means the use of the work for scientific purposes in the sense of art. 1274 of the Civil Code of the Russian Federation that does not require the consent of the authors. However it does not directly follow from the logic of legal relations, therefore the argument appears to be fairly weak.

The subject matter of this report goes wide beyond the situations described above; it is far more fundamental and can be considered on a far *higher* level. On the one hand, art. 16 of the International Covenant on Economic, Social and Cultural Rights provides the right of every person for protection of the moral and material rights resulting from any scientific, literary or artistic production of which he or she is the author. On the other hand, art. 29 of the Constitution of the Russian Federation sets out the right of every person to information access and art. 43-44 – the right to access to education and cultural values. However there is no contradiction between the rights mentioned above since they are generally recognized principles of the legal status of the person.

Therefore, the main task of the legislation in this area seems to be the search for a compromise when both the rights to access to education and information and the right to protection of the intellectual property are equally recognized and protected. It makes obvious that no radical patterns can be used. Neither a full prohibition of free use of works nor, on contrary, the transfer to the free access mode for all works will be in line with the international standards for human rights protection. Therefore, the concept of free use of works seems to be a successful choice of the lawmakers that allows to find the happy medium and keep the balance of interests of writers and readers.

Nevertheless, in our view, the regulations on free use of works for educational purposes need to be improved. First, the fact that users of libraries do not pay fees for the use of works does not mean that libraries (electronic as well as fundamental) cannot be obliged to pay royalty fees to the authors. It is especially possible because libraries, as a matter of fact, make

profits from works photocopying, digitizing and from other digital services. That means that commercial (for profit accumulation) use of works by libraries is in place.

The second proposal follows the first one and suggests allowing users of libraries to download the works in electronic format. The regulation allowing access to digital copies of the works within the library premises only and without any possibility to make a copy [13] seems to be outdated. When this regulation was first included in the Law of the Russian Federation 'On Copyright' six years ago, users of the libraries did not have an opportunity, for example, to take photos of such works with their mobile phones. Alas, today it occurs everywhere, so that the regulation seems outdated. It would be much more reasonable to allow users downloading such works at a charge and to oblige the libraries to pay royalty fees to the authors, which should be reflected in the law. In this case, the authors should preserve the right to prohibit digitizing of their works at their will. In our view, such legal pattern can be successfully applied both in offline and electronic libraries. In this case the issue of calculating such fees becomes relevant. In our opinion, it would not be correct to calculate the royalty fees based on the market value of non-digitized works. In our view, the pattern used in Section IV of art. 1286 of the Civil Code of the Russian Federation appears to be much more reasonable. Accordingly, the Government of the Russian Federation is authorized to set the minimum royalty fee rates for certain ways of use of the works. In this case authors can preserve the right to sign contracts with libraries and set fee rates for use of electronic versions of their works. In our view, such pattern will fit smoothly into the general structure of Section IV of the Civil Code of the Russian Federation.

Special attention should be paid to how the legal pattern globally known as Creative Commons license may be applied to the legal relations considered in this report. Unfortunately, this concept is being unreasonably criticized in the press and sometimes even in scientific literature where it is almost equated with author's full abandonment of his or her rights. In reality the Creative Commons system comprises six different kinds of licenses [14] allowing for instance to permit or prohibit the commercial use of works. Therefore, in our view, such licenses could be used to regulate the relations resulting from creation and operation of OER. The practical implementation of Creative Commons licenses in Russia would soon enable the development of projects in the Russian segment of the Internet at the level comparable to Wikipedia, the public online encyclopedia. Obviously, there is no need to reflect these licenses (as well as GNU Free Documentation Licence (GFDL), Open Publication Licence (OPL), etc.) directly in the legal acts. All that is necessary is to eliminate legal hindrances for their use in the Russian Federation. For example, currently the use of works in the Internet is only possible under a license agreement that, according to Section IV of the Civil Code of the Russian Federation, should be concluded in the

written form and contain a number of significant conditions (art. 1286 of the Civil Code of the Russian Federation). Nevertheless exceptions are provided by the art. 1286: agreement on publication of the work in a periodical may be concluded orally. It seems quite reasonable to extend such exceptions to agreements on the use of works in the Internet or other telecommunication networks.

In particular, establishment of criteria for educational or non-educational, scientific or non-scientific purposes of use may be one of the top-priority measures to create conditions for such license-protected works to appear in Russia. The introduction of such criteria will make the law enforcement practice significantly easier for judicial bodies as well as for participants in civil-law relations. Furthermore, in our view, these criteria might be stipulated in the form of law or in the form of decrees of supreme courts.

The modification of the law enforcement monitoring system also seems to be one of the most important measures to enhance the law enforcement practice related to the OER placed in the Internet. Such modification should involve a fundamental revision of the system – revision through a gradual transition from administrative control to a self-regulation system in combination with administrative oversight. Collective rights administration system has already proved successful in the most developed countries of the world. It seems to be the optimum solution for the Internet environment when taking into account its very significant property of having no boundaries of national jurisdictions. Regrettably, transition to the collective rights administration is constrained first of all by regulations of the Civil Code of the Russian Federation. Although in principle art. 1242 allows the existence of collective organizations for administration of copyrights in the Internet, the use of works in the Internet is not included on the list of areas of collective administration being subject to the state accreditation provided by paragraph 1 of art. 1244 of the Civil Code. It is first of all due to the transboundary nature of the Internet. It is impossible to set boundaries of the national jurisdiction of the Russian Federation in the Internet, where such organizations could be operable. However one of the ways to resolve this problem might be entitling the collective rights administration organizations to conclude direct agreements with the authors and to charge users with the royalty fees tracing the use of the works in the Internet. Otherwise, alas, it is too early to speak of the collective rights administration in the Internet.

At the same time, a combination of the system of Creative Commons licenses with the collective management system in the open information networks could become a strong impetus for the OER development in Russia. Thereby one of the main tasks of Section IV of the Civil Code of the Russia Federation would be fulfilled – implementation of the constitutional rights for education and information access.

Conclusion

The analysis of the Russian legislation on copyright protection allows to make some interesting conclusions. Problems arising at the interface between the regulations of the information legislation and the copyright legislation have a direct impact on OER. One cannot deny the high importance of OER for Russia as a developing economy. In particular for educational institutions in the regions, the Internet seems to be if not the single then the optimum access to up-to-date information. This is the area where the interests of civil society and OER developers are in harmony. Hence, in the short term, OER development should become one of the top-priority areas of the information society development in Russia.

1. On the one hand, copyright protection should not be an impediment to the OER development. On the other hand, an adequate remuneration of the authors for their work is an important guarantee for the creative process of the generation of new knowledge. Hence a balance should be found between the interests of OER consumers and the authors of the works used in OER. Lawmakers cannot and should not take the position of the authors or the readers by prohibiting any use of the works without the author's consent or, on the contrary, making it absolutely free. Therefore, the balance of interests should be declared as a fundamental principle of the legal regulation under which copyright holders and users will make mutual concessions aimed at achieving their common interests – both art and education development. This is the only way to keep the balance between the two different human rights – right for information access and the freedom to create.

2. Successful implementation of the legal regulations related to creation and use of OER requires, firstly, elimination of regulations preventing the use of international light copyright systems, in particular Creative Commons system in Russia from the Russian legislation. Secondly, it is necessary to create a legal framework for transition of the legal relations in the Internet to the collective rights administration system in a combination with the state administrative oversight. Thirdly, the Russian information legislation should not be a mere synthesis of paper copyright regulations and technical norms regulating the work in the Internet, but rather be based on the new Internet-specific legal regulations. On the whole, the proposals mentioned above may be defined as a concept of transition from the hard to the light copyright system for the Internet.

3. As an optimum legal pattern for OER, a system may be introduced under which the use of works for educational or scientific purposes is free of charge for the end user but a royalty fee is paid by the person gaining commercial profit from the use of the works, e.g. owner of the website or resource administrator. At the same time collective rights adminis-

tration systems or electronic billing can be used to pay the fees to the copyright holders.

4. One of the top-priority measures for the OER development in Russia is the concretization of criteria drawing the line between the use of works for educational and non-educational purposes which could be made, for instance, by one of the supreme courts of the Russian Federation through adoption of a related Decree.

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14. In particular, the license (by-nc-nd) "Attribution-NonCommercial-NoDerivs" has the most restrictions from the six main licenses. It allows the users only to download the works and share them with others insofar as they mention the author and refer to him/her, but they are not allowed to change the work in any way or use it for commercial purposes.

IITE OER Project: New Dimensions

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Recognizing particular importance of open educational content for ensuring wide access to quality formal, non-formal and informal education and life-long learning in developing countries, UNESCO started its efforts in promoting Open Educational Resources (OER) in 2002 (Forum on Open Courseware for Developing Countries, UNESCO, Paris, 1–3 July, 2002). The International Community of Interest established by UNESCO integrated 600 members – experts in ICT in education who held the online deliberations on the open content for education and OER during 2005–2007. The next steps to be undertaken to promote the OER movement were summarized by Susan D'Antoni [1] in the conclusions of the deliberations: awareness raising at the international level, networking of regional, linguistic and topic-specific communities, capacity development, quality assurance, search for sustainable models for OER and solving copyright-related issues.

The Cape Town Open Education Declaration adopted in 2007 stressed the opportunities to dramatically improve the lives of hundreds of millions of people around the world through freely available, high-quality, locally

relevant educational and learning opportunities provided by OER covered not only the issues related to OER formats and licensing: OER should be freely shared through open licenses and published in formats that facilitate both use and editing, and that accommodate a diversity of technical platforms. The Declaration emphasized the importance of using the formats that would OER accessible to people with disabilities and those who do not have access to the Internet yet.

The importance of OER for the world education community was highlighted in the Communiqué of the 2009 World Conference on Education "The New Dynamics of Higher Education and Research for Societal Change and Development": ODL approaches and ICT present opportunities to widen access to quality education, particularly when Open Educational Resources are readily shared by many countries and higher education institutions (UNESCO, Paris, 5–8 July 2009). The Maastricht message considered OER as a priority area (Global ICDE and EADTU Conference, June, 2009).

In 2009, within the activity line "Fostering ICT-enhanced learning through knowledge sharing, Open Educational Resources, networking and cooperation" the UNESCO Institute for Information Technologies in Education (IITE) launched its OER project. Main objective of the project is the promotion of the OER movement based on the exploration of the needs and opportunities for the production and use of OER in non-English-speaking countries. At its initial stage the IITE OER project was focused on educational content in the Russian language and covered most CIS and Baltic States. Most of these countries still share common educational traditions inherited from the USSR past. The Russian language is a second national language in some of these countries, in the others – a considerable share of population speaks Russian or even refers to it as a mother tongue. In addition, language barrier is a common hinder to the wide use of English-language OER in CIS. In this region, OER in Russian could play the role similar to that played by English-language OER in English-speaking countries and worldwide.

The preliminary study of the state-of-the-art of OER was carried out in the Republic of Azerbaijan, Republic of Armenia, Republic of Belarus, Republic of Kazakhstan, Republic of Moldova, the Russian Federation, Ukraine, Uzbekistan, as well as in Latvia and Lithuania. The study revealed that most of these countries are at a very early stage of OER movement; some of them being more advanced, others less. The concept of OER is not widely recognized in most of these countries. The majority of faculty and management staff in higher education institutions remains unfamiliar with OER and related activities.

There are educational resources openly accessible via Internet in CIS domains, but very few of them meet the UNESCO definition of OER:

educational resources are enabled by information and communication technologies and provided openly for consultation, use and adaptation by a community of users for non-commercial purposes. Even fewer resources fit into the Hewlett Foundation definition: "OER are teaching, learning and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use or re-purposing by others. Openly accessible educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials or techniques used to support access to knowledge".

One can find various examples of OER in the CIS Internet domains. However, "big OERs" that are large-scale repositories are very few, "small OERs" are more frequent. There are also resources available upon registration, restricted to users from a certain educational institution or country, which are not OER in the pure sense of the word. A cross-national review of the state-of-the-art of OER in several countries identified examples of best practices and different patterns of OER movement – from national initiatives on localization of English-language OCW/OER or establishment of national repositories to the efforts of individual professors who publish their lectures on the Internet.

Experts from several CIS countries mentioned the incentives that make educators spend their time and energy to create OER: interest to innovative teaching methods and resources, willingness to expand the access of students and colleagues to their materials and to enhance the visibility of the university, opportunity to get additional merit and score during appraisal, etc. The experts believe that the use of OER might bring two major consequences on the education systems of their countries. Firstly, these are financial savings due to elimination of duplication of efforts in development of teaching materials. Second, they believe that the use of OER can have a positive impact on the quality of education.

The survey of expert opinions made it possible to reveal the factors that prevent wider introduction of OER into educational practices in the surveyed countries. Below are those most frequently mentioned by the experts as the most typical of CIS education systems:

- National and institutional strategies and initiatives in informatization of education are mainly oriented towards infrastructure and seldom encourage the development of educational content;
- Lack of awareness of educators about the availability and opportunities provided by OER;
- Most people are not familiar with intellectual property rights; moreover, national intellectual property rights regulations are hardly compatible with open licenses;

- Accepted pedagogical approaches are yet to be adopted to the use of OER;
- Quality assessment and assurance provisions for OER are non-existing;
- The reward/encouragement system for introducing OER in educational practice is non-existing at educational institutions;
- Lack of knowledge-sharing culture and re-using of materials traditions.

Indeed, as explained by Andy Lane in IITE Policy Brief on OER, "...the biggest barrier for teachers is a cultural one around teaching practices and overcoming academic practices surrounding using, reusing or remixing other people's material for fear of infringing copyright or being accused of committing plagiarism; or of believing that it is inappropriate for local needs or poor quality. Equally the culture in many institutions or academic communities of practice is to value research or producing your own content rather than put effort into teaching or use other people content."

There are some country-specific barriers as well. In some countries, the current level of development of ICT infrastructure is insufficient to support the development of OER. Though during the recent years much efforts was invested in computer literacy trainings for teachers, their skills in some CIS countries are insufficient to use open source software and OER in their professional activities on an everyday basis.

All experts agree that the OER movement should develop in CIS both top-down and bottom-up: strategic decisions should be taken at the national level, administrative decisions at institutional and activity of educators should supplement each other. In with OECD recommendations formulated in "Giving Knowledge for Free", it is important to ensure that there is comprehension at all levels that academic and research output as well as the natural heritage made available in digital format with the use of public funds should also be available for free for education. Due to the abovementioned affinity, it is advisable to support the OER movement in CIS at the Commonwealth level, as it is done in the "Commonwealth of Learning" in the Commonwealth of Nations.

The survey undertaken with the IITE OER project has laid the basis for new activities to be undertaken in the future. Geographical scope of the IITE OER project will expand to include Japan, People's Republic of China, Brazil and Turkey. These surveys should provide a further insight into how OER-related patterns vary in non-English-speaking countries.

IITE plans to raise awareness on the advantages of OER among educators and policy-makers. In addition, to the already published policy briefs "Global trends in the development and use of open educational resources to reform educational practices" and "Open Educational Resources and Intellectual property Rights", IITE will publish a synthesis report "CIS on

the Way towards OER" that will generalize the results of the survey of the state-of-the-art of Open Educational Resources in these countries. The survey has resulted in the overview of the challenges and opportunities of OER in CIS, but also it enabled inventorying of big and small OERs in the countries surveyed. The inventory laid basis for IITE OER gateway, its user-friendly interface facilitates navigation though the repositories of Open Educational Resources in CIS.

Special efforts will be taken to develop the capacity of educators in OER production and re-use. For this purpose an online training course, including a special tool for OER development will be elaborated and made openly available at IITE website.

The above activities shall be supported by networking and building a community of experts in the international OER communities and networking.

The issues related to copyright and licensing with respect to OER will be considered in the context of legal regulations on intellectual property rights in CIS and other countries. A special event will be organized in 2011 to share experiences in the use of OER in CIS and other non-English speaking countries, to introduce the open licensing frameworks and to discuss ways of harmonizing national IPR regulations with Creative Commons licenses. The workshop is intended to upgrade the capacity of UNESCO Member States in production of local content and repurposing of available resources. Workshop participants will discuss where and how policies and practices in education need to change in order to harness the potential of OER. UNESCO and UNESCO IITE OER initiatives, tools and products will be publicized. It is expected that the workshop will result in developing and prioritizing strategies for the next steps and in elaborating appropriate guidelines and recommendations to encourage OER sharing and use.

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SESSION 2

Establishing Partnership between IITE, UNITWIN/UNESCO Chairs on ICT in Education and UNESCO ASPnet Schools

UNESCO Chair and IITE Cooperation in the Field of ICT in Education Programmes Development and Realization

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Brief history of the Chair, major areas of activity

The UNESCO Chair 'Distance Education in Engineering' was established at the State University of Aerospace Instrumentation (SUAI) in the frame of the UNITWIN/UNESCO Chairs Programme in April 1999. The creation of the Chair was supported by several foreign higher educational establishments-partners, namely Beijing University of Aeronautics and Astronautics, Beijing (China), Institute de Maintenance Aeronautics of University Bordeaux-I (France), Neve Yerushalayuim College, Jerusalem (Israel), Institute of Computer Science and Information Systems of Technical University of Czszecin (Poland). The Chair is headed by Prof. Anatoly Ovodenko, Doctor of Technical Science, Rector of SUAI, Distinguished Scientist of the Russian Federation, Laureate of President's Prize in the field of Education, Commander of the Order of Honor of the Russian Federation.

The basic directions of the Chair activity are development and implementation of distance education courses in the field of engineers training, organization of international scientific forums, conferences and seminars on the problems of distance education for engineers, and application of new information technologies in higher education.

The UNESCO Chair 'Distance Education in Engineering' of the State University of Aerospace Instrumentation which was created to provide access for higher education to residents of remote districts as well as to enhance the quality of education is permanently engaged in development of computer manuals in different fields of science. It set up a Russian network to provide access to educational resources and to test the correspondence students. The methods of distance education and knowledge examination are tested and used for students training at the University branches.

Main projects of the Chair

A well-equipped Internet class for development and testing of software for distance education courses support was created to achieve the technical realization of the Chair projects. The special software was developed in SUAI for the distance education tasks solution. As opposed to traditional systems of distance education, this software uses a new approach that allows to decrease server and Internet-channel loading and provide maximal use of student computer resources. This approach is based on the usage of so- called JAVA-applets.

In the frame of the Chair activities, the Russian version of the IIPE/UNESCO education course 'Methodic of school textbooks preparation' project was created. Over the last year, 5 programmes within 5 majors became available on the webpage. Correspondence students are involved into academic process by means of e-mail and interactive education, namely, videoconferencing. Moreover, at the present, the Chair develops multimedia courses 'Applied issues of informational security' and 'Application of wireless networks: problems and perspectives'.

According to the Treaty with the UNESCO International Institute for Educational Planning, the UNESCO Chair 'Distance education in engineering' supports the Russian language webpage of IIEP 'IIEP Newsletters'. Quarterly informational bulletin 'IIEP Newsletters' provides essential information on management and planning in the field of education in different countries. It also contains comprehensive information on the IIEP activities. In particular, it assists the former IIEP participants to keep in touch with IIEP and upgrade their knowledge on state-of-the-art methods and directions of management and planning in the field of education.

The UNESCO Chair of SUAI continues the project 'Aided learning of Russian as a foreign language with use of technology of virtual reality', originally (in 2003) financed by UNESCO Participation Programme, Project of virtual museum 'Overview of the Second World War'. For the last year, the UNESCO Chair of SUAI in close cooperation with St. Petersburg-based General Consulates as well as organizations and higher educational establishments of states-participants of the Second World War accumulated information and worked out the concept of its representation in virtual reality. Creation of this museum will provide access to the resources depicting the events of the Second World War from different perspectives and attract attention of young people throughout the world to the issues of peace.

International Forums and Conferences held by the Chair

Yearly, since the establishing, the UNESCO Chair has been organizing international forums and conferences on problems of science and education,

international academic cooperation. Highly qualified specialists training became traditional. These events are well known in the Russian Federation and abroad.

The UNESCO IITE joint with the UNESCO Chair 'Distance education in engineering' of SUAI held the meeting of experts in the frame of the International Forum 'Information and Communication Technologies and Higher Education – Priorities of Modern Society Development' in the period of 26–30 May 2009 on the board of the 'Vissarion Belinsky' cruise ship. Twenty specialists from the CIS, Baltic and Central Asian States and other countries – representatives of Ministries of Education and Science, ICT and Educational Departments and Centres, UNESCO Moscow Office, UNESCO Institute for Information Technologies in Education, rectors, professors took part in the event. The main goal of the meeting was to discuss issues on ICT in Higher Education in CIS, Baltic and Central Asian States, to establish a new project on higher education that would provide national potential strengthening of CIS, Baltic and Central Asian States in the higher education development based on information and communication technologies. In the frame of the meeting the following questions of the state policy formation in the field of ICT application in education were discussed: strategic planning, new standards of ICT application development, ICT regulatory support, infrastructure development; international cooperation and national experience effectiveness, including positive experience of best practices; lifelong learning, distance education, open educational resources, education for individuals with disabilities, and ICT development for higher education. The Analytical Survey 'ICT in higher education in CIS, Baltic and Central Asian States: state-of-the-art, challenges and prospects for development' was developed in the end on the basis of the meeting outcomes.

In the period from 30 May to 3 June 2011, XII International Forum 'Modern information society formation – problems, perspectives, innovation approaches' will be organized by the UNESCO Chair 'Distance Education in Engineering' with support of the Ministry of Education and Science of the Russian Federation, the Federal Space Agency, the Government of St. Petersburg.

Directions of the Chair development

Under the auspices of IITE, SUAI UNESCO Chair is planning to take active part in the UNESCO Chair's network in the field of ICT application in education established for enhancing the use of ICT in teacher education, proliferation of open educational resources (OER), open education and upgrading teaching practice, development of cooperation between IITE, UNITWIN/UNESCO Chairs and leading IT enterprises in the field of ICT application in education.

At the present time the issue of using free distributed software in the systems of distance education is at focus. This problem brings a special benefit to remote users (students). Open Educational Resources (OER) development, application and dissemination are discussed at international conferences and forums. The UNESCO International Institute for Educational Planning (IIEP) with active participation of the UNESCO Chair 'Distance Education in Engineering' held the Internet-forum 'Open Education Sources'. The application of domestic OER and already existing foreign OER localization is the main component for the future development of distance engineering education in Russia. The Centre of Competence in the field of information transfer and protection, created on the basis of SUAI with Intel Company assistance may become the experimental platform for development, testing and dissemination of domestic OER joint with IITE.

UNESCO Chairs in Synergetic Paradigm of Educational Networks' Development

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The network of UNESCO Chairs is being actively developed within UNITWIN international programme. Experience of network cooperation of UNESCO Chairs on the basis of the Herzen State Pedagogical University of Russia proves that development of networks and network cooperation – first and foremost in education – becomes a brand new foundation and a social evolution model of modern world community. Emerging concepts of nomadic and ubiquitous learning (u-Learning, m-Learning) particularly correspond to this model of the new world order, the studies of which are primarily based on the principles of synergetic methodology.

The UNESCO Chair on Sciences of Education founded at the Herzen State Pedagogical University of Russia in 1993 is a Chair which activities are based on project and network principle. The Chair has developed and has been implementing different network projects providing academic mobility and knowledge exchange: 'Eurasian Association of UNESCO Chairs', 'Western Slavists' at the Herzen State Pedagogical University of Russia, 'Reality of Ethnos', 'Advance Study Centres' as part of the international cooperation activity, 'Ethnodidactics of Peoples of Russia' on the basis of Nizhnekamsk Municipal Institute, 'Intercultural Communication in Human Dimension in the European North' at Murmansk Pedagogical University, 'Regional Peculiarities of Linguistic Education' at Kuzbass Pedagogical Academy, 'Inclusive Education: Education for All', 'UNESCO

Chairs in Education for Sustainable Development', etc. The Chair is actively participating in UNESCO Internet forums on interconfessional dialogue. In 2006 UNESCO approved of foundation of the international pedagogical network 'Pedagogical Education: Multicultural Dialogue' at the Herzen State Pedagogical University which in 2010 launched the subproject called 'UNESCO Chairs in Education for Sustainable Development'. In 2007 the UNESCO Chair joined the Global University Network for Innovation.

The experience of network cooperation of UNESCO Chairs in such projects has testified that network organization is a much more effective relations regulator than administrative management since it is founded on professional monitoring and self-regulation mechanisms. Network technologies foster participants' development and eliminate consumer way of thinking; the network is interested in development of each and every participant because it is beneficial for everyone, that is why the network not only supports its members, helps them and takes part in their activities, but also motivates, coordinates, tests them and, if necessary, takes harsh decisions concerning them.

Meanwhile the peculiarity typical for ICT development in education in contemporary world is that the development of traditional ways of network cooperation establishment is coupled with the formation of nonlinear alternative models of educational networks' institutionalization. An example of alternative approaches in this field is the theory of educational institutions' development elaborated by Ivan Illich, philosopher, educator and critic of modern models of consumer society [1]. Recognizing that school serves as embodiment of fundamentals of any society, Illich puts forward the idea of going beyond this traditional educational institution and entering the new educational space free of school dogmatism.

Despite the extreme nature of Illich's proposal, it contains a number of ideas which help to see not only new capabilities of open educational resources in network interaction, but also new status positions of the participants of this interaction. According to Illich, new educational institutions should be developed first of all through the expansion of pedagogical activities, which should stretch beyond school and use "all networks of contemporary society to give educators means to funnel their message to us – for our own good... On the other hand, the growing awareness on the part of governments, as well as of employers, taxpayers, enlightened pedagogues and school administrators could offer an extraordinary opportunity to a large amount of people: that of preserving the right of equal access to the tools both of learning and of sharing with others what they know or believe" [1, p. 117]. As Illich puts it, the main condition for existence of this new order in the architecture of educational institutions is "to liberate the individual from the obligation to shape his expectations to the services offered by any established profession – by providing him with the

opportunity to draw on the experience of his peers and to entrust himself to the teacher, guide, adviser, or healer of his choice, which inevitably will blur the distinctions between economics, education, and politics on which the stability of the present world order and the stability of nations now rest" [1, p. 118].

It is important to note, that these ideas expressed by Illich in the 70s of the last century, were reflected in the concept of inclusive society and development of such kinds of pedagogical theory and practice as support pedagogy and inclusive education. It is remarkable that the criticism of alleged stability of the society of Illich's times and the criticism of its institutions turned out to be prophetical, and now we witness the global crisis of this society in response to which leading international organizations including UNESCO started to develop the concept of sustainable social development. In this project authorities indeed have to take into account the experience gained in formation of network educational institutions as one of contemporary factors of social development stabilization. The analysis of educational networks' development conclusively proves that communicative network ethics is founded primarily on synergetic principles of administration, participation and solidarity. Thus we believe it to be visionary to consider network models of UNESCO Chairs' activity in education as part of general synergetic paradigm.

As a synergetic approach to assessment of contemporary world development trends proves it, here "we speak about coevolution (interconsistent evolution of complex systems) rather than about mere evolution; we speak about participation, cooperation and collaboration rather than about individual acts; about coherence and interactivity (mutual and agreed actions in such pairs as executive – subordinates, teacher – students, older generation – youth, linked by chains of nonlinear reverse connections) rather than about simple activity; we speak about an action as means to discover inner talents of people and social organizations rather than an action as mere incentive or even means of coercion. Ideas of uniting and relating become the main ideas which take roots in scientific creativity, philosophical thinking, and ethics of interpersonal relations. To construct means to create the organic and coherent whole, the whole which acquires new, emergent qualities missing in its components taken separately, and, inversely, the qualities which influence and modify these components" [2, p. 203, 205].

Therefore, a new image of social, cultural and educational space formed by network communications emerges. "Network theory encourages to measure space in flows rather than sections, to keep time in events rather than hours" [3, p. 75]. The meaning of the concept 'event' also drastically changes, because task-oriented creation of events turns them to one of the key components of humanitarian ICT, to communication constant of

contemporary culture. Such events as, for example, the Year of the Teacher in Russia, the International Year for the Rapprochement of Cultures, the Year of France in Russia, etc. not only translate certain ideas and consolidate the community, but also influence mindset and value paradigms of modern humanity.

Ratio of global and local forms of interaction is changing in the course of network society development. In the past, international connections allowed for coordination of joint efforts within the framework of educational and academic community, but it was constrained by national activities. In the process of educational networks' development a new communicative effect has come into being: national aspects themselves become the embodiment of globally agreed and launched actions. In the meantime, according to the synergetic principles, cultural pluralism does not vanish, on the contrary, it is preserved, cultivated and becomes a creative resource for the network society development. "It becomes clear that to live in such a mixed, multicultural world means to live not only differently, but also to live alike; to live not only in isolation sustaining yourself, but also in cooperation; to plan not only for short term perspective (2-3 years), but to elaborate development strategies for decades" [2, p. 203, 204]. These very synergetic principles became the foundation of UNESCO long-term development programmes of the last decade.

Conclusion

The network interaction of UNESCO Chairs based on synergetic methodology has allowed refining the development of educational processes and laying foundation for new order of international cooperation in education, science and culture. New initiatives undertaken under network interaction development are aimed at getting educational models beyond traditional local (national and disciplinary) frames, based on synergy of general methodological principles of interdisciplinarity, polydisciplinarity, and transdisciplinarity, which contributes to mutually enriching synthesis of findings in different sciences and constructive cross-disciplinary and cross-cultural dialogue between representatives of different academic fields and national systems of education.

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Strategies for Change towards Sustainability in Tertiary Education Supported by ICT

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Conceptualizing ICT in the context of Education for Sustainable Development

Over the past decade, we have seen a significant expansion of ICT (Information and Communications Technologies) in schools, not only across economically developed countries, but also around the world (Makrakis, 2006; Pelgrum and Law, 2003). ICT advances, especially social computing, go beyond personal computing, facilitating collaboration and social interactions, thus enhancing social development and social computing (Cartelli, 2007). The latter is a new paradigm of social learning, networking, communication and technology development, which has become a hot topic attracting broad interest from various fields of enquiry, scientific disciplines and social theories (Parameswaran and Whinston, 2007; Wang, 2005). In this sense, social computing is a cross-disciplinary research and application with increased potential for new ways of communicating, socializing and sharing knowledge. From an application perspective, social computing technological infrastructure encompasses the Web, distance learning, hypermedia, wireless communication tools and software engineering technologies. From a theoretical perspective, social computing has attracted interest of information processing theorists, cognitivists, constructivists, sociologists, anthropologists and organizational theorists.

In the field of education, ICT are increasingly deployed as tools to extend the learner's capacity to learn and teacher's capacity to deliver quality teaching and develop professional skills. One emerging area concerns merging ICT with the United Nations (UN) call for the Decade of Education for Sustainable Development (DESD) to create a more sustainable development future. As education is seen key in the process of achieving sustainable development, there is an urgent need for reorienting formal education to address sustainability (UNESCO, 2005). In this context, teachers are increasingly called upon to switch from roles of being consumers of outside expert knowledge and knowledge transmitters towards taking an active role as curriculum developers, knowledge constructors and transformative learning agents. To prepare teachers to function within this role, they have to receive an appropriate take off training and be committed to on-the-job self-professional development. They should also be committed to play a leading role in promoting other teachers' professional development in their own schools (Makrakis, 2006). In this context, ICT may play

an important role in advancing ESD in two ways: first, by increasing access to educational materials about sustainability (e.g. via distance learning, educational networks and databases) and second, by helping to promote new ways of interacting in order to facilitate the learning called for in ESD, that emphasizes not just knowledge, but choices, values and actions (Paas, 2008).

Indeed, social computing and online communities are changing the fundamental way people share information and communicate. The intent of this expansion is aimed at changing the way students learn and teachers teach. Yet despite this investment, there are certain issues that should be considered. The first one concerns the extent to which ICT has transformed everyday classroom activities and the second concerns the extent to which ICT integration in schools is connected to the social, environmental, cultural and economic reality and experiences of the learners. These two issues are related to the domains of 'learning to transformative change' and 'learning to live sustainably'. They constitute two new pillars or domains for learning which could be perceived as an extension to the four pillars (learning to know, learning to do, learning to live together and learning to be) proposed by the International Commission on Education for the 21st Century appointed by UNESCO (1996).

Identifying and setting the problem

Learning and behavioural change are essential for achieving sustainable thinking and living (learning to live sustainably), which is inextricably connected to transformative perceptions of learning. Transformative learning, in that sense, focuses on learning-based change that involves 'learning to be', 'learning to live together', 'learning to know' and 'learning to do'. It is a shift of consciousness that alters: our way of being in the world (learning to be), our way for discovering others by discovering ourselves (learning to live together), our way of learning how to learn as well as acquiring, constructing, disseminating and managing knowledge (learning to know) and our way of putting knowledge into action (learning to do). It is above all learning that "transforms problematic frames of references – sets of fixed assumptions and expectations – to make them more inclusive, discriminating, open reflective and emotionally able to change" (Mezirow, 2003, p. 57–58). The argument for emphasizing the development of action-oriented competence in education through transformative practice (learning to transformative change) in connection to learning to live sustainably is threefold.

First, research shows that even in developed countries where educational levels are high, the education system has not succeeded in influencing choices and behaviors that would support "development which meets the needs of the present without compromising the ability of future generations

to meet their own needs" (WCED, 1987). In the Western world, for example, although a very high rate of the population has higher education, the rates of energy use and the generation of waste are among the highest in the world. At the turn of the millennium, humanity finds itself in a global economic, ecological, social and political crisis. This crisis is largely based on the following processes:

- Unsustainable modes of production and consumption
- Increased proliferation of arms races and unsustainable techno-culture
- Growing gaps of social, economic and political inequality
- Homogenizing the world through globalization of the market economy

Education systems at all levels and especially Higher Education and Teacher Education bear their own responsibility for this crisis, for the simple reason that they educated the highest polluters on the planet and those that have taken decisions at all levels. It is also notable that while most people have positive environmental attitudes and are concerned about environmental issues, a much smaller proportion of people actually translate their knowledge and concern into action (Fujii, 2006; Sattmann-Frese, 2005; Finger, 1994). Simply educating citizens to higher levels does not necessarily lead to higher levels of sustainable ways of thinking and living. If this discrepancy is not bridged, the call of the 'Decade of Education for Sustainable Development' (DESD) to re-orient educational policies, programmes and practices towards sustainability will remain an unfulfilled wish.

Second, it can be argued that the stated discrepancy between environmental knowledge and environmental action may be due to that: 1) most of the educational research has focused on research that does not merge the produced knowledge with action; 2) the teaching methods used and the research that underpins them do not produce learning-based change; and 3) teacher professional development has mostly ignored adult learning principles, context and has not exploited the potential offered by social computing theories and technologies. Action research interventions in teaching and learning seem to offer an alternative research paradigm which can help merge knowledge with action (Coombs and Fletcher, 2005; Elliot, 1991) and figures as a dynamic process of "engagement, education, communication, action and reflection" (Finn, 1994, p. 27).

Third, although the use of ICT can offer exciting new possibilities to promote the changes called for developing knowledge and skills needed for a sustainable future along with changes in values, behaviour, and lifestyles (UNESCO, 2003), simply merging ICT to the transmissive teaching and learning practices will not work to achieve sustainability. Such a teaching model is principally based upon an objectivist approach – seeing knowledge as something stable that should be replicated in learners'

minds, decontextualized from social reality and perceived as existing independently from learners' experiences. In decontextualized learning, school curricula and teaching methodology are mainly used in the context of instrumental rationality and technical interest in knowledge, which does little to develop human self-realization and critical discourse (Makrakis and Kostoulas-Makrakis, 2005; Apple, 1999; O'Loughlin, 1992). Instruction that is confined to a limited range of contexts leads to inert knowledge in which facts and procedures remain isolated and are not activated in different problem-solving situations (Hasselbring and Moore, 1996). It is no longer considered enough merely to transfer knowledge to 'empty vessels'. A new philosophy of education is needed, the one which provides youth and future citizens with the capacity to re-establish the unity between people and nature as well as knowledge and action.

Previous research (Makrakis, 2006) shows that despite technological progress and infusion of ICT in schools, the teachers' community falls between prospective and occasional users. It is estimated that a 'take off' towards the innovative user stage, when 40 to 50 percent of teachers will have reached the stage of engaged ICT users is still to come. Teachers' ICT uses seem to focus more on surface techno-centric skills associated with applications that do not integrate sound learning principles. Deep learning ICT engagement is more concerned to higher thinking skills, integrative skills and reflective thinking. In general, teachers tend to use more frequently computers for low level uses, such as preparing student tests, demonstrating information for a lesson and less on more cognitive level uses related to creative thinking and problem solving. These results largely reflect the kind of training these teachers have received, as well as the ways in which new technologies are implemented in schools. In this narrow perspective of framing teacher professional development, ICT-related changes in the curricula, changes in the teacher role and understanding learning theories have been neglected or at best tackled marginally.

The simplest and most common teacher professional development activities undertaken in the ICT area have been those, aiming at developing skills that would qualify teachers to ICDL certification. ICT skills associated with ICDL certification include basic ICT literacy competences which cover the whole spectrum of ICT. Although such skills constitute a basis for advancing the educational aspects of technology, the over-emphasis placed on these skills, without considering the pedagogical context, usually leads to trivia results.

Any professional development attempt without connection to learning theories and practices as well as to curriculum and classroom applications add nothing to educational reform and change. In addition to that, access to and use of ICT tools alone will not help a teacher who does not have a sound understanding of how students learn and how best to address students'

needs and learning styles. It does not make sense, for example, to expect a teacher to use a communication tool, like the Internet, to support cooperative learning without knowing the theory and practice behind cooperative learning. Technology is just a tool and not an end in itself. Compared with traditional forms of training, constructivist learning and training environments place more responsibility on trainees for autonomous learning and the connection of content with the context. For example, introducing word processing into language instruction will not have much of an effect if students use Microsoft Word as an electronic typewriter. The successful integration of Word as a writing tool will have real value when students are engaged in a writing process, whereby technology enables them to improve writing skills. It is not the mechanisms of the functions of word processing that a teacher should focus on, but the teaching of the process of writing with the computer tool. The integration and use of word processing with other technology tools and software will also add a new dimension in writing and composition. Thus, teachers' knowledge about ICT must go beyond the acquisition of mere ICT skills and the application of software to the understanding of the educational processes. This implies that the conceptual skills required by teachers to integrate ICT into their everyday educational practices are more critical than the mechanics of technology tools. Indeed, the successful integration of ICT into the classroom context depends, to a large extent, upon teachers' pedagogical readiness and their attitudes towards innovation and change. This requires a fundamental and continuous process of rethinking what is to be taught, how it is to be taught and why.

Looking for solutions to the problem: preparing teachers for building a sustainable society

For teachers to be considered as agents of pedagogical innovation and learning-based change that leads to the advancement of education for sustainable development implies that they assume the role of pedagogical leader. There is a need to focus on teachers as pedagogical leaders guided by moral purpose and an action-based change orientation. For example, (Fullan's, 2001) the second dimension of leadership is that leaders must understand the change process and be warned that the moral purpose takes into account both the means and ends of the change process. The traditional way to identify school and instructional leadership solely to the role of the school principal is inadequate given the new emphasis on ICT in education and ESD. Indeed, while the concept of instructional leadership has been predominant in theorizing about school leadership, the concept of pedagogical leadership has been given attention in the last decade (Gupton, 2003; MacNeill and Silcox, 2003; Crowther et al., 2002; Lashway, 2002; Spillane, Halverson and Diamond, 2001).

In the context of pedagogical leadership, the concept of School Resource Teachers is envisaged (Makrakis, 2008; 2006). This refers to ordinary

teachers who are assuming responsibility for their own learning and that of their colleagues. In other words, they are committed to support building 'communities of practices' in their own schools. This innovation is in line with the belief that: a) there is no way to advance any reform and change practice in schools towards ESD, unless it is developed and spread from the bottom up or inside, and b) pedagogical leadership should be confined not only to administrative personnel, but also to ordinary teachers. Teachers who have good background in ICT could be trained as School Resource Teachers in order to successfully be involved in the school-based professional development dealing with issues of ICT in ESD with objectives such as:

At the trainee level

- be able to apply computer graphic organizers in all school subjects as well as cross-thematically to explore ESD themes and assist other teachers towards this end;
- be able to apply and connect virtual manipulatives in the teaching of school math with ESD themes and assist other teachers towards this end;
- be able to use data handling (spreadsheets and databases) in math, sciences and social studies for ESD issues as well as to assist other teachers towards this end;
- be able to apply ICT ergonomics, safe behaviours and social, ethical issues related to ICT use and assist other teachers towards this end.

At the student level

- expand awareness of the multidimensionality of social and environmental problems;
- encourage critical thinking and creative problem solving across all subjects through hands-on experimentation with ICT;
- stimulate personal, social and environmental responsibility as well as future-oriented thinking;
- engage in active and responsive local, national and global concern about sustainability.

At the educational level

- be able to organize and prepare ICT and Sustainable Development Plans for their schools;
- be able to develop inter-disciplinary and cross-curricular thematic lesson plans, integrating ICT and sustainable development issues across the curriculum;

- be able to develop curriculum connections between school knowledge and local, national, regional and global sustainability issues;
- be able to organize school-based 'communities of practices' for merging ICT in ESD.

Besides the integration of ICT in ESD, the issue is how to spread the innovation of School Resource Teachers in a particular educational context and make them able to function on the roles emanated from the above objectives, taking also into consideration possible contextual and personal barriers. As it was pointed out earlier, time and overloaded administrative activities exerted a significant barrier to teachers who want to integrate innovative learning activities into their teaching. Teachers must have substantial time if they are going to acquire and, in turn, transfer to the classroom the knowledge and the skills necessary to effectively infuse technology into their curricular areas and advance the issue of sustainable development in teaching and learning. E-learning approaches and applications which are supported by pervasive technologies have brought in great benefits to the development of 'communities of practices', beyond time and space. Indeed, the affordances of online learning technologies have enabled more widespread development of learning environments that facilitate the exploration and solving of complex and realistic problems (Brickell and Herrington, 2006).

Strategic points for action

A number of strategic actions that could help teachers move from perspective and occasional ICT users to engaged and innovative users are:

1. Capacity building on ICT-enabled ESD based on blended models of training which would start with the training of a number of well-motivated ICT/ESD-literate teachers to function as resources in their own school and district.
2. Connect ESD capacity building to educational reform and change, giving due emphasis to the process as well as the substance of change. Such a strategy implies:
   - a 'whole school' approach to ICT-enabled ESD;
   - turn trainees as role models of ESD;
   - prioritize learning, then pedagogy (teaching) and curriculum and then technology.
3. Introduce post-graduate courses and study programmes on ICT-enabled ESD, preferably deployed on a virtual platform in order to cope with teachers' lack of time and geographical barriers.
4. Revise traditional teaching method and practices. This implies that:

- teachers need to work in contexts supported by experimentation;
- avoid isolating technology as a separate discipline and instead provide an instructional focus that illustrates how technology can support ESD goals and objectives;
- provide a learning environment that is sensitive to the individual teacher's level of interest, expertise and experience.

5. Administrative support: if teachers trained to integrate sustainable development and ICT in teaching and learning is to be effective, then responsible authorities should:
   - provide teachers pursuing training in this area with all the facilities;
   - encourage and reward teachers who introduce innovative practices into their teaching;
   - encourage teachers to share their ESD experiences;
   - certify teachers who participate successfully in ICT-enabled ESD professional development activities;
   - give ESD innovative teachers additional access to hardware and software;
   - provide ESD innovative teachers' schools with extra computers and software;
   - reduce administrative overloaded tasks for ESD innovative teachers to take part in ICT-enabled ESD professional development.

From theory to praxis

As a response to these challenges and barriers, the UNESCO Chair ICT in Education for Sustainable Development established at the University of Crete in 2008 has set up a number of projects, which are described briefly.

Developing web-based curricula addressing education for climate change

We have set up a working group consisting of experts in ICT, Education for Climate Change and Instructional Design to develop web-based inter/cross-disciplinary curricula addressing the integration of climate change in the Greek school curriculum. The instructional material we are developing is expected to engage primary school learners in social activism and an exploration of the impacts of climate change on ecosystems and natural resources, on local community, and on individuals and global society. We are open to international cooperation from Ministries of Education and Foundations to transfer our know-how through customisation to their own educational systems.

Euro-Mediterranean online ESD 'Community of Practice' for reforming higher education curricula to address sustainable development

This participatory action research project aims at developing a Euro-Mediterranean 'community of practice' in higher education committed to the principles of transformative learning and sustainable development. In particular, it aims to design, develop and assess an online 'community of practice' that goes beyond awareness raising to action competence and re-orienting higher education curricula and campus practices to address sustainability. It is founded on a sound basis of merging theory and practice in higher education systems and constructivist web-based open and flexible learning management systems. This project is integrated into the TEMPUS project 'Reorient University Curricula to Address Sustainability', involving universities from five European Union countries as well as from Egypt, Jordan and Lebanon.

Development of an online problem-based learning environment for health education

This project deals with the development and assessment of an online problem-based learning 'community of practice' enriched with inter-disciplinary hypermedia-based instructional lessons on health education issues. Participatory action research is the research method adopted with two parallel action research teams working together in the prefectures of Rethymnon and Chania on the island of Crete. Through this project we are expected to provide sustained, reform-based professional development to guide teams of teachers through the process of creating and implementing interdisciplinary and cross-disciplinary hypermedia-based learning interventions focusing on local environmental health issues for primary and lower secondary school graders. We are open to international cooperation from Ministries of Education and Foundations to transfer our know-how through customisation to their own educational systems.

WikiQuESD

This concerns an action research initiative geared towards developing strategies for using digital media and technology to help pre-service and in-service teachers both understand and contribute to the UN Decade of Education for Sustainable Development (2004–2015). The major question addressed in this project is how to profit from open education resources concerned with sustainability issues and how to empower teachers to function as change agents with the support of more advanced learning technologies. 'WikiQuESD' integrates Wiki technologies, the WebQuest idea and Education for Sustainable Development (ESD). It is used as a scaffolding hypermedia tool to turn teachers from instructional content users to ICT-enabled ESD curriculum developers. WikiQuESD applications are being designed to use multimedia (images, animation, videos, text and sound),

various mindtools and open education learning objects to promote collaboration, connectivity, 'real-world' learning and systems thinking, which are emerging as key pedagogical methods conducive to education for sustainability. Results of an assessment study revealed that the WikiQuESD concept and platform can give both teachers and students a voice in teaching and curriculum decisions that is often neglected in education (Makrakis, 2010).

ICT-enabled education for sustainable development: a joint Master degree on ICT in ESD

Seven European Universities from Greece (University of Crete), Ireland (Dublin City University), Latvia (Daugavpils University), Cyprus (Frederick University and Open University of Cyprus) and Sweden (Uppsala University) with considerable experiences in the fields of ICT and ESD formed a Consortium under the coordination of the University of Crete (UNESCO Chair ICT in ESD) to submit a project entitled 'ICT-enabled in Education for Sustainable Development' within the framework of the ERASMUS Virtual Campus Programme. This project, which has been selected and financed by the European Commission, aims to develop a joint online Master degree in the field of ICT in ESD offered in English. It targets experienced practitioners in schools, colleges, community education, NGOs, government bodies and development agencies, all of whom are engaged in applying ESD in many different contexts and countries.

Through this joint effort we make considerable innovative efforts: 1) to improve our own Universities' 'sustainability profile' by developing 'learning environments' conducive to ESD supported by ICT and 2) to develop a new open and flexible postgraduate programme that responds to the increased needs of experienced practitioners who want to play a key role in moving forward the issue of ESD. The content of the curriculum design and development is *participatory* (e.g. involving end-users, teacher trainers, teachers and students in the process); *interdisciplinary* (involving various subjects); *contextual* (dealing with local/global sustainable development issues); *holistic* (balancing environmental, social, cultural and economic pillars of sustainable development); *interactive* (ICT-based). It also reflects a shift away from reliance on structured and compartmentalized Master course curricula focusing on curriculum as process (learner-centered) and praxis (transformative and reflective). It provides tools and services that facilitate 'social networking' and allows for virtual collaboration and virtual peer mentoring amongst learners and e-tutors. The joint Master programme will be ready to take its first students in the academic year 2012–13. It will consist of 120 ECTS (90 ECTS courses and 30 ECTS dissertations).

Changes envisaged are: a) greater access of experienced teachers and teacher trainers to be trained as ESD Leaders in their formal and/or non-formal

settings independent of temporal and geographical restriction; b) interdisciplinary and individualized programme of study on how to use ICT in integrating ESD issues reflecting environmental, social, economic and cultural perspectives; c) competent ESD practitioners taking leading roles in their education settings and functioning as human resources for transformative ESD practices; and d) promotion of virtual student and staff mobility which adds value to a new dimension of mobility.

TEMPUS project 'Reorient University Curricula to Address Sustainability'

A Consortium consisted of six European Universities (University of Crete, University of Athens, Dublin City University, University of Padova, University of Bordeaux and University of Stockholm), together with the universities from Egypt (Heliopolis University for Sustainable Development and Suez Canal University), Jordan (Hashemite University and University of Jordan) and Lebanon (University La Sagese and Notre Dame University), the UNESCO Regional Office for the Arab States and three NGOs, MIO/ESCDE/MEdIES, IndyACT and SEKEM Development Foundation formed a Consortium under the coordination of the University of Crete (UNESCO Chair ICT in ESD) to submit a TEMPUS project entitled 'Reorient University Curricula to Address Sustainability'. The project was approved by the respective authority of the European Commission.

The overarching goal of the project is to help partner Higher Education Institututions infuse ESD into their curricula (study programmes) and teaching methodology through capacity building of university staff. The key question is how to best advance curriculum change towards ESD, given the regional priorities and the need to modernize curricula to address ESD. This cannot be achieved without well-prepared and committed staff to lead curriculum reform and innovation towards ESD (Makrakis, 2010).

The project integrates a wide range of activities to develop resources, revise and develop new curriculum initiatives, build capacity and strengthen national and regional networks. More specifically, the project specific objectives are to:

- support the development of ESD in the higher education sector in Egypt, Jordan and Lebanon;
- build capacity amongst university staff to embed ESD in curricula and pedagogy;
- review and revise undergraduate curricula to address ESD in line with Bologna and Lisbon processes;
- assist the coordination and dissemination of ESD policy, research, curriculum reform and practice relating to ESD in the partner institutions that are expected to function as role models in the region.

This process entails six key components:

1. Develop ESD competences for higher education students contextualized to the EU and Arab region
2. Evaluate ESD student competences in the participating Higher Education Institutions
3. Establish new models of professional development in ESD
4. Revise education and certification requirements to include ESD and align these revisions to correspond to the ESD student competences and the Bologna process.
5. Apply and evaluate the revised education curricula with respect to the ESD student competences
6. Promote reorienting of higher education towards ESD as a viable avenue for 'whole institution' curriculum reform, research and teaching across all Higher Education Institutions in the Arab region.

The development, adoption and implementation of each of these components will be articulated over the three-year duration of the project (October 2010 – September 2013). Curriculum review and revision will be carried out in the disciplines of Educational Sciences, Engineering, Information Technology and Applied Sciences. Appropriate resources will be developed such as an ESD Curriculum Review Toolkit, Virtual Centres for Curriculum Reform in every partner Higher Education Institution, and workshops will be implemented to prepare university staff for curriculum review and development of syllabi/modules addressing ESD. It is expected that more than 40% of the content of the study programmes in the involved disciplines will be redesigned to address sustainability issues. Institutional mechanisms and building inter-faculty cooperation and inter-faculty student mobility will be developed to ensure continuity. A pilot initiative for student placement and practicum in local NGOs connected to ESD will be implemented to strengthen the role of higher education institutions in society to reach the targets of the UN DESD.

Conclusion

In recent years, ideas and specific technologies have found wide applications in the education sector and are expanding to new areas of research, theorizing and applications. In this paper, there was an attempt to raise a number of ICT in ESD issues to address the UN call for ESD. Developing the capacities of teachers to work for a sustainable future is, essentially, an educational enterprise. Indeed, the need for achieving sustainable human development reflects the six pillars of education described here, which are inextricably associated with ICT and ESD. The emphasis should be placed on developing a sociocultural approach to

the transformative powers of ICT and e-learning resources (Pearson and Somekh, 2006).

However, web-based open distance professional development activities applying PBL methodologies should rely more on the principles of pedagogical design, rather than the technologies used (Makrakis, 1998). In designing such environments, before making final decisions the following principles should be considered: a) examination of the type of the specified training goals and expected outcomes; b) consideration of the type of modules (content planning) and their ordering routes (sequencing); c) consideration of the training philosophy to be used; and d) examination of the teachers' profiles, and the content to be delivered. It is also of particular importance to connect content with context.

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Development of ICT Skills and Abilities of Multigrade Teachers through Arts and Science Projects

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Multigrade educational context

Multigrade education is an organizational method of primary level education for communities with a small number of school age children, with low income families, and consequently, with limited local financial resources for education. Teaching and learning occur in partially divided school spaces coordinated by a teacher who manages two classes that learn different disciplines at different levels during the same time period. Two grades and age groups – usually first and third grades (ages 6 and 8), and second and fourth grades (ages 7 and 9–10) – with about 5–15 pupils in each grade are taught simultaneously. A decrease in the number of school age children

during the last few decades in Hungary[1] has seen an increase in the number of Multigrade schools, as small villages have had to adopt this economical organizational format – two teachers and two classrooms for four grades – to keep their schools functional. At present, Multigrade primary schools constitute one fifth of all Hungarian public schools. Similarly, the 21st century descendants of the 'one room school house' are becoming a significant segment of the educational palette in rural areas all around Europe[2].

In the framework of UNESCO and EU supported research projects[3] on promoting equal rights to learning through collaborative ICT solutions, our team at ELTE University, UNESCO Chair for Multimedia in Education, Budapest, administered a national survey on professional goals, ICT competence, educational strategies and training needs of Multigrade teachers. A new form of in-service training, called Mentored Innovation Model, was developed and supported by the use of cognitive tools in the U-funded KP-Lab project (www.kp-lab.org). Our team of teachers, researchers and software developers elaborated the Interdisciplinary Multigrade Curriculum and related teaching aids in the course of a 3-year experiment involving 22 primary schools and their village communities. Working with Web 2.0 technologies resulted in the improvement of educational strategies and professional self-esteem of teachers, and increased learning attainment, motivation and creativity of their pupils.

Research questions and evaluation instruments

In Multigrade schools, pupils of different age groups (one space for 1st and 3rd graders, another for 2nd and 4th graders in most schools) are taught by only one teacher at the same time, with one class working silently while the other being instructed. The integrity and self-esteem of small villages are closely related to these schools, their cultural institution, and even if schools underperform in learning results, local communities are fighting for their survival and support from regional and national educational authorities. According to biannual national assessments, the knowledge level of pupils in small village schools with a staff of 2–3 primary educators is significantly lower than the average national level (Imre, 2009). Teachers of these schools are suffering from professional isolation and the irrelevance of both pre- and in-service training programmes, which targeted

[1] In Hungary, the decrease in birth rates was more than 20% between 1983 (127,000), and 2007 (97,000) with a linear decreasing tendency continuing. Since 1998, the number of births has remained stagnant, around 95–97,000 per year until today.

[2] See data and regional characteristics of European Multigrade education at the web site of the Network of Multigrade Schools in Europe, www.nemed-network.org

[3] 'Knowledge Practice Laboratory', an EU IST project, 2008–2011, www.kp-lab.org; 'Development of communication and learning to learn skills of socially disadvantaged students through interdisciplinary arts and science programmes', UNESCO Participation Project, 2008–2010.

single-grade schools to their special needs. In some counties, due to poor achievement results, many small village schools were closed and children aged 6–10 years were transferred to town schools. In other counties the issue is still being debated with decisions still being postponed. The loss of these schools could well result in depopulation of the area and a consequent abandonment of farming. The villages themselves organised protests to keep their schools, but at the same time realized the need for an improved primary education.

The methods employed today in most Multigrade schoolrooms in Hungary imitate 'normal' school procedures and do not make use of the 'handicap' of the Multigrade arrangement – children of different skills and experience levels sharing a learning space. As a continuation of projects in Gypsy schools where ICT-based methods were successfully employed to enhance numeracy, literacy, combinative skills and inductive thinking skills (Karpati and Molnar, 2005; Karpati, 2004), the UNESCO Chair at ELTE joined the Knowledge-Practice Laboratory (KP-Lab) project, supported by the Information Society Technologies Fund of the European Union, to develop computer supported collaborative learning methods to improve teaching quality and professional motivation of Multigrade teachers. Remedial efforts aimed at reforming Multigrade education from the outside, through the introduction of new methodology and content developed by researchers and teachers of high-achieving, urban primary schools, failed to improve performance and gain acceptance by Multigrade teachers.

Our objective was to develop, with the help of a Multigrade teacher community, a new methodology and a curriculum that capitalises on Multigrade features as benefits. With partial success, this objective was realized in the course of a three-year design-based experiment premised on the interdisciplinary organization of knowledge, individualized instruction through ICT tools, project work and portfolio assessment. We established a teachers' community that connects village teachers in professional and geographical isolation through ICT tools as an enhancement for peer interaction and introduces collaborative ICT platforms to facilitate teaching and learning in the undivided multi-age learning space.

Methodology of teacher training: the Mentored Innovation Model

Traditional (dialogical) training models for in-service teacher education assign researchers and trainers the role of knowledge providers. They organise learning experiences for teachers who are supposed to acquire and (slightly) adapt an elaborate set of educational methods and content. The Mentored Innovation Model (MIM) works the other way around: it invites teachers to identify teaching problems and training needs and provides peer support and coaching while working on a boundary object

– an innovative educational programme. The dialogical collaboration model is linear; MIM has a spiral structure where cycles of exploration, learning and creation of new knowledge are iterated on higher levels. MIM is integrated in school practice: teachers and researchers/trainers are equal partners who may alter shared knowledge objects profoundly if educational practice requires different approaches. Differences of monological, dialogical and trialogical models of knowledge creation are shown in Table 1.

Table 1

Monological, Dialogical and Trialogical Models for In-Service Teacher Education

Activities of Training	Monological model	Dialogical model	Trialogical model
Problems are identified and elaborated...	...separately by individual teachers and researchers	...by teams of teachers and researchers working separately	....by teams including both teachers and researchers
Research and development agendas are...	...identified by the individual in response to needs on the job or personal improvement plan	…identified by researchers who invite teachers to realize a programme designed by the research team	...shared objects of activity (innovative teaching practices/ tools) that are identified and developed in *the mentored innovation process*
Supporting structures: (mentoring)	help seek individually (use of textbooks and web-based information services)	mentoring is provided by researchers and training experts *(mentoring)*	mentoring is provided on demand, during the innovation process *(mentored innovation)*
Cognitive tools employed during training ...	...promote one's own professional development process	...promote understanding of researcher's innovative methods/content	...promote scaffolding through structuring inquirers' activities to facilitate complex problem-solving
Innovative teaching practice is…	...realized voluntarily	...not part of the training process, but is expected to be after the course	...essential part of the training course: *design-based research* through school experiments in several iterations

Dissemination is…	...realized voluntarily	...encouraged through competitions	...realized on *a local and national level* through a wide variety of channels. Both teachers and researchers act as innovators and mentors for new adaptors of teaching programmes

Teams of teachers of 21 Multigrade schools, local community stakeholders and researchers formulated differently the 'Multigrade case' as a set of financial, social and educational problems. A common research and development agenda was negotiated, with the involvement of local community stakeholders (policy makers, parents). Supporting structures to solve complex pedagogical problems were provided by researchers and training experts through a specially designed Moodle environment. Design-based research in the form of school experiments was performed in three iterations to refine shared pedagogical objects[1]. In the Multigrade Teachers' Community, participants (the ELTE mentoring team and teacher-mentees) shared examples of good practice (the Authentic Mathematics and Integrated Arts learning programmes (Karpati and Munkacsy, submitted) and used them as an inspiration for the development of similar pedagogical programmes, adapted them for a different educational purpose, criticised them or opted for not even trying – because the learning process described or the tools showcased seemed to be too complex or obscure.

Collaborative cognitive tools employed in mentoring for innovation

We used two cognitive tools to catalyse the innovative work of teachers: the Map-It discussion supporting software and Viddler, a semantic multimedia annotation tool. The main purpose of the Map-It discussion moderating tool[2] was to help prepare for a meeting of software developers, teachers and researchers, ensure its efficient workflow and document the emerging ideas in the form of a multimedia document that features the sequence of contributions as an audio or video recording with text files and images used and web sites visited during the meeting. The discussion map helped to

[1] In 2006/2007, 21 schools tested a variety of ICT supported educational methods through collaborative projects performed mainly as free time, optional activities that were connected to the curriculum but not integrated in it. In the following two school years, 2007/2008, 2008/2009, 4 schools selected to co-develop and integrate new methodology and content in the whole of Multigrade education with the ELTE research and mentoring team.

[2] For the description of the tool and its pedagogical functions see http://www.knowledge-practices.info/module-pages-display-pageid-46.html

reconstruct – also for non-participants – major occurrences of the session, showed who exactly contributed to what and when, which contribution elicited more reactions. It also revealed the flow of ideas and indicated 'dead alleys', or heated confrontations, during the meeting. The map is synchronised with the oral (and eventual video) recording of the session and facilitates the recall of any given segment (Karpati, Molnar and Drachman, 2008).

Map-It was used both online – as a discussion support environment, and offline – for taking notes. The tool is based on the trialogical learning paradigm (Paavola et al., 2004), characterised by work around shared knowledge objects by a team of mentors, mentees and other professionals with relevant expertise for a learning task. With Map-It we managed *to increase learning motivation, improve collaborative skills and increase self-respect of learners as capable professionals at the same time.* The tool was found useful also as a flexible mind mapping application that visualises threads of discourse in relation to predefined thematic areas.

Viddler[1], the second collaborative tool used while mentoring innovation efforts of teachers, is a social networking site with integrated powerful video-based features. Individual users are able to pick friends and create a friend list; moreover, groups of users (like our Multigrade teacher community) are also supported. Groups have their own space with a built-in forum and video repository, but communication is also possible between two users by a private message-sending option. When starting an annotation process, users have to upload their videos first, as content cannot be taken over from other video sites. Furthermore, it is possible to record video directly through Viddler by using a web cam on the record page and share films with a group. Viddler has three types of tags to identify content (Global, Timed, and User tags), and users are able to add textual or video comments. The added annotation items are listed under the video film, but they are viewable on the player and on the timeline of the player as well (Paksi and Karpati, 2008).

The main advantage of Viddler for our experiment was its unique interface of social networking and video-sharing and annotating service. Teachers were able to share films and annotate those of others through pedagogically relevant tags and comments, and thus develop their professional reflection skills and benefit from a direct observation of classroom work of others.

Improving ICT competence and teaching skills through mentored innovation

ICT competence inventory (ICI) was used to assess teachers' attitudes and motivation as well as capacities to innovative using computer models. The survey was administered before and after the in-service training project. A

[1] For the description and downloading of the free annotation tool see www.viddler.com

substantial increase in 'ICT readiness' was clearly shown both in the surveys and in the field data. In the course of three years, 29 Multigrade teachers from 21 village schools, participating in our training experiment, increased their ICT readiness in the following indices:

Index (1) – School access to ICT: through constant mentoring while working on innovation projects, teachers realized educational opportunities of ICT and could convince local sponsors to support the schools through computers and peripherals. Project funds were also used to improve infrastructure, so 87% of teachers reported high and 13% – medium values for better access both for students and teachers in the second survey.

Index (2) – Home access to ICT: teachers' PC and Internet access increased significantly during the project, with 57% of teachers reporting high, 27% – medium and only 16% – low increase in this index. Purchases were mostly driven by personal goals: better communication, more access to friends and relatives living in other areas of Hungary. While working with their mentors, Internet-based communication options were acquired, and Skype, MSN and Web 2.0 platforms (Facebook and YouTube) were employed for personal as well as professional purposes. Participation in social computing resulted in high improvement of home access and use.

Index (3) – ICT related attitudes: here we witnessed the most significant difference between the two surveys before and after the project. The majority of teachers (68%) reported low, 28% – medium and only 4% – high values about the appreciation of ICT-supported methods and motivation for ICT use. The respective responses were 8, 45 and 47% at the end. We found no correlation between the quality of infrastructure and positive attitudes. The increase in positive attitudes was due to satisfactory user experiences and not to improved infrastructure.

Index (4) – ICT related competencies: many teachers did not even have an e-mail address at the beginning of the project, so the increase of teachers with medium competence (from 17% to 43%) is a considerable success. There were no 'high' values for this index in the pre-experiment survey and we found 14% in the post-hoc ICI. The group produced top ICT users to provide examples of good practice and peer support, while a robust medium level user group guaranteed sustainability of computer-based educational innovations in the Multigrade school community.

Index (5) – Educational use of ICT: this index was in the low range for the vast majority of participants (87%) before the project and showed a significant, but not ground-breaking increase in the post-hoc survey: half of the low level users achieved medium level. Teachers reported growing confidence in the use of ICT both in the post-experiment ICI, and in their blogs. The types of used ICT solutions also showed a very promising change. While only presentation tools were utilized before the experiment,

the introduction of collaborative tools and related educational methods showed a significant increase thereafter.

The project attempted to increase ICT competence, while improving teaching performance at the same time. This, however, was not always possible. Educational ICT use was rarely reported in the first survey, while it was prevalent in the second. However, personal use of ICT increased even faster. Computer culture novices (two-thirds of our participating teachers) had to gain competence in (highly motivating) personal use of ICT before employing it regularly for school-based collaboration and communication. These ICT beginning users most often utilized the tools that support frontal education: presentation, announcements, development of an educational home page. Learning new technological skills and altering teaching methodology (two profound change factors for the teaching practice) could not occur simultaneously.

However, those teachers who used ICT more competently before the experiment could focus their attention on learning new educational skills. They acquired and used computer-supported collaborative methods that profoundly altered their teaching repertoire. The question is why these accomplished ICT users never utilized their competence before the experiment? Why didn't they facilitate learning in the Multigrade context where individual, pair and group work could so evidently ease the burden of multitasking with two learning groups of different ages? Focus group interviews revealed that those participating teachers who underwent professional development programmes in ICT use, were trained through traditional (dialogical) knowledge transmission processes, that resulted only in the enhancement of theoretical knowledge. No relevant connections between everyday practice and new educational methods were identified, as these methods were presented through examples from well-equipped schools with single-grade classrooms.

Our school-based training programmes, however, targeted their everyday teaching needs. Teachers with no prior ICT skills were able to integrate current ICT solutions in the oldest of educational environments – the multi-age village school room – to implement arts and science projects and thus enhance digital abilities of their students. Through the use of social computing tools, they took ownership of their professional problems, consulted their peers and selected from the methods those that fit in with the Multigrade school environment. Thus, current computer supported methodology helped modernize the oldest school environment – the one-room schoolhouse.

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ICT in Context of Student-Driven Project-Based Active Learning

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China, being the most populous nation in the world, and having the largest manufacturing capacity of engineered products and supply of engineering talents has a direct impact on global economy, and quality of life around the world. The quality and aptitude of engineering talents in China has immediate consequences on how we sustain the global living conditions. It has been observed that China's current higher engineering education is not conditioned to adequately prepare its students to perform their professional duties. A significant part of this has been attributed to China's exam-driven educational system, or in other words, learning to take exams. This approach almost directly goes against the principles of the Four Pillars of UNESCO (learn to know, learn to do, learn to live together, learn to be).

It over-emphasizes paper-based theoretical exercises, while lacking practical elements that enhances students' ability to cope with a wide range of real-world problems. Problems that cannot be tested on paper alone. This basic problem has already caused a significant shortage of qualified engineers in China. The important message is that China has an abundant supply of head-count in various engineering programmes, however, only a small percentage of these graduates is considered being properly prepared for the workforce. Therefore, we have a problem in terms of quality, not in terms of quantity.

The above-mentioned paradox reflects the problem that a high percentage of college graduates cannot find suitable jobs, but on the other hand, industries have great difficulty to find qualified engineers. To tackle this problem, we need to be aware of the motivating forces and identify possible mechanisms to induce positive change. In terms of the motivating forces, we want to assess the strength of these forces, such as the labor demand and salary differentials that drives both institutional and individual decisions. However, curiosity is also a very important dimension of motivating force other than surviving consideration. In terms of mechanisms for change, we need to identify or design new structures of educational environment, new format of pedagogic contents and the ways to deliver them. All these challenges must be considered with respect to the dynamic nature of talent supply. Our solutions need to directly address the issues whether the scope and scale of these changes can sufficiently address the societal needs in time.

Survey and analysis on the current status of engineering education in China

To study the current status of engineering education in China, we must start from the origin of the educational context by collecting accurate data from China, such as the need of industry for engineering talents in terms of quality and quantity, then investigate the gap between supply and demand, analyze the problems of pedagogic process, from curricula design to assessment of learning outcomes and academic programmes, find solutions to fix them and meet the requirements of society, students, families, industry and educators. Comprehensive surveys have been carried out continuously for these purposes by the UNESCO Chair's partner, Mycos Educational Data Inc., which is led by Dr. Boqing Wang. Based on the first-hand original data from large scale of samples, a comprehensive analysis was implemented.

(1) Survey conditions

The surveys were conducted 6 months after the students had graduated from the schools. The graduates were invited for answering the questionnaire and if they accepted the invitation, they could access the online questionnaires. It took 15-30 minutes to answer the questionnaires. In the year

of 2008, 76,000 answered questionnaires were retrieved; in 2009 – 81,000; in 2010 – 31,000, which represented the employment statistics for graduates in 2007, 2008 and 2009 classes respectively.

(2) Data and analysis

Abundant data was collected by the online questionnaire survey. Here, only a small portion of the data is illustrated and analyzed below.

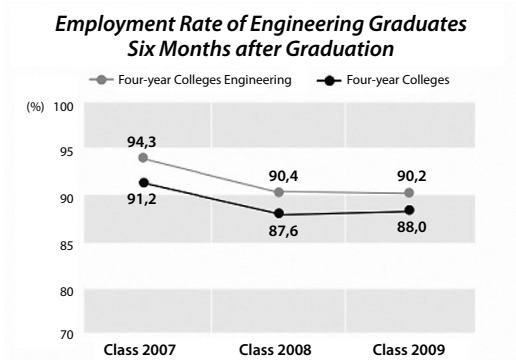

Figure 1. Employment rate of engineering graduates

The employment rate of 4-year engineering college graduates is higher than average for all college graduates. The rate reflects the employment status of the graduates six months after their graduation. However, other data show that, within 6 months after graduation, about 24% graduates left their job for various reasons: about 12% were fired by employers; 88% quit, among them 35% – due to no satisfaction for career development, 23% – due to low salary and benefit, 13% – due to unhappiness with the job or profession (Fig. 2).

Figure 2. The reason for graduates to quit job

The above diagram shows the percentage of the graduates who took entrepreneurship or self-employment after graduation among all graduates from the same class. In general, higher vocational graduates have higher

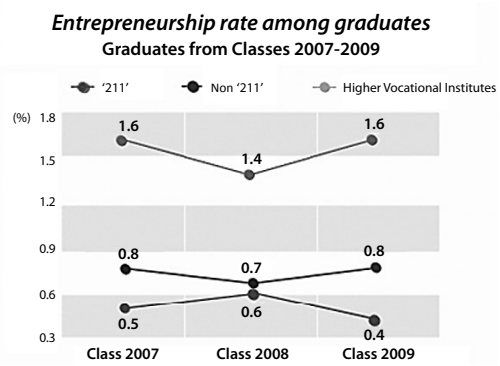

Figure 3. Entrepreneurship date of engineering graduates

rate than 'non-211' 4-year college graduates, and the '211' college graduates have the lowest rate in this regard. Here, '211' denotes 100 top universities in China, most of them are research-oriented; whereas 'non-211' denote ordinary universities or colleges at provincial or city level. The statistics seems illogical: the higher level the students reached or the more they studied, the less they desired to pursuit their own business. The interesting phenomena may be related to some problems in education system: lack necessary training on innovation and entrepreneurship in the pedagogic process.

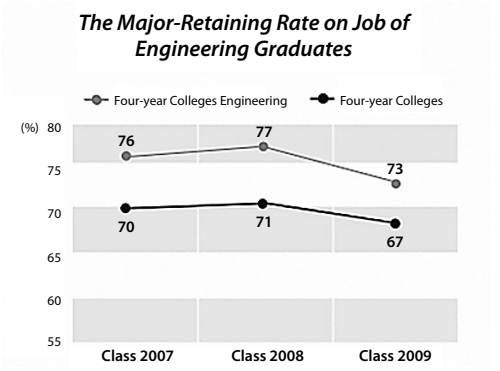

Figure 4. Major-retaining rate on job

The major-retaining rate shown in Fig. 4 is the indication of what a large percentage of graduates took jobs related to their academic programme in colleges: engineering graduates have higher rate than average college graduates, but still ¼ of engineering graduates changed their profession after graduation. This means the engineering profession cannot attract them after 4 years full time study on engineering, or the engineering education didn't train them enough to retain in this profession.

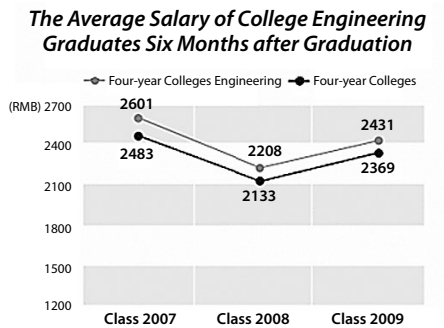

Figure 5. Average salary of graduates

The average salary of engineering graduates is higher than that of among all college graduates for all 3 years, which reflects that China was in fast development in terms of manufacturing, that is why so many engineers were needed. The lowest rate in 2008 shows the recovery of the Chinese economy after the crisis.

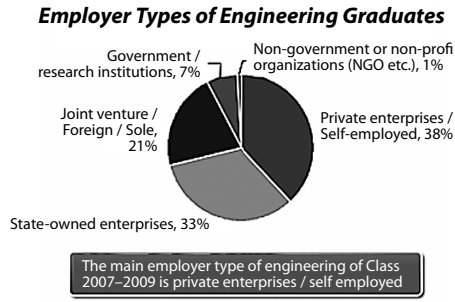

Figure 6. Employer types of engineering graduates

The diagram on Fig. 6 shows the types of the employers who hire engineering graduates. Near 60% of engineering graduates were absorbed by private sector or joint-venture/foreign companies in industry. Other data of the survey also show that the average salary of graduates in these two types of employers is higher than in state-owned companies. This may also mean the quality of graduates working in private sectors of the two types may be higher than that of in state-owned companies, although they may face less job security and greater working pressure.

Figure 7 shows the effectiveness of the curricula from the view of graduates after they get the real engineering profession. The light bars show the importance of the knowledge or skill in their work, whereas the dark bars show the effectiveness of the courses they studied in schools. The big difference reflects that the contents of the courses or/and the way of

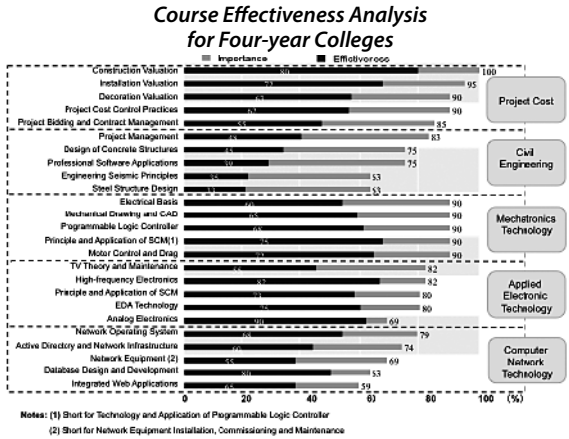

Figure 7. Course effectiveness analysis

providing knowledge were not suitable for engineering professional occupations, which is also indicated in Fig. 8.

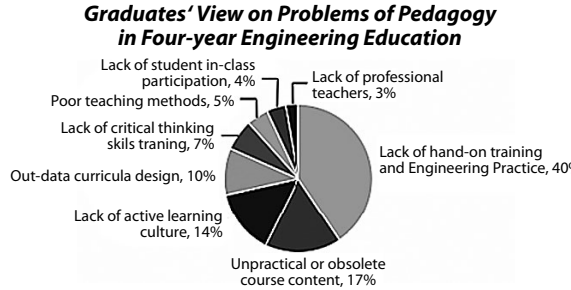

Figure 8. Graduates' view on pedagogic problems

The gap between requirements of engineering profession and the quality of graduates is caused by some problems in pedagogic process, which are shown in Fig. 8. The graduates attribute 40% of the problems to lack of practical training in academic programmes, 17% – to obsolete course contents, 14% – to lack of active learning culture in school, 10% – to inadequate curricula design system. This view agrees with many other surveys because it is based on the comparison between the contexts of engineering profession and universities/colleges made by engineering graduates. However, other key stakeholders should also be surveyed to get a more complete view on the needs of industry and the outcomes of the engineering education.

Due to the lack of necessary mechanism and some resources, the survey was carried out among graduates, not directly involving employers. We feel it is necessary to do a survey on many important issues with employers,

which may bring in different opinion and results, especially in quantitative index, if not big difference in qualitative index.

(3) Conclusion of survey

The out-of-balance supply of engineering talent can be traced to a few well-known factors:

1. The severe knowledge and value gap between higher engineering education and industries has put engineering colleges running in an isolated environment. This indirectly was the reason for the goals, curricula, assessment of educational results of engineering education be conducted in the absence of industrial stakeholders.
2. The pedagogic process is implemented in a theory-oriented and exam-driven culture, which is far more differentiated from the context of engineering profession. Therefore, it is not surprised to see the unsatisfied performance of graduates when they are engaged into the real engineering world.
3. Engineering course material can be out-of-date due to the refreshing rate of old-styled teaching and textbook publishing cycles in an isolated environment without close support provided by industrial partners. This is the cause of the knowledge content of engineering students lagging behind the wave of industry demand.
4. Instructors are not adequately organized and properly compensated to provide the guidance for students to survive in the long term. Specifically, the current salary structure for instructors almost guarantees that instructors who spend reasonable amount of time on teaching to assure the quality of pedagogy cannot survive economically. Instructors also need to have a solid personal career plan before they can speak confidently when providing career-planning advice to their students.
5. A massive number of new engineering programmes in China demand a proportionally large number of qualified new instructors. These new instructors must have sufficient practical engineering experience and should have pedagogical skills to guide students of the latest generation. In a traditional school system, training and deploying qualified instructors to a wide geographical region in a reasonable time frame can be a challenge. Solving the problem for the long term, we need to leverage advanced technologies and new modes of learning activities to compensate for the inadequate conditions.
6. Student-centered learning context has not been put in place; so most students can only study passively by following classroom instructions. A large number of engineering students in China are not prepared to actively participate in project-based or problem-based learning. This

results in the lack of self-motivation by main student body, and leads to low efficiency in learning and insufficient outcomes.

7. There are missing regular mechanisms and means to assess the performance of universities and colleges by key stakeholders with evidence based scientific methodology for continuous improvement. The development of engineering education system has been left behind the pace of society and industry, especially during the past 3–4 decades.

In UNESCO Report published in 1972, it was pointed out and anticipated that "for the first time in history some societies are beginning to reject many of the products of institutionalized education. This social, economic and psychological phenomenon is due to the fact that accelerating development and structural change tend to accentuate the gap which normally exists between structures and infrastructures and superstructures. This shows how easily educational systems can become out of phase. A system designed for a minority – when knowledge was slow to change and man could, without undue presumption, hope to 'learn' in a few years everything to satisfy his intellectual and scientific needs – quickly becomes out of date when employed for mass education in times of whirlwind change and when the volume of knowledge increases at an ever faster pace. The effects of multiple conflicts – unequal growth, discrepancies in social and economic development, movements and counter movements – all have a tremendous impact on education. The system finds it difficult to keep up with the demands of an expanding society; the people it educates are not properly trained to adapt themselves to change, and some societies reject the qualifications and skills being offered when these no longer answer direct needs" [1].

As nowadays there is a global shortage of engineering talents and the crisis of engineering education, the above statement has been proven true and should be appreciated for its wisdom and great foresight from near 40 years ago.

Proposed new paradigm for engineering education

To tackle the problems identified in the analysis based on the survey, a new paradigm for engineering education has been proposed as illustrated in Fig. 9 [2].

(1) The four pillars of education

The new paradigm is to design and implement mechanisms that bring together technology providers and academic partners to conduct learning activities that embody UNESCO's Four Pillars of Education. For example, organizing students to run international conferences that demonstrate how advanced technologies can be applied to change the way we learn is one possible mechanism. In the process of running an international technology

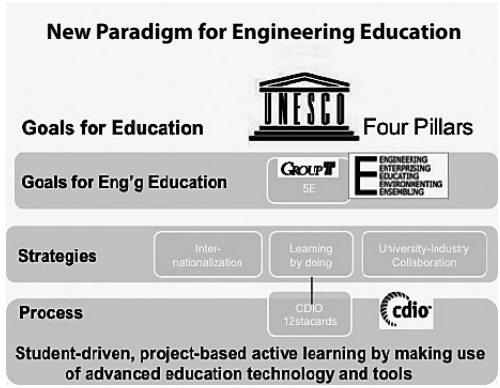

Figure 9. New Paradigm for Engineering Education

conference, the conference organization committee must provide a concrete timeline to synchronize students' activities and logistic events. These activities will naturally raise their awareness of their own identity, and wanting to improve their own nature and public image (Learning to Be). Students' social skills (Learning to Live Together) and technical skills (Learning to Know) are also likely to improve due to various challenges presented in the processes of organizing social activities and implementing technical infrastructures. Clearly, while students are willing to participate in activities beyond reading books and passing exams, they are exemplifying the act of Learning to Do. In short, our mission is to identify and create learning opportunities that complements classroom-based educational programmes.

(2) The 5-E model for Engineering education

More specifically, we have taken the 5-E Model [3], which denotes for Engineering, Enterprising, Educating, Environmenting, Ensembling and can be considered as a concrete version of UNESCO Four Pillars to fit engineering education as comprehensive goals. The 5-E is: to learn to know and to make things with innovation; to learn to work together for a mission with vision and management; to develop oneself and others by communicating and life-long learning; to adapt to multicultural and natural environment; to be ethics and integral with responsibility for a harmonic world.

(3) The three strategies to reform Engineering education

At operational level, in order to reach the goals of Four Pillars and 5-E Model, we have developed some of our own implementation strategies, namely University-industry Cooperation/Learning by Doing/Internationalization, and some of the ideas were documented in the book 'Three Strategies to Reform Chinese Engineering Education' [4]. The three strategies are illustrated as the 3rd layer in Fig. 9. The first strategy 'university-industry

cooperation' is to set up a necessary mechanism to run engineering education with requirements and professional context from industry, and to make use of all available resources in industry in the pedagogic process: from expertise, projects, materials and equipment to final evaluation involvement. The second strategy 'learning by doing' is a general pedagogic methodology which basically emphasizes the tie in the theory and practice in learning process in order to master knowledge and skills more effectively, efficiently and applicably. The last strategy 'internationalization' is to make use of the best student resource and engineering education capability to foster engineering talents for worldwide human resource market, and the core is to cultivate talents by international standard, which is most likely defined by multinational companies and engineering profession community.

(4) The CDIO Engineering education model

For the comprehensive pedagogic process we adopted and participated in the global CDIO Initiative [5], originally started by MIT, to gain insights and best practices that were invented by other universities in the world. CDIO model is considered as a systematic and complete methodology for the strategy of 'Learning by Doing', which consists of 12 standards that cover context of engineering education, development of syllabus, design of integrated curricula, all the way to competence of teachers in engineering practice and pedagogic abilities, assessments on students' learning outcome and performance of academic programmes. CDIO model has been implemented in more than 40 universities and colleges worldwide, and the results show great advantage over the old paradigm.

Student-centered learning paradigm

To implement the above strategies and methodology in order to reach the goal of engineering education, a paradigm of student-driven, project-based active learning by making use of advanced education technology and tools has been carried out , which is illustrated at the bottom of Fig. 9. The rational for this paradigm is that students, as one of the key stakeholders of engineering education and the main body of learning activities, should be fully motivated and committed to learning process with heart-on, mind-on and hand-on. No education system can push students to learn unless they want to do so.

A unique feature of our research programme is to focus on the dynamic properties of industry demand, and the lifecycles of academic programmes. Having listed non-exhaustive but well-known challenges to our engineering talent supply chain, it may appear to be extremely resource-constrained. Based on 'conventional wisdom', to solve the problem of supply of qualified engineering graduates, first of all it is necessary to train a large number of qualified engineering teachers. Then one would need to organize them

in a highly effective engineering educational administration programme, so that some administrators of importance can monitor and manage ongoing programme execution. Finally, one must wait for 5 to 10 years before the first batch of 'qualified' engineering teachers become effective in their educational posts. Maybe after 15–20 years from the start, one may hope to observe some positive effects from these extraneous 'teaching-oriented' efforts. In supply chain terms, this can also be classified as a 'push' method.

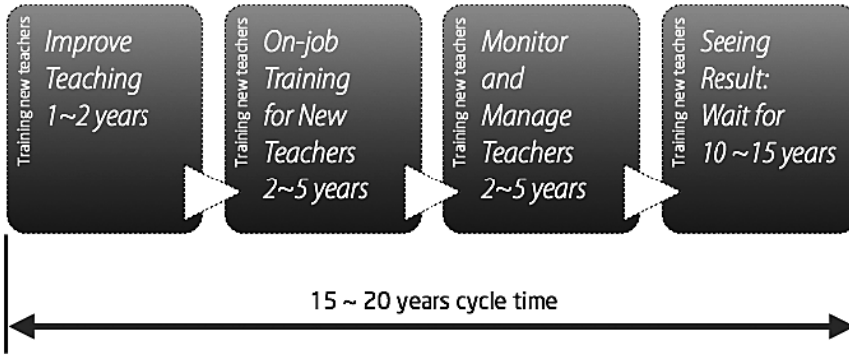

Figure 10. Lifecycle of change under teaching-oriented improvement policies

Solving the problem of engineering talent supply is not a problem specific to China. It is also a major challenge for other developing countries and even for the developed economies. Instead of focusing on the impossible challenges, our research programme will focus on a set of small, yet highly innovative programmes, so that we may tackle the problem from a different angle. Specifically, we will not only focus on the 'teaching' or 'push' side of the talent supply chain, but also be working on the 'learning' or 'pull' side of the knowledge economy. When students will be motivated and committed to learning activities with active involvement, they may challenge and push teachers to change and pull the reform forward to some extent, then 'push' or 'teaching' from teacher's side will become positive. This dynamic iterative process will lead to a substantial change of the education process more rapidly than the conventional one.

1. Learning vs teaching

We focus our research programme on learning, not just teaching. In the last few years, we have already started a small number of 'adaptive learning experiments' in three different universities. We found that by focusing on the process of learning, we will be able to systematically overcome or bypass the challenges in teaching-oriented pedagogy. This also naturally fits UNESCO's Four Pillars of Learning. We consider these Four Pillars as four levels of student survival skills. The inter-connections among these four learning initiatives can be illustrated in the following diagram (Fig. 11):

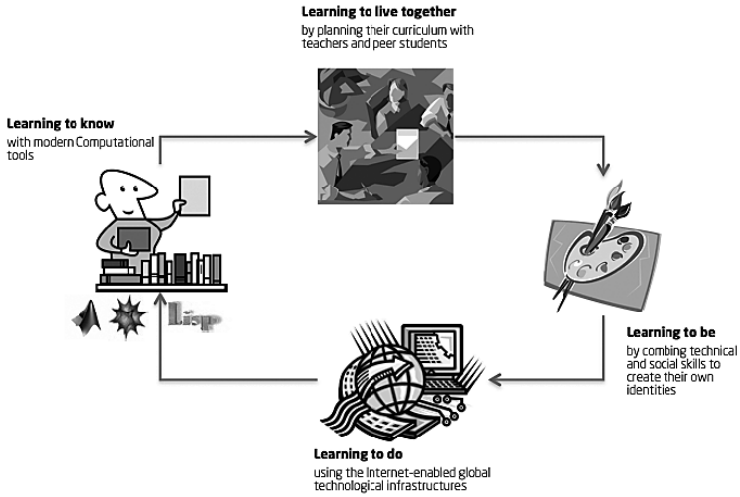

Figure 11. A self-reinforcing learning loop of the four pillars

In Fig. 11 we explicitly pointed out that today's engineering students have more computational tools than their professors had when they were educated 5 or 10 years ago. This time the difference created a huge gap between students' potentials and professors' expectation. In today's classroom, it is possible that students know more tools and have more detailed knowledge than their professors do, if they spend a lot of time in the Internet collecting and compiling new information. Their ability to 'do' is strongly amplified by the global technological infrastructure, such as the Internet and high-speed wireless networks, mobile phones and Global Positioning Systems (GPS). Students can and are able to accomplish a lot on their own, just by using the latest technologies as a hobby. The role of effective engineering curriculum has started to drift away from giving students rigid lecture content. More classrooms have become a location of intensive discussion and demonstration of practical and advanced topics, assuming students are truly interested in the subject matters. Their interests in traditionally 'hard' and 'boring' subjects are colorfully transformed to 'challenging' and 'interesting' subjects, because they can combine various engineering tools and cultural content on a regular basis. If the engineering content becomes a source of their artistic inspiration, they will not consider these subjects boring, and will consider hard tasks just a challenge for their own destiny. Finally, teachers must work with students to plan and design personal career plans. This can be easily accomplished in groups and help students to refine each other's plans. Once students see teachers and other peer students as their career partners, it will be easier for them to recognize the importance on learning a technical language spoken by their peers and other senior members of the technical society.

All of these healthy attitudes toward learning engineering skills and relevant social skills must be established early in a students' curriculum. They need to build a good habit before they are poisoned by negative connotation of their own chosen discipline. Based on our experience, it is rather easy and fast to conduct this transformation, if we start early in the engineering programme, say, the first two years of engineering programmes. It does not cost much, as most of the infrastructures are already in place. When a large number of students start to recognize the value of positive attitude and good habits, it will affect their teachers. In a sense, students are the best teachers to the professors who couldn't see the potential of changes. They are young and moldable, they will demonstrate to professors that changes are naturally happening.

2. Implementation experiences

We already have some operational experience of what we outlined in Figure 2. For the last three years, we have conducted two courses at Tsinghua University's Industrial Engineering Department. The more detailed programmes descriptions are published in two articles of the Chinese journal 'Research in Higher Engineering Education' [6, 7] and one of the articles has already been translated into English [8]. In these programmes, we first treated classrooms as just a part of the learning process. Our operational goal is to conduct classroom activities that induce a kind of social/group dynamics in students' daily environment, so that they can enjoy the process of acquiring engineering knowledge and social skills. They can observe that their new knowledge can be immediately applicable to their lives during and after classroom hours. We think that students will start pushing and pulling each other to acquire knowledge together if they find the knowledge has practical connection to their daily activities.

From the beginning of 2010, we have conducted a more comprehensive experimental programme at Beijing Jiaotong University's Industrial Engineering Department with financial support from the Ministry of Education of China. Instead of changing individual courses, we have worked at academic programme level by developing syllabus with industrial partners to meet the needs of engineering profession on learning outcomes, designing integrated curricula to correlate courses based on comprehensive projects, developing an introduction course by introducing the context of engineering profession with industrial expertise and students' practical experiences by learning through doing, carrying out project-based active learning in courses. We organized interactive activities among students, teachers and industrial partners by establishing broad connections between university and industry. We also organized joint-in-company-projects among BJTU students, American students from WPI (Worchester Institute of Technology, USA) and students from other foreign countries. This project actually implemented the new paradigm with the three strategies as an

integrated solution for the reform of engineering education. The outcomes of the project-based learning cover broad range of requirements from engineering profession, from knowledge, technology to abilities of teamwork self-learning, communication and industrial practice.

We hosted the International Symposium on Systems Simulation and Education Technologies in Beijing in 2009 and 2010. We invited many international practitioners of technical education to share their insights and tools to promote students' active learning experience. At this symposium we asked our own students to share their learning experience with the international audience. To support the above-mentioned learning activities, we also extensively adopted many open-source or popular methodologies and tools to enhance learning. We used Moodle ('Modular Object-Oriented Dynamic Learning Environment') as a web-based tool to synchronize lecture content, student discussions, and share digitized course content.

The success of these events generated significant interest from various parties. Through government and local sponsorship, we already established two Experimental programmes on engineering education – one in Beijing Jiaotong University, and the other – in Ningbo Polytechnic College. Having many learning objectives, the programme in Beijing Jiaotong aims at giving students more academic freedom, so that they can spend more time exploring their own academic interest. In August 2010, we also started a programme in Ningbo Polytechnic aiming at using a 'Learning-by-Playing' style of instructional method to inspire students to create and assimilate professional skills during play-time. We just recently finished the construction of a new 'learning centre' for this programme. It is a mixture of workshop/classroom equipped with high-performance network and large data storage systems. This new learning centre spots a multi-terabyte data storage infrastructure, media display and editing technologies, so that students can conveniently view and collaboratively create free educational content produced by students and teachers around the world. Many other schools, including Tsinghua University, Beijing Petro-Chemical University, North Eastern University in Shenyang have started or plan to participate in our experimental programmes. More detailed progress and research results can be found in our internal publications and related websites.

Organization and reproduction of 'crowd sourcing' Internet lecture content

With the massive amount of free video lectures on the Internet, many students have already started learning from audio/video lectures outside of their own campuses. However, downloading complete series of lectures can be time-consuming, and can be costly for campuses, as it charges students for a download fee. To reduce the cost of content access, we plan to organize a network of student volunteers, who will provide data management infrastructure to share free downloaded lecture content. This will

not only reduce the unnecessary data traffic, but will also ensure that students can receive timely updates and repeats of certain high quality educational content. When certain lecture episodes are missing or incorrect, it is possible for the office to serve as an intermediary to help acquire the corrections or patches of existing content. This service will be organized using the 'crowd sourcing' model – people around the Internet are welcome to volunteer their content classification and reproduction services. We will also cross reference materials that are already made available on data pools provided by commercial entities, such as http://www.udemy.com and http://itunesu.com. It is important to note that many of these data services are not reliably accessible in China and places outside of developed countries. Therefore, having a local data sharing infrastructure becomes the only technical solution. To kick-off the 'crowd sourcing' movement on content organization, we will start attracting student volunteers to our existing experimental programmes.

Initial content selection

Instead of covering all available content over the Internet, our programme will start focusing on a few well-known lecture series on basic mathematics and introductory courses to physics. We have chosen these popular basic topics, since they will have the greatest coverage for students of various backgrounds and ages. Another consideration is that many students in China are not ready to absorb English-speaking content without translated subtitles on the screen. Therefore, focusing on popular lectures gives us a starting point to identify materials that are already translated. For the year 2010 and 2011, we will focus primarily on Prof. Walter Lewin's three lecture series on Classical Physics, Electricity and Magnetism, and Waves and Vibration [MIT OCW]. These lectures are relatively complete, and many lectures have already been translated. The content has enough general appeal, due to the rich amount of physical experiments and intuitive explanations provided by Prof. Lewin.

Interdisciplinary collaboration

We have 3–4 students from the senior years of computer science disciplines to join our programme in designing a data sharing infrastructure to redistribute this free content. We also have a team of English major students who can help review and correct mistakes in the translated Chinese subtitles. Most importantly, we have students who are currently taking these physics related classes, recreating some of the experiments produced in Lewin's class, and make series of video logs or computer animations to supplement the existing video material. The above mentioned data management experts and English major students should help them organize and deploy the final results. We believe that through the content creation process, these students would learn many new ideas from the same set of video lectures.

Infrastructures in multiple data-intensive learning centres

Production of video content requires a modest amount of hardware. This will be supplied through existing learning centres that we already established in Ningbo, Beijing Jiaotong, and Tsinghua University. Initially, data sharing centres and multi-terabyte scale data storage devices must be located in these learning centres for on-site consumption. These learning centres must also have wide bandwidth connections to the campus network. The goal of these learning centres is to establish a usage pattern, so that all other schools can replicate the infrastructures relatively easily.

Minimal infrastructure requirements

The complete set of Khan Academy video lectures comprises around 1500 episodes of 15-minutes lectures. It takes about 30Gb in size after compression. Similarly, the data size of one complete lecture series (about 30 episodes per series) on MIT's Open Course Ware will take about 4Gb. At the rate of roughly 1Gb per RMB for hard drive cost, it is very cheap to provide a sufficient data storage pool for the most popular video content. However, if one started sharing this data content over the network, the process of data movement could overwhelm network traffic, therefore interfere other network activities. Based on this observation, designing a video data redistribution network/procedure is a major challenge in this project.

Besides copying data, producing local video content would also require significant amount of data storage and video production equipment. By year 2010, professional grade high definition video camera can be purchased within 20,000 RMB. A high performance computer dedicated to video editing can be purchased within 20,000 RMB range. A high quality high definition project can be purchased within 30,000 RMB. To start off the project, a comprehensive, yet minimal set of equipment can be purchased within 100,000 RMB. This initial equipment investment is necessary, and has been made in some of our experimental programmes. Our goal is to identify the right set of equipment and infrastructure set up, so that we can lower the total cost of ownership for such a learning centre.

Operational Expertise

Having functional equipment is not sufficient for producing useful content. The skills required to operate the camera, set up lighting, and write meaningful scripts are all necessary elements for the overall learning process. Students must acquire the skills to operate this equipment. They might consult local experts, watch tutorial videos from the web, or read operation manuals on their own. In the process of authoring their learning logs and creating videos to demonstrate their learning results, they will exercise a different set of skills and bring out their creativity. Conservatively speaking, these digital content management and content

creation activities will naturally raise the students' awareness of new technologies.

3. Summation of positive outcomes

1. Student-driven learning teams heavily utilize the Internet to gather content knowledge. Their collective work seems to be able to identify authoritative works online. To help them digest the content, they also have the tendency to associate their content knowledge with late-breaking news, technical achievements, or information tidbits that best synchronize their experience with the current world.

2. Instructors realized that students' ability to learn is a resource pool, not a resource of drainage. Working with highly motivated students helps instructors to see technical content from fresh perspectives actively discovered by students. Asking students to document their career plan also helps many instructors to rethink their own career objectives and plans.

3. We found out that there is a large number of talented students across a broad demographic profile. That means we don't need to wait until we finish educating the first batch of 'qualified teachers' before we can have an effect on students' learning activities. By conducting the learning-oriented practice, we instantly gain productivity from students. Talented students have powerful effects on their fellow students. They even help their professors to acquire better ways to teach.

4. To involve teachers and students in engineering schools to actively practice 'Learning by Doing' approach in their curricula would include running 'Instructor Workshops' that guide teachers to organize 'Project-based Learning'. In these workshops, we will supply teachers and students with the management tools to engage student leaders in their project-based learning activities. We will involve both teachers and students in these workshops. Our management tools include various kinds of 'balanced score cards', content management infrastructure, leadership training and online community supports. Our goal in these workshops is to help teachers to 'learn' to become better teachers by doing various project work with other teachers and student leaders. In this way, we can build a community that includes both students and teachers to work together at changing their curricula.

Through the adaptation and accumulation of programme execution experience, we have realized that 'teaching' tasks are naturally a part of the 'learning' activity. In Nonaka's terms, schools should be treated as a kind of 'Knowledge Creating Companies' [9]. We also realized that we could elevate our anecdotal experience by summarizing it into more rigorous and replicable pedagogical patterns, so that some of our findings can be better utilized, even systematically deployed around the world.

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Exploring Online Learning in India

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India is rich in traditional knowledge which requires to be transformed into electronic mode/version if it wants to benefit from both its own resources and those acquired from other sources (CSTD, 2003). The citizens, therefore, have to be technologically literate and acquire necessary skills to use these devices for storage, dissemination and retrieval of information. India believes that acquisition and sharing of knowledge, which as per UNESCO, are keys to economic and social development, have been dramatically changed and accelerated by ICT which enhance productivity of the teaching-learning process and offer unique and unconventional solutions to problems confronted by the education sector.

Among the various modes of education, online learning in India is becoming a need of the hour. The rapid growth of technology along with increased access to networked computers makes online learning possible in India. India is projected to have the third largest online population by 2013. As in many developing countries, internet access in India has largely been the preserve of the rich, urban and industrialized communities. Realizing its importance in improving the quality of life, India has initiated various schemes to connect remote areas so that digital isolation of rural communities can be addressed. As a result, substantial online growth rates would be higher in the coming years.

With increased ICT connectivity, it has become mandatory for all the higher education institutions in the country to have Internet connectivity. This facility has been scaled up and used for teaching, learning and tutorials/counseling purposes. Many institutions are gearing up their resources to exploit the potential of web-based teaching and learning in due course of time. The Government of India hopes that the ICT infrastructure would help in addressing the deficiency of quality teachers in institutions located in the rural area.

India has now realized that in an information society, technological infrastructure/network is a must for its development. Though the entire country is not yet wired, ICT connectivity is gradually penetrating across the length and breadth of the country. India is poised to become the third largest country in terms of Internet users across the globe. India has elaborate plans to expand broadband and Internet access as part of its e-governance projects.

The learners express diverse views about the credibility of online learning. Many institutions and educationists see great hope in online learning and find it geared to meet the demand of the new age learners while others put a question mark over the credibility and quality of this mode. The advantages of online learning are being viewed with caution.

Online education is likely to co-exist with other communication technologies and modes of teaching and learning which will continue to be relevant for the heterogeneous group of learners. With easy availability and accessibility to computer hardware, the online mode would curve a niche for itself in both conventional and ODL systems. The need of the hour is to build sound infrastructure and provide basic amenities, particularly in rural and semi-rural areas, for the success of online learning.

Children's Legal Website as an Innovative Means of Developing the Legal Culture of Children and Teenagers

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The formation of the social legal state and civil society in the Republic of Belarus brings to the forefront the primary meaning of the law, and one of the main objectives is to ensure a dignified life for the individual citizen and society as a whole. In this context, particular relevance is noted in the formation of a new system of legal education and training for the younger generation, which is designed to have a significant impact on legal psychology, legal ideology and legally significant individual behavior as the subject of vital functions, the state, morality and law. A special place in this system is occupied by the Children's Legal Web-site (http://mir.pravo.by) as an innovative means of developing the legal culture of children and teenagers.

Modern pedagogical science remains interested in developing solutions to educational problems in the progressive development of the Belarusian society. Under modern conditions, there are new fundamental approaches to understanding the essence, content, features, trends, methods and other important aspects of modern education for children and teenagers. Changes occur in the evaluation of the role and place of legal knowledge in the education system in terms of perception by pupils of the ideas of humanism, respect for human rights and freedoms, tolerance, civility, and

responsibility as democratic values. The dominant feature of legal education is the formation of personality, the ability and willingness to exercise the most important qualities and properties to affect a positive change in social environment and to attain full self-realization in the society and state in the interest of personal development.

Modernization of the theoretical and practical aspects of legal education and training of the legal culture of children and teenagers is stipulated by a change in the educational paradigm, taking into account humanistic trends in the context of a learner-centered approach. The interdisciplinary nature of the problem manifests itself in the consolidation of the capacity of legal and pedagogical thought in the organization of the information and legal space, using modern information technologies, interactive forms and means to enhance the effectiveness of forming legal consciousness, an adequate system of personal orientations, values, skills, law-abiding behavior and social activity of the younger generation.

One of such means, consistent with the current requirements of the theory and practice of legal education and training of children and teenagers, is the Children's legal Website (hereinafter – the Site) as an innovative project of the National Center of Legal Information of the Republic of Belarus.

Realizing the importance of the emergence of new information and legal resources for children and teenagers in the national system of legal education and training, at a high state level it was decided to establish information and legal resources for the younger generation aimed at creating a positive image of law as a state institute, legal knowledge, a value system and respect for the law, and legal behavior skills necessary to live and work in a modern democratic society.

At the request of the Deputy Head of the Administration of the Republic of Belarus, Natalia Petkevich, in early 2007 the National Center of Legal Information of the Republic of Belarus began to develop the Site concept, which was preceded by a detailed analysis of domestic and international Internet resources for children on legal subjects. The comparative analysis confirmed the effectiveness of the use of modern information technologies in the organization and development of new forms of legal education of the younger generation, and at the same time revealed certain disadvantages which were taken into account by developers of the Site when making conceptual decisions regarding organizational and methodological aspects of its information content. The results of the poll conducted in early 2007 at the National Legal Internet Portal of the Republic of Belarus (pravo.by), showed a high percentage of public interest (around 70%) in the creation of new information and legal resources for children and teenagers. As a result of this work, the Site was put into operation on 23 August 2008 to complement the legal Internet system covering the scope of the legal interests of children and teenagers.

The main purpose of the Site launching was the creation of a tailored information environment allowing children, through interactive means, to obtain the necessary systematic knowledge about legal conduct, to develop a positive attitude towards law as the regulator of social relations, and based on game situations, to form practical skills of conflict resolution through legal means. The concept of the Site is built on the provision that children receiving these skills will promote a system of personal legal values that are adequate to the conditions of civil society and legal state. The age range of the Site's target audience is 6 to 16 years old, which was determined by recording the ages of actual and potential users when designing the Site structure, the spectrum of its interactive capabilities and customized information content. In addition to children, the project was also designed for parents, teachers, professors of legal disciplines, and lawyers. Monthly it is visited by about 12 000 people from more than 60 countries.

Based on the trends in the use of modern information technology in legal education and training, one of the high-demand conditions of success of new information and legal resources is not simply to inform children and teenagers about these or those rules of law or to explain the fundamental principles of law, but also to provide the opportunity for a given audience, by means of perception, to see and learn how the legal relationship is implemented in specific situations. Taking into account the aforementioned publications, the Site directs users, primarily through practical skills, to exercise their rights, protect the legitimate interests and the performance of duties imposed by the legislation, which is certainly a timely and necessary condition for the formation of legal culture of the individual and society as a whole.

For a more effective and visual presentation of legal information, the Site created a more kid-friendly method of presenting information by providing various kinds of flash-movies, animation, illustrated texts, quizzes, contests, games and thematic videos based on modern design and software development. Therefore, within the structure of the Site, in addition to the information part, a game part has been integrated which consists of game situations, sequentially illustrating the legal issues faced by children in everyday life. The main character in this part of the Site is the guide assistant, Pravoznayka. Taking into account specific scenarios, this part has the following characters:

- children and teenagers of different ages (from 5 to 17 years old);
- parents (mother and father);
- law enforcement officers (local inspector, DMV inspector);
- employees of educational institutions (teacher, school principal).

Games within the information resource have indisputable advantage and represent a macrogame in which every single game situation may be related to specific topics from the information part of the Site. The aim of the game becomes the acquisition of friends during the development of gaming space, and dialogues with the characters which change their attitude towards the player in a positive or negative direction. Positive evaluation gives the player extra points, changing its status within the game space. The more characters have a positive attitude towards the player, the more points he gets, and vice versa. The main task of the game part of the Site is to help the character tackle the emerging legal issues during the game. Separate from the game part of the Site, a section with a rating of all players was created. By solving certain legal problems and gaining the maximum number of friends, a player can take a higher place in the rankings, which is an additional incentive of the game.

The information part of the Site – the 'Library' – is aimed at building on knowledge about law, its branches and legislative history of the Republic of Belarus and its foundations. This part contains the necessary legal information to resolve legal issues in the game part of the Site. Its structure consists of the following main sections:

'News' – a section containing information on law and about events related to the process of training and education;

'Legal A-B-C book' – a section containing definitions of common legal terms and concepts; aphorisms and proverbs about law, rules of law, morals and ethic; wise thoughts in Latin; 'winged' expressions of the state and law giving the children the opportunity to try to explain the origin and the evolution of the meaning of these expressions and the vocabulary of association;

'Legal Labyrinth' – a section which provides information about law and its systems, about the legislation of the Republic of Belarus, about the rights of the child in particular, and the Constitution of the Republic of Belarus. In addition, this section contains information about the role of legal acts in the activities of the State and people's lives, and how law emerged and was formed. Among materials presented in this section are those about the legislation of the Republic of Belarus, intended to be used by users to select the correct answer in the course of evaluating legal situations presented in the game part of the Site;

'Journey to the Past' – a section which contains information about the history of law in Belarus and the ancient acts of legislation;

'Our country – the Republic of Belarus' – contains information about the State structure of the Republic of Belarus, the bodies of the State administration, and the State symbols;

'Belarusian State and law in photographs, drawings and songs' – a section which contains photographs, pictures and music dedicated to the Belarusian statehood and the State symbols (the State emblem, the State flag, the State anthem, etc.), and the Constitution of the Republic of Belarus.

The third part of the Site – 'Contests and Quizzes' – offers visitors the opportunity to consolidate their skills obtained in the game process. Here there are customizable crossword puzzles and virtual quizzes, as well as information about children's contests, quizzes and competitions held in the Republic of Belarus. In addition, this section contains drawings and photographs and creative works sent by users participating in various competitions. For example, during the period from March to June 2010 the competition of children's drawings 'Law in Drawings', in which more than a thousand of young artists of our country participated, was held by the Site together with the Ministry of Internal Affairs. All drawings submitted in the contest are available in the gallery of this section, so that everyone can assess the degree of skill, imagination and originality of each work.

The structure of the Site is designed not only to develop children's skills to find independent solutions to legal dilemmas, but also to learn them to receive legal information, as well as consolidate their knowledge in various game situations, solving practical problems using scanword puzzles, crossword puzzles, rebuses, creative assignments, etc. The Site features allow users to use it as an interactive tool in solving pedagogic problems; as an innovative resource integrated into the educational and training space of educational and cultural institutions, youth associations and others. The usage of the Site considerably extends the capabilities of the law enforcement agencies in addressing crime prevention and juvenile delinquincy, and in the direction of correcting deviant behavior of minor offenders. For the two years of its existence, the Site has implemented an extensive package of measures aimed at its promotion, by forming partnership contacts for further development and improvement and informing subjects of the system of legal education and training about the flexible use of the Site in educational, training, developmental and recreational purposes. Undoubtedly, these activities contribute to an increase in the popularity and demand for the Site, while accumulating a larger audience and engaging all the parties concerned.

The Site keeps evolving and improving. For example, this year the information part of the Site has got a new section – 'Useful information' – which contains the necessary information for children and teenagers, parents and teachers. The Site includes an interactive flash map of the world, which is gradually filled with information about foreign countries and their legal system. Within the structure of the resource, the service called 'Virtual Waiting

Room' has been integrated, where members of the National Commission for the Rights of the Child respond to users' questions.

In 2010 the Site successfully passed the examination of the Safer Internet Centre in Russia under the Public Chamber of the Russian Federation, the Regional Public Organization 'Center of Internet Technologies', and the company 'Sky Link', and was included in the catalogue of secure information resources – 'Children's Internet', which indicates high assessment and recognition in the global Internet community of the project made by the National Center of Legal Information of the Republic of Belarus.

Today the Site has become an indispensable companion for educators, teachers, lawyers in their work to build awareness and the legal culture of children and teenagers. A superior legal culture of our younger generation today is the guarantor of strengthening the legal framework of the state and public life, and, therefore, a strong and prosperous State tomorrow.

The public mission of the Site as an innovative project is to improve the quality of legal education and training of children and youth through the use of modern information technology. Games and competitive parts of this information and legal resource guide users in the world of law, helping to make this world understandable, accessible, interesting and necessary for every young citizen of our country.

SESSION 3

Innovative Technologies and Resources in Education: Key Trends and Prospects for Partnership

Best Practices of ICT Policy in Education: Republic of Korea

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Planning ICT policy in education

ICT in education in Korea has been developed based on three five-year master plans by the Ministry of Education. The first Master Plan (1996–2000) was focused on the establishment of world-class ICT infrastructure in primary and secondary schools. The objective of the second Master Plan (2001–2005) was to enhance the quality of education by integrating educational contents and classroom activities with a focus on teacher capacity development. In addition, the National Education Information System (NEIS) was developed for efficient management of all education-related administrative tasks within the framework of e-Government initiatives. The third Master Plan (2006–2010) has been focused on the creation of sustainable learning environments with ubiquitous learning and future education through different services including the development of digital textbooks.

The use of ICT in education of Korea has been driven by a strong cooperation among three key players: central government – Ministry of Education, Science, and Technology (MEST), the National Institute specialized in ICT in education – Korea Education and Research Information Service (KERIS), and 16 Metropolitan Provincial Offices of Education (MPOEs). MEST has been coordinating the processes from policy planning to implementation. As a government agency, KERIS has been playing an exclusive role in supporting and planning implementation of the national ICT policy. Sixteen MPOEs have been autonomously implementing the national ICT policy at the regional level.

Implementation of ICT policy in education

The establishment of ICT infrastructure in schools was aimed to promote education equity by bridging the digital divide. The School Advancement Project, which included the establishment of school LANs,

Internet-connected multimedia labs, provision of PC and information devices for classrooms, and personnel support, was implemented according to the first Master Plan. Since the mid-1990s national initiatives for supporting ICT integration into the school curriculum have been gathering momentum. The projects ranged from educational content such as supplementary materials and educational software for the development of digital textbooks. Educational content, which almost in full has been provided and shared in EDUNET, plays an important role in the curriculum integration of ICT.

Since the late 1980s the government of Korea has provided teacher training for both ICT literacy and integration purposes. The focus of teacher training, however, has changed over the course of the three master plans from computer literacy to curriculum integration. In addition, the government has built the teacher training framework for ICT in education to meet the specific needs faced by teachers throughout their career. The new teacher roles and adequate ICT competencies should be taken into consideration for the future design of teacher training.

The information service system in education is comprised of three main groups: EDUNET (for teaching and learning), EMIS and NEIS (for administration), and CHLS (for home learning). EDUNET was developed to operate and provide multimedia materials, instructional lesson plans and evaluation items according to school level. EMIS focuses mostly on collecting annual statistical data from educational institutions while NEIS manages and integrates personnel, financial, and school affairs within or between institutions, regional offices and the Ministry of Education. CHLS provides individual learning materials and online tutorial support in order to bridge the education divide for after school private tutoring. These services are aimed to provide an effective environment, improve productivity and efficiency, and harness ICT in education nation-wide for teaching and learning and administrative purposes.

As e-Learning technologies become increasingly utilized for educational courses, issues related to standardization for reusability and interoperability, assurance of quality, and prevention of adverse effects become crucial. Therefore, national standards for e-Learning were developed; a prime example is the enactment of the Korea Educational Metadata (KEM). Furthermore, in 2008 it was proposed to the Joint Technical Committee (JTC) 001/SC36 of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) to integrate South Korean national standards for e-Learning in international standards. To enable quality control of e-Learning, the E-Learning Quality Assurance System (EQAS) was established using such criteria as content, service and platform. To promote and ensure a safe and sound cyberspace in the educational area, MEST set up the Education Cyber Security Center (ECSC) and implemented various e-safety and e-ethics campaigns, as well as additional training programmes.

Monitoring and evaluation systems are vital for the diagnostics of the current status of the initiatives, evaluation of the outcomes and planning of the measures for further improvement. The overall scheme of monitoring and evaluation of ICT policy in education consists of measuring ICT in education for schools, ICT literacy tests for students, as well as an external evaluation of major national ICT projects.

Beyond domestic implementation, the Korean government has expanded its cooperation with the global community to reduce the digital divide through ICT in education. Representatives of over 50 countries visit the Republic of Korea every year to benchmark best practices in this sphere. The number of requests for consulting projects for ICT in education through ODA grants and EDCF loans has increased considerably.

The achievements of Korean e-Learning and ICT in education policy are recognized as a result of a solid legal framework, systematic implementation mechanism, secured budget and support, timely capacity building, successful cooperation between public and private sectors, and an effective monitoring and evaluation system. The important factors that affected the success of implementation policies and initiatives of ICT and e-Learning can be summarized as follows:

(1) Capacity of implementation organizations

One factor in the success of e-Learning implementation was securing the implementation of the system through the effective delegation of responsibilities. In the case of Korea, the central administrative organ, the Human Resource Development Bureau of MEST established the basic policy proposal, prepared a budget, and set up guidelines for the implementation of policy by MPOEs. In this process, related organizations such as KERIS took the lead in drafting policy and supporting MPOE implementation.

(2) Implementing policy through liaison and cooperation between the main and branch organizations

The degree of cooperation between main and branch departments of the same organizations greatly influences the success of the education implementation project. In particular, not only such factors as liaison, standardization, and circulation are important in informatization, but what was initially a project affected by specialized branches, making such intra-organizational contact and cooperation is even more important.

(3) Sustainable financing of ICT in education

In the beginning of the adoption of computers to primary and secondary schools, MEST encountered numerous problems relevant to securing budgets, and one of the ideas the government took over was to gather the change from public telephones installed in the Republic of Korea for investing to ICT in education. Upon recognition of such unstable funding

MEST tried to secure stable budgets guaranteeing continuous investments for ICT in education in association with MKE, which established the Informatization Promotion Fund to support building up ICT infrastructure. Thanks to the Informatization Promotion Fund, the Republic of Korea was able to become a country equipped with a well-established and world-class ICT infrastructure. Installation of high speed Internet at schools and major ICT initiatives taken by MEST and construction of the Information Super Highway geared by MKE were attributed to the funds.

(4) Establishing a policy monitoring and evaluation system

E-Learning policy is not merely the mechanical introduction and establishment of technology and systems in educational institutions. Just as important for the success of e-Learning is the preparation of legal systems and a change in the way of thinking about this policy by teachers and other personnel accompanying technical implementation. Together with this, a monitoring and evaluation system for the implementation process must be established. The Republic of Korea has been evaluating informatization implementation since 1997. Other essential elements required for success are risk management and standardization to deal with appropriate outsourcing, and outside order services.

(5) Consumer-centered policy implementation

The most important external factors in the success of e-Learning policy are the consumers, teachers and students. While informatization utilizes technology, its effects can only be realized through human involvement. That is, only through the active utilization of this system by teachers and students can the policy succeed. No matter how large is the budget of the informatization system, if teachers oppose it or if it is not properly utilized, the system will essentially fail. With this in mind, the e-Learning project in the Republic of Korea was designed and implemented as a consumer-oriented system.

(6) Shift in policy to respond to technological and societal change

Internal and external environments of 'Education informatization' affect the success and failure of e-Learning policy. E-Learning policy should incorporate the nature of rapidly changing telecommunication technology. The educational paradigm shift accepted by the society will play a critical role in the success of the e-Learning policy. The emphasis on democracy rather than efficiency in society is reflected by the substantial importance placed on personal privacy and human rights protection in formulating e-Learning policy.

Conclusions

In order to secure sustainable development of e-Learning and innovation in education, it is necessary to continuously pay attention to investment on ICT in education in the following areas.

First, existing ICT infrastructure is getting old; its maintenance and renewal is very important. Technical personnel is needed at the individual school level rather than at the MPOE level in order to address this issue properly.

Second, teacher capacity building has always been considered to be an important factor for ICT in education. The new paradigm of education needs new ways of teaching and learning. However, as new media is created, teachers tend to be overwhelmed by the new technology. Because new media continuously emerges to support the new paradigm of education in the future, teachers need open, flexible, and creative mindsets for new ICT technologies. Accordingly, future directions for teacher training and development should include comprehensive topics not limited to ICT technology to develop innovative ways of teaching with ICT for future students and future education. Finally, teacher training for ICT in education should facilitate teachers' pedagogical mind and performance in innovative ways.

Third, though curriculum integration of ICT is not easy because it requires more than the quantitative use of ICT, it rather ensures quality use of ICT for meaningful education. Large amounts of digital educational content in Korean led many teachers to use ICT for their teaching. Moreover, the recent development of digital textbooks has provided a great opportunity for curriculum integration of ICT because these are textbooks and much more than that. However, if digital textbooks are successfully integrated into regular curriculum and add values to traditional printed textbooks, school curriculum should be well understood by policy makers and developers. Also, promoting strategies and events for school principals and teachers should be considered. Still many teachers are not familiar with digital textbooks.

Fourth, information service initiatives can be provided in three ways. It is important to establish collecting, creating and sharing processes and an organizational structure for quality educational resources for teaching and learning. EDUNET has evolved from an educational portal to the national teaching and learning centre, which coordinates and facilitates the efficient collaboration between the central government and regional government. Services as CHLS were developed to support after school learning opportunities specially focused to bridge the socio-economic divide among student backgrounds. Innovation of the national governance through the initiatives of e-Government can be formulated by participation of various stakeholders and beneficiaries. In accordance with the implementation of the information service system, it is essential to develop national standards for educational resources and an adequate quality assurance system. Since each country has its own context, the specification of standardization processes and quality assurance categories and guidelines can vary.

Fifth, as the monitoring and evaluation of national projects become increasingly important, the Korean government should continuously enhance the efficient and effective monitoring and evaluation system to diagnose current status, check the outcomes and improve ongoing initiatives.

Lastly, national policy intervention should focus on reducing and diminishing disparities among gender, region, and economic status to improve and achieve sustainable equity in the education sector through mobilization of public resources and establishment of public private partnerships. Though accessibility is one of the key issues in policy, especially for developing countries, the development of the social and cultural environment and soft – skill human resources such as digital literacy should also be considered.

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Research Methodologies on Integrating ICT into Modern Education

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For more than 20 years in our Department of Informatics Education we have split our efforts between future teachers' education and the development of educational software based on Logo culture and the Constructionism

theory of Seymour Papert (Papert, 1999). Some internationally recognized software environments have resulted from our work, such as Imagine Logo, Thomas the Clown, Revelation Natural Art, Visual Fractions, etc. Due to them we have become a partner in several ambitious international research projects, including Kaleidoscope Network of Excellence, Playground Esprit project and others. Within these projects our software environments have often been exploited as the platforms for development and research. Based on the experience we have gained in those grand collaborations we gradually became aware of the importance of high quality educational research, which would help us find answers to many questions we have been encountering.

The latest decade of our team's work can thus be characterized as a period of growing need to seriously and systematically reflect upon questions and doubts, which attend everybody who strives to understand and modify the reality around. Our reality, i.e. our area of scientific interest is set by the potential of ICT offered to teaching and learning processes and the quest of how to let children (and their teachers) profit from that potential and thus be engaged in new teaching and new learning.

We assume that this potential can be productively exploited in every single school and with every single girl and boy. However, to make this happen we have to develop new educational interventions, which will prove such assumption. If we want to do so in order to contribute to the transition of learning towards supporting the development of the 21st century competencies, we have to learn about various strategies of the educational research and correctly employ them in supporting our goals.

To conclude and summarize the introduction, let us emphasize our main reason why we consider educational research so important in the field of integrating ICT into modern education. It is because educational research is the only way to cultivate our field of interest; it is the only way to seriously learn about problems of modern learning supported by new educational interventions based on ICT.

Seven stages of our research journey – so far

The main goal of this paper is to present and explain seven stages of our long journey of adopting different research strategies – from traditional quantitative research design, through qualitative strategies up to quite a new and promising methodology, not yet well established. It also proves that in our area many situations standards and well-established methodologies do not help. The reason is that often we as researchers cannot enter a certain reality, observe certain pedagogical intervention there and examine it in a traditional way.

We will characterize – in a bit simplified and shortened manner – seven research stages we have passed through during the previous ten years.

1 Non-experienced or intuitive period

The development of educational software and other innovative materials, which we were involved in since the beginning of the 1990s, was mostly based on our personal experience and educational intuition. However, we inclined to get a deeper insight into the learning processes and started asking questions, which we could not answer solely from the intuitive ground.

2 Discovering quantitative methodology

We discovered certain principles of the quantitative research methodology, but we did not pay too much attention to the issues of the validity and reliability. The most important imperfection was that we tended to draw too general conclusions, for which we did not have properly representative samples.

3 Discovering qualitative methodology

Our long-term cooperation with the colleagues from the IOE and London Knowledge Lab and our intensive involvement in *the IFIP Technical Committee for Education* taught us that it was not necessary to work with a wide sample of children to get the answers to our research questions. If we systematically work with a small group (of one or two or five pupils), we can learn a lot, so that a theory may be formulated afterwards concerning certain aspects of the learning process. In this way we can obtain deep knowledge and much data about a small sample of children.

4 Discovering problems with qualitative methodology

For the recent years we have repeatedly run up against the following contradiction in our research projects: if a researcher applies qualitative strategy, he/she enters a learning environment to study a certain phenomenon. He/she becomes either participant or detached observer of the studied phenomenon, relation or setting. We want to do exactly the same – but we want not only to enter the setting and study it, but also to develop, or modify, or even create it in parallel as well! For example, if we want to study, which ICT could effectively support learning objectives in the preschool kindergarten class, we have to first project such setting, build it, implement the processes, observe them and analyze. If we want to learn whether and how we can develop programming skills and competencies for solving problems of lower secondary students, we have to iteratively build such opportunity and in parallel with that evaluate it and revise by correct research methods.

First, we only felt this problem and were not able to articulate it. However, due to our participation in the Kaleidoscope network of excellence and in the discussions with foreign and local specialists, we gradually started to understand that other researchers and educators share similar problems in our or closely related fields.

5 TEL: Technology Enhanced Learning

The main area of our research is the subject of Informatics and its didactics at primary and secondary stages, as well as various connections and implications of such education for other age groups like preschoolers, future teachers or in-service teachers. We are also interested in exploring integration of ICT into learning processes in all subjects and different contexts, for different age groups and forms, both within formal and informal education. To classify such a broad area of interest as a theory of Informatics education is not sufficient and proper. Thus, we prefer to engage new, mostly European field of research known as TEL – Technology Enhanced Learning. In 2004 we became a founding partner of the 6th FP Kaleidoscope network of excellence, which declared its goal as creating a complex and functional European network for this new discipline (see www.noe-kaleidoscope.org). At present, Kaleidoscope represents a network of more than 1000 researchers from 24 different countries. Members of the network deal with developing and exploring new methods for studying the learning processes supported by ICT. According to (Mor and Winters, 2007), "a fundamental problem that TEL researchers as a community face is the lack of cumulatively built understandings within the field. In the worst case, this affects the ability of the community to develop key underlying theories and methodologies for solving many of the critical problems concerning the use of technologies in learning and education, or to find ways to apply theories coherently at the level of design.If we look to the natural sciences, there is a direct link between current and previous research, leading to well-founded cumulative knowledge. In the social sciences such linearity is difficult to achieve because, by their nature, the social sciences are embedded with real-world complexities and contradictions: and worse still, they involve those unpredictable beings – people – who act back on the system".

After five years of our presence in Kaleidoscope, we consider as the biggest profit for our group the opportunity to learn about new style of scientific work within TEL, new methods of educational research, access to extensive sources of literature and building numerous personal contacts with researchers in many European countries. We witnessed advanced processes in the project management and in planning, running and evaluating scientific work, which are at present conducted in Kaleidoscope at the best level in the world.

6 iBeaver: rediscovering quantitative methodology and its correct application

When we strive to properly utilize the potential of ICT within the learning process of children, rich assortment of strategies and instruments should be engaged to support the opportunities for every boy and girl, as a part of their general education appropriate to contemporary creative society. Such strategies clearly include organizing a range of contests for all pupils' age

groups. One of them – currently the most influential iBeaver (or informatics Beaver) contest plays an important role in our research activities and development.

iBeaver, (see Dagiene and Futschek, 2008; Kalas and Tomcsanyiova, 2009) is an international contest for students of lower and upper secondary stages. It has a 5-year tradition and a massively growing interest of students – which validates its main goal: to promote interest in ICT and Informatics… for every school student. In Slovakia (similarly to other involved countries) we strive to implement the contest as a nation-wide event, acting as a kind of visionary message sent to thousands of students and hundreds of teachers saying: this is modern Informatics, this should be its contents, forms and problems to be dealing with.

Let us start with some recent figures from Slovakia: in 2008 there were over 9.000 contestants from 276 schools; in 2009 there were nearly 12.000 pupils engaged in the contest, coming from 408 schools; in 2010 there were 22.139 contestants from 540 schools. Running the iBeaver contest, analyzing and evaluating the data obtained from the students every year is an important lesson for us. Within a few days, we managed to get an extensive file of data about thousands of students from hundreds of schools in Slovakia. As far as the main objective of the contest is nationwide promotion and development of general and modern Informatics education, we devote great attention to the data collected. We consider them as an exceptional opportunity to (a) learn as much as possible about the contestants – how they solved the tasks, how they commented the contest, and also (b) use this analysis as an input to improve the contest for the next year so that it even better helps us to meet our educational and research goals.

As far as in this context we are interested in various phenomena, like scoring of pupils in correlation with their age and gender, their actual scoring in specific tasks, or the analysis of how difficult the tasks were, it was rather natural to turn back to quantitative methodology of research. We have been learning to employ instruments, which are appropriate to study certain events and at the same time inspire us to (a) articulate proper questions leading to deeper insight, (b) consider possible correct hypotheses and conclusions, and (c) support us in deciding general principles for creating tasks for the next rounds of the contest so that they produce interesting data about the studied phenomena.

7 Discovering new research paradigm – design-based research

As we have already mentioned above, quite often we run across problems, in which traditional research methods do not equip us with proper and necessary instruments to support us in our inquiry and development. Therefore, we try to learn and apply new alternative research paradigms

from the field of Technology Enhanced Learning. One of them is the design-based research, which currently fits the best our needs in ICT and Informatics educational research.

It is an interdisciplinary approach, in which researchers and practitioners (teachers) try to build pertinent theories of learning through designing, developing, studying and iteratively refining interventions for learning in real settings. This research methodology is attractive to us because:

- it is empirical research – that is, we may apply correct scientific methods to get answers to questions which arise from observing the real world around us;
- it is educational research – its goal is to expand our understanding of the learning processes;
- it is research mediated by development – that is, we are applying a methodology, when the researcher actively enters the learning process, tries to better understand it and in parallel support and enhance it through developing his/her interventions.

Educational research usually has a double goal: it ought to help us (a) understand learning processes and (b) design and develop interventions. The new paradigm we have recently engaged strives to meet both goals in parallel. It is "a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories" (Wang and Hannafin, 2005).

Based on (Cobb et al., 2003) and (DBR Research Collective, 2003) we can formulate five key principles of the design-based research methodology:

- Designing learning environments (i.e. interventions) and building theories of learning are two intertwined processes.

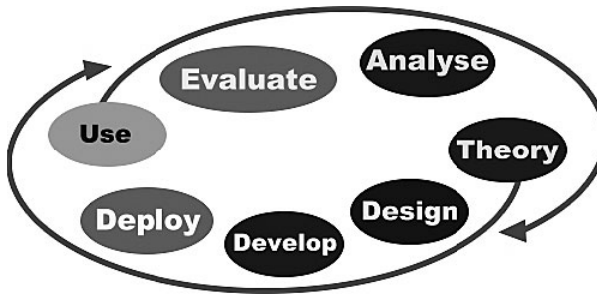

Figure 1. The cycle of design-based research
Source: www.lkl.ac.uk/projects/designresearch/

- Development and research take place through continuous cycles of design – development – deployment – use – evaluation and analysis to theories, see Fig. 1.
- Research on interventions and corresponding development must lead to sharable theories that help communicate relevant implications to practitioners and other educational designers.
- Research must explain why our interventions function in authentic settings. It must not only document success or failure, but also focus on interactions that refine our understanding of the learning issues involved.
- Research should validate the process of intervention's integration.

We have to admit that (relatively short) history of the design-based research goes back to pre-ICT era. However, since 1990s the knowledge gained in the field of the software development boosted that research strategy, especially by its new approach of the iterative design. Why are iterations so important here? There are several reasons:

- iterations allow the researcher to gradually discover, realize and evaluate many diverse phenomena (or variables) which operate in a complex environment of a classroom environment (Pratt, 1998);
- they allow the researcher to profit from his or her own experience, from data analysis and findings from previous iterations;
- they play the role of systematic variation in traditional experimental designs (Cobb et al., 2003);
- they permit the researcher to flexibly adjust his/her decisions regarding research methods, theories or developed interventions;
- they allow critical reflection on the part of practitioners, for example, researchers, teachers or pupils.

Due to these features, the design-based research is considered to be highly flexible educational research. In each iteration it consists of two phases (see Fig. 1): design + development + deployment and observations + analysis. The conclusions, which we obtain in the second phase, will influence the first phase of the next iteration. Such approach reflects the process of consecutive evolution of the researcher's understanding of what he or she is studying and developing.

D. Pratt (1998) suggests new structure of a doctoral research project with four iterations:

- Iteration 0 – **orientational**. It provides opportunity for a free-form exploration of the platform and the tools it offers. Iteration 0 typically comprises reflections on previous work and experiences; initial

readings of the literature; thought experiments about generic learners engaging in tasks; storyboarding, sharing and discussing prototypes with peers; and pilot trials of emerging design ideas with pairs of children.

- Iteration 1 – **exploratory**. It represents the initial development and testing of tools within the platform or environment. The emphasis is still on the basic usability and intuitive indicators of learning potentials to support the learning process.
- Iteration 2 – **developmental**. The designs have achieved a level of maturity which allows the researcher to shift attention to questions of learning and specific aims and research questions within a content domain.
- Iteration 3 – **analytical**. The researcher conducts relatively minor changes to his/her design; he/she pays careful attention to the questions of data collection, analysis and theorisation of the conclusions to be drawn at the end of the research.

Several of our recent doctoral projects seem to prove that the methodology of the design-based research helps us (a) develop notable interventions for learning, supported by educational research and (b) conduct such research through the iterative intervention development.

Integrating ICT into early childhood education

One of the examples of productively applying new strategy of the design-based research is our study of the ways how ICT could be integrated into early childhood education. Three years ago we entered the environment of an early childhood centre in Bratislava with the goal to thoroughly explore it and develop strategies and scenarios for the teachers to exploit modern ICT and integrate them into ordinary and everyday activities, which they carry out with children. We wanted this integration to (a) support the development of children in every domain and (b) eliminate or minimize all risks and possible concerns, which parents and educators often have when working with children and ICT. Obviously, we could not apply usual descriptive method of collecting data by observation and subsequently analyzing them by traditional quantitative instruments, because at that time there was nothing (or nearly nothing) to observe in the context of ICT and their creative and helpful application. Instead, we had to start developing such interventions and support or lead that process by parallel educational research. Therefore, we eagerly engaged the design-based approach to our research.

In 2009, after two years of our endeavour, we presented our new classification of various educational goals, scenarios and problems related to organizing such activities in a preschool class (see Moravcik, Pekarova and Kalas, 2009), at the IFIP World Conference on Computers in Education in Bento

Gonçalves, Brazil. Consecutively, we managed to benefit from that valuable experience in our comprehensive analytical survey 'Recognizing the potential of ICT in early childhood education' conducted by the UNESCO Institute for Information Technologies in Education (see Kalas, 2010).

Conclusion

> *So the choice is not whether we will consider deep changes in school but how many children will be lost before we recognize that we have to do so.*
>
> *(Caperton, Papert, 1999)*

The goal of this paper has been to argue that if we want to (a) responsibly solve the problems, which extensively arise in the area of the Technology Enhanced Learning, and (b) efficiently exploit the potential of new digital technologies, and also (c) minimize all possible dangers and various safety concerns, we have to systematically engage high quality educational research. We have to learn how to apply well-established strategies; but in parallel with it we also have to discover, extend and develop other approaches – less established strategies, which are specifically well-suited for the questions typical in our field of interest. We have presented one such strategy, which emerged already before ICT era, but has spread only recently. This approach offers us an educational design suitable for competent development of interventions for modern education.

We should remember that ICT are not the goal for our educational research. What really interests us is the potential of new technologies for supporting modern education, for building new culture in school. To discover and exploit it we necessarily need strategies, which will help us to find proper and valid answers to our emerging questions. And that is why we need quality educational research.

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Promoting Support to Teachers on ICT Usage for Building Accessible Education Environment for Persons with Disabilities

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Scientific and technological progress of the last few decades has brought not only worldwide expansion of technologies but also changes in social relations, culture and education. Fast development of telecommunications, media and information technologies bears huge potential of improving the quality of life. It is particular vital for those, who cannot obtain an appropriate level of education without assistance of educational and technology specialists, i.e. people with disabilities. Technological advance has

unveiled meaningful social opportunities for such citizens by providing a more convenient access to information and communication tools. Thereby, it gives a chance to enhance skills and involve everyone in active social life.

Decades of experience have shown that equal education for people with disabilities must be supported not only by application of high technologies, but also by profound integration of ICT into curriculum and adjustment of educational materials in compliance with accessibility and usability requirements. This could be implemented by the specialists with high professional qualification.

In the first instance, the diversity of individual learning needs is affected: it requires the educators' ability to teach based on a variety of academic and behavioral features. Therefore, the staff involved in education of persons with disabilities, have to master different vocational knowledge and skills to analyze carefully every learning situation, choice of objectives, applications of educational means and methods, monitoring and evaluation of learning progress, and personal or collective reflection of the process.

Modern technological devices applied in education to improve the learning outcomes of disabled students require the specialists' experience and qualification to be enriched continually, a wider access to more expert knowledge, guidance and professional advice to provide for individual-based education. Special programmes of training and retraining ICT specialists involved in education of people with disabilities are of paramount importance to keep the staff informed on progressive inventions and abreast with the world developments.

Evidently, the technologies can be powerful tools of students' education; however their value depends on how efficiently teachers employ them to support instructions. Accordingly, qualitative education of students with disabilities who fail to benefit from regular school education is impossible without appropriate teachers' training allowing them to integrate new technologies easily and effectively in their daily practice. In order to accomplish the required teachers' training both common-core and cross-disciplinary educations are required. Common-core education gives basic knowledge and skills in the field of ICT usage in education of people with disabilities, while cross-disciplinary education – awareness and some practical knowledge of non-professional background (e.g. medicine, social economy, and technology).

The planning must carefully correlate with the skills and competencies of the target group of specialists. Perfected skills will help teachers gain the proficiency in new learning environment of the Digital Age.

To develop consistent and reliable teachers' training programmes, educational requirements and quality standards must be identified. On the one hand, it is assumed that requirements for specialists must satisfy the quality standards of professional teachers' excellence (including the excellence

of special needs teachers); on the other, they should meet the ICT competency standards of teachers' excellence.

Wide spread of ICT and their large potential in the field of education have resulted in the technology integration in the programmes of professional teacher training. Major ICT competencies for educators are developed by 'ICT Competency Framework for Teachers' (ICT-CFT) project, initiated by UNESCO[1]. The goal of the project is to improve teachers' practice. However, the Framework does not merely focus on ICT skills. By combining ICT skills with emergent views in pedagogy, curriculum, and school organization, the framework is designed for the professional development of teachers who want to use ICT skills and resources to improve their teaching, collaborate with colleagues, and perhaps ultimately become innovation leaders in their institutions. The overall objective of the project is to improve teacher practice in a way that contributes to a higher quality education system that can, in turn, produce a better informed citizenry and higher quality workforce that can, as a result, advance a country's economic and social development.

To elaborate the teachers' training programmes meeting the demands of the Digital Age and relating to key principles of inclusion-oriented pedagogy, a comprehensive model of teachers' training must be worked out. Firstly, basic and advanced training must be provided for 'no-tech' or 'low-tech' audience. Secondly, training initiatives will encourage special programmes to emerge regarding the application of appropriate assistive technologies and introduction of new didactical approaches to new learning environments. In this connection, training initiatives must differ in thematic scopes according to the goals to be achieved. Some programmes narrowly focus on ICT skills, while others treat ICT only as a tool of gaining educational goals.

Anyway, in all scenarios, training must aim at helping teachers include ICT in their daily practice and individual plans of students specifically. In addition, any training to use ICT must cover methodology, didactics and organization of learning with clear links between theory and practice.

"Appropriate and flexible forms of support for teachers working with learners with SEN [special educational needs] should be the aim and result of policies. The availability of support from specialized teachers plays a crucial part, as it cannot be expected that all classroom teachers have the knowledge and expertise to meet every specific need. Policy makers must ensure that the content of teacher support systems is diverse and responsive to local level and individual needs"[2].

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[1] For more details see UNESCO website http://portal.unesco.org/ci/en/ev.php URL_ID=22997& URL_DO=DO_TOPIC&URL_ SECTION= 201.html

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Adequate support in ICT application to meet individual students' needs is crucial for teachers involved in education of persons with disabilities. Limited or lacking access to certain facilities may hinder the equality of educational opportunities for such students, thus inhibit the inclusion.

To realize proper conditions of teachers' training in the field of special education, the measures like incentives, capacity-building and technical assistance must be put in effect. There exists a variety of ICT support arrangements in education: services, centres, resources and personnel being politically directed and practically facilitated in the countries.

The report of European Agency for Development in Special Needs Education specifies support structures offering inter-related ICT services for teachers working in SNE[1]:

- National agencies for ICT in education
- Support services working directly with teachers and students
- Resource centres where teachers receive advice, materials and information
- Regional working groups
- Websites and online networks
- In-school support

It is very important to review and renew teachers' training programmes continually to ensure that they meet the changing expectations and take advantage of the opportunities offered for teaching and learning by ever more powerful technologies. Therefore, careful monitoring and evaluation are needed. In this regard, policy and decision makers must focus their attention on granting that teachers receive the knowledge and skills adequate to teacher's changing roles and working conditions assist teachers in performing their roles. Specific information about special education teachers' progress in ICT application in their practice can help policy and decision makers plan appropriate professional development activities.

Appropriate assessment is essential in successful implementation of policy measures. Without this data policy and decision makers will remain unaware of how their actions support the accomplishment of qualitative training of specialists in ICT usage in education of persons with disabilities.

In order to monitor the policy in the field of teachers' training efficiently, the principles of assessment must be analysed and introduced in practice. Some principles of assessment developed by the National US Board for Professional Teaching Standards (NBPTS) for teacher trainers are summarized in Box 1.

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[1] European Agency for Development in Special Needs Education (2001) Information and Communication Technology in Special Needs Education. Online: http://www.european-agency.org/ict_sen_db/docs/ict_in_sne_sum.doc

Box 1. NBPTS principles of assessment for teacher trainers[2]

Teacher Assessment Development Teams, comprised of accomplished teachers in the field, standards committee members and National Board staff, work with a general contractor for assessment development to develop assessment exercises and pilot tests them with groups of teachers active in the field in question.

The National Board's assessments are based on standards that define accomplished teaching for the content area and development level of students. All NBPTS standards share a common vision of accomplished teaching, one that values conscious and deliberate pedagogical decisions that are based on a deep knowledge of the particulars of content and context. The underlying principles in the assessment development process are that:

- tasks should be authentic and, therefore, complex;
- tasks should be open-ended, allowing teachers to show their own practice;
- tasks should provide ample opportunity and encouragement for analysis and reflection;
- subject-matter knowledge should underlie all performance;
- tasks should encourage teachers to exemplify good practice;
- each task should assess a cluster of standards; and
- each standard should be assessed by more than one task.

In its assessment development work, the National Board uses technology for assessment, where appropriate; ensures broad representation in all stages of the process of the diversity that exists within the profession; engages pertinent disciplinary and specialty associations at key points in the process; collaborates closely with appropriate state agencies, academic institutions and independent research and education organizations; establishes procedures to detect and eliminate instances of external and internal bias with respect to age, gender, and racial and ethnic background of teacher candidates; and elects the method exhibiting the least adverse impact when given a choice among equally valid assessments. The National Board strives to assure that every assessment meets five requirements known as the APPLE criteria:

- Administratively feasible
- Professionally credible
- Publicly acceptable

[2] See http://www.nbpts.org/standards/dev.cfm#pilot

- Legally defensible
- Economically affordable

The following step toward efficient monitoring and evaluation of the training process is expected to form an evaluation strategy. Although some promising models of evaluation strategy are elaborated, it should be noted that there is still insufficient evidence that the policy measures taken are ample to encourage special needs education regarding the training of specialists capable of using ICT effectively.

Box 2 shows the model of evaluation strategy which represents consequential steps of the evaluation process and can be useful in fostering ICT policy in education of persons with disabilities.[1]

Box 2. Model of evaluation strategy

The following model of an evaluation strategy developed by D. Baume and C. Baume (1995), though based on a more general educational evaluation mode proposed by Nevo (1986), represents a ten-stage evaluation process:

1. Identify the object(s) to be evaluated. What you wish to evaluate may be a policy, a development unit or service, a programme, an event, activity or a project.
2. Identify the main stakeholders in the objects(s) to be evaluated. The main stakeholder groups are likely to be intended clients and users of the development activity, and their managers, policy makers, staff development unit managers, individual developers, and project staff.
3. Identify the questions or concerns of each major stakeholder or group. A good way to identify their questions or concerns is to ask them!
4. A particularly valuable step is to go beyond stakeholder questions to stakeholder criteria for a satisfactory answer to the questions. For example:

   How much are the expressed stakeholders' needs satisfied?

   How far are broader institutional or national policy goals achieved or supported?

   How are agreed standards, norms and processes met and followed?

   How effective are the methods compared to other possible methods?
5. Plan and pilot the methods and instruments to be used.
6. Carry out the evaluation.
7. Seek to understand the object(s) being evaluated, to make sense of why what was done had the effect it had.

[1] Source: Baume, D. (2003). Monitoring and Evaluating Staff and Educational Development. In A Guide to Staff and Educational Development. P. Kahn and D. Baume. London, Kogan Page.

8. Report to stakeholders on answers to their questions and concerns.
9. Change staff and educational develop practice as appropriate.
10. Periodically review evaluation methods and processes.

Thus, the training of ICT specialists capable of delivering appropriate services to students with disabilities is a complex issue requiring systematic support and commitment.

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Educational Interactive Television Network Alippe.TV on the Basis of an ITU Pilot Project on Interactive Multimedia Broadcasting in the Kyrgyz Republic

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There is a significant increase in the role of education in the dynamic world today. International Telecommunication Union (ITU) keeps proposing and implementing a number of initiatives in the sphere of education. One of the projects devoted to education is the project that organises a digital educational television network Alippe.TV. Alippe.TV network is

an innovative educational net, which appears to demonstrate the way opportunities of convergence in telecommunications can contribute to development of education and to show an example of a successful partnership of the government and private business. ITU in its activities pays great attention to the issues of education and promotes a number of initiatives in that sphere. ITU 'WSIS' and 'Connect a school, connect a community' initiatives are aimed at developing of telecommunications opportunities for achieving the millennium goals, overcoming the digital divide and ensuring sustainable economic growth. ITU supports projects in the sphere of education on a systematic basis, the projects that are nominated by the regional administrations of communication and by the members of the organization. Issues of the development of telecommunications standards have always been considered in the focus of opportunities in education. One of the perfect examples of regional initiatives supported by ITU-D is the project of digital interactive educational television Alippe.TV, which is being implemented in the Kyrgyz Republic. The word Alippe means ABC-book if translated into English. The Alippe.TV project involves an organization of the interactive educational television network in developing countries, in conditions of insufficient funding for education, underprivileged people, underdeveloped infrastructure and low Internet penetration.

Alippe.TV is a DVB-T network with a return channel, the air of which is composed only from educational programmes with no advertising, news or other programmes that are not aimed at acquiring the knowledge. Alippe.TV channel proposes a unique network of about 200 teachers living in remote regions able to give lessons live and open their knowledge to children and adults all across the country. Classes are held live with the return channel so that children are deeply involved in the process, having an opportunity to affect the course of training by asking and answering questions, holding discussions with the teacher in Online mode. Besides, each subscriber of the Alippe.TV has an access to e-mail, directories and dictionaries, which will help him/her during the extracurricular work and communication with the teacher offline. Children develop their skills through using specially invented hardware and software. Children use a computer keyboard and a microphone connected to a special STB. The image is viewed on usual home TV. The Alippe.TV project demonstrates an example of usage of the convergence potential in telecommunications and opportunities offered by DVB-T for the development of the society. In addition to that, Alippe.TV shows an experience of a successful governmental-private partnership, when the government supports business that cultivates socially significant projects. Besides the education for a target audience – children from 5 to 18 years old, Alippe.TV gives a number of opportunities for adult and parental education. It is worth mentioning the possibility of usage of Alippe.TV in the sphere of governmental services as well.

ITU initiatives and the Alippe.TV project demonstrate the importance and the need to continue the active work for development of communities and achievement of one of the key Millennium Goals of Development – the complete overcoming of illiteracy by 2015. It is important to extend the support of projects similar to Alippe.TV and to spread that useful experience in other countries.

IBM Initiatives in Education

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Academic programmes

IBM Academic Initiative is a global programme that facilitates the collaboration between IBM and educators to teach students the information technology skills they need to be competitive and keep pace with changes in the workplace. Shared University Research – SUR programme is designed to establish or enhance the strong IBM technical presence at selected leading research universities. Faculty Awards are competitive, cash-only awards. Faculty Awards are granted annually on a global basis. Ph.D. Fellowships are intended to award, attract and recruit exceptional technical talent into IBM, to strengthen IBM's relationships with premier faculty.

Initiatives for students

Internship Programme is specifically for students entering their final course of studies, and who are interested in committing at least 20 hours per week to both professional development and their own diploma work. Great Minds student internship is a competition for internship positions at IBM Research – Zurich, the European branch of IBM Research, destined for students from Central and Eastern Europe. Academic Qualification Programme is designed to help students to use materials of IBM 'Academic Initiative' in laboratory works, seminars and university projects.

KidSmart Early Learning Programme

The IBM KidSmart Early Learning Programme integrates new interactive teaching and learning activities using the latest technology into the pre-kindergarten curricula. The programme is now being implemented in 60 countries internationally, serving more than 2 million children from remote geographic areas.

Educational Initiatives by Kaspersky Academy – Complex Approach

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Kaspersky Laboratory is the largest European producer of anti-malware software, anti-hacker and anti-spam systems. The company is among four leading global producers of information security software. The company's products provide protection for computers and mobile devices of over 300 million users worldwide, and the technologies are used in products of leading global vendors of software and hardware solutions. Kaspersky Laboratory is a group of companies with central offices in Moscow, five regional headquarters and dozens of local representatives all over the world.

Since 2004, the company has been rapidly developing its educational initiatives and calling for cooperation in information security sphere. As Svetlana Efimova, the head of educational programmes, put it: "Year by year, we try to develop already existing resources and create new opportunities for our academic partners in the framework of 'Kaspersky School and Academy' educational programmes, the principal objective of which is to make the company's knowledge and technologies available, to learn and develop together".

All educational programmes and projects of Kaspersky Laboratory are aimed at organizing continuous education in the field of information security and improvement of general level of literacy in this sphere; creation and development of pupil and student potential in protection of computer threats; development of research and innovation activities as well as of general culture of global information protection.

On the basis of the abovementioned tasks, the work with education sector is being carried out in the following directions:

1) Training

2) Research activities

3) Academic partnership

4) Favourable conditions of software purchase

Training is one of the priority directions of Kaspersky School and Academy.

Within the framework of these programmes the company gives in-class as well as online training courses: webinars; teacher training in two directions:

'Elements of computer security' – basic level, and 'Computer threats' – advanced level; Computer Security Days for students with extra-mural lectures provided by company's experts in institutions of higher education on modern computer threats and methods of struggling against them, and on educational initiatives and opportunities for students. Both in-class and distant training make it possible for the participants to get professional consultation from Kaspersky Laboratory technical experts and new knowledge in computer security sphere.

Another equally important direction of Kaspersky Laboratory's educational projects is research activities that are being realized by the company within several different projects.

In 2010 'Innovative Project Support Programme' (grant programme) was launched, but for the moment it has been being realized only in Russia. The programme's objective consists in support and development of innovation activity in the sphere of information security and in related branches among scientific and academic communities. The programme is oriented to students, postgraduates, teachers of higher education institutions, professors and members of academies of science. This programme makes it possible for specialists to realize their potential and get financial support for development of their research ideas. Depending on the complexity of scientific projects, participants may be granted up to 150 thousand rubles.

Fields of research are quite diverse and are not confined to technical topics. Undoubtedly, all works are related to information technologies, but, however, the subject may be viewed in different, absolutely new and unexpected ways. For instance, one of the winners of this year in the 'Modern cybercrime' nomination did research on the psychology of a person committing computer-related crime. Indispensable conditions of participation in the programme are innovative and practical components of the work and its authorial uniqueness. According to the results of the 2010 project, 7 young professionals received money rewards for development of their research ideas.

The programme was launched on 1 September 2010, the collection of application forms was finished on 20 November, and 51 application forms were received. At the moment the Kaspersky Laboratory's evaluation commission is selecting the most interesting projects for realization of which participants will have six months. During this period they will have to give flesh and blood to their ambitious ideas and after that present a detailed progress report to the members of Kaspersky Laboratory's commission, who will assess the amount and quality of performed work as well as the compliance of the real results with the planned ones. The final of the 'Innovative Project Support Programme 2010/2011' will take place in August 2011. For the provisions of the 'Innovative Project Support Programme' visit

the educational programmes site http://www.kasperskyacademy.com/ru/grants.

Another important resource for students and young scientists is the international student conference 'IT Security for the Next Generation', which brings together young professionals studying problems of computer security, for sharing experience, development of innovations and information protection culture. Year by year the conference extends its frontiers. To this date there are three rounds held in Europe, Asia, Russia and CIS. The winners of regional rounds of 2011 will be invited to the conference final that will take place in Germany and will have an opportunity to represent their countries. The scope of topics was also extended this year – along with technical nominations there are social, economic and legal ones. The conference gives an excellent chance to young professionals in information security field from all over the world to approve themselves, share experience, gain new knowledge and find likeminded people. One can take part in the conference after registering and presenting the project until 20 December 2010. An example of research work on one of the topics is offered on the site http://www.kasperskyacademy.com/ru/it_security_conference_about. All submitted works will be assessed by the conference programme committee consisting of leading experts of Kaspersky Laboratory and professors of higher education institutions of Russia and CIS. The authors of the best works will present their projects at the in-class round of the conference that will take place 10–11 March 2011 at the Faculty of Computational Mathematics and Cybernetics of Lomonosov Moscow State University. Participation in the conference is free. For the authors of the best works Kaspersky Laboratory pays all expenses for travel to the in-class round in Moscow (transportation and accommodation). All participants will get commemorative diplomas and souvenirs, and the winners will receive valuable prizes and invitations to the international round in Germany (Munich) that will take place in April 2011.

Furthermore, in the framework of Kaspersky Academy the company offers opportunities for students of interning and reinforcement of theoretical skills acquired at higher education institutions. As Svetlana Efimova, head of educational programmes at Kaspersky Laboratory, argued: "Higher education institutions give good basic theory, but students need more practice. Moreover, high technologies are developing so rapidly that they leave behind educational programmes of institutions – students lack 'hot' knowledge in the IT-sphere". If the interning is successful, the candidate may undertake a traineeship with further employment at the company.

Currently, there is also a programme called 'Diploma with Kaspersky Laboratory', within which talented and interested students can get consultations and assessments from company's technical experts.

For the participation in these projects you need just to fill in the application form on the site http://www.kasperskyacademy.com/ru/for_students_practice. Students are selected on a competitive basis.

Another education direction of Kaspersky Laboratory is active work and development of academic partnership with education authorities and IT and academic communities that are called upon to solve such global issues of education as development of modern ICT-education standards, updating of regulatory and teaching-methodological bases, development and consolidation of various forms of multilateral public-private partnership, etc. For instance, Kaspersky Laboratory is a member of the Information and Computer Technologies Industry Association, of the Education Committee and of Education and Methodic Association of Russian Institutions of Higher Education for Information Security. Kaspersky Laboratory also is a member of the ICT Multivendor and Academic Consortium, and actively cooperates with the Academy of Professional Development and Additional Professional Education of Educators, the Moscow Institute of Open Education and other state education institutions.

Apart from training, research and academic activities, Kaspersky Laboratory makes special offers for education institutions to purchase software on favourable conditions. For instance, schools and universities can purchase software at a discount of 80% as a special offer 'Protection of education'; for research institutions and institutions of further education there is an offer 'Science' by which the discount on Kaspersky Laboratory's software is 30%; for students there is an offer 'Zachet antivirus' with a 40% discount. For more information about special offers and conditions of participation, see http://www.kasperskyacademy.com/ru.

For the moment Kaspersky Laboratory has achieved certain success and has gained recognition in the sphere of education. In March 2010 Kaspersky Laboratory received the award of the Federal Agency for Youth Affairs in the contest 'Employer of the Year of the Youth: Engineering Personnel for Innovating Russia', and in May 2010 it was awarded by the Russian Rectors' Union for the 'Biggest Contribution to Support Gifted Students and Young Teachers'.

Kaspersky Laboratory is open to cooperation and discussion of new interaction forms with the purpose of improvement of training process quality and creation of modern high-technology society.

Certification of Computer Literacy and ICT Competence

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This article generates information about certification of computer literacy and ICT competence in education, which has been developed and implemented by Informika. This system is an entire complex of organizational, analytical, methodological and programme procedures designed to test ICT competence among educators.

Certification system of computer literacy and ICT competence is meant to increase the quality of education at all levels of education system from primary to higher vocational education. Certification is based on the official documents of education system: state education standards, education job descriptions and other regulatory instruments effective in the Russian system of education.

The development of the certification system of computer literacy and ICT competence was launched in 2008 as part of the Federal Education Development Task Programme in order to create a complex of ICT competence testing and test development programmes. For the moment we have created 5 certification areas, over 4000 tests on more than 100 topics of catalogues; industrial implementation of the system has been carried out in the Russian regions, a ramified network of regional certification centres including 20 centres in 16 regions has been created.

The system is being constantly upgraded, new areas of certification and tests created; new programme modules developed, new regional certification centres opened. System developers are full of different ideas which will be applied in further improvement of the system. Over 40 regions of Russia have shown interest in the system.

Nowadays 5 areas of certification are provided:

1. Certification on meeting requirements of computer literacy in education;
2. Certification on meeting job requirements in ICT for science and mathematics teachers;
3. Certification on meeting job requirements in ICT for humanities teachers;
4. Certification on meeting job requirements in ICT for school management staff;
5. Certification on meeting requirements of ICT competence for teachers.

In the near future we are planning development of four new areas for intermediate vocational schools staff, and, to this end, four catalogues and respective tests will be developed on the basis of regulatory instruments for intermediate vocational schools.

Certification system provides educators with the following advantages:

- helps to assess the level of own professional knowledge;
- confirms current level of own professional knowledge;
- helps to determine areas of further education;
- makes it easier to get used to the new work place;
- gives a competitive advantage on the labour market, simplifies and expedites the procedure of suitable job search;
- provides social stability on the labour market;
- increases chance to get a better paid job;
- improves employee's image.

Certification system can also be beneficial for an employer since it can be helpful in:

- selecting quality personnel on the labour market;
- providing confidence in quality of staff performance;
- encouraging staff professional growth;
- improving quality standards through monitoring and staff professional development;
- motivating staff;
- attaining effectiveness – high economic and management performance, high service quality, increased competitiveness;
- monitoring staff professional qualities.

For students certification serves as means to smoothly move from one education level to another. It helps school leavers to prove the quality of their education, test their knowledge and gain a competitive advantage for recruitment.

Certification system of computer literacy and ICT competence is registered in two voluntary certification systems and has all necessary licenses granted by the Federal Agency of Technical Regulation and Metrology:

- voluntary staff quality certification system, reference number ROSS RU.ZH174.04PZH00;

- Informikasert voluntary certification system, reference number ROSS RU.V612.04ETS00.

The system is also recognised by the European Center for Quality.

The system is supported by the Department of State Policy in Education of the Ministry of Education and Science of the Russian Federation. Head of the Department, Mr I.M. Remorenko, signed a special letter in which the Department recommends to use the certification system developed by Informika.

At the 11th forum 'Education Environment 2009' which took place on September 29 – 2 October 2009 in All-Russian Exhibition Centre in Moscow, the certification system of computer literacy and ICT competence was acknowledged the best product in nomination 'Training Teachers to Use ICT in Education Process' of All-Russian Creative Contest of Research and Technology Ideas, Educational Products and Services in Informatisation, and Informika was awarded a diploma of the winner in this nomination.

All tests used in the certification system of computer literacy and ICT competence are made only on the basis of the official documents approved by the Ministry of Education of Russia including state education standards, qualification reference books and study guides.

Nowadays certification system development is financed not from the federal budget, but from regional budgets and public donations. Due to the fact that the development of the system's main nucleus was funded within the Federal Education Development Task Programme, the cost of computer literacy certification procedure is 10 times lower than that of the European ECDL and amounts to 300–400 rubles depending on the area of certification.

Shaping the requirements of students' computer literacy and ICT competence we used regulatory documents, recommended textbooks and study guides. We used the following documents and materials:

- federal basic study plan and exemplary study plans for educational establishments;
- concept of field-specific training on higher stage of general education;
- standards of basic general education for the subjects covered by the federal basic study plan;
- standards of secondary (complete) general education for the subjects covered by the federal basic study plan;
- exemplary plan of information science and information technologies classes in complete (secondary) school (basic level);
- course content catalogue to make tests for unified state examination;

- mandatory content required for secondary (complete) general education; education field: mathematics (mathematics, information science); annex to order of the Ministry of Education and Science of the Russian Federation of 30.06.99 No.56;
- textbooks and courseware on information science and ICT approved by the federal education supervisory authorities; primary and secondary school.

Requirements of computer literacy and ICT competence among teachers and administrative and managerial staff of educational establishments are based on:

- state education standards for higher pedagogical education which stipulate respective positions for teachers of all subjects;
- state qualification requirements for teachers and administrative and managerial staff (those concerning computer literacy and ICT competence);
- recommended programmes of further education and professional retraining in ICT for teachers and administrative and managerial staff of educational establishments;
- recommendations, study guides published in Russian periodical editions, conference materials, etc.;
- professional experience of invited experts.

Certification system has the following capabilities:

- Knowledge and skills assessed embrace different areas of computer literacy and ICT competence.
- Knowledge and skills assessed are maximally objective and results can be directly compared in different areas for different categories of test-takers and educational establishments.
- Procedure of knowledge and skills assessment is conducted through tests with the help of modern computers at the disposal of regional certification centres.
- Knowledge and skills are tested in 13 different areas.
- Testing procedure takes 60–90 minutes.
- In case of computer-based testing, each test-taker gets his/her own unique set of tests.
- Each test has one-best-answer questions, multiple choice questions, matching questions, put-them-in-order questions and fill-in-the-blank questions.

- All in all there are 4000 tests in 13 areas covering more than 100 topics of catalogues.
- Assessment procedure and tests are standardized in order to be used in different regions and in different environments.
- Assessment procedure is entirely automated and doesn't require any extra knowledge and skills either from testers or test-takers.
- After testing a codified protocol with test results is automatically created and sent to the head certification office for analysis and summarizing of the certification results.
- After being tested each test-taker can study the diagram with the results on different areas of testing and discover test results.

Testing covers the following knowledge fields:

- information and information processes;
- information models;
- computer structure and architecture;
- operating systems;
- office software;
- work with databases;
- multimedia technologies and graphics;
- information security;
- computer networks;
- Internet technologies;
- basic programming and algorithms;
- programming technologies;
- social information science.

Programming complex of certification system of computer literacy and ICT competence has the state registration certificate of computer software No. 2009611187, Alfa-Omega, included into the Register of Computer Software 26 February 2009.

The system is provided for 5 test types:

- one-best-answer questions, when a test-taker is supposed to choose only one answer from a list of answers;
- multiple choice questions, which require that a test-taker should choose all answers that are appropriate;

- put-them-in-order questions, when a test-taker is required to sort all answers in ascending or descending order;
- matching questions, when a test-taker is supposed to match answers to given categories;
- fill-in-the-blank questions, when a test-taker is required to type missing text in.

To measure the level of computer literacy and ICT competence, we use special test sets created on the basis of well-known scientific approaches to creation of criteria-oriented tests.

Informika is developing its own network of regional centres and looking to cooperate with organizations concerned. In order to create a regional certification centre and gain respective status, an educational establishment should get a recommendation from education supervision authority of the subject of the Russian Federation. A letter with the recommendation to authorize an educational establishment to become a regional certification centre of computer literacy and ICT competence can be written in free form on behalf of the administration of the education supervisory authority of the subject of the Russian Federation. The letter must contain the following information: name of the educational establishment, address and name of contact person with contact information including e-mail address. Without approval of the education supervisory authority of the subject of the Russian Federation, it is impossible to found a regional certification centre in an educational establishment and run testing activities.

A letter from the education supervisory authority should be sent to the following address: 127287 Moscow, Stary Petrovsko-Razumovsky Proezd, bld. 2B, Informika, without acknowledgement of receipt. Electronic copy of the letter should be sent to our e-mail address: info@icttest.edu.ru.

Having received the approval from the education supervisory authority, Informika makes a decision on creation of a regional certification centre, and in case of positive decision, we conclude contract on providing services to the regional centre for certification of computer literacy and ICT competence of students, teachers and administrative staff of educational establishments (of all levels) within the system of continuous education.

For the moment 1362 people were tested for computer literacy and ICT competence, 982 of them got certificates. Certification process is most actively running in Irkutsk and Tver regions where the number of test-takers totals 960.

Conclusion

Monitoring and certification system of computer literacy and ICT competence is a powerful instrument for knowledge testing and staff certification

in the field of information and communication technologies; the system is being constantly upgraded and developed. We are looking to cooperate with all organizations interested both in regional certification centres foundation, and partnership.

You can find further information on the web-site of the system: http://ict-test.edu.ru/, where latest information on the system, cooperation with regions, different activities, answers to questions, etc. is published.

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E-Learning Portal for School Teachers: Partnership Opportunities

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1. Educational projects implemented by IT Academy

IT Academy has vast experience in projects for educational institutions. Among the customers of such projects are the Ministry of education and science of the Russian Federation and a number of educational establishments of higher and secondary vocational education.

2. Federal Educational Project 'Implementing of Open Source Software in Russian schools' (NP-12)

The main aim of the project realized by IT Academy was to train school employees throughout Russian Federation to introduce and use of Open Source Software in the learning process.

3. Training programmes and educational formats

During realization of the project a new educational format to cover educational establishments within the whole country was developed by IT Academy. It included one-day conferences, e-Learning activities and full-time training and testing.

4. E-Learning technologies

The majority of school employees were trained using e-Learning technologies. At the e-Learning portal 'pspo.it.ru' about 80 000 users were registered in total. On the basis of online training full-time final testing was organized in each subject of the Russian Federation.

5. Development of e-Learning portal, supporting the implementation and usage of Open Source Software within the learning process

Technological aspect is the key element in organization of educational project. As a technical core for e-Learning portal to organize the interaction of teachers and students Open Source Software – Moodle was selected.

6. E-Learning portal audience

The audience of the 'pspo.it.ru' portal includes teaching stuff, representatives of educational institutions administration, schoolchildren and others (e.g. system administrators).

7. The results of Federal Project NP-12

Within the project educational and methodological framework was developed. There has been organized e-Learning for 77 706 school employees form 83 Russian regions, full-time testing for 53 473 school employees, and full-time conferences in 20 Russian cities.

8. Opportunities of partnership

'Pspo.it.ru' portal provides a number of unique opportunities for collaboration, that include report of the information to the target audience; use of the operating e-Learning portal for educational purposes, provided with 24/7 technical support; the access to up-to-date teaching materials for installation and administration of Open Source Software.

Towards the Knowledge Society via Hi-Tech Library

Farit Yalalov
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New information infrastructure is being formed in the Russian society nowadays. It is the infrastructure which includes hi-tech libraries. By a hi-tech library we mean an information and education centre accumulating both hard-copy as well as electronic and digital resources. That is why a hi-tech library fulfills the function of a shared use centre of information and educational resources. Teachers and students have remote access to a hi-tech library from their home computers through the Internet. This is exactly the kind of library we managed to create at Nizhnekamsk Municipal Institute.

It is symbolic that in 2010 together with the All-Russian Census of Population the Census of Libraries was conducted. Currently only 17.8 percent of all our libraries are equipped with computers, and even less than that – only 7.2 percent of libraries – have access to the Internet. In western countries online library services and practice of retrieving information from remote sources have become commonplace, but in Russia there is still a long way to go. Nevertheless, modernization of library system is an indispensable prerequisite for the Russian society to move forward – towards the knowledge society.

In order to raise awareness among population and society, to advocate new opportunities of the library, the foundation 'Pushkinskaya Library' (St. Petersburg) created the Mobile Complex of Information and Library Service (KIBO) on the basis of a truck van, in other words, a bibliomobile. This mobile hi-tech library is equipped not only with bookshelves, but also

with advanced hardware. Readers are provided with access to modern laptops, the Internet and copy machines. The satellite platform mounted on the roof of the bibliomobile allows getting online almost from any place in Russia. Moreover, an automated antenna station makes it possible to deploy the equipment within fifteen minutes at most. The bibliomobile also has all technical tools necessary to organize reading conferences, cultural events, etc. On the basis of KIBO it is even possible to set up a mobile stage! Furthermore, for the comfort of people with disabilities the bibliomobile is equipped with a special lift mechanism, and for the youngest readers it has a children's corner with child development books and board games. Today six van trucks of the kind are crossing the country. Project authors themselves agree that it is just a sort of 'library ambulance' which is not able to replace our traditional system of public library service. As for the 'filling' of the bibliomobile, it is undoubtedly the paragon of a hi-tech library for every library to follow.

A real breakthrough in the field of librarianship informatisation was the foundation of the Boris Yeltsin Presidential Library. From the very outset the library was meant to be a digital repository of the country's documentation. In its creation the experience of the US Library of Congress was used, but unlike the Library of Congress, where millions of documents are stored in hard copy format, the holdings of Boris Yeltsin Presidential Library are entirely digital. To replenish the holdings a unique centre was created designed to digitize and convert especially valuable black-letter books and manuscripts, rare historic documents as well as little-known archive materials previously closed for large audience.

In accordance with the order of the President of the Russian Federation of 18 June 2007, the branches of the Boris Yeltsin Presidential Library will be opened in due course in all federal subjects. Large-scale preparatory work was started in the regions: premises were found, hardware and software purchased and installed. Thanks to the development of branch network, e-holdings of the Presidential Library will be accessible for everyone interested, and through the Internet they will come to every town and village, to every school and house. Regional branches of the library will also provide access to scientific information, unite researchers specializing in Russian history and culture.

The Republic of Tatarstan will become the first Russian region to accommodate a branch of the Presidential Library. In 2009 a special long-term programme of libraries' informatisation called 'Development of Librarianship in the Republic of Tatarstan for 2009-2014: Future Prospects till 2020' was initiated. Today 18 percent of all the libraries in Tatarstan are computer equipped, 11.5 percent of libraries have Internet access. Notably, according to the format composition analysis of the library holdings, e-resources are in higher demand. They are used 6.5 times more often than all

conventional data carriers together. That is why during the first stage of informatisation 60 percent of public libraries in the Republic are planned to be modernized.

Digitization of the unique collection of a Kazan bibliophile Ivan Vtorov including 1714 items is currently under way in the national library of the Republic of Tatarstan. These are books on theology, philosophy and logic, history and theory of art, Russian philology, as well as almanacs, encyclopedias, works on history and geography. More than eight hundred of books are already available at web portal kitap.tatar.ru which accumulates the resources of four libraries: two public libraries (National Library and Adolescent Library of the Republic) and two municipal libraries. In future this portal will pool library networks of all government agencies into a single information centre which will provide access to the library holdings of Tatarstan for everybody concerned regardless of location. Development prospects for cultural content of Tatnet Tatarstan portal are directly related to the creation of digitized e-resources in the Tatar language. They include not only e-books, but also film and theatrical performances collections, virtual museum tours. National traditions, artifacts and cultural values will become available in cyberspace for everyone interested.

A unique project of Tatknigafond electronic library system was launched in Tatarstan. Now it contains over 2.5 thousand books. The virtual reading room is absolutely free. Today on Tatknigafond website one can find classical, modern, children's and religious literature. A reader is provided with a virtual library card right after registration on the site. A reader cannot copy the whole book. Readers are allowed to download 10 percent of the book at most. The same limit is applied to printing the text out.

To create this virtual library 15 million rubles was spent from the budget of the Republic. It is a unique example of how authorities facilitated the emergence of an electronic library which is legal in all respects. Tatknigafond is the first legal regional electronic library in Russia. Here electronic holdings are created on the basis of direct contracts with copyright holders. Tatknigafond is a good starting point for young authors. Having uploaded his or her work, the author will be able to see how popular the work is by the number of clicks.

At the first meeting of the Committee on Modernization and Technological Development of the Russian Economy, the President of Russia Dmitry Medvedev outlined five major development areas, one of which was the area of information technologies. Informatisation of university libraries is one of the elements necessary to create innovation economy; it opens real opportunities for the improvement of specialists training quality and expanding their competencies. It was already in 2008 that the President instructed the Ministry of Education and Science to explore the possibility of introducing electronic library systems (ELS) at universities. The

Ministry of Education and the Federal Service on Education and Science Supervision (Rosobrnadzor) eagerly embarked on this task; an order stipulating to replenish university libraries with courseware included into ELS was issued. By its order Rosobrnadzor approved of the state accreditation criteria obliging universities and academies to provide access to ELS within the framework of educational process. By the beginning of academic year 2010/2011 a new order (No. 588 of 7 July 2010) was issued by the Ministry of Education and Science saying about changes in documentation provided for licensing. The fourth paragraph of the note on availability of educational literature, courseware and other library and information resources and tools necessary to provide the educational process reads as follows: "Providing educational process with electronic library system necessary to implement programmes submitted for licensing". Specific requirements for ELS are stated further: possibility of individual remote access twenty four hours a day for every student from any Internet access point; possibility of simultaneous individual access to the electronic library system including simultaneous access to every item in the electronic library system for not less than 25 percent of students at every mode of study. In his letter of 16 December 2009 the Deputy Minister of the Ministry of Education and Science says that "In the course of year 2010 higher educational establishments must implement all the requirements set by the federal educational standards for higher professional education, including the requirements of providing students with access to the electronic library system".

Contemporary e-resources market offers different options for providing university libraries with access to ELS, but all of them can be narrowed down to three ones:

- creation of own ELS;
- subscription to existing ELS from third organizations (integrators);
- creation of interuniversity electronic libraries.

Let us look closer at every option mentioned above.

First option implies foundation of own ELS at every university which would meet the requirements of state authorities and university own needs; it would be installed on its own server and would be used at its own discretion.

The second option seems to be the easiest one. Nowadays the market is abound with content integrators who provide subscriptions to thematic collections of books and archives of periodical editions in electronic form. For example, rather professionally electronic information resources were made by Integrator AP which launched IQlib electronic library system. This integrator that has been active in the Internet since 2007 has an impressive holding of up-to-date educational and scientific literature in all fields of study (www.iqlib.ru). Today Cinergia unified knowledge base is becoming

an active player. It is an information resource accumulating various electronic educational materials. The uploaded materials are intellectual property of different educational establishments and educational content developers (www.cinergia.ru).

But in practice it turns out that it is not so easy to find an offer with adequate quality/price ratio. For now access charge for full-text databases is rather high. It covers scanning, document describing and indexing charge, etc. But the hardest and, thus, the most costly processes are those related to content legalisation (contract work with authors) and technology (systems of content collecting and storing and accessing systems). At the end of the day an integrator shifts the costs for this work to universities. Furthermore, subscription to these resources is usually taken out for a year and after its termination the access to the documents expires as well.

The third option implies uniting electronic collections of several universities into a single ELS. Every participant uploading his/her collection into this corporate system gets access to the collections of partner universities and fills in the gaps. In this case expenses related to the technology and technical basis development as well as system maintenance are also divided between the participants.

It was already in 2006 that the administration of Nizhnekamsk Municipal Institute made a strategic decision to found its own electronic library system, and this decision proved to be a proper one. We started our work from creation of our own content. Since 2006 ELS formation has been conducted in three main fields.

The first field is purchase of textbooks and workbooks in electronic format (CD-ROM). Nowadays the library has over 500 electronic textbooks and workbooks on economic theory, organization theory, strategic management, law and other subjects, majors and branches of study.

The second area of ELS formation is creation of a full-text collection of intrauniversity TGCs (textbooks, study guides and study complexes developed by university professors). Study guides appear to be the sources of unique information which is most demanded in educational process. The development of full-text TGCs was launched in 2007. Today this base accumulates over 1500 full-text study guides and complexes and is actively replenished when new items appear. Study complexes and guides in the base are classified according to the university majors in order to reduce search time. Moreover, users can both get acquainted with the uploaded items and download them on their own memory devices.

The third area of ELS formation is the creation of a full-text database of educational and scientific literature on the basis of direct contracts with copyright holders. For now the electronic library has more than 500 items.

Convenient interface helps users to search for the necessary book by any available bibliographic detail (author, title, place and year of publication, etc.) and key words; it is also possible to convert an image to text, copy and download information on memory devices.

A significant step on our way towards library informatisation was development and incorporation of a hardware and software complex based on the Celebritas library information system whose copyright belongs to Nizhnekamsk Municipal Institute (License No. 2010611133 of Federal Service on Intellectual Property, Patents and Trademarks of 8 February 2010). Compared to the programmes offered on the market, the Celebritas system has five major advantages:

- automated service process through bar-codes and individual smart-cards;
- automated library business processes throughout whole book life cycle from purchase order processing to the filling out of a certificate of book discharge;
- possibility of network (via local network of the educational establishment) as well as remote access to ELS from remote computers through the Internet;
- possibility to provide the readers with controlled access to the Internet by individual smart-cards in the premises of the library;
- full compatibility of the project programmes with all Russian ELSs.

At a first glance the book delivery process looks rather simple: a librarian scans the library card barcode and inputs the data of the borrowed books on the borrower's records. But the preparatory work underlying this superficial simplicity is huge: creation of electronic catalogue, registration of books in the electronic system, smart-card issuance and finally library staff training in basic electronic service operations. But all these costs are covered within one academic year since with this system it takes much less time (5–10 times) to deliver a book. Thanks to automated circulation system we managed to halve our in-house library staff which is very relevant in the context of the economic crisis.

Automation of library business processes is executed by such modules as Library holdings record and acquisition, Inventory, Statistics, Books availability for educational process which in a matter of seconds allow to get any necessary information about the number of books delivered to a borrower within a certain period of time from his/her electronic database record. What is more important is that a librarian has to perform less routine and cumbersome operations, which increases effectiveness and efficiency of circulation work. From a comfortable room readers can get access to educational resources and full-text databases. Library staff continuously

work to find and provide access to full-text bibliographical databases by university specialization, Russian electronic libraries, information centres, and other Internet resources. The possibility of remote access to the ELS from remote computers for unlimited number of users made the library of Nizhnekamsk Municipal Institute (NMI) a hi-tech resource fulfilling the mission of a shared use centre (www.nmi.su). NMI hi-tech library completely meets the new requirements for university information and educational resources stipulated by order No. 588 of 7 June 2010 of the Ministry of Education and Science.

It is clear that specialists trained in hi-tech information and educational environment will be better suited for work in innovation economy.

ANNEXES

Annex I
Conference Programme

Venue:

Herzen State Pedagogical University of Russia	Opening and Plenary Sessions, Closing Ceremony, Parallel Session 1	48, bld.5, Naberezhnaya Reki Moyki (metro "Nevskiy Prospekt" or "Gostiniy Dvor")
State University of Aerospace Instrumentation	Parallel Session 2	67, Bolshaya Morskaya Street
State University of Information Technologies, Mechanics and Optics	Parallel Session 3	49, Kronverkskiy Prospect

MONDAY, NOVEMBER 15, 2010

Official Opening of the Conference (Heraldic hall, Herzen State Pedagogical University of Russia):

Chairperson: Mr. Dendev BADARCH, UNESCO Representative in Armenia, Azerbaijan, Belarus, the Republic of Moldova and the Russian Federation, Director of the UNESCO Moscow Office and Director a.i. of UNESCO IITE

Welcome speeches:

Mr. Qian TANG, UNESCO Assistant-Director General for Education

Mr. Bernard CORNU, Chairperson of the UNESCO IITE Governing Board, Director for Education, CNED-EIFAD, France

Mr. Valery GOLOSHCHAPOV, Assistant to Plenipotentiary Representative of the President of the Russian Federation

Representative of the Government of the City of St. Petersburg, Russian Federation

Representative of the Government of the Leningrad Region, Russian Federation

Representative of the Ministry of Education and Science of the Russian Federation

Mr. Grigory ORDZHONIKIDZE, Executive Secretary of the Commission of the Russian Federation for UNESCO, Deputy Director of the Department of International Organizations of the Ministry of Foreign Affairs of the Russian Federation

Mr. Gennady BORDOVSKY, Rector of the Herzen State Pedagogical University of Russia, Head of the UNESCO Chair in Sciences of Education, Russian Federation

Plenary session I: Teacher Development Policies and Programmes Integrating ICT and ODL ***Chairpersons:*** Mr. Dendev BADARCH, UNESCO Representative in Armenia, Azerbaijan, Belarus, the Republic of Moldova and the Russian Federation, Director of the UNESCO Moscow Office and Director a.i. of UNESCO IITE Mr. Gennady BORDOVSKY, Rector of the Herzen State Pedagogical University of Russia, Head of the UNESCO Chair in Sciences of Education, Russian Federation
Digital natives in a knowledge society: new challenges for education and for teachers Mr. Bernard CORNU, Chairman of the IITE Governing Board, Director for Education, National Centre for Distance Education (CNED-EIFAD), France
UNESCO teacher development policies and programmes, including ICT Mr. Alexander KHOROSHILOV, UNESCO IITE
Teacher development policies and programmes Mr. Doran BERNARD, UNESCO International Expert, USA
Teacher education and ICT in Azerbaijan Ms. Fatma ABDULLAZADE, Head of the Department of Humanitarian Policy Issues, Executive Administration of the President of Azerbaijan Republic
Russian school and new information technology: next decade vision Mr. Alexander ASMOLOV, Director of the Federal Institute for Education Development of the Ministry of Education and Science of the Russian Federation
Teacher education and ICT in Armenia Mr. Manuk MKRTCHYAN, Deputy Minister of Education of the Republic of Armenia
Teacher education and ICT in Belarus Mr. Piotr KUKHARCHIK, Rector, Maxim Tank Belarusian State Pedagogical University, Republic of Belarus
Teacher training system in Korea Mr. Dae Joon HWANG, School of Information and Communication Engineering, Sungkyunkwan University, Republic of Korea
Teacher education and ICT in Latvia Mr. Guntis VASILEVSKIS, Director of the State Education Centre, Ministry of Education of Latvia
Teacher education and ICT in Moldova Mr. Nikolay GENCHU, Head of the Department of Information Technology and Didactics, Ministry of Education of the Republic of Moldova
Teacher education in the Global Campus Mr. Roumen NIKOLOV, State University of Library Studies and Information Technologies, Bulgaria
Discussion

Plenary session II: Emerging Technologies and ICT Competencies of Teachers

Chairpersons:

Mr. Bernard CORNU, Director for Education, CNED-EIFAD, France

Mr. Dmitry BOIKOV, Vice-Rector of the Herzen State Pedagogical University of Russia

Supporting teacher development of competencies in the use of learning technologies

Ms. Diana LAURILLARD, London Knowledge Lab, United Kingdom

UNESCO ICT competency framework for teachers

Ms. Michelle SELINGER, Director for Education, Public Sector Internet Business Solutions Group, Cisco

Towards global education: the need for the 21st century literacies

Mr. Tapio VARIS, Head of the Research Centre for Vocational and Professional Education, University of Tampere, Finland

Current and prospective trends of ICT use in general education

Ms. Irina GOTSKAYA, Acting Head of Department of the Methods of Teaching of the Technology and Enterprise, Herzen State Pedagogical University of Russia

Integrating e-Learning into Future Teachers' Education

Mr. Ivan KALAS, Department of Informatics Education, Comenius University, Slovakia

Learning and teaching in a Digital Society with digital tools

Mr. Sindre ROSVIK, Education Head of pedagogic institute, Volda University College, Norway

Discussion

TUESDAY, NOVEMBER 16, 2010

Parallel sessions of the International Conference

Session 1: From Open Educational Resources to Open Educational Practices

International experts will discuss the current situation in open educational resources, the issues related to development, use, distribution of open resources, as well as copyright. It is expected that the session participants will elaborate recommendations on promotion of OER, copyright and other emerging issues for the Member States, especially CIS.

Venue: Herzen State Pedagogical University of Russia

Chairpersons:

Mr. Dendev BADARCH, UNESCO Representative in Armenia, Azerbaijan, Belarus, the Republic of Moldova and the Russian Federation, Director of the UNESCO Moscow Office and Director a.i. of UNESCO IITE

Mr. Sergei GONCHAROV, Vice-Rector of the Herzen State Pedagogical University of Russia

Open Educational Resources: main tendencies

Mr. Toshio KOBAYASHI, Subcommittee for Communication of the Japanese National Commission for UNESCO, Japan

The role of Open Educational Resources in promoting learning Mr. Rory McGREAL, UNESCO Chair in OER, Athabasca University, Canada
Open Educational Resources for higher education in the Russian Federation: achievements and problems Mr. Alexei SIGALOV, State Institute of Information Technologies and Telecommunication, Russian Federation
State-of-the-art and prospects of OER and distance learning technologies in Armenia Mr. Hmayak DANIELYAN, Yerevan University of Management and Information Technologies, Republic of Armenia
Tracing OER phenomenon in Lithuania: state-of-the-art and development perspectives Ms. Airina VOLUNGEVICIENE, Distance Study Centre, Vytautas Magnus University, Lithuania
Pedagogical aspects and trends for the use of electronic educational resources in Belarus Mr. Piotr KUKHARCHIK, Belarus State University, Republic of Belarus
Open Educational Resources in Ukraine: current situation, challenges and prospects for development Ms. Inna MALYUKOVA, Ukrainian Institute for Information Technologies in Education, Ukraine
Open Educational Resources in Uzbekistan Mr. Sadikjan KASIMOV, Tashkent University of Information Technologies, Republic of Uzbekistan
Open Educational Resources in Mongolia: current situation, challenges and initiatives Mr. Baatar OCHIRBAT, Mongolian University of Science and Technology, Mongolia
Content provision for information and education environment in the Republic of Kazakhstan Ms. Elena ARTYKBAEVA, National Centre of Informatization, Republic of Kazakhstan
IITE OER project: new dimensions Ms. Svetlana KNYAZEVA, UNESCO IITE
Open Educational Platforms Mr. Abel CAINE, UNESCO
OER and its impact on teaching practices Meena HWANG, Director, Communications and Community Outreach, OpenCourseWare Consortium
Fostering open educational practices Mr. Patrick McANDREW, Open University UK, United Kingdom

OER and copyright Ms. Karen CROPPER, Open University UK, United Kingdom
OER and copyright in Russia Mr. Mikhail FEDOTOV, UNESCO Chair on Copyright and Other Intellectual Property Rights, State University – Higher School of Economics, Russian Federation
Discussion

Session 2: Establishing Partnership between IITE, UNITWIN/UNESCO Chairs on ICT in Education and UNESCO ASPnet Schools UNESCO Chairs working in the field of ICT application in education and distance learning are invited. The main objective is to establish a network of the UNESCO Chairs. ***Venue:*** State University of Aerospace Instrumentation (67, Bolshaya Morskaya Street) ***Chairpersons:*** Mr. Alisher UMAROV, Programme Specialist for Education, UNESCO Moscow and IITE Mr. Yury SHEININ, Vice-Rector of the State University of Aerospace Instrumentation, Russian Federation
UNESCO Chair and IITE cooperation in the field of ICT in education programmes development and realization Mr. Anatoly OVODENKO, Rector of the State University of Aerospace Instrumentation (SUAI) and Head of UNESCO Chair on Distance Education in Engineering, SUAI, Russian Federation
World Conference on Higher Education and UNITWIN/UNESCO Chairs on ICT in Education Mr. Alisher UMAROV, UNESCO Moscow Office and IITE
Media literacy and global e-Learning Mr. Tapio VARIS, Head of the Research Centre for Vocational and Professional Education, Head of UNESCO Chair in Global E-Learning with applications to multiple domains, University of Tampere, Finland
Educational Technologies as a Tool for Empowerment and Engagement Ms. Emma KISELYOVA, UNESCO Chair in E-Learning, Open University of Catalonia, Spain
Organizational structure of distance learning system of a regional university complex Mr. Konstantin AFANASIEV, UNESCO Chair on New Information Technologies in Education and Science, Kemerovo State University, Russian Federation
Educational technologies of online and distance learning in modern university Mr. Dmitry POLYAKOV, UNESCO Chair in Training and Retraining of Specialists under Market Economy Conditions, Academy of Management «TISBI», Russian Federation
Discussion

Strategies of change towards sustainability in tertiary education supported by ICT: from theory to praxis Mr. Vassilios MAKRAKIS, UNESCO Chair in Information and Communication Technologies (ICT) in Education for Sustainable Development, Department of Education, University of Crete, Greece
Development of ICT skills and abilities through arts and science projects Ms. Andrea KARPATI, UNESCO Chair in Information and Communication Technologies Education, Eötvös Loránd University, Hungary
Information systems and technologies for providing quality education Mr. Yury LIGUM, UNESCO Chair in Information and Communication Technologies in Education, International Science and Technology University (ISTU), Ukraine
Educational potential of ICT for preserving language diversity Mr. Tamerlan KAMBOLOV, UNESCO Chair in Multilingual Education, Northern Ossetian Pedagogical State Institute, Vladikavkaz, Russian Federation
Latvian UNESCO ASPnet schools and UNESCO Chairs and ICT in Education Ms. Baiba MOLNIKA, Education Programme Director, Latvian National Commission for UNESCO, Latvia
UNESCO Associated Schools and ICT in education initiatives Ms. Tatyana POTYAEVA, National ASPnet Coordinator for the Russian Federation, Deputy Head of the Moscow City Department for Social Protection, Russian Federation
Discussion
The role of Open Educational Resources in promoting learning Mr. Rory McGREAL, UNESCO Chair in OER, Athabasca University, Canada
ICT in Context of Student-driven Project-based Active Learning Mr. Jianzhong CHA, UNESCO Chair on Cooperation between Higher Engineering Education and Industries, Jiaotong University, People's Republic of China
Teacher Education for the Digital Age: International Trends Mr. Evgueny KHVILON, Ms. Tatiana KHVILON, UNESCO Chair in Innovative and Information Technologies in Higher Professional Education, The All-Russia State Tax Academy, Russian Federation
Exploring online learning in India Mr. Sohan Vir Singh CHAUDHARY, UNESCO Chair in Teacher Education through Distance Mode, Indira Gandhi National Open University (IGNOU), School of Education, New Delhi, India
Law website for children as an innovative means of developing a legal culture of youth Mr. Viktor SHARSHUN, UNESCO Chair in Information Technologies and Law, National Center of Legal Information of the Republic of Belarus
Discussion

Session 3: Innovative Technologies and Resources in Education: Key Trends and Prospects for Partnership

This session will be focused on discussion of the use of emerging technologies in education: cloud computing, mobile learning, etc. Key experts of IT companies and leading professionals are invited. The session will provide an opportunity for establishing partnerships between IT companies and universities.

Venue: State University of Information Technologies, Mechanics and Optics (49, Kronverkskiy Prospect)

Chairpersons:

Ms. Diana LAURILLARD, London Knowledge Lab, United Kingdom

Mr. Andrey RYBIN, Vice-Rector of the State University of Information Technologies, Mechanics and Optics, Russian Federation

Best practices of ICT policy in education: Republic of Korea

Mr. Dae Joon HWANG, School of Information and Communication Engineering, Sungkyunkwan University, Republic of Korea

Research methodologies on integrating ICT into modern education

Mr. Ivan KALAS, Comenius University, Slovakia

Information educational environment as a basis for innovative media technologies in education

Mr. Vladimir VASILYEV, Rector of the State University of Information Technologies, Mechanics and Optics, Russia

Digital television potential in education: interactive educational television network ALLIPE.TV on the basis of ITU-D pilot project through the interactive multimedia broadcasting in the Kyrgyz Republic

Mr. Orozobek KAIYKOV, Head of the area office of the International Telecommunication Union for the CIS countries, and Mr. Almazbek ABEKOV, Director of DIMTV Ltd, Kyrgyz Republic

Development of Knowledge Society key competencies as a platform for long-term cooperation between IITE and IT industry

Mr. Alexander KHOROSHILOV, UNESCO IITE

Learning through collaboration and ICT

Ms. Michelle SELINGER, Director for Education, Public Sector Internet Business Solutions Group, Cisco, and Mr. Alexander TURILIN, Cisco Networking Academies Coordinator, Cisco

IBM initiatives in Education

Mr. Alexander SOROKIN, Manager for cooperation with universities, IBM

Intel international educational programmes in Russia, Ukraine and CIS

Ms. Tatyana NANAIEVA, Corporate Affairs Manager, Intel RCIS

Microsoft initiatives in Education system: perspectives for adaptation of UNESCO CFT in Russia

Mr. Alexey TRUBINOV, Head of Sector of Regional Development in Education, Microsoft

International Institute of Technologies and other HP programmes in the field of social innovations Mr. Igor BELOUSOV, Leading manager for Education, Research and Government Relations in Central and Eastern Europe, CIS, Russia, Hewlett-Packard
ORACLE academic initiatives – new horizons Mr. Yury GORVITS, Business Development Manager, Education and Research, Oracle Russia and CIS
Educational initiatives by Kaspersky Academy, complex approach Ms. Irina SELEZNEVA, Coordinator of educational programmes and Ms. Svetlana EFIMOVA, Head of educational programmes, Kaspersky Laboratory, Russian Federation
Using e-Learning technologies effectively Mr. Dmitry IZMESTIEV, Director, Academy of Networking LANIT, Russian Federation
Basic ICT-competency, e-Learning and e-Testing. BitMedia experience Mr. Vladimir BARANYUK, BitMedia, Russian Federation
Certification of computer literacy and ICT competence in education Mr. Alexey SKURATOV, Deputy Director, Informika, Russian Federation
E-Learning portal for school teachers: partnership opportunities Mr. Igor MOROZOV, Rector, IT Academy, Russian Federation
Information web portal of educational institution as convenient IT service, actual for all groups of users – from the university entrant to the rector Mr. Denis BUSHKOVSKY, Deputy General Director, Galaktika-IT, Russian Federation
Multivendor and academic ICT Consortium: the experience in multi-stakeholder partnership Mr. Sergey KORSHUNOV, Chief Executive of MAC ICT, Vice-rector for Educational and Methodical Work, Bauman Moscow State Technical University and Mr. Andrey PHILLIPOVICH, Chief Executive Deputy of MAC ICT, Chief of Laboratory of Technical Education in Russia of Bauman Moscow State Technical University, Russian Federation
Discussion

Closing Ceremony ***Venue:*** Herzen State Pedagogical University of Russia ***Chairperson:*** Mr. Bernard CORNU, Director for Education, National Centre for Distance Education (CNED-EIFAD), France **Adoption of the Conference Final Document**

Special event:

During the Conference, a round table will be organized for leading pedagogical and IT universities to discuss prospects for cooperation in development and implementation of the International Advanced Training Programme/ International Master Degree programme “ICT in Teacher Education”.

Annex II
List of Participants

ABEKOV Almazbek	Director of DIMTV Ltd., Kyrgyz Republic	aabekov@gmail.com
ABDULLAZADE Fatma	Head of the Department of Humanitarian Policy Issues, Executive Administration of the President of Azerbaijan	office@apparat.gov.az
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AKULOVA Olga	Head of the Educational Division, Herzen State Pedagogical University of Russia	oakulova@yandex.ru
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AZARENKOVA Marina	Professor of the Modern languages Department, Northwest Technical University	lingua@nwpi.ru
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BERESNEV Dmitry	Educators Audience Lead, Microsoft, Russia	dberes@microsoft.com
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Annex III
Conference Resolution

General Framework

The International Conference IITE-2010 ICT in Teacher Education: Policy, Open Educational Resources and Partnership held in St. Petersburg in November 2010 brought together over 120 education and ICT experts from more than 20 countries. In their papers covering a wide range of topics focused on ICT application in education, the Conference participants raised the issues related to the strategic approaches to teacher training, improvement of teachers ICT competencies, open educational resources and practices as well as the ways of cooperation between UNESCO IITE, educational establishments and IT companies in the field of ICT integration into teachers education, training and professional growth. In addition, the issues of partnership between UNESCO IITE, UNITWIN/UNESCO Chairs on ICT in Education and UNESCO ASPnet Schools on ICT-based professional development of teachers were discussed. A round table related to a new international master programme on ICT in teachers education and professional development was organized.

The participants highly estimated the Conference outcomes and confirmed their commitment to further collaboration on ICT integration into educational practices in the Conference Recommendations. In particular, supporting the concept of the development of education as a key factor of the Knowledge Society through policy advocacy, capacity development and building of a partnership, the Conference participants recommended:

- To organize IITE International Conferences biennially;
- To publish the Conference Proceedings and make Conference materials available online.

Plenary Session 1 Recommendations

Teacher Development Policies and Programmes Integrating ICT and ODL

Having discussed the topics of the teacher development strategies and programmes, including teacher supply and retention; teacher education reform; innovations in pre-service and continuing education development of teachers; standards, competencies and reward systems for good teaching and teaching in less favourable settings; ways to enhance effectiveness of open and distance learning (ODL); interactive teaching; combining formative and summative evaluation in the classroom,

Considering the fact that the UNESCO IITE s mission is to serve as a centre of excellence and provider of technical support and expertise in the area of ICT use in education, the Conference participants agreed:

- To participate in the UNESCO s review of the teacher development policies in five countries (Armenia, Azerbaijan, Belarus, Republic of Moldova, and the Russian Federation) to elaborate strategies that would address the needs for teacher recruitment, development and retention with a special focus on ICT and ODL;
- To enforce the UNESCO IITE activity in policy advocacy and research, capacity building and development, knowledge management and information support in the area of ICT application in education through collection, analysis and dissemination of information and best practices on the use of ICT in education with particular emphasis on teachers.

Plenary Session 2 Recommendations

Emerging Technologies and ICT Competencies of Teachers

Recognizing the exceptional role of the teachers education for the Knowledge Society development and the necessity in retraining of educational personnel,

Taking into account the growing impact of ICT on teachers education and professional development and confirming that e- and m-Learning, open and distance education, as well as other training technologies influence teachers competence, the participants of the Conference proposed:

- To establish a professionally-oriented social network and community of practice for teachers and experts to share expertise, and to discuss the problems of ICT use in teachers training;
- To launch under the supervision of UNESCO IITE a set of international educational programmes of different levels on ICT integration in teachers education, training, retraining and professional development including online and offline courses, e- and m-Learning technology support and access to global informational educational resources;
- To join together the efforts of UNESCO IITE, leading universities, research centres, IT companies, professional pedagogical and IT organizations to elaborate, implement and disseminate the UNESCO ICT-CFT (ICT Competence Framework for Teachers) model, to ensure its adaptation to national educational and professional standards in order to support the activities on improvement of teachers technological literacy.

Thematic Session 1 Recommendations

From Open Educational Resources to Open Educational Practices

Taking into consideration that most of the non English-speaking countries are at an early stage of OER movement and that the introduction of OER contains a number of challenges of strategic, financial, legal, pedagogical and cultural character at institutional and national levels,

Realizing that the major factors that impede wider use of OER in educational practices are lack of awareness and encouragement as well as restrictions of national intellectual property rights and lack of knowledge-sharing and remixing traditions,

Recognizing the importance of OER for the improvement of learning opportunities for people worldwide and being supporters of the OECD recommendation stated in "Giving Knowledge for Free": *academic and research output as well as the natural heritage made available in digital format with the use of public funds should also be available for free for education*, the Conference participants agreed:

- To use both top-down and bottom-up approaches: strategic decisions for the promotion of OER at the national level, administrative decisions at the institutional level and activity of educators should supplement each other;
- To arrange awareness-raising campaign on the advantages of OER for educators, to strengthen the capacity of educators in OER production and dissemination;
- To promote OER movement through networking of the universities and educational institutions creating and using OER in their educational practice;
- To address the issues related to copyright and licensing with respect to OER by means of adapting Creative Commons licenses and harmonizing the IPR legislations with CC licenses;
- To ensure free access to using and distributing of any informational educational resources developed and created at the expense of the governments budgets.

Thematic Session 2 Recommendations

Establishing Partnership between UNESCO IITE, UNITWIN/UNESCO Chairs on ICT in Education and UNESCO ASPnet Schools

Realizing the importance of close cooperation between UNESCO IITE, UNESCO Associated Schools and UNESCO Chairs on ICT in Education to improve the pedagogic practices,

Considering the broad representation of UNITWIN/UNESCO Chairs and UNESCO ASPnet participants (from Belarus, Canada, Finland, Greece, Hungary, India, Latvia, Spain, Ukraine, People s Republic of China, Russian Federation), the participants of the Conference proposed:

- To continue the UNITWIN/UNESCO Chairs activities in order to follow-up the Final Communiqué of the 2009 World Conference on Higher Education The New Dynamics of Higher Education on encouraging diversity in higher education and in the scientific community;
- To develop the UNESCO Chairs activities on ICT use in teacher education, bearing in mind the Recommendation adopted by the General Conference of UNESCO in 1997 concerning the Status of Higher Education Teaching Personnel and the provisions of UNESCO s Medium-Term Strategy for 2008–2013 related to higher education and research;
- To establish a new UNITWIN Network of the UNESCO Chairs, which will define specific effective mechanisms and options of cooperation between UNESCO IITE, UNITWIN/UNESCO Chairs and the UNESCO ASPnet Schools and will strengthen monitoring and evaluation of the activities related to the sustainability, quality, relevance and effectiveness of educational programmes;
- To provide an opportunity for creating new alliances within the university community in the framework of the UNITWIN/UNESCO Chairs Programme as well as to advocate for inviting UNITWIN/UNESCO Chairs partners to join the new Network;
- To discuss the proposal made by the UNESCO Chair on Distance Engineering Education of the State University of Aerospace Instrumentation (St. Petersburg) to host a Round Table (in June 2011, St. Petersburg, Russian Federation) to elaborate the concept and action plan for the new Network.

Thematic Session 3 Recommendations

Innovative Technologies and Resources in Education: Key Trends and Prospects for Partnership

Recognizing the importance of the use of emerging technologies such as cloud computing, e- and m-learning for educational and training purposes,

Taking into account that modern technologies in case of their evidence-based application can raise significantly the quality of provided educational and informational services considering individual user abilities,

Keeping in mind the necessity to join together the efforts of specialists within various occupational areas aiming at development and application

of emerging hard- and software tools in education, the participants of the Conference agreed:

- To define joint strategies, effective mechanisms and forms of collaboration between UNESCO IITE, educational institutions and IT companies on application of information technologies in teachers education and targeted training to stimulate teachers professional development;
- To consider a possibility of establishing an ICT in Education Consortium with the participation of IT companies, educational institutions, NGOs and international organizations;
- To facilitate access of interested organizations to data, documents and statistical materials produced by the members of the ICT in Education Consortium for the exploitation thereof where appropriate;
- To promote intensification of international community cooperation within UNESCO Member States (particularly in African, South East European, Baltic and CIS countries) to ensure accessibility and quality of education on the basis of ICT application through international workshops, conferences, round table discussions and exchange programmes.