E-SKILLS IN THE KNOWLEDGE SOCIETY.
CONTRIBUTION OF INTEL EDUCATION PROGRAMS

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Abstract: Both teachers and students participating to education in the 21st Century are using several new skills in order to build and to acquire knowledge, competences, attitudes for increasingly competitive social and professional life. Educating today for tomorrow means bringing challenges of the cutting edge of technologies, methodologies, and conceptual development in the education set-up. Together with e-skills and indissolubly connected to them, competences such as critical thinking, cooperation, communication, creativity are nowadays part of the learning acquisition, developed in advanced distributed learning environments, facilitated by competent teachers and innovative tools. Intel’s contribution is taking various forms, addressing the very core of education. Projects and programs are developed and implemented, for long periods, all over the world in collaboration with governments and development agencies. Main components of the Intel Education Initiative are targeting improvements at education policy level, in teacher training, in developing creativity in learning, and in science education.

Keywords: e-skills, competences for 21st Century, education policies, e-learning, Intel, education programs

I. INTRODUCTION

Our professional and social living is continuously transforming as a result of the new challenges of today’s world: rapid social and technological transformations, economic and cultural globalisation, growing individual and social diversity, substantial inequality of opportunities, poverty and conflicts, economic crises and ecological destabilisation. The i2010 policy proposed five years ago by the European Commission is a strategic framework addressing these transformations, focused on key-elements such as ICT competences, shifting from “access for all” to “e-Skills for all” concepts and general orientation. The underlying philosophy of the development of a European information society for growth and employment relies on the “lifelong learning” and “quality education” pillars, being strongly related to competences for the 21st Century such as creativity, innovation, communication, cooperation, critical thinking etc. The new technologies are becoming “just technologies”, naturalised tools of the Knowledge Society in which we are living.
Therefore, e-Skills are to be viewed in a larger framework, as abilities, capacities or competences both to use and to transform the ICT tools. E-Skills are part of the education for tomorrow - a significant component of the knowledge-citizens’ baggage of competences in order to be prepared to use and to further create knowledge.

ICT is improving performances of other sectors, from media, industry, agriculture, to culture, health and education. European Union specific policy documents promote the positive contribution that information and communication technologies can make to the economy, society and personal quality of life. Overall, it is essential that the approach to e-Skills development would take into account on one hand, various ways to integrate digital competences development into the formal education system, and, on the other hand, the added-value that various stakeholders could bring into the process: companies, NGOs, opinion leaders, researchers, decision-makers. A common effort is necessary to form the human resources properly equipped with skills and knowledge to act and to live in today’s world.

In this respect, it is Intel’s belief that quality education could be achieved through continuous commitment and participation, through collaboration and shared responsibility. As a guiding principle, mission and concrete engagement, Intel is directly involved in education today to inspire tomorrow’s innovators.

II. E-SKILLS CONCEPT AND INITIATIVES

As part of the digital agenda for the EU, in 2007 the European Commission launched a strategy for promoting the ICT skills of European citizens and ICT practitioners under the title: ‘e-Skills for the 21st century: fostering competitiveness, growth and jobs.’ The EU’s drive to become a leading knowledge-based economy within the Lisbon Strategy targeted not only the shortage of high-level ICT skills, but also the lack of basic ICT skills of different population groups in Europe, which contribute to lower employability and social exclusion. In 2010, designated as the European Year for Combating Poverty and Social Exclusion, a special focus is placed on digital literacy training and promoting equal access for all to ICT, with an emphasis on meeting the needs of disabled people and people in disadvantaged position.

In this context addressing the ICT skills of European citizens requires different approaches according to the level and type of necessary skills. IT practitioners and the younger generation, who grew up surrounded by technology and developed high-level internet skills can benefit from extending their already advanced skills. People in disadvantaged conditions without access to ICT and digital literacy can benefit from developing skills for benefiting from digital technologies to improve their life and work. People with basic ICT skills can benefit from acquiring skills to employ digital technologies for solving problems and as tools for reaching objectives, for enhancement and innovation, including generating business solutions and opportunities.

The concept of e-skills reflects this heterogeneous group of competencies related to ICT and to active participation and leadership in the knowledge-based economy and society. e-Skills are only a subset of the broader range of talents and skills that people need to compete and succeed in this context. These include information and communication skills, thinking and problem-solving skills, including creativity and intellectual curiosity; as well as interpersonal and self-directional skills (Partnership for 21st Century Skills, 2007). E-skills encompass a broader set of competencies than ICT skills. The definition for e-skills adopted at the European e-Skills Forum of 2004 is three-fold and distinguishes between skills of ICT practitioners, ICT users and for e-Business (Table 1).

| Table 1. E-Skills sub-skills as defined at the European e-Skills Forum in 2004 |
|-------------------|-------------------|-------------------|
| **e-Skills**      | **ICT practitioner skills** | **ICT user skills** | **e-Business skills:** |
| Capabilities required for researching, developing, designing, strategic planning, | Capabilities required for the effective application of ICT systems and devices by the | Capabilities needed to exploit opportunities provided by ICT, notably |

According to European Commission’s specific policy documents, the positive contribution of information and communication technologies is significant for the economy, society, and personal quality of life. Overall, it’s essential that e-Skills development would integrate digital competences into formal education systems and account for the added value of various stakeholders, including companies, NGOs, opinion leaders, researchers, and decision-makers. A common effort is necessary to equip the human resources with the necessary skills and knowledge to act and live in today’s world. Intel believes that quality education can be achieved through continuous commitment, participation, collaboration, and shared responsibility, directly engaging in education to inspire tomorrow’s innovators.
managing, producing, consulting, marketing, selling, integrating, installing, administering, maintaining, supporting and servicing ICT systems

individual. ICT users apply systems as tools in support of their own work. User skills cover the use of common software tools and of specialized tools supporting business functions within industry. At the general level, they cover “digital literacy”

the Internet; to ensure more efficient and effective performance of different types of organizations; to explore possibilities for new ways of conducting business/administrative and organizational processes and/or to establish new businesses

In “Building E-skills for the Information Age,” Lanvin and Passman (2007) argue that the need for e-skills at all levels and in all industries will significantly increase due to the global knowledge economy. Providing the required e-skills has already posed a serious challenge to the educational systems and there is a growing gap between the requirement of knowledge-intensive economies and the capability of the current educational systems to equip graduates with e-skills.

A broad approach to promoting e-skills through changes in the educational system, however, faces many challenges, including the question how to identify all sub-skills within the concept of e-skills. One framework was suggested as a result of a study conducted in Germany in 2004. The eSkills-Competence study of the D21 Initiative in Germany surveyed human resources (HR) experts and managers about their expectations for skills of young people entering the workforce. The aim of the study was to find out which skills and personal characteristics students need for a successful transition from school into work. The results from the survey were related to categories concerning e-skills identified in an extensive literature review of publications on this topic. E-Skills were defined as competencies and personality characteristics, which enable people to deal with the changing conditions posed by the information age in school and work. Thus e-skills include general and IT-specific skills, media-, methods-, and social skills, and skills related to personality characteristics (Figure 1).

**Figure 1.** e-Skills Cylinder (Adapted from Taubken, 2004)

Despite the limitations of such a broad and empirically-based approach, this framework offers a different foundation for exploring ways to promote e-skills by addressing needs on different levels. While the study found out that all levels of e-skills were important for HR managers, it stresses the importance of personality characteristics in relation to ICT use, which were rated highest. It was shown that school graduates were expected foremost to be committed, responsible, reliable, independent and flexible in order to have a successful transition from school into work. Furthermore, they were expected to be able to communicate via new media and handle it responsibly (media competencies), to be goal-oriented and able to take action to solve problems efficiently (methods competencies) and to be willing to improve their skills and to learn, and be ready for collaboration and communication (social competencies). Additionally almost all HR managers considered as obligatory
that young people are literate, and that they are able to use applications for word processing, spreadsheets and presentation (general and IT basic skills).

From this perspective e-skills overlap with the concept of 21st century skills, particularly in relation to knowledge. According to Kozma (2008), approaches to educational reform toward building 21st century skills can be based on the three factors that drive productivity-based economic growth—capital deepening, higher-quality labor, and knowledge creation. Thus, efforts can focus on increasing the technological uptake and basic literacy skills (knowledge-acquisition approach), increasing the ability of the workforce to use knowledge to add value to economic output by applying it to solve complex, real-world problems (knowledge-deepening approach), and increasing the capability of the workforce to innovate and produce new knowledge and by increasing the capability of citizens to benefit from this new knowledge (knowledge-creation approach). Respectively, policies to educational change toward 21st century skills development from these perspectives should address different competence areas:

- **Knowledge acquisition**: The policy goal is to prepare a workforce capable of taking up new technologies and contributing to economic productivity. Education policies focus on increasing students’ enrollments, ICT skills, and scores on standardized tests, primarily in reading and math.

- **Knowledge deepening**: The policy goal is to upgrade the productivity of the workforce so that it can add value to economic output. Education policies focus on improving the understanding and problem-solving skills of students and connecting school learning to real-world problems and contexts.

- **Knowledge creation**: The policy goal is to increase innovation and knowledge creation to drive the knowledge economy. Education policies are focused on the research, development, generation and sharing of new knowledge, and on continuous learning. Schools, teachers, and students participate in these endeavors.

Both empirically-based and theoretical approaches to the question how to prepare young people to succeed in the conditions of global knowledge economy argue for a more pronounced role of formal education in developing students’ skills related to ICT use. When formal education is concerned, Europe is considered well placed in international rankings, such as OECD’s PISA. However, for the most part the digital literacy of young people is acquired in informal contexts and remains mostly related to communication and entertainment. More efforts need to be put in developing students skills through formal education, which gives better chances for targeting the areas identified by employers as most needed. Central role in such efforts is played by teachers and it is urgently needed to provide professional development for this purpose. Targeted educational policies, teacher professional development for technology integration and changes in the curriculum therefore can be seen as key areas for measures toward developing e-Skills through formal education.

### III. CONTRIBUTION OF INTEL TO E-SKILLS DEVELOPMENT

The development of e-Skills for new generations is a complex endeavour, linked to all levels and types of education, supported by various components and by different related skills necessary in the 21st Century.

E-Skills are among the key competences putting basis of the education today. It is important to emphasize that these transversal skills are not to be seen only as an achievement of learning, but as well as a premise for acquiring other competences, behaviours and attitudes. Consequently, in the education process the computer should not be seen only as a means for informing students, but as a tool for promoting initiative, involvement of students in the activity, and fostering autonomous learning.

Therefore, when we talk about introducing ICT in education we mean a broad area of interventions, aimed to raise, along with e-Skills, an entire set of competences specific to 21st Century future professionals.

The programs initiated by Intel Corporation are addressing the very basis of the education for 21st Century, being oriented towards several core components of the education and training systems:
education policy, teacher training, pedagogical and technological support. The paradigm circumscribing these interventions relies on social constructivism, encouraging education actors to involve into project-based learning activities and to develop significant learning situations, very well designed and thoughtfully valorised towards life-long learning acquisitions and competences for tomorrow.

**Education policy support.** Intel’s name is constantly brought into public discourses as being a competent and trustful partner, contributing to designing of modern education policies in European countries. Intel is supporting governments to develop education policies towards implementing education solutions for the 21st Century through providing specialists to elaborate ICT competence standards for teachers, establishing common arena for stakeholders networking, designing appropriate frameworks for policy documents etc.

**Teacher training.** Intel Teach program is focused on the integration of ICT into classroom activities, helping teachers to be more effective educators by training them on how to integrate modern tools into their lessons and promoting problem solving, critical thinking and collaboration skills among their students. Intel Teach is the largest, most successful program of its kind, with over 1 million teachers trained in Europe and over 6 million teachers trained worldwide.

**Teaching and learning support.** A series of pedagogical tools and materials are available online for teachers, supporting them into their daily activities, to shift the accent from knowledge acquisition to competences development. Furthermore, Intel Learn program is helping young learners in developing countries to learn key skills, with a focus on technology literacy, problem solving, and collaboration.

**Promoting creativity and innovation.** By supporting world largest science competitions for pre-college students, Intel is encouraging and promoting innovation among young people. Annually, Intel International Science and Engineering Fair (ISEF) is bringing together more than 1400 young scientists from more than 40 countries, regions and territories to share ideas and showcase cutting-edge science. E-skills are combined with knowledge in various domains in order to reach competitiveness and to put basis of solid professional grounds.

### 3.1 Intel Teach programs in Europe

The Intel Education Initiative is Intel’s sustained commitment to prepare all students, anywhere, with the skills required to thrive in the knowledge economy by improving teaching and learning through the effective use of technology, and advancing math, science and engineering education and research. Through a sustained public-private partnership with educators and governments, Intel works with international organizations and governments at an international, national, and local level and invests significant resources in education programs adapted to address the needs of each country to advocate for 21st century educational excellence through policy work and awareness efforts.

Intel Teach program uses a "train the trainer" model to provide either face-to-face or online instruction to help teachers around the world integrate technology into their classrooms. The program has been implemented in more than 50 countries worldwide, and it has trained nearly 1 million teachers in Europe – in countries like Germany, France, Ireland, UK, Israel, Italy, Romania, Russia and Turkey.

The use of the new technologies in education requires new knowledge, skills and attitudes from teachers and the development of an information culture, which is understood not only as a register of specialised skills, but also as a new orientation and consideration of reality. European teachers going through continuous professional development offers of Intel are more prepared to approach the design and implementation of modern, student-centred, and efficient lessons. More than 80% are declaring their satisfaction towards the program and, more important, the concrete positive outcomes of their improved educational activity with their students.

Recently, Ute Erdsiek-Rave, President of the Ministers of Education Conference in Germany, described the Intel Teach program benefits referring to their contribution towards improving education and training systems: “I do not know of anything comparable in Europe. This cooperation between teachers points the way forward because it satisfies the new EU Directives for professional development, e-learning, and lifelong learning.”
3.2 Intel Teach Essentials

Intel Teach program addresses pre-university education teachers of all subject-matters. In brief, teachers are thought to design better learning situations and to create lesson plans that can be immediately implemented, meeting national education goals and standards, helping to integrate technology in the classroom.

The Intel Teach program is implemented in a country whenever there is a will to create a shift towards 21st Century learning and teaching in the education system; the course is about teaching strategies and about assessment, empowering teachers to make full use of the pedagogical principles in educating the new generations. On the other hand, having a complex content of high-level quality, the program needs several months of preparation and a certain level of support from the local partners: Ministry of Education and, in many cases, a training agency.

The Intel program is considered a firm component of professional development offered by many states across Europe since a decade ago.

Like other educators across the world, European teachers recognize the importance of helping youth acquire digital literacy skills. But more important, a significant number of teachers utilising technology for lesson planning and for various teaching sequences started to use ICT focusing on learning process and on students’ acquisitions in specific study domains.

Students are gaining technology literacy and developing other key 21st century skills after their teachers’ involvement in the Intel Teach Program. They are also engaging in more student-centered learning and taking part in projects with real-world relevance, including projects that help them learn about other cultures and explore common bonds.

In short, Intel Teach program can be described by several main points:

Challenges
- Today’s students need to learn technology and other 21st century skills in order to participate in the knowledge economy.
- While many teachers use technology in lesson planning, few use technology in the classroom.
- Teachers are in need of effective strategies to integrate technology into instruction and help their students acquire key 21st century skills.

Approach
- Provide professional development to teachers to enable them to integrate technology effectively in their classrooms and to help students acquire key 21st century skills, including digital literacy, problem solving, critical thinking, and collaboration.
- Employ project-based learning to help engage students in meaningful learning experiences, including projects addressing real-world issues.

Benefits
- Through the Intel Teach Program, 1 million European teachers are now able to effectively integrate technology into their instruction and help their students develop key 21st century skills.
- As a result of improved instruction, tens of millions of European students are now learning the skills they will need to compete and thrive in the knowledge economy. Therefore, it is not only about students acquiring technology skills, but they also have honed other 21st century learning skills, such as thinking critically, problem solving, and working collaboratively. Further, the integration of technology has expanded the diversity of methods employed by teachers and their pedagogical background to better approach their daily contribution to human resources development.

3.3 Intel Teach Advanced Online

Intel Teach - Advanced Online was developed in Germany, following the successful implementation of a basic course for technology use in teaching. The concept for the advanced course was developed by the Academy for Teacher Professional Development and Personnel Management in Dillingen (ALP) - a state-owned Teacher Training Centre belonging to the Ministry of Education in Bavaria, Germany. It was subsequently localized and implemented in England, France, Ireland, Israel, Italy and Jordan. The program is based on blended format of face-to-face meetings and individual and collaborative learning supported by an online platform, which enables self-paced on-the-job
professional development. The “train-the-trainer” approach used for the course enables a high degree of support, through the presence of mentors in the schools and communities of the participants in the program.

The professional development process in Intel Teach - Advanced Online follows a step approach. After registration for the program teachers are introduced to the concept and content by a trainer in a face-to-face meeting. The next steps include using the online platform to study the available methodological information for integrating technology in a learner-centred classroom and example materials, and discussing in groups the requirements and objectives of the training. Teachers select a focus for their training from the possibilities available on the online platform, based on their personal professional needs. This pedagogical framework is called ‘Learning Path’ and within it teachers use a selected pedagogical approach or certain technological tool to develop a unit plan, implement it in their classroom practice, evaluate it and enhance it for further use.

Learning paths are either driven by the used pedagogical approach or by the application of specific digital media, e.g. data handling and data analysis; using digital technology to allow students to work collaboratively online. Learning paths can be chosen by subject, by concept (e.g. task-oriented, inquiry, hands-on, etc.), by various teaching methods and learning styles. The program curriculum consists of a minimum of one learning path, while the participant teachers are free to choose to work on more paths. The intended distribution of time for completing a Learning path is 8 hours for introduction to the concepts, methods and technology, 12 hours for working on a Learning path collaboratively with other teachers, and 20 hours of individual learning using the available online resources and tools.

The online platform is customized for the countries where it is implemented, with several main areas to suit personalized needs at a particular time: areas for work with the learning path and areas with resources, collaborative tools, additional information and online support. Using the training platform is flexible and teachers have the choice to participate in the training from home or from school, depending on their preference and technology availability.

In order to complete the chosen learning path, teachers work collaboratively with other teachers. The majority of their learning is done either in collaboration with their team, or individually, and is extended over a period of time. When teachers develop an effective method that is working very well in their teaching and has shown good results with their students, they are encouraged to share it through fitting the method within the pedagogical template and then positing it on the platform for other teachers to benefit from. Teachers also evaluate their learning individually and collaboratively and plan for further enhancement and extension, which provides them at the same time with knowledge how to embed research and continuous evaluation in their day-to-day teaching.

The program Intel Teach - Advanced Online in Germany is subject to systematic external evaluation for determining the direct effects of the training and for enabling continuous improvement and sustainability. In the period from 2005 to 2008 the evaluation of the program was conducted by the Institute for Media and Educational Technology in the University of Augsburg (Ganz & Reinmann, 2005, 2006, 2007; Hauptle, Florian & Reinmann, 2008). The evaluation includes surveys, interviews and case studies. The main body of data has been collected through an online, self-report end-of-training survey of teachers who completed the program in the period from January 2005 till April 2007 (n=4633) and between May 2007 till October 2007 (n=403) with a total number of 5036 online questionnaires filled out.

According to the self-assessment of the participating teachers, the program improved their technical and methodological competencies for using digital technology in instruction. As result of their participation in the program teachers declare to have a lot of new ideas to use digital media in teaching, and increased their confidence to use new media in the classroom, their appreciation for self-evaluation and collaboration as part of the teaching practice.

Concerning the indirect effect on students, increased motivation is among the most frequently reported positive effects from applying digital media in class in combination with learner-centered approaches (87,5%). Teachers also report higher interest (75,8%) and participation (75,7%) of students in the lesson. Less effect is seen on students’ active learning through generating more own ideas to reach the objectives of the lesson (51%) and raising questions (43,7%). However, teachers report increase in students’ support (64,3%) and self-organization (64,2%) during team learning after implementing in class the unit developed as part of the Learning Path. Improvements in students’
skills for digital media use, such as handling software applications, using digital media in a more targeted way and for self-directed learning, were also indicated by the majority of the teachers.

The positive outcomes from the implementation of Intel Teach – Advanced Online confirms that a program based on effective design principles supported by solid theoretical background and empirical evidence, such as provision of self-directed, authentic, collaborative and sustained learning opportunities in a blended format has positive effect on teachers’ methodological skills for integration of technology into the classroom and consequently on students’ e-skills. More efforts are needed for encouraging teachers to participate in such professional development, which empowers them to provide facilitating learning environments for developing students’ e-skills.

IV. Conclusions

Information and communication technologies have become an integral part of many spheres of the professional and private life of European citizens. Skills for using ICT as users, practitioners and entrepreneurs play an increasingly important role in today’s networked economy and society. Despite the generally high level of ICT skills in Europe, their further promotion is seen as a potential catalyst of economic growth, social well-being and prosperity. Leading position is attributed to high-level technical skills as drivers of innovation and competitive advantage. At the same time digital literacy, or the ability to find, use and create information through digital technology, has an equally important place among the skills necessary for active participation in the knowledge-based society.

The most significant reform towards promotion and competent use of ICT is regarding transformation of the education system, in particular those changes aiming to prepare educators to design and conduct learning situations making use of the new technologies, in an effort to raise the learning performance and to equip students with competences for the 21st Century. Advanced distributed learning environments are means to get to this goal, but in order to set up education environments with ICT component, a series of new skills are required from both the teachers’ perspective and the students’ learning goals.

The support offered by Intel programs is creating the premises for adequate education reforms. The areas of support shows the concern and the added value provided by Intel to education in the last years: development of education policies towards implementing education solutions for 21st Century, teacher training programmes, access of teachers and students to reliable IT equipments, access to Internet and knowledge, support for education process through pedagogical materials for teachers, establishing a common arena for all stakeholders: education policy makers, researchers, teachers and trainers, education software developers, opinion leaders.

References