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What is the role of education for the society development in the information age? What ICT means are required for the education to meet the claims of a modern society? What are the main features of ICT-mediated teaching and learning? What is the place of ICTs in the overall spectrum of modern didactic methods? What are the main features of teachers' ICT competence to provide appropriate knowledge and proficiency?

Answers to these and many other questions of modern education development are the subject of this UNESCO IITE position paper. This paper provides an in-depth review of new strategies and tactics that aim to achieve learning progress for successful participation of new generations in the Information Society.

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NEED AND RATIONALE

What matters most is not the moment when the student uses the technology, but how that use promotes improvement in that student's education. — S. Ehrmann

Evolution of the information society entails dramatic changes in production and business activities, as well as in a larger social context. Information society is not only about digitised information or electronic networks. The transformation of information society can only be understood if we view it in broader context where bits, networks and knowledge have a social meaning. To understand the results of technological change we have to study the social dimension of information society. Rapid development of the information sphere of society is drastically altering the structure of work and employment, and produces new occupations and jobs. More and more people are being drawn into the information society as learners, workers and consumers. People all over the world have high hopes that new technologies will lead to healthier life, greater social freedoms, increased knowledge and more productive livelihoods.

It will not be an exaggeration to claim that succeeding generations will face the challenge of adjusting to a new social environment, wherein information and scientific knowledge will replace matter and energy as pivotal factors and will define both society's strategic potential and prospects for its development. For the developing countries the most likely scenario is when information progress goes together smoothly with agriculture and agroindustry. Information technology is the most attractive tool and infrastructure for the younger generation to facilitate the awareness and actual craftsmanship in business for local communities. In order to make this process happen, the traditional education goals should migrate toward gaining locally relevant goals, skills and, most important, establishing networks for economic partnerships.

EDUCATION FOR THE EMERGING INFORMATION SOCIETY

Education for new emerging societies requires ICTs to facilitate large-scale learning needs for social and economic development. For the first time in history, information and scientific knowledge are not simply means of improving society only, but main products of the economy. Moreover, knowledge is a major asset and product of the society, upon which continued economic well-being and social development depend. ICTs are in the mainstream of these developments. ICTs and information society are concerned with the creation, acquisition, sharing, dissemination, delivery, support and recognition of knowledge. ICTs are the means for providing an access to and engaging in the continuous learning that becomes necessary for successful participation in the society development of all social groups of population.

ICTs have become a critical tool for professional training; the sooner learners know how to use ICTs, the easier they can find their way to capture the newest methods of data acquisition and transformation to knowledge. Scientific and technical progress and the global spread of technologies developed in the most advanced countries of the world constitute one of the main arguments in favour of the leading role of education in the 21st century. The level of technological development is indicative nowadays not only of the economic power and living standards of a particular country, but also of the place and role of this country in the global community, and the scope and prospects of its economic and political integration with the rest of the world. At the same time, the level of development and utilization of modern technologies in different countries is determined not only by their material resources, but, to a large extent, by the degree of society's ability to produce, absorb and apply new knowledge. These achievements, in turn, are tightly linked with the level of education. These processes are largely driven by information and communication technologies, where scientific knowledge and information increasingly determine new patterns of growth and creation of wealth and present possibilities to reduce poverty more effectively.

National Education Policies and Society Development

The leaders of almost all countries striving to prepare the citizens to respond adequately to the challenges of the 21st century have professed the desire to transform their countries into learning economies and learning societies, inasmuch as the information society needs competent knowledgeable citizens. The era of new ICTs does not eliminate the most difficult problems that the world of education faces now and that have to be solved irrespective of whether the new technologies are adopted or rejected. Nevertheless, training and development, social and professional requirements, globalisation of communication, economy, and political projects of building a new society heavily rely on the introduction of ICTs into education. The alternative is to lag behind these developments chronically and, in effect, fail to meet the challenges of the 21st century.

The main features in the educational system of the information society are: production of knowledge, geographical and temporal independence on knowledge acquisition, pedagogic and structural innovation in teaching-learning process. To provide this, educational policy must ensure:

- up-to-date pedagogical competence in the information society;
- the integration of new pedagogic opportunities;

Knowledge and information increasingly determine new patterns of national development and wealth creation.

The use of computers and the WWW is essential for the further progress of education.

The global education problem can not be solved by conventional means like building classrooms and training large numbers of teachers.

The keywords in the educational system of the future are: production of knowledge, geographical and temporal independence, pedagogic and structural innovation.

Building a new society heavily relies on the introduction of ICTs in education.

- equal and flexible access to education;
- effective and flexible education structure and organization.

Presently, there are tremendous efforts on behalf of most governments to modernize their countries' educational systems on the basis of ICTs perceived as a key to such modernization. Some countries consider ICTs a vital component in upgrading the quality of education through changes in curricula, mastering of new training skills and wider scope of knowledge. In other countries ICTs are utilized mainly to ease access to education for various groups of population or are used for the narrower purpose of facilitating self-education through programmes broadcasted via radio and television. Yet, some countries emphasize the reliance on technologies as means to transform the educational environment or satisfy specific needs of different categories of students.

Attempts to improve education through the use of ICTs suffer from the absence of sound educational paradigms that could really support fundamental renewal. This renewal can be contributed by pointing out that beyond the delivery of information, that is, of "content", we systematically need to take into account interaction and activity, the learning "contexts", the completely renewed social and cultural environments that education is calling for, and ICTs are now capable of delivering.

No matter which aspect of ICT use currently prevails in this or that country, it appears on the whole, that most national plans to introduce ICTs in the educational system should:

- take into consideration specific national economic, social, and cultural conditions;
- borrow from similar plans and experience of other countries (particularly those with a comparable economic and social framework);
- ensure matching of the desired scale of ICT introduction in education and available technical, financial, and human resources;
- develop comprehensive action plans for various levels and agents within the educational system;
- take into account the consequences of ICT application and use as experienced by various categories of students, educators, educational systems and society as a whole.

One cannot make sensible policy choices without assessing the current situation, specifying the goals to be reached, projecting the means to attain them, implementing the strategies, and evaluating the results.

The concern of policy-makers, thus, is twofold: to reach a better understanding of the validity of education in its own specific dimensions and to help in defining appropriate strategies for change.

Mobile learning communities and networks

Like tourism, culture, industry and politics, education also has a need to extend partnerships for learning. Open and Distance Learning has a long tradition, like we see in the Open Universities and "Learning by Correspondence". A more drastic evolution is the migration toward self-organized learning communities. In contrast to the institutional learning networks it is the unforeseen interaction and development of mutual learning needs that determines how a learning community develops. The pragmatic learning need is crucial here, not the need for a higher learning certificate. Looking from the last few years at the regular secondary schooling certification, it is highly probable that the web

communication focuses on examination items. However, the survival of a synchronous learning community has a much higher level of impact; its members experience a learning need and will undertake discussions much more fundamental compared to traditional systems, based on arbitrary cornerstones like the entrance and final examination.

Three dimensions are brought forward as organizing for the new-coming “learning communities” and so-called “learning networks”:

- Learning scenarios will be embedded in communities of practice, and less orchestrated as top-down delivery processes like in the traditional schooling and corporate training. Mobile and online learning is likely to benefit from new flexible paradigms that bring a learner back into the centre. Key function of mobile learning is to find the right learning partners.
- Student learning will be continuously shifting toward project-based learning and problem-based learning, in which curricula and teachers mostly facilitate the process. Learning by gaming (simulations and meta-modelling) is one of the methods to make students curious about underlying processes and meaning. As it comes to cultural sciences like geography, history and art, it is the existential motive rather than the certificate criterion that will soon determine how and what learners intend to learn.
- Participation in virtual realities will provide a growing opportunity to make learners alert and better prepared to complex jobs. Mobile learning in the light of these evolutions will change institutional learning practices dramatically.

Lifelong learning has become a key subject in dialogue among social partners, between them and governments. Partnerships of governments, the social partners, enterprises, and a wide range of institutions and representatives of civil society increase the effectiveness and resource base, and improve the equity outcomes of learning and training programmes. Education experiences the gradual shift from teacher-centred education and training toward learning by the individual. Rapid growth in information available, and individuals’ need to use it selectively for knowledge creation have accelerated this shift.

More and more, individuals use ICTs and the Internet as sources and media for their learning. Such learning tends to be informal. Therefore, recognition and certification of informally acquired skills and knowledge become central to policies that endeavour to enhance individuals’ motivation to learn, improve their access to further learning opportunities, and reward them for qualifications gained. The main priorities of the international community are to pursue cooperation policies that promote universal access to basic education as a pillar of sustainable policies for economic and social progress. Such policies are best pursued in the context of dialogue and consensus building between governments and social partners.

Ethical, Psychological and Legal Issues

The penetration of ICTs into educational settings requires the formulation of new ethical, psychological, legal and moral aspects of applying such technologies to learning. ICTs offer wonderful opportunities to reach out to our fellow human beings, but the darker side of human nature finds its way into cyberspace, too. The full spectrum of reprehensible or outright debased moral behaviour is represented online: aggression, violence, crime, deception, brutality, rudeness and so on. The global nature of ICTs not only opens up broad opportunities for dissemination of knowledge, but also increases the danger of conflict between values and standards espoused by different cultures. For such global informa-

tion community to become a reality, an effective mechanism of information exchange should be developed to inhibit the erosion of national and cultural identity. The past century has clearly demonstrated that in the great history of times and peoples no culture or nation is small – only together they constitute the supreme value of the world civilization and the basis for the sustainable development of the world community.

TEACHING AND LEARNING FOR INFORMATION SOCIETY

The issues of teaching and learning are of central importance to the evolving information society. The development of modern ICTs is creating an environment of rapid and ongoing changes. This environment requires a fundamentally new approach to education. A human being demands new skills and understandings and must develop the facility to enhance these skills and understandings on an ongoing basis. In other words, humanity must embrace and promote a culture of lifelong learning. ICTs exceed the traditional framework of the education process. Learning can no longer be viewed as a ritual that one engages in during the early part of a human being's life only. ICTs are being used to cross age, time and space barriers to bring lifelong learning to all. People of all ages whatever they are doing, in all places and in all different environmental contexts are learning all the time. Thus, they constitute the learning society.

Learning can no longer be viewed as a ritual that one engages in during the early part of a human being's life only.

People of all ages whatever they are doing, in all places and in all different environmental contexts are learning all the time, thus constituting the learning society of the 21st century.

The amazing standards and prospects of applications offered by ICTs in learning and teaching show that humanity is on the threshold of new stage of the educational revolution which will entail a dramatic shift in all spheres of human existence. These circumstances and new social demands, the new world community shaped by the new ICTs and models of action call for new literacy for the information society. Provision of this new literacy implies the creation of new technology for obtaining scientific knowledge, new pedagogical approaches for teaching and learning, new school curricula and methodological materials for teachers and learners. This is to awaken student's intellect, shape an individual's creative potential and mentality, and develop a holistic world outlook in an individual to let him or her gain a foothold in the information society.

Thus, it will be a mistake to think that the application of new ICTs automatically raises the quality of education. In order to exploit their opportunities effectively, such fields as computer psychology, computer didactics and computer ethics should be better developed, explored and employed by educationists. It is worth keeping in mind that in spite of a variety of information sources and teaching technologies that transform information into knowledge, there is only one way to convert knowledge into education. Such conversion takes place in a person's consciousness. It is the most interesting and sophisticated interaction that is going between the mental- and cyber space. A human personality is born and develops as a result of this interaction. It allows us to contend that no two educations evolving as a result of this interaction can be treated as completely congruous, inasmuch as no two human personalities are the same because each individual is unique.

The priority of the human personality was the main result of the past century. The primacy of the human personality is the main imperative of the 21st century. Here we expect education to play a vital role in the multimodal representations for articulating prior stages in one's experiences and perceptions, and restructuring them into the actual state of life. Restructuring experiences can be seen as the metaphoric umbrella for learning in general, especially as part of the constructivist paradigm.

Constructivism for Knowledge Development through Media

The WWW-based media like multimedia and highly immersive virtual realities, allow learners to participate in high-tech environments. It seems opportune,

however, to pay extra attention to the fact that we know through long traditions, that “receiving the right information” is only a small first step to learn a topic really. The WWW allows us to provide “just-in-time” and “just-for-you” information. It also allows students to work closely together with peer students, even with those in other countries, belonging to different cultures and participating in different types of courses. From a multi-cultural point of view, this access and communication are quite vital to make progress in bridging parts of the world.

New dynamic programmes are available now, that help learners to become aware of prior knowledge, analogies, discrepancies and omissions. Conceptual schemes have proved to be elegant and efficient to share and negotiate knowledge. Especially, in case the topic concerns moral values, belief systems and existential stories, the concept maps have an added value both for learners, teachers and co-students.

Secondary school learning is the age of attempting to understand complex processes like in the sciences and humanoria. Constructivism is a paradigm that highlights the need for learners to “build” their own concepts. Addressing the question how students can actually prepare themselves for the 21st century, we need additional didactics in order to motivate the new generation to invest and participate in technology and, hence, stimulate economies and improve infrastructures. It entails to the question what new skills and attitudes we may expect to be in the teachers of tomorrow. As an overall thesis it may be stated that the knowledge economy of this century cannot be attained by “teaching subject matter from the shelves”; learners need to learn to excavate and exploit new concepts as creative acts: learning and teaching become a process of “developing” rather than “transferring” knowledge. In this respect it becomes highly vital to sketch architectures for “interest-based learning communities for learners” and “networks for mutually learning teachers”. We expect that larger organizations like UNESCO¹, the OECD², UNICEF³ and the World Bank⁴ will further demonstrate initiatives to propel these ICT-based mechanisms.

¹ <http://www.unesco.org/>

² <http://www.oecd.org/>

³ <http://www.unicef.org/>

⁴ <http://www.worldbank.org/>

ICTs IN SECONDARY EDUCATION

The fields of education, schooling, learning and training have to do with learning mainly. However they are different cultures. Its actors, its infrastructure and its procedures like inauguration and assessment have been developed as certain social and economical situations demanded for a certain transfer from experienced adults to the younger generation. The same is the case for primary, secondary and higher education: they have different orientations, especially if it comes to the integration of ICTs.

The nature of Secondary Education has been a subject of evolutions during the last two centuries. Pivotal was the step toward accepting that school was a direct key to social mobility. As universities became more accessible via social regimes in the second half of the 20th century, Secondary School became an arena where didactics played a special crucial role: students were supposed to continue learning because of their parents' high expectations, rather than students' intrinsic motivations, on average.

With the focus on the role of ICTs in Secondary Education, it becomes clear that it cannot be measured with a pure criterion of learning outcomes to get prepared for national final examination only. ICTs potentially offer a powerful dimension to transform the way the young generation prepares for further learning. However the limitation of the potential ICT impact is in the fact that the schooling content, methods and assessment criteria are rather inert to the reality of our societies, economies and industries. The question why Primary and Tertiary educations have a higher potential to migrate with the ICT potentials is exactly in the fact that the schooling sectors are more autonomous. At the same time it can be seen that once the standardized final exam has been offered, an enormous scale of restructuring emerges, if ICTs are fully accepted as support mechanism in Secondary Education. The reason is that the most sensitive phase for attaining learning skills is the years between 11 and 16. A clear indication backing up this thesis of developmental psychology and didactics is the new Secondary School paradigm observed. Its underlying message is the fact that students should invest in learning skills and attitudes, driven by intrinsic motivation and curiosity, rather than by pressure of covering a large number of subject domains in order to pass a final examination.

Though Secondary Education traditionally orients toward strict curricular content specifications and national final examinations, there is an ongoing trend to invest in students' capacity to learn independently and authentically. This trend needs ICTs as infrastructure and cognitive support tools.

ICTs for Teaching in Secondary Education

Teachers are the key players in the learning process. Teacher training is crucial for laying a road map toward "learning schools" via "learning teachers". ICTs are a sympathetic mode to mobilize teachers' creativeness and make their didactic practice more flexible and ingenious. The dominant paradigm so far is that teachers need to be taught likewise they are supposed to teach later on. The dilemma of bringing teachers and would-be teachers to a new didactic method, like the integration of ICTs, comes from the fact that teachers themselves have been taught in traditional ways for many years. Moreover,

The limitation of the ICT impact is in the fact that the schooling content, methods and assessment criteria are rather inert to the continuous changes in reality.

Potentially ICTs are a very powerful dimension to transform the way the young generation prepares for further studying.

Students should invest in learning skills and attitudes, driven by intrinsic motivation.

The road map toward "learning schools" runs via "learning teachers".

ICTs are a sympathetic mode to mobilize teachers' creativeness and make their didactic practice more flexible and ingenious.

One of the new teachers' roles is that of a facilitator: a person who fosters and stimulates a learner.

Networks of teachers stimulate the exchange of best practice, multi-cultural character and self-appraisal.

many Western European countries experience a dramatic lack of students willing to be teachers.

Intensified teacher desire to use ICTs in the learning process nowadays is sustained by the fact that alternative methods of assessment are being developed to decide whether to permit teachers to work on the basis of their expected classroom performance. E-communities become quick and popular ways to discuss staff perfection and teachers' training. Alongside with the role of ICTs as a learning tool, their potential role for the teaching process came into focus. It is remarkable that so far the ICT support for teacher has not been focused on the didactic integration of cognitive learning tools; more interest has been paid to WWW-based learning management systems. Its main asset is the Internet-based functionality to deliver the "just-for-you" content "just-in-time", and to promote correspondence between the learners. Due to the ubiquitous nature these systems have contributed to Higher- rather than Secondary Education so far.

Much more challenging is further integration of cognitive learning tools with an interface to the learner and the teacher. The overall spectrum of didactic methods now includes the learner as a deploying personality who needs gaming, experimentation, negotiation, crises and reflection in order to learn genuinely. ICTs are no longer an instructional means to provide prerequisite learning activities; it offers an exploratory space where the learner is in charge. Another new role of a teacher is that of a facilitator: a person who stimulates the learner to take risk, understand by analogy and reflection. Its essence is pedagogical and should not be underestimated.

The main role of ICTs is to act as a catalyst for the learner's interest to get acquainted with the "unknown". Even if the content is understood, it is not obvious what to learn and why it is important to learn. At the core of curiosity is one's existential awareness: what do I see as crucial for me and what (ICT) tools are critical in this process? It means that ICTs are a bridge between existential and intellectual aspirations. As soon as learners perceive the need to learn to improve living conditions, it becomes difficult to prevent them from learning. The scale of available knowledge impacts the way it functions in society. Here, the notion of "memes" fits well; it claims that ideas compete, survive, or extinct due to their power of prediction. It does not matter how to transport ideas; what does matter is how to bring learners to the right communities so that they become critical thinkers rather than absorbers of information.

Teachers have been polarized in their acceptance of the new technologies. Whilst some have enthusiastically integrated computers and the Internet into the classroom, other has been cautious in their welcome, and some have simply rejected the technologies. There is a level of justifiable cynicism based on previous experience of computer based applications such as computer-aided learning. Ironically, some enthusiasts have inadvertently damaged the reputation of ICTs by poor classroom practice – using the technology for the sake of its novelty value. With the inevitable proliferation of ICTs in the classroom, the role of the teacher must change, and here are four key reasons why this must happen:

1. It is no longer sufficient for teachers merely to impart content knowledge. It will be crucial for teachers to encourage critical thinking skills, promote information literacy, nurture collaborative working practices and prepare children for a new world. The Internet is a network of networks providing opportunities for inquiry-based learning where teachers and students are able to access some of the world's largest information archives.

2. Teachers must begin to reappraise the methods by which they meet children's learning needs and match curricula to the requirements of human thought.
3. ICTs may also make some assessment methods redundant. In ICT environment, online tests can easily be used, which instantly provide the teacher with a wide range of information associated with the learner's score.
4. ICTs will cause certain teaching resources to become obsolete.

Development of didactic methods in ICT context

ICTs as a facility for teaching and learning had gone through various stages before it arrived in its catalytic function nowadays.

1. The early software prototypes that demonstrated the "computer as an electronic teacher" stems from the early seventies. The attempt was to program a dialogue between an expert and novice. The expert role was to explain and correct mistakes of the learner.
2. Since more complex structures were introduced, the computer took the role of representing the knowledge domain. Expert systems were established in the early eighties. The key problem was to make human thinking explicit. The so-called fifth generation of "thinking machines" failed, except smaller attempts in practical reasoning.
3. Intelligent tutoring, simulation and embedded task support systems were built in the early nineties. The attempt created large expectations for the instructional and curriculum designers.
4. In the mid nineties hypertext, hypermedia and multimedia were introduced. CD-ROM, DVD and the WWW became the default information resources.
5. Since 2000 Virtual Reality and its 3D user interface have carried users through fictitious and other worlds. Learners are supposed to navigate through unknown spaces and receive high realism.

The overall trend of this development is that ICTs become an extension of our senses, thus, address the mental faculty of imagination. As it will be pleaded later in this document, it is the emotional, affective and aesthetic dimension that will become important in our next generations' media programmes. Already for airplane pilots and, for instance, medical surgeons, the haptic and tactile sensation is included to let trainees "feel" and "touch" critical variables in the task performance. The overall spectrum of didactic methods includes now the learner as a deploying personality who needs gaming, experimentation, negotiation, crises and reflection in order to learn genuinely. ICTs are no longer the instructional format for reconciling prerequisite learning steps; now they offer an exploratory space where the learner is in charge of his own education. The teacher here is just a facilitator who stimulates the learner to take risk, understand by analogy, reflect and offer consolation. Video conferencing, broadband connection in combination with virtual reality allows the learner to exist in foreign environments, swim and float through micro and macro cosmos.

ICT dissemination through alternative teacher education

Traditionally teachers are considered the key players in the arrangement of learning. It seems quite logical that teacher training is the solid moment of starting this innovative process. So far, the paradigm has been that teachers need to be taught as they are supposed to teach. The dilemma of bringing teachers and teacher students to a new didactic method, like the integration of ICTs, is in the fact that they themselves have been taught in plenary, discursive, non-ICT supported ways. Finally, there is an overall lack of candidate teacher students in many of western European countries, and this deficit is compensated by the imported workforce from the other side of digital divide. The processes of intensifying teacher attitudes to use ICTs in the learning process nowadays is helped by the fact that alternative assessment methods are being developed the

admission of pre-service teachers and distinguishing their predicted classroom performance. E-communities become urgent and popular ways to discuss staff development and teacher training.

ICTs for Learning in Secondary School

Learning is a process of growing awareness on various realities.

ICT as a facility for teaching and learning had gone through various stages before it arrived in its catalytic function today.

Learning from wide open information resources can only be successful if a learner masters methods and tools to use the interconnection to the full.

One of the central notions around the question “if” and “how” ICTs should play a role in education is that as a facility it requests young people to acquire skills and attitudes to benefit from. “Computer Literacy” was the quintessence for the curricular adjustment until the early 90s. As ICT functionalities progressed with development of expert systems, simulations, multimedia and recently the virtual reality, the key question appeared how to integrate ICT capacities for learning in regular didactics. So far, only the text processor, spread sheet and database penetrated the didactic arena. Gradual adoption of the constructivist paradigm of learning allowed practitioners to see how learners may convey the highly personal learning process like exteriorisation of concepts and problem solving strategies.

A more obvious dimension for didactic ICT support is a spectrum of meta-cognitive knowledge representation tools like concept-, mind- and cognitive mapping. Its main underlying paradigm is that learners’ sustainable and generic learning progress depends upon adequate imaginations of foreground and tacit knowledge. Intuitive knowledge was previously regarded as primitive, undesirable and even erroneous that should be kept out of the didactic procedures. Constructivism accepts intuitive knowledge as essential before the formal learning is built. Conceptual representations in concept mapping procedures have been introduced in diverse subject fields. Its main procedure is to elicit the student to schematise conceptual entailments in order to guide thinking toward the contours between the known and the unknown.

The need of using ICTs in learning becomes quite clear as the information access via the WWW has become abundant, both learners and teachers need tools for adequate selection and navigation in order to keep the balance between noise and silence in their searching. The overall pattern is that ICTs become an extension of our senses and, thus, address the mental faculty of imagination, the emotional, affective and aesthetic dimension that will play an important role in our media programmes for the next generations to come.

From schooling ideologies to flexible learning

If there is no external reason to transform schooling ideologies into such ideals as flexible learning, lifelong learning, and knowledge creation rather than knowledge reproduction, there is also no reason for ICT integration in school.

For more than two centuries learning as a top-down process and teacher-centred learning became mutually dependant; the introduction of new media in school will pay-off only if it is carefully linked to an adequate reform in didactics and a reform in assessment paradigm. It means that learners should finally be evaluated to the extent of producing relevant understanding rather than demonstrating common understanding by others. A solid underpinning of this position will not be found in epistemological analyses; it will be promoted by new urgent qualifications demanded by the evolving “knowledge economies.”

The knowledge economy needs players in the “knowledge game”. These persons are selected based not only upon their actual knowledge. They need the capacities to synthesize newly developed ways of working and cooperation skills in large networks of specialists and reformulate important trends to any relevant sector in the society and economy. For these highly wanted citizens, knowledge is not only an end product or raw material; it is the mentality that expertise manifests among specialists. Like in larger technical and social processes, there is a need to combine various disciplines in knowledge economy as well. Knowledge workers have the capacity to mediate between expertise domains;

learning and allowing other persons to learn is the key process here. Media and communication facilities will play an ever more important role. The issue of this document is to clarify that Secondary Education has a vital role in preparing the next generation citizens. This paper aims at explaining what and how new learning methods will emerge, and how schooling institutes will attempt to accommodate these trends.

Continuous evolution in learning paradigms

Twentieth-century learning theories are based upon the works of I.P. Pavlov (1926), E. Thorndike (1913, 1921 and 1932) and C. Hull (1933, 1940 and 1943) and are characterized by attempts to identify endemic mechanisms in human learning. The search for “first principles” revealed a rather deterministic and later a cybernetic aspiration. The legendary victory on the complexity of learning happened in the heydays of behaviourism in the 1950s when B.F. Skinner (1950, 1953 and 1954) defined operant conditioning as the key mechanism: if the environment reacts systematically to the organism, a certain behaviour (skills and the expression of knowledge) can be shaped. The strength of Skinner’s theory was its analytical approach: if a molar achievement like understanding relativity theory was broken into small prerequisite steps, any hungry creature would be able to solve problems in this domain. Its weakness is in the fact that large human tasks rely on quite different mechanisms than just performing a certain desired response.

Long before the distinction between behaviourist and cognitive approaches were made, much more fundamental bases for learning theories were laid by L. Vygotsky (republished posthumous in 1962, 1978), F.C. Bartlett (1932, 1958), J. Piaget (1929, 1969 and 1970) and J. Bruner (1963, 1966). The fundamental line in the cognitive and later constructivist approach is that the molar rather than the molecular nature of learning is important. Vygotsky asserted that the social development is necessary prior to any cognitive or intellectual maturation. Bartlett’s important contribution was that learning of meaningful topics relies on Gestalt-like structures, later called schemata.

Piaget and Bruner start from the assumption that learning essentially exceed the scope of instruction; students’ learning is not so much an effect of information access, it is the effect of a cultural assimilation with the existential awareness as the central focus. Important idea derived from Bruner is the notion that knowledge is a process rather than a product. Seymour Papert (1980) extrapolates Bruner’s idea by saying that knowledge is the side-effect of a construction activity by the learner. Papert transformed a large trend in constructive learning theories into fascinating learning by programming in LOGO. His book *Mind Storms* illustrates the unparalleled “learning by stepwise creation, experiencing and understanding the laws of data, expressions and algorithmic execution”. The more complete explorations in *Learning & Instruction*, you can find on the Web under the name “TIP” (The Theory Into Practice database). It provides a clear idea on the varied and intertwined nature of more dominant learning theories.

ICTs AND QUALITY OF EDUCATION

It is a mistake to think that the application of new ICTs automatically raises the quality of education.

The crucial lesson from the past ten years of experimenting with new learning tools in Secondary Education is that educational ICT media are a temptation for the traditional test-regimes in schools.

We should conclude that “learning by assimilating the teacher’s knowledge and preferences” is the most appropriate and efficient way to attain traditional schooling criteria; not necessarily to attain the learning modalities of tomorrow.

It goes without saying that emergence and successful development of the evolving societies is impossible without improving quality of education of individuals and, consequently, improving quality of education of a given society as a whole. In the absence of common formal definition of the term ‘quality’ in education it is possible to include into this definition such abilities of an individual as:

- keeping abreast with the modern ideas and discoveries in the areas of science and technology;
- acquiring skills required by the latest technologies and the market;
- developing his/her resourcefulness through self-education.

So, scientific and technological knowledge and self-sustaining professionalism as the products of quality education should provide a successful participation of an individual in the development of the evolving societies.

Necessary and sufficient conditions can be identified in the process of improving education quality that allows meeting this important final objective of education. The necessary conditions would include such educational components as:

- well equipped class rooms and lecture halls;
- highly professional administrators in managerial positions at the educational institutions;
- highly qualified teaching and technical personnel;
- easy access for students and teachers to quality textbooks and professional literature, as well as to modern teaching aids and supplementary information.

The sufficient conditions are related to a person’s ability to transform knowledge and skills received into education, i.e. into customized system of ethical, cultural and professional values, and also to the ability to apply this system in various areas of intellectual and practical activity. The sufficient conditions of education quality are defined by a person’s ability to meet the demands of contemporary society.

The unique role of ICTs in improving education quality is based on their ability to effectively facilitate the fulfilment of both necessary and sufficient conditions for receiving quality education. Modern level of ICT development significantly broadens opportunities available to students and teachers for gaining access to educational and professional information; improves operational ability and management effectiveness at specific educational facilities and the educational system in general; facilitates integration of national information educational systems into the world network; considerably assists in accessing international information resources in the areas of education, science and culture.

At the same time it is worth mentioning that the present level of ICT development permits their successful application in education. The use of computers is very important in realization of creative potential of student. It can be even more efficient in individualizing the classroom work with the help of adaptable curricula. ICTs have brought about dramatic changes in the technologies of obtaining knowledge, its converting into education and further in practical application. Moreover, when we speak about the role played by ICTs

in education, we should proceed from the understanding that not only they facilitate educational opportunities but assist an individual in perfecting his/her perceptions, as well. Modern ICTs provide learners with richer information objects such as images, videos, complex structures of knowledge and their combinations available via the Internet or other intelligent computer networks. ICTs radically extend possibilities for visualization, including visualization of the invisible, visualization in changed colours and shapes. Colourful images of architecture, sculpture or painting, grouped thematically and accompanied by well-written texts and beautiful music have a strong emotional effect on the student, develop his or her artistic taste and at the same time enable the student to learn more about culture, art and nature. It is worth mentioning here the well-known words of O. Wilde: “For the good we get from art is not what we learn from it; it is what we become through it”.

At the same time we should take into account that parallel to education as a means of preparing students to life, cyberspace as another educational milieu is developing. The seminal works of Vygotsky, Piaget and Bruner gave rise to the term interiorisation of physical objects, which suggests our creating “psychic” equivalents of the latter as “conceptual” models to be further used to construct variants of our own internal reality or virtual realities. Cyberspace prompts a reverse process, which could be called exteriorisation: models of the physical world constructed in the human mind are let out into cyberspace. So, we should proceed from the understanding that it is necessary to develop in an individual a particular perception of his or her habitat, which comprises objects of the physical world and the ideas of these objects in the human mind, as well as the system of ideas in information space. Thus, ICTs do not merely enhance intellect; they designate new dimensions of the human mind, produce an orderly system of a new global culture and open up vast and exciting perspectives of their use in improving quality of education.

It should also be stated that if the first approach to human interaction with the environment arose through many centuries of our species’ evolution, the second approach has introduced amazing changes into human consciousness in a brief period of a few decades. We can only guess what the nature of these changes is, what is the scope of their impact and future implications. So, we can only hope to be right in suggesting that one of the most complicated problems that has to be solved in the evolving societies is the problem of a human being in the changing world.

In contemporary discourse on education effectiveness, the world quality is frequently mentioned. A problem of defining the education quality arises when one chooses the aspect of education that will be the focus of attention. If the focus is on the outcomes of education, a further problem occurs, since there is no general agreement on what the purposes of schooling should be. For some the role of secondary education is fostering students’ cognitive, moral, and social development; for the others, secondary education is a means of promoting social cohesion and nation building; or it may be a preparation of the individual for the world of work. This brings us back to the question of education quality and possible approaches to its measurement. One of such approaches leads us to a development of appropriate indicators system of education quality. This system of indicators can be based on the abovementioned necessary and sufficient conditions of quality education.

More detailed consideration shows that systemic analysis and quantifiable measurement are applicable only to those indicators that describe necessary conditions of education quality provision. In the area of ICT usage in education these indicators constitute several groups, including:

- State documents regulating ICT usage in schools.
- ICTs in curricula.
- Hardware equipment of educational institutions.
- System and educational software availability.
- Access to the Internet and global communications.
- Training and upgrading of computer competence of educational personnel.

The request for quality indicators of educational systems can hardly be isolated from various economic aspects that go together in terms of teaching load, equipment and innovation support.

As for the sufficient conditions of quality education, they can be considered only as a result of interdependent integral processes of economic, scientific, technological and cultural development where ICTs play a partial role. This narrative requires a more detailed deliberation and cannot be described as a result of indicative approach.

One aspect of ICTs' effect in Secondary Education is the question to what extent ICTs facilitate the achievement of prior (traditional) goals as assessed in national and international comparative studies. Another aspect of the same question is to what extent ICTs in Secondary Education facilitate smoother transition from schooling to the labour market. Yet another aspect is the question of how far ICTs facilitate the continuous evolution from the existing schooling concept to the schooling concept that fits the learning needs of tomorrow's society, especially if we mean the information society.

It may be clear that the interpretations mentioned above do not necessarily converge in implementation; a high scale of ICT use to achieve traditional learning goals may hamper the catalytic function in the evolution of schooling paradigms. Through the ICT applications in education humankind seeks to respond to the challenges of the 21st century by integration of national information educational systems into the world network that will considerably facilitate an access to international information resources in the sphere of education.

UNESCO ACTIONS TO PROVIDE QUALITY ICT USAGE IN EDUCATION

In spite of massive technological progresses, the practices of education have remained almost unchanged for the last two centuries. Inspired by the machine paradigm of the Industrial Society, education was viewed as an industrialized way of “delivering” knowledge. Now, as learning and education extend into cyberspace, and the rise of the Knowledge Society is announced, we seem to be unable to break away from those traditional practices into the practices that value community, interaction, context, organic processes, complexity, change, and many other attributes that radically distinguish our era from that of our industrialage ancestors.

Global economic competition has brought to the fore the critical importance of quality of human resources, and the demand for new competencies in today’s information society. It is a need that is likely to be articulated in the country with a well-developed educational system in the industrialized world, as well as in a developing country that has not reached the goal of universal primary education yet.

Strategies for introduction of substantial educational changes and improving quality have been a concern of educational policy-makers for many years. Concern of education quality has progressively shifted its focus from input to outcomes in terms of learning achievements. The educational system, schools and individual students are under increasing pressure to reform. In considering these reforms and proposals to implement them, education policy-makers, planners and managers face two major decisions. The first is: should resources be invested in ICT activities (either to improve existing ones or to introduce new ones) or would better results be achieved if resources were invested in some other aspect of education system, such as school buildings, textbooks, teacher training or number of teachers? Given the contemporary worldwide emphasis on ICTs, it is unlikely that it will be dismissed as an area that does not merit further consideration and investment. In this case the next question arises: what kind of ICTs and what usage and in what conditions are likely to impact the quality of education in schools?

It could be possible to get an answer to this question after reaching the quality of education definition which further requires the choice of particular aspect of education that will be the focus of attention. Since education has many purposes, components, and competences, questions regarding quality may reasonably arise concerning any important aspect of a system: infrastructure, school buildings, administration, teacher training, education materials, teaching, or student achievements. These elements are interrelated, and serious deficit in one is likely to have implications for the quality of others. Policy-makers traditionally privilege a linear and sequential approach, while evaluations based on the lessons from the past suggest that it is a multifaceted challenge.

In this situation the decisions about the application of ICTs and their relation with improving quality of education can be considered in view of overall strategic goals of education development, including following aspects:

- Not limiting the application of ICTs exclusively to the learning process. The use of ICTs in the administration and management of school and local community could save time, improve performance of staff and allow to devote more energy to overcoming pupils’ learning problems;

Global economic competition has brought to the fore importance of quality of human resources, and the demand for new competencies.

Should resources be invested in ICT activities or would better results be achieved if resources were invested in some other aspect of education system?

Decisions about the application of ICTs and their relation with improving quality of education can be considered only in view of overall strategic goals of education development.

- Providing teachers, in the context of pre-service education and prolonged professional development, the opportunity of mastering in ICT competence for educational application, and of contributing to the development of methodology and educational information environment. Special attention should be paid to distance methods of teachers' vocational development;
- Using ICTs to encourage communication, networking, exchange of information and experience among teachers, pupils, and schools at both national and international level;
- Introducing easy ways of using ICTs based on the idea of commonly available technological resource centres;
- Harnessing the potential of this use in order to create easily accessible services which are designed to help and advise teachers in their daily work;
- Strengthening joint efforts among governments, educational authorities and teachers' organizations, business and industry to ensure availability of adequate ICTs at all levels of education;
- Developing research and information exchange on the impact, role and limitations of ICT application in education.

The UNESCO Medium-Term Strategy 2002–2007 stresses that ICTs play a significant role in various fields of competence of UNESCO. ICTs open up new horizons for progress and exchange of knowledge, education and training to promote creativity and intercultural dialogue. These technologies can help strengthen social cohesion of individuals and groups within each society. Nevertheless, the growing digital divide is actually leading to greater inequalities in development, which exclude entire groups and countries from potential benefits of digital opportunities in networked societies and lead to a global gap between those who are “online” and those who are “stand-alone”. Therefore, bridging the digital divide between developing and developed countries and within countries becomes a prime strategic challenge throughout UNESCO's activities. It leads to those activities and such professional attitude of a human beings, that strengthen national capacities to create a new content of education, enlarge access to information, foster scientific research and share scientific knowledge through networking, communication media and information systems.

SUMMARY AND CONCLUSION

Information and communication technologies are already a vital factor in successful development of education. Secondary Education is a decisive stage, however; learning and studying at this age has the most potential impact on forming new members of the knowledge community. This paper is a plea for educational policies that promote and sustain further ICT infrastructures for Secondary Schools. It signals that school institutions face the need to become “Learning Organizations”. This document goes more in-depth to the new strategies and tactics at the didactic level, in order to achieve learning progress, to contribute to the new generation’s participation to the Information Society.

The most specific effect of new ICT facilities is a catalytic one – not only in the continuous evolution of the innovative teaching/learning processes in traditional Secondary Education. Even more important are the ICT effects on contextual factors like the restructuring of classroom-based learning and its complement to home-based learning, vocational training and most important the new-coming Web-based Learning Networks and its subsequent Web-based Learning Communities. Most likely is the introduction of Web-based Communities for Teachers. As teachers are in many cases the top experts in local school settings, it seems an attractive option to let them refresh and operationalize the content expertise and didactic methods via participation in the larger Web-based Teacher Communities.

The combination of ICT infrastructures and software facilities in schools and the participation in Learning Networks is expected to be the critical factor in a longer-term sustainable innovation in Education. The first-order effect is the change in teacher roles, once information access becomes widely available. The second feature is the new learning environment in school that allows learners to participate in distributed learning communities. Resulting from this synergy will be an ongoing process where teachers and students work together, partly face-to-face in the same physical location, partly in the virtual learning communities.

It is the role of this position paper to sketch the conceptual outline of how traditional teacher-oriented school education will gradually develop into learner-oriented education and evolve toward a community, where students and teachers manifest a culture for continuous learning. As overall conclusion we may say that the ICT impact on Secondary Education should not be limited to the innovation of didactical measures, but it should also lead toward the internal development of Educational Institutions as “Learning Organizations.” Its main self-transformation will be the accommodation of students’ learning in Web-based Communities inside and outside traditional schooling institutes.

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