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ICT POLICY DEVELOPMENT: A COMPARATIVE ANALYSIS THROUGH THE EDUCATION TRANSFORMATION POLICY GUIDE

This presentation introduces a support system for a holistic approach to integrating ICT in education: the Intel Education Transformation Policy Development Toolkit[1]. It features an extensive collection of global policy resources including case studies, reports, best-practice policy documents, and videos, organized around a four-phase model developed through policy analyses and expert workshops in 2012–14. Case studies, checklists for action, videos and other resources presented in the Guidebook and the accompanying Online Tool are designed to be used by a variety of users (ranging from school heads to regional or national educational policy makers) in a variety of policy contexts. They support planning through examples of good practice and also through the discussion of issues to be considered when making decisions about infrastructure purchases, curriculum content or methods of digital pedagogy to be included in training programs and introduced in classrooms.

ICT has been a central component to the social and economic transformations that are requiring new responses from educational systems. Still, few countries address these challenges through a holistic policy including teacher training, innovative pedagogical approaches and assessment techniques, and new ways of educational management. (European Commission, 2003) The figure below illustrates how different aspects of transforming education through ICTs are integrated in the Policy Guide to constitute a coherent policy defined by different levels of leadership.

[1] The authoring group of the Education Transformation Policy Guide (referenced as Kozma, 2013 in this paper) was lead by Robert Kozma, chief investigator of IEA's ICT competence surveys (the three SITES modules, cf. http:// www.iea.nl/sites-m1.html) and UNESCO's teacher and student ICT skills framework studies (cf. http://www.unesco.org/new/en/unesco/themes/icts/). A large group of experts from a variety of educational cultures also contributed with good practice cases as well as problematic policy issues.

Figure 1: Education transformation issues to be addressed by educational policy makers.
(Source: Kozma et al., 2013, p. 6.)

The Guidebook and Tool has been disseminated at UNESCO events and workshops in Europe and America. Participants reported to be able to use both cognitive tools for planning and developing ICT policies in schools, school districts, countries and at international organizations.

The focus of these policy planning instruments is to support making proper decisions on the most expensive educational expenditure to date: school computers, peripherals and internet connection etc. The Guidebook and online planning tool not only assist planning, but also help to focus on the most important issues of ICT implementation that have affected the success of policy implementation worldwide. The Guidebook analyses more than a hundred documents from thirty countries in five continents. Case studies of good practice (represented in documents, outlines and video commentaries) from more than 20 countries support decision making and inspire new developments. They are grouped around issues of selecting appropriate infrastructure, methodology and educational content in four major phases of policy development:

- Envision the Future
- Develop a Master Plan of ICT development
- Implement initiatives to realize the Master Plan
- Evaluate progress and make necessary adaptations

Phases described here may be used in any order, depending on the time when a planning or execution issue occurs that needs consultation. The figure below illustrates the content and interdependence of the phases:

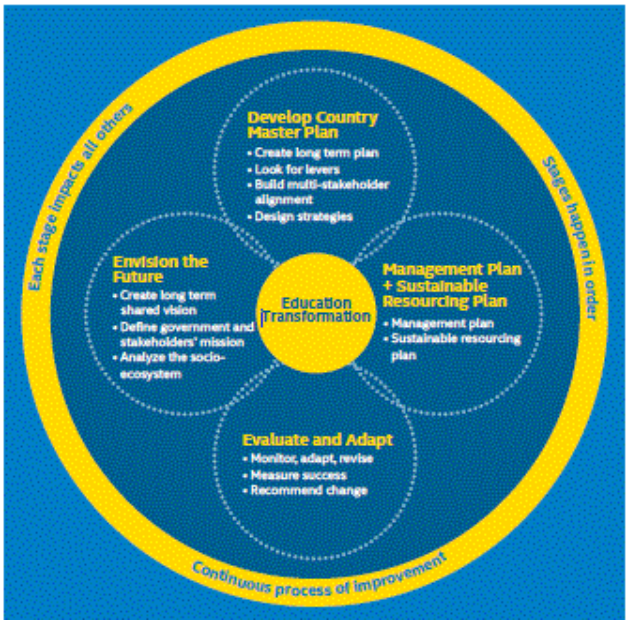
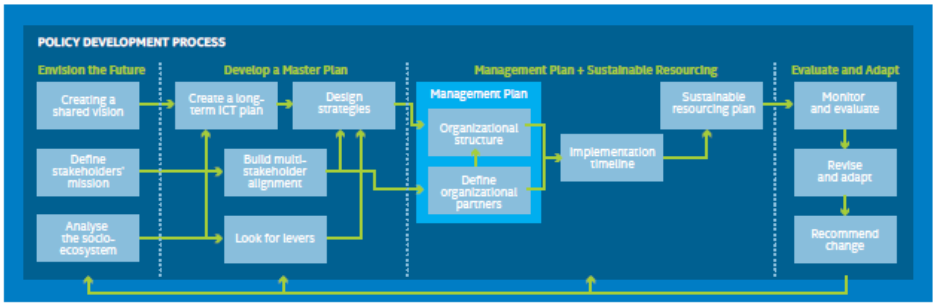


Figure 2: Phases of transforming education through ICTs.
(Source: Kozma et al., 2013, p. 5.)

The Policy Guide provides cognitive tools for staff development, school management, communication and networking from local through regional and national level. As ICT is considered in the broader context of educational transformation, planning devices in the toolkit (activities, questionnaires, checklists, observation and evaluation methodology etc.) address issues related to curriculum, assessment, teacher professional development and technical support. These actions all contribute to the integration of innovations and sustainability. Phases may be interchanged, but in most countries, policy making follows the sequence presented on the chart below:



Fiure 3: The policy development process model of the Education Transformation Policy Guide.
(Source: Kozma, Ed., 2013, p. 6.)

The presentation will illustrate the use of the Guidebook and Tool through examples of ICT policy development in South Korea, an exemplar for the use of ICTs for educational innovation showcased in the Guidebook, and my native Hungary, to illustrate similarities and differences in educational goals and objectives, and the introduction of creative solutions to support education through ICT.

Phase 1: Envision the future!

This planning phase involves long-term policy development through these steps:

1.1. *Creating a long-term vision* – preferably a 15-year plan with the first five years elaborated in detail and its actions related to future initiatives;

1.2. *Defining stakeholders' mission*: identification of institutions, companies, agencies and social groups with an interest in ICTs development;

1.3. Analyzing the socio-ecosystem: identifying resources and linking them to plans and visions.

South Korea[2]

South Korea has always considered education a key factor for social and economic development. The government of the Republic of South Korea established, with a population of 55 million, a modern educational system in 1948 that is composed of six years of elementary school, three years of middle school and three years in high school, with pre-schools and colleges are options. There are about 350 colleges and universities in South Korea, among them, 76% offer e-learning options.[3] E-learning has been adopted as a supplementary tool for the delivery of education already by 85% of primary and secondary institutions, too. Information and Communication Technologies (ICTs) are used

- as tools to support educational processes
- as catalysts (or enablers) for education innovation
- as informal learning environments
- as platforms for innovative methods (cf. the SMART Schools Project: KERIS, 2011a, 2012, 2013)

„Currently, the Republic of South Korea is seen as a leader in education and ICT. Korea consistently scores at or near the top on PISA. The Ministry of Education, Science, and Technology has received international prizes from UNESCO and the IMS Global Learning Consortium for its innovative approaches to the use of ICT. Nonetheless, the goal set out by the ministry is to become an „education superpower" through the effective use of ICT. This goal is driven by the desire to foster a knowledge-based society by developing the nation's human resource base. The premise is that knowledge is changing so fast that the economy demands people with outstanding

[2] The country officially called the Republic of Korea (established in 1948 in the south part of Korea), will be referred to this paper by its internationally used name: South Korea. (The north part of historic Korea is the Democratic People's Republic of Korea, a country also established in 1948).

[3] In 2012, 7.8 million students studied in primary and secondary education institutions and 3.6 millions in higher education institutions.

communication abilities who can swiftly acquire new knowledge and technology and solve problems with creativity. Furthermore, in South Korea, every citizen has a right to access eLearning, as enshrined in the constitution."[4] (Kozma et al., 2013, p. 22.)

- Goals of adoption of ICT and e-Learning in education
- Create mater plans based on clear context of ICT in education
- Stability of funding: IT promotion fund
- Holistic approaches: infrastructure, organization, legal foundation, government leadership and initiatives, and coordination
- Implementation strategies: framework based approach, open networking for content development, local computing –> cloud computing, open source SW, open educational resources, IPR
- Encourage participation and coordination: rewarding system, teachers, students, parents- private-public partnership, and government leadership
- Nurturing competence: teachers & school CEOs, administrators, and students
- Performance management: monitoring, evaluation of outcomes, indicators, quality control (Cho, 2014)

Hungary

Hungary has been employing ICTs in education among the first countries in Europe, from the 1990s. Information Technology was introduced both as a discipline and as a platform for teaching / learning about other areas of knowledge. First efforts of computerization of Hungarian schools targeted mainly secondary institutions, (cf. Kárpáti and Horváth, 2009) but by now, both levels are equipped with ICTs infrastructure and connected to the internet on an average EU level (cf. European Schoolnet, 2013, Hunya, 2014).

Information and Communication Technologies (ICTs) are used

- as tools to support teaching, learning and e-assessment (Csapó et al., 2014)
- as catalysts (or enablers) for education innovation (Bakos, 2014, Főző et al. Ed., 2012)
- as mobile learning environments (Molnár et al., 2011, Kis-Tóth et al., 2014)
- as a tool to support e-Government and eCitizenship initiatives (Ollé, 2013)

Open learning courses are available but only on higher education level. The table below, using the structure suggested for policy outline by the Education Transformation Policy Guide, shows current ICTs policy effort and their indicators.

[4] Explore Korea's ideas for the future of its education system at this web site: http://future.keris.or.kr/eng/index.html See how Korea is using ICT to stimulate a creative approach to learning that gives students access to education materials wherever and whenever they want: http://www.pearsonfoundation.org/oecd/korea.html

Strategy and Action	Measurable Goals	Method	Instrument and / or Key Indicators
Digital infrastructure: provision of broadband connections necessary for the use of public services online; establishment and / or further development and maintenance of local, regional and national networks.	1. Speed ;and accessibility of broadband networks; 2. Smooth functioning due to regular maintenance.	Providers' reports , User satisfaction surveys.	1. Size of networks; 2. Network speed; 3. Number of local personnel trained in maintenance.
Digital literacy: development of digital competence of citizens, staff of SMEs and staff of public management.; enhancement of skills and competences from basic to medium, from medium to proficient level.	1. ICTs courses organized with suitable content for all stakeholders targeted; 2. Actions assure accessibility ad successful completion of courses.	1. National in-service course accreditation; 2. Introduction of (inter)national student performance assessment tools (e. g. ECDL[5] examinations and standardized competence tests)	1. Number of accredited courses open for each stakeholder group; digital materials developed or purchased; number of curricular standards addressed 2. Number of students enrolled / successful graduates.

Table 1: Indicators of measurable, education-related goals based on the Hungarian National Infocommunication Strategy – Developmental strategy of the information and communication sector, 2014–2020.

The National Infocommunication Strategy for 2014–2020[6] is a strategic document that defines policy guidelines and also identifies resources for their implementation. The strategy was created by the Ministry of National Development and rests on four pillars:

1) Digital infrastructure;
2) Digital literacy and competencies;
3) Digital economy;
4) e-Government.

The first two pillars have direct connections with education, however the document is more focuses on economical issues. Horizontal issues addressed by the document are *digital citizenship* (e-Inclusion), *RDI* (Research + Development + Innovation) and *e-security*. All of these issues have implications for education.

[5] ECDL= European Computer Driving Licence, cf. www.ecdl.org, www.ecdl.hu

[6] The National Infocommunication Strategy, (in Hungarian: Nemzeti Infokommunikációs Stratégia), is available in Hungarian here: http://www.infoter.eu/alapdokumentumok/nemzeti_infokommunikacios_strategia_2014-2020

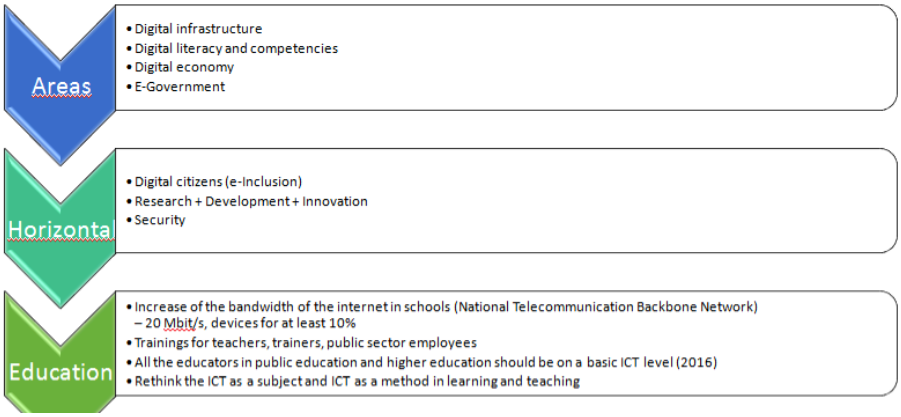


Figure 4: Areas and issues of the Hungarian ICT Strategy (as quoted by Bakos, 2014)

The *emphasis on mobile communication* provides a new challenge for education: the development of educational tools and content optimized for tablets, (supported) provision of mobile devices for schools and, above all, developing pre- and in-service training programs for teachers. A successful initiative in this area that new projects may rely on is the national dissemination and piloting of Intel's Classmate PC-s in Hungary. (Molnár et al., 2013)

In the previous decade, *employability* was the main reason for the development of ICTs skills at school, while *in the current educational strategy documents of the European Union, objectives are broader,* ranging *from e-citizenship to equal access to cultural resources and new ways of creative expression*. (European Commission, 2013a, 2013b, on Hungarian applications, Ollé, 2014). Modernization of education is a major strategic goal, and ICTs are once again an important area for achieving it. After a decade of relative neglect, digital literacy is back on the agenda as a „life skills" and an important „21. century skill".[7]

The National Infocommunication Strategy (NIS, 2014–20) defines the following objectives for ICTs in education:

- digital content development for education should be increased substantially;
- curricula for discipline based instruction (Information Technology) should be modernized, along with the integration of ICTs in all areas of education;
- widening of e-government and e-citizenship services needs digitally literate citizens to make full use of them; therefore, educators in primary, secondary and higher education institutions should be fully computer literate by 2016;
- in order to motivate educators (and other participants of the labor market) to acquire ICTs skills, digital literacy should be a basic requirement for all educational positions.

Substantial funds to realize these objectives are being allocated by the national Program for Economy Development and Innovation under the heading, „Info-

[7] See description of ICTs as core 21. century skills on the web site of the 21. Century School Partnership: www.P21.org

communication development". A resource allocation of this scope indicates that IT services are considered important accelerators of economic development.

The Hungarian Strategic Plan for Public Education, 2013[8] also assigns s*trategic actions related to ICTs in education* in these thematic clusters:

- ICT in schools,
- e-learning,
- e-inclusion,
- digital/media literacy,
- e-skills development (mainly in the following areas: knowledge of computer hardware and electronics, using a computer, using mobile devices, using office applications, searching for information, using multimedia, developing programming skills, and using social media)

These developmental objectives are based on previous efforts to integrate ICTs in all school disciplines as a lever, while also offering Information Technology as a separate discipline both on primary and on secondary level.

Phase 2: Develop a Master Plan

This phase involves the following activities:

2.2 *Look for Levers*: identifying economic and social factors beneficial for the integration of ICTs in education;

2.3 *Build Multi-Stakeholder Alignment:* catalyzing and supporting co-operation among those institutions and individuals with an interest in digital literacy development;

2.4 *Design Strategies* for successful educational innovation

2.1 *Create a Long-Term ICT Plan* in order to ensure the success of long-term changes

South Korea

The Ministry of Education, Science, and Technology in South Korea has an ambitious vision, backed by international survey results of student competence: to *become an „education superpower" through the effective utilization of ICTs*. This vision is driven by the realization that the economy demands people with outstanding communication and knowledge acquisition abilities as well as creative problem solving skills – and these can all be developed efficiently and flexibly through digital pedagogy. In the Constitution of South Korea, the right for every citizen to access e-learning is secured. Their third Master Plan for ICT in Education, Science, and Technology (2010–2014) consists of 62 tasks in four areas:

[8] The Strategic Plan for Hungarian Public Education (in Hungarian: Magyar Köznevelés-fejlesztési Stratégia, 2013) is summarized in English in the National Reform Program 2013 of Hungary by the Government of Hungary:
http://ec.europa.eu/europe2020/pdf/nd/nrp2013_hungary_en.pdf

1. Nurturing creative talents: Increasing educational use of cutting-edge information technology and expanding the all-around education system to promote lifelong education
2. Strengthening researchers' capabilities, advancing the research environment, and broadening the base of the science and technology field
3. Creating an environment where education and science can fuse and communicate
4. Establishing infrastructure for ICT in education, science, and technology (KERIS, 2011b)

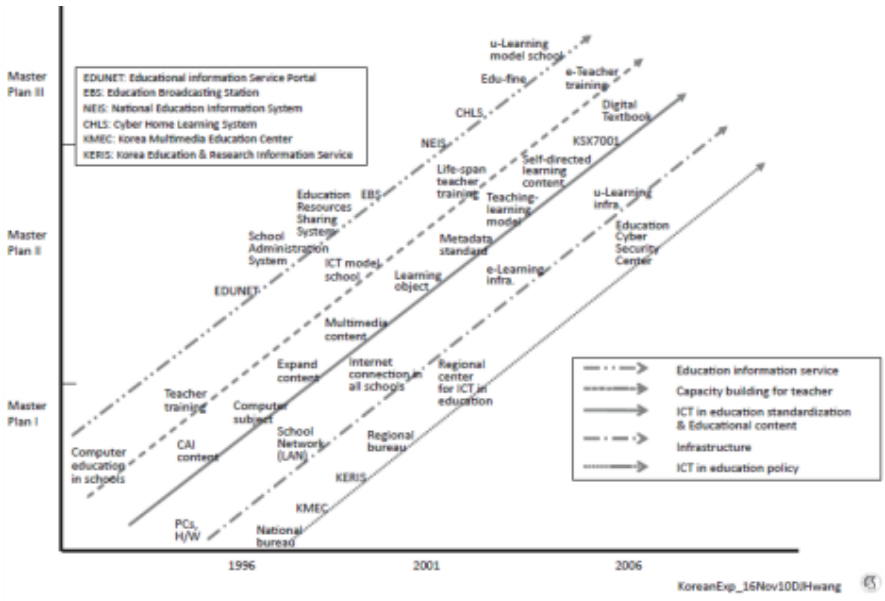


Figure 5: Initiatives of South Korea's three ICTs master plans (Source: Hwang, 2014)

Evidently, educational objectives may only be realized if they are in harmony with broader socioeconomic policy objectives. Therefore, the SMART model involves all areas and includes policies under the actions of Smart Culture, Smart Government and Smart Business as well. Ths overarching policy making strategy is one of the most important aspects of the success of South Korea's ICTs-supported educational reforms.

Hungary

According to official steering documents, students at primary and secondary level, and teachers at secondary level, are expected to integrate ICTs in the curriculum of all disciplines and also make extensive use of it in complementary educational activities. There are no central recommendations on the use of ICT in student assessment yet, but substantial national and European development funds are allocated to research and innovation in this area. (About the national e-assessment system called eDIA, cf. Csapó

et al., 2014) Educational priorities and related ICT actions are summarized in the table below.

Educational actions	**Digital pedagogy solutions**
Curriculum design (national, regional, local level)	Documents of research and innovation in digital pedagogy
Mission statements and strategies of development at national, regional and school level	National, regional and local ICTs strategy
Regional and local teaching plans	Hungarian Schoolnet's Digital Knowledge Base
Regional and local lesson plans	Online planning tools
Digital teaching/learning tool and content development	Databases of good educational practice
Integration of ICTs supported methods	Help desks on national, regional and local levels

Table 2: Educational priorities and the ICT action plan

Public-private partnerships (PPP) for promoting the use of ICTs are encouraged and good examples (like Microsoft's *Partners in Learning* initiative[9], *Intel's 1:1 laptop initiatives (*cf. Molnár et al., 2013)*, or Apple's mobile learning projects*[10]) are among the most successful training projects in the country. Most of these PPP projects are geared towards better employability through enhancement of ICTs skills and knowledge relevant for the workplace. All of them involve profound teacher training initiatives and competitions for students and teachers with lucrative prizes. Coupled with sponsored or subsidized infrastructure development, these projects are important contributors to national policy goals.

In line with the National Infocommunication Strategy, most educational goals in relation to ICTs are targeted towards better employability and more competent use of e-citizenship services. However, decreasing results in student performance surveys have emphasized the need for digital tools to support the modernization of teaching and learning methodologies and assessment. In order to b able to benefit from these, students' and teachers' digital literacy development also became an important target. In terms of infrastructure development, an obligation *to submit all types of data online (from enrolment statistics through student performance reports to textbook orders)* resulted in an increase of digital literacy among school heads and administrators and brought along positive changes in all areas of management and communication in the educational sector.

The EDUCATIO Public Services Nonprofit LLC, an institution of the Hungarian Ministry of Human Resources for schools is the central institution to support ICTs integration in Hungarian education. (cf. Főző, 2008). Services of EDUCATIO LLC:

- in-service training for teachers
- consultation services
- development of teaching aids

[9] Microsoft's Partners in Learning Project: www.pil-network.com

[10] Apple's Education laboratories and projects: http://www.apple.com/uk/education/labs/, on Hungarian initiatives, see Kis-Tóth et al., 2014.

- actions in support of local innovations through EDUCATIO LLC and its Schoolnet Agency[11]

In Hungary, decisions about educational ICTs infrastructure, contents and methods of teaching and learning and the training of trainers fall within the capacity of several ministries. Although EDUCATIO LLC acts as an efficient moderator, it is not always easy to harmonize efforts and channel resources from different institutions to major innovation targets.

Phase 3: Implement Initiatives

Actions in this phase are:

3.1 *Develop Management Plan* to realize innovation objectives;

3.2. *Develop sustainable Resourcing Plan* to provide actions with resources that will be available in the foreseeable future to maintain results.

South Korea

Within South Korea's current ICT plan, EDUNET[12] provides integrated services and digital resources that support teaching and learning related to the school curriculum. Cyber Home Learning System (CHLS) supports learning at home, including online tutors who are in-service teachers. The Digital Textbook Project[13] targets a roll out of interactive digital content for all primary and secondary students in 2013, delivered in a one-to-one scheme on a range of devices. Edu-Café is the Ministry's online professional community for teachers. The National Education Information System collects information on ICT use and connects teachers with the parents of their students. (KERIS, 2011b, KERIS, 2012)

The strategy for promoting SMART education means **S**elf-directed, **M**otivated, **A**daptive, **R**esource-enriched, **T**echnology-embedded teaching and learning. This overarching policy and inherent educational strategy is being implemented in parallel with the Master Plan for ICT in Education, Science, and Technology (Hwang et al., 2010). The goals of the SMART strategy include:

- Developing and applying digital textbooks
- Introducing online classes and online assessment system
- Improving the copyright system for free use of educational content
- Augmenting teachers' capabilities for implementing SMART Education
- Establishing wireless Internet environment in all schools (cf. figure below for details of actions).

[11] The portal of the Hungarian Schoolnet for in-service teacher education: www.sulinet.hu/sulinettan

[12] Overview of EDUNET activities: http://www.edunet4u.net/engedunet/ed_01.html

[13] Home page of the South Korean Digital Text Book Project: http://www.edunet4u.net/engedunet/bs_01_01.html

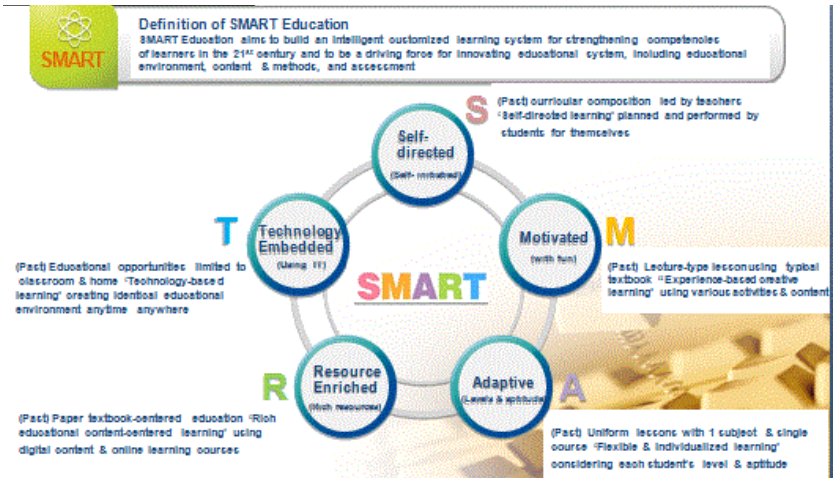


Figure 6: Phases of the SMART initiative in South Korean education. (Source: KERIS, 2011a)

The *National Teaching & Learning Center(EDUNET),* is a comprehensive education information service in South Korea with public access, but designed specifically for teachers and students. Through linkage to the central government, local governments, and schools, EDUNET provides a range of instructional and learning support material and other education-related information. The Cyber Home Learning System[14] is a web-based that enables self-study at home or at sites other than schools. Students can learn at their own pace with adjustable materials to suit individual needs. The *Digital Library Support System (DLS)* is a system that supports school libraries built within metropolitan and provincial Offices of Education, and is an Internet-based, one-stop service system that helps school libraries carry out the functions of a teaching-learning support center, digital library, and reading and culture center.

The *Digital Textbook Pilot Project* is the most significant initiative in the current ICT plan. In the South Korean approach, a digital textbook provides various digital resources and interactive functions that include didactic text, reference works, dictionaries, interactive workbooks, video clips, animations, and virtual reality environments that can be accessed at school or at home, any time of day or night. The project is based on the assumption of a one-to-one environment where each student has his or her own device. The pilot project started in 2004 with the development of fifth-grade social studies and science textbooks for the web, CD-ROMs, and PDAs. Next digital textbooks were developed for mathematics in grades 5 and 6. These were field tested in schools in 2006–2007. In 2007, textbooks for music and art were developed in the „freestyle" method, in which the contents of existing texts were redesigned for the capabilities of the technology. Texts in the other subjects were essentially digitized versions of traditional texts but combined with various digital functions to enhance their effectiveness. In 2008,

[14] The home page of the Cyber Home Learning System: http://www.edunet4u.net/engedunet/bs_02_01.html

digital textbooks were developed in additional subjects. The plan is to go nationwide with the project in the 2014 school year. The sums allocated are really substantial. They have assured the successful realization of the strategies.

Period	Budget	Implementation Strategy
1996 ~ 2000 Master Plan I	$1,406 million	Edu-Rate: Reduce Internet communication expense through collaboration with KT Tax benefit for private sector Collaboration with private IT training center to provide PC labs and instructors for public schools
2001 ~ 2005 Master Plan II	$1.596 million	Establish national IT Fund
2006 ~ 2010 Master Plan III	$269 million in 2006	Autonomy to regional government Intergovernmental collaboration Public-private partnerships

Table 3: Budget provisions for South Korea's National ICTs Strategies

Hungary

„Computers arrived to Hungarian schools the same way as the strange, wooden creature appeared in front of the walls of the besieged city of Troy. A threat and a promise, donation of God (in an educational setting: the Ministry of Education) with dubious intentions… With no previous training and very little immediate support offered, computers looked almost as strange as the wooden horse must have. Teachers decided the same way the adventurous Trojans did: let us take the mysterious instrument inside and see what happens. We all know what happened in Troy that night: the „gift" of the invading Greeks yielded warriors who opened the gates of the city for an army that was to change the fate of the city forever. But what is „inside" school computer programs? Many of us believe that the ICT culture inherent in the machines will do much more than offer another instrument for educational technology. It will alter the way we think about teaching and learning, communicating and playing at school. New paradigms of learning have been offered a chance to enter – in lucrative technological disguise – the walls of education, well defended so far from most of the modernization movements of our century." (Kárpáti, 2000a, p. 287)

This quote indicates high hopes about a massive innovation effect have vanished, but modernization of education through intensive and creative ICTs use is still on the agenda. Research centers for educational technology and ICTs have been established already in the 1980s Hungary is constantly taking part in several European ICT based innovation initiatives. The major partner for such projects is EDUCATIO LLC, but the National Institute of Educational Research and Development is also active, especially in early childhood education and ICTs use. Social implications of entering the Information Society are being investigated by the *ICT Society and Trend Research Center*[15] and

[15] English language home page of the *ICT Society and Trend Research Centre*, an important research institution in the field of social effects of ICTs (Hungarian name: Információs Társadalom és Trendkutató Központ): http://www.ittk.hu/ittk

UNESCO Chair or Multimedia in Education at ELTE University[16]. Both centers act as catalysts for educational research and the introduction of computer culture in various levels of education. The ICT Society Trend Research Center regularly monitors digital literacy and use patterns, and provides surveys on socially sensitive and / or economically important issues of the realization of the Information Society in Hungary. Major research efforts of the UNESCO Chair include the introduction of authentic tools for teaching science in pre-service teacher education, development of online testing and practice packages and development and piloting of multimedia teaching aids.

The Digitally equipped school – a model from the European Schoolnet is „ well equipped, has fast broadband (above 10mbps) and is 'connected' (i.e. has at least one of these: a website, email for teachers and students, a local area network, a virtual learning environment). Analysis of the data revealed three clusters of schools according to these measures:

- Type 1: Highly digitally equipped schools, characterized by relatively high equipment levels,
- fast broadband and relatively high connectedness
- Type 2: Partially digitally equipped schools, with lower than type 1 equipment levels, slow
- (less than 10mbps) or no broadband, and some connectedness
- Type 3: As type 2 but with no connectedness

In Hungary, very few grade 8 students are in type 1 schools but percentages in either type 1 or type 2 schools are above EU means at all grades." (European Schoolnet, 2012, p. 26.)

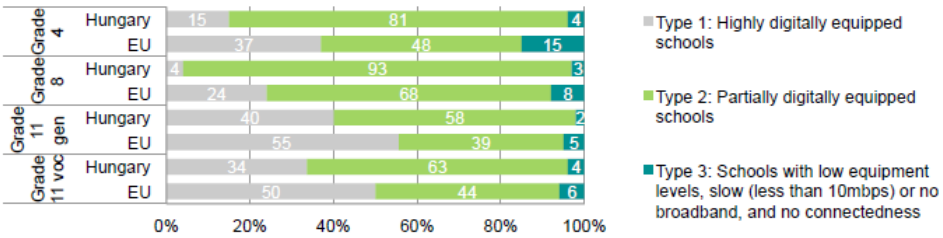


Figure 7: Digitally equipped schools (in% students, Hungary and EU, 2011–12). (Source: European Schoolnet, 2012, Fig. D.)

In the number of digitally equipped schools, Hungary ranks among the bottom group of countries, with the highest percentages of students in type 2 schools compared to other countries – almost all students are in this type of school. At other grades, the situation is similar, with Hungary among the bottom group of countries on this measure, with high percentages of students in type 2 schools at grade 4, and less pronounced at grade 11.

[16] Home page of the UNESCO Chair or Multimedia in Education: http://edutech.elte.hu/en

„Students in Hungary benefit from levels of computer access close to the EU mean, and almost all are in 'connected' schools with broadband internet (although at slower speeds than in other countries). It is at grade 8 where both teacher and student use of ICT is highest, and is close to the EU average, above as regards students. At all grades surveyed teachers' confidence in ICT is lower than the EU mean but students' is generally higher. Professional development is generally formal and takes place outside school, and many students are in schools without ICT coordinators although when they are in port they tend to be better rewarded than in other countries.

Analysis of the data in the *Survey of Schools: ICT and education* suggests a '*5C approach*' to addressing issues identified in the survey:

- *Capacity building*, through sustained investment in teachers' professional development
- *Concrete support measures*, accompanying specific policies at school level
- *Combined policies and actions*, in different policy areas within a systemic approach
- *Country-specific support*, addressing large differences and degrees of ICT provision and implementation
- *Competence development*: these four actions directed at increasing effectively and dramatically young people's digital competence and the key competences described in the European framework." (European Schoolnet, 2012, p. 28.)

Pre-and in-service teacher education and ICT

In 1999, Hungary has adopted the Bologna process for higher education and reformulated degree requirements for teachers as well. Teaching degrees for the senior grades of primary education (grades 5-8, ages 11-14) and secondary education (grades 9-12 or 13, ages 15-18 or 19) are now offered on Master level: 5 years of training on teaching two disciplines (for example, Chemistry and Physics or English as a Foreign Language and History). Bachelor level certificates are issued to teachers in junior primary grades (1-4, ages 6-10) and for Kindergarten educators (ages 3-5).

Basic training in ICTs-supported education is part of the pre-service teacher training curriculum in Hungary. In 1999, when it was first introduced as an optional course, training consisted mostly of technical skills development – nowadays the compulsory course (4 credit points, 4 lesson hours of 45 minutes per week for two semesters of 4 months duration) offers an introduction to digital pedagogy.

Compulsory in-service training involves 120 hours of course attendance every 7 years[17]. ICTs-supported teaching and learning methods may be acquired through a wide variety of optional courses, some of which will be outlined below. It is the Hungarian Schoolnet Agency, part of EDUCATIO LLC, who co-ordinates the *Intel Teach Program*[18] for in-service training in digital pedagogy. Courses frequented by 10 million teachers in 70 countries are based on the competence development model of the *21.*

[17] 120 lesson hours of compulsory course credits may be obtained through attending one course of 120 lesson hours or several shorter courses mostly 30 and 60 hours. This way, teachers can select professional areas that they find most useful for their teaching practice.

[18] Information about the Intel Teach Program Worldwide: http://www.intel.com/content/www/us/en/education/k12/intel-teach-ww.html/?iid=SEARCH

Skills Partnership[19] (in which Intel is a founding consortium member). In Hungary, initiating courses like „Skills for Success", „Getting Started Essentials", „Course Essentials Online", „Advanced Online Thinking with Technology" are very popular.

The common feature of these courses is *project based, disciplinary content driven teaching and learning*. This approach means direct links to the National Curriculum and smooth applicability of training materials. A further advantage is connected to course methodology: participants are engaged in e-learning and face-to-face, computer-supported education in ways they can introduce at school. They work in groups on a task, share results with other groups, engage in pair work in an interactive, online, computer-supported workspace environment and use the analysis of their own online activities (as manifest, for example, in comments and log file entries) to evaluate the effects of a teaching process.

Training and collaboration projects for teachers, organized by the European Schoolnet are being localized for Hungary by the EDUCATIO LLC, a partner institution of the Ministry of Human Resources. It is hoped that *innovation projects as examples of exemplary ICT use will influence educational policies* and accelerate the dissemination of digital pedagogy in the country.

Phase 4: Evaluate and Adapt

This phase involves the following activities:

4.1 *Monitor, Adapt, Revise* to see the results of individual actions and policy realization processes.

4.2 *Measure Success* to observe milestones achieved and motivate for continuation of the realization of policies

4.3 *Recommend Change* to suit plans to educational / social / economic etc. reality

South Korea

Regular, yearly surveys monitor the realization of South Korea's National ICTs Plans[20], (Song, 2011). Assessments performed about individual actions include

- *ICTs policies*: laws, regulations and budgets that contribute t the realization of National Plans;
- *Infrastructure*: access to hardware, software and the internet;
- *Human resources*: training opportunities, motivation and competence level of teachers and ICTs support staff ;
- *Curriculum*: assessment of results of the introduction of National Standards for ICTs use in Education and ICTs Literacy; realization of cyber ethics laws;
- *Service*: support for teaching, learning and educational administration;
- *Educational resources and their usage*;

[19] The portal of the Partnership for 21. Century Skills, with downloadable publications, is available here: www.p21.org, 21. century skills framework: http://www.p21.org/our-work/p21-framework

[20] Survey results are included in the annual report of KERIS, and are available here from 2010 onwards: http://english.keris.or.kr/es_ac/es_ac_220.jsp

– *Equity*: equal access by gender, region and special needs.

The periods of national data collection are short: ICTs policy makers receive updated information every four months through the analysis of online questionnaires. Surveys show high ICTs use readiness and competence levels for teachers and increased services, especially in the field of equity – a national priority. (Song, 2011, KERIS, 2011b 2012, 2013). According to the latest PISA studies published in 2014, South Korea has retained its first place (employed since 2007) in the ICT Development Index. It is among the best countries in digital text comprehension and in e-Government services (where the country has been ranked first since 2009).

Factors contributing to the success of South Korean education include strict adherence to government policies (that werecontinued after elections); appropriate provision of funds for infrastructure as well as for the development of human resources; curriculum reforms that gradually included ICTs supported innovations in the content and methodology of all school disciplines; and the introduction on educational innovations in teacher education both on in- and pre-service levels.

Hungary

Hungarian educational ICTs strategies are constantly being monitored by national and international agencies and research groups. In this part of the paper, results of the most recent European comparative survey, ESSIE, will be briefly outlined, and then, insights from an ongoing Hungarian survey effort, eLEMÉR, will be given. Both surveys indicate modest improvement in teachers' readiness and motivation as well as infrastructure for computer-supported teaching and learning, but also call attention on unresolved issues in both areas.

The European Survey of Schools: ICT and Education (ESSIE), conducted by the European Schoolnet in 2012. (European Schoolnet, 2013). This study provides up-to-date information about infrastructure and the digital skills and motivation for ICT use of teachers and students.[21] In this survey, a computer is defined as a desktop or laptop, netbook or tablet computer, whether or not connected to the internet, available for educational purposes in school. The figure below shows that at grade 8, Hungary is among the middle group of countries on this indicator with 6 students per computer, and is ranked among the middle group of countries at all other grades. In terms of internet-connected laptop computers at grade 8, Hungary is placed among the leading group of European countries – with a ratio of 18 students per laptop, and it also ranks at this level at grade 4 and grade 11 of vocational education. (Peculiarly, PC supply is on medium level at grade 11 in general secondary education).

[21] Hungarian participation in the survey: 51% of schools in Hungary for the survey of students and teachers in Grade 4, (EU participation mean: 37%), 67% for Grade 8 (EU mean: 40%), 44% for Grade 11 in general secondary schools (EU mean: 35%), 46% for Grade 11 in vocational secondary schools (EU mean: 36%).

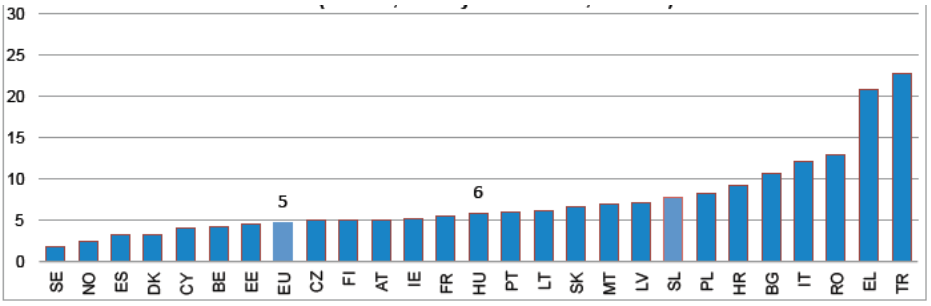


Figure 8: Students per computer in Hungary, 2011-12, grade 8, country and EU level. (Source: European Schoolnet, 2012, Fig. 2.1)

The smaller the settlement and the more inferior the school's infrastructure, the more it can benefit from ICTs-supported, collaborative, constructivist teaching methods. Therefore, infrastructure has to *be improved* here faster than in more affluent areas, as access to traditional teaching resources and in-service training is also most difficult for this group of educators. (Kárpáti et al., 2014) *Social status of families of students is related to ICTs infrastructure in a disadvantageous manner.* The higher the percentage of students from low-income families in a school, the fewer online desktop computers tend to be available in vocational schools in Hungary. Therefore, the beneficial effects of digital tools and resources (proven by research summarized in this section, under „Equity and ICTs", are nonexistent in many areas.

Computers are mainly located in computer labs at all grades, around 80% at grade 11. (This situation makes computer-supported teaching and learning a tedious lab time management issue.) Students have access to interactive whiteboards more than in most EU countries, with Hungary ranked second highest at grade 8. Hungary ranks last (11%) as regards virtual learning environments at grade 8, and is among the bottom three countries at other grades. (EU average in this indicator is 61%, the best performers – Norway, Portugal and Denmark – are above 90%). The percentage of students in schools without broadband is below the EU average at all grades, however, connection is still slower than the speed required for smooth classroom use. The availability of broadband speed faster than 10mbps, is lower than the EU mean. The percentage of students in schools with a website is slightly above, but the availability of virtual learning environments are much lower than the EU mean. (cf. figure below).

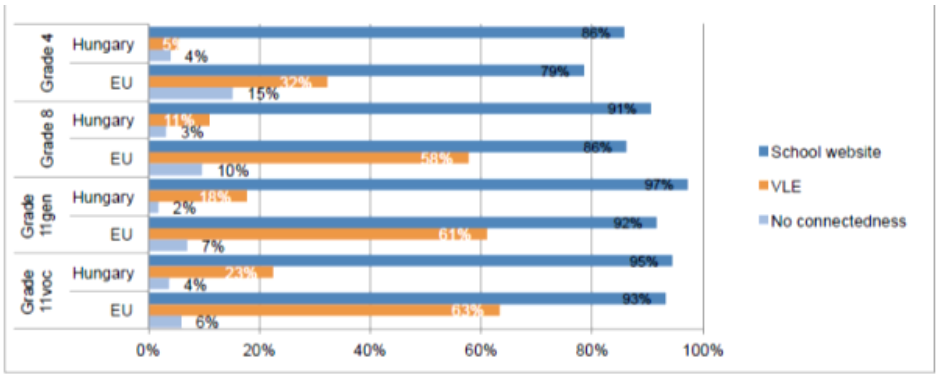


Figure 9: Percentage of students in connected schools in the EU and in Hungary, in 2011-12. Indicators: school website, virtual learning environment, no connectedness. (Source: European Schoolnet, 2012, Fig. 2.5)

Surveys about the enablers and obstacles of ICTs use in schools at the country-level are done every year in Hungary through the eLEMÉR[22] assessment system (Hunya, 2014). Created in 2010, eLEMÉR is a national portal for self-review of schools about their educational ICT use. Surveys provide reliable and sophisticated data for school development, making effects of public investments in ICT measurable on a local and national level at the same time.[23] In the first four years of the existence of this detailed and practice-based survey instrument, 2010–2013, about 700 primary and secondary schools have provided data about their ICTs culture, two-third of them more than once. This is more than one tenth of all Hungarian schools – but a sample that contains those institutions that are (or intend to be) active in ICTs-supported development. Thus, data reflect achievements of „those who care". However, they are not necessarily the best ICTs users, so results of the survey are utilized to define central developmental measures and evaluate the results of previous national ICTs management decisions.

Hundred positive statements serve orientation purposes for schools and their regional and national managing institutions in four broad areas:

1. Learners and learning
2. Teachers and teaching
3. School management
4. School ICTs infrastructure

[22] The part of the portal that contains information about ICT-related projects and the eLEMÉR school self-assessment system is http://ikt.ofi.hu. The name of the system is a pun that cannot be translated literally into English. „*Elemér*" is a Hungarian first name for males, „e" as a prefix usually stands for electronic solutions (as in *e-tanulás* in Hungarian, e-learning in English) and „*lemér*" is a Hungarian verb that means „to assess". The logo of the software is a tailor with a measuring tool. Questions to the Editor of the system may be sent using the 'Question to the editors' box, or by sending an e-mail to elemer(@)ofi.hu.

[23] Schools voluntarily complete this survey any time and receive a yearly feedback about their performance in comparison to the average of other schools in the survey. As a stimulus, data providers are invited to staff development courses, and regularly receive news about grants.

The system is run by the Hungarian National Institute for Educational Research and Development[24]. Schools may use a Likert scale to assess the level of their ICTs use with the following values: (0) Not applicable, that is the statement is not relevant to your school. (1) Unsolved, that is the problem in question is not solved in your school. (2) Partly solved, but there are already initiations to solve it. (3) Nearly solved, but there are a number of measures to be taken. (4) Completely solved. (Hunya, 2014) On 28 February each year[25], a new report is generated from the data of the eLEMÉR online self-report system for ICTs infrastructure and use at schools, described in the „Monitor, adapt and revise" section above. These documents outline national trends and results according to school type (see Hunya, 2014, for the latest report)[26]. Using results as benchmarks, change and development in individual school can be compared with regional or national data published in the document and stored in a database. The general public may access reports and their background data but may not see documents uploaded by the individual institutions.

In the second survey executed in 2012, 723 participating schools fell within four categories, according to ICTs development:

1. 218 of them showed basic ICTs use, described by the label, „ICTs have appeared"
2. In 251 schools, „ICTs are being implemented"
3. 207 institutions reported „integration of ICTs"
4. 47 schools indicated „change catalyzed b the use of ICTs", the highest user level. (Hunya, 2013)

Data collected in 2011 and 2012 were compared in a study about the process of ICTs integration in 83 schools that participated in both surveys. In the schools that performed the survey for the second time, intensive improvement was observable. Their accession in the higher levels of ICTs use is larger than average improvement. (See figure below.) This result indicates that *regular self-assessment is an effective method for the increase of performance through evidence based policy making on local level.* If regional and national policy makers utilize survey data to intensively, similar trends may be observable.

[24] The Hungarian name of the institute: *Oktatáskutató és Fejlesztő intézet,* acronym: OFI. English language pages of the Institute: http://www.ofi.hu/en/hungarian-institute-educational-research-and-development

[25] This is the name day of Elemér, the male name behind the acronym for the assessment system.

[26] Survey reports and school portraits – volumes of studies – are accessible in Hungarian only here: http://ikt.ofi.hu.

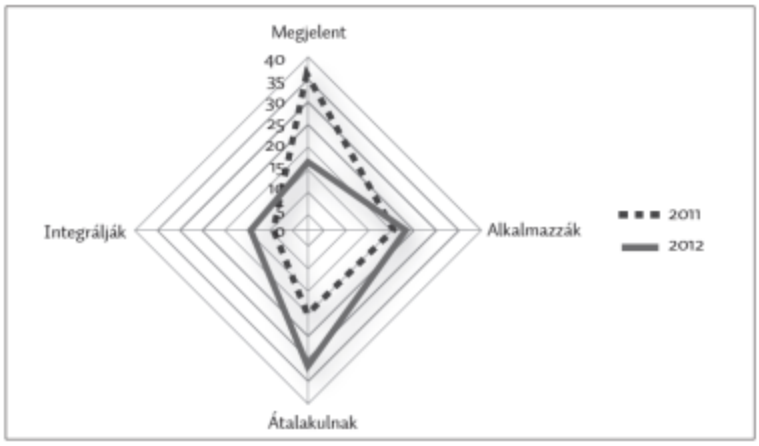


Figure 10: Improvement in ICT infrastructure and use of schools assessed for the second time. Translation of Hungarian words in the image, clockwise: Megjelent = ICT has appeared at school; Alkalmazzák = ICT is employed in teaching / learning, Átalakulnak= ICT has transformed teaching / learning; Integrálják = ICT integrated in all areas. (Source: Hunya, 2003, p.136., Figure 2.)

In 11 out of 83 institutions, very significant change occurred (they „jumped" two user cathegories); 23 schools stepped one level up; 48 institutions stayed on the same level and only one decreased performance. In the evaluation criteria for „institution management", schools who did the eLEMÉR survey for the second time, have achieved significantly better results than the national average. This finding also indicates that regular (self)assessment significantly contributes to the enhancement of school management. *The use of Intel's Guidebook (Kozma et al., 2014),* that is a also a self-assessment tool for national ICT integration and *may produce increase of performance on a national level.*

Summary

Results in ICTs supported teaching and learning of South Korea are due to its attention to investment in ICT in education, the major prerequisite for sustainable development. E-Learning and digital textbooks are being made available in all levels of education and teachers' training follows course with improvements through the integration of ICTs supported innovations. Still, there are issues to be addressed to maintain this favorable position – one that has substantially contributed to the country's outstanding results in international surveys of student competence. (Cho, 2014, Hwang, 2014)

Existing ICT infrastructure is getting old; its maintenance and renewal is imminent. Technical personnel needs to be employed more than before to address this issue. *Teacher capacity building* has always been considered a key priority, and it needs to be intensified as new media, methods and tools of teaching and learning are being introduced. Teacher training programs should include comprehensive educational issues

not limited to ICT technology solely, to empower teachers to develop innovative ways of teaching with ICTs.

Large amounts of *digital educational content* available in South Korean encourage more and more teachers to use them increasingly to replace traditional methods of teaching and assessment. However, the functions of digital teaching aids need to be improved successfully integrated into regular curriculum and add values to traditional printed textbooks. E-content or education needs to be more organized: it is important to establish a national organizational structure collecting, creating and sharing processes of quality educational content. EDUNET, the school network agency that 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, can be instrumental in this process. It is an imminent task to develop national standards for educational resources and an adequate quality assurance system.

National policies should continue to focus on *reducing and diminishing disparities among gender, region, and economic status* of teachers and students and achieve sustainable equity in the education sector. Accessibility is one of the key issues in this policy, the social and cultural environment relevant for authentic training in digital literacy should also be considered.

In Hungary, educational researcher regularly monitoring the role of ICTs in Hungary provide a range of *evidence based suggestions for policy makers* that may beneficially influence further efforts in ICTs integration in Hungary. A selection from these illustrates what our country can learn from South Korea (and other leaders of ICTs supported innovation) and which areas need urgent attention:

- *ICTs policy should be developed in sufficient detail for all levels* (national, regional and local) and backed with necessary funding (for infrastructure and training as well as assessment, and related research / development) to realize its goals;
- *Schools' ICTs strategies should approach infrastructure and content to students' private ICTs environment*. Info- and edutainment are a necessity, gamification a viable option, integration of Web 2.0 technologies an imminent need.
- *E-assessment for better e-learning*: readily available assessment options like eLEMÉR and eDIA make data-driven policy development a reality at all levels. These optional surveys, when professionally employed, may greatly contribute to the attainment of general, educational and ICTs strategies alike;
- *For a more efficient and transparent communication among major educational stakeholders* (educational policy makers, school leaders and administrators, teachers, students, parents, community partners etc.) should also *make adequate use of ICTs.* Education as a public service should be made more transparent, approachable and interactive;
- *Infrastructure should be exploited to its full potential* – more content and methodologies and less hardware are needed;
- *Central provision of textbooks, supported with digital teaching aids should be coordinated with pre-and in-service teacher education*; training institutions should prepare for the use of new types of materials suitable for blended learning methodology and materials;

- *„Bring your own device" (BYOD*) is a reality, not a dream: Hungary being one of the most proliferate mobile phone user in the world, educational use of these and other communication tools (tablets, notebooks) should also be made more frequent.
- *Community ICTs center s are still important learning environments* that may substantially contribute to equal access to and just-in-time, in-depth development of digital literacy of children, youth and adults.
- *Creative and documentary use of visualization options* provided by the graphic, photographic and filming tools built in most mobile and desktop devices should make learning more motivating and meaningful.
- *Web 2.0 technologies should be used as platforms for informal learning:* student proficiency in their private use would make them ideal learning environments. Their regular utilization would increase time spent on learning tasks, provide additional communication channels among educational stakeholders, support involvement of experts in teaching and learning and support authentic acquisition of knowledge.

The Educational Transformation Policy Guide introduced in this paper through illustrating its suggested phases of developing and assessing ICTs related educational policies, may be an appropriate tool for assisting this development.

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