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HIGHER EDUCATION IN THE AGE OF KNOWLEDGE REVOLUTION

Abstract: The current educational structure was created in response to the demands of an industrial society, which, alongside workers, needed an elite of highly educated professionals. The knowledge revolution accelerated this trend: professionals are now not only the people who „have" the knowledge, but they should be also able to find it quickly and efficiently, and have the skills to apply knowledge in new situations, extending the scope of their initial field of expertise. With massive growth of free open educational resources, knowledge become available and accessible to everyone with a simple Internet connection. All these conditions currently call into question the role and operationalization of educational processes in Higher Education, since Universities are no longer the one central source of knowledge generation. In this paper we present an analysis of the impact of globalization and technology advancement in the evolution of curriculum and educational programs at Higher Education from the Europena perspective. We will provide a review of the theoretical framework and existing applied research in order to define critical factors that influence the implementation of technology in curriculum development and a teacher's ability to successfully implement innovations in the classroom. Beyond seeking to answer key questions about the current use of technology (or the lack of it) in higher education practices, or the need of more trans-disciplinary work in curriculum development, we also attempt to address some key research questions emergent from analyzing the current scientific results and practitioners' experiences reported in the literature.

Key words: *Knowledge revolution, Open education, E-learning 2.0, Curriculum development, Epistemology of learning*

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1. INTRODUCTION

Educational visionaries and reformers have long predicted a significant transformation of teaching and learning where technology would play a principal role. These visionary changes cover a spectrum that moves from cognitive approaches, such as customization of learning (e. g. Personal Learning Environments), to more socio-constructivist conceptions such as the latest challenges surrounding social learning and learning analytics. However, technological implementations in education have consistently fallen short of generating profound revolutions. Why have our most visionary dreams not been realized? Why hasn't technology dramatically transformed teaching and learning in Higher Education? The answer to these apparently simple questions is rooted in a complex combination of a variety of factors associated to the interplay between technological developments, scientific advancement and societal evolution.

The first strong impact of technology in higher education was at the time of the industrial revolution. Universities were changing their role from being scientific clusters towards being producers of highly qualified workers (professionalization and democratization of university studies), mainly specialists in the subjects' content, and hence the teacher's role was to be the expert in the subject. Professionals, including scientists and researchers, were expected to be 'experts' in their fields of expertise. When the advancement of Information and Communication Technologies (ICT) transformed industrial society into a networked and knowledge society, expert knowledge started to be at everyone's disposal. The demands from labor markets became more complex, since not only was expert knowledge needed, but also the development of social skills and autonomous learning, in order to cope with the new societal and workplace rules. The Bologna reform is a good example of changes in societal demands and those of the labor market. This is one of the biggest attempts to gather resources from all European higher education institutions, so as to cope with the complexity of educating professionals in a networked society and globalized market. One key point of this reform was the change from subject-centered curriculum toward a competences-based one. More than a superficial change, it turned to be a conceptual move from rooting formal education in behavioral and cognitivist learning theories, toward implementing socio-constructivist theories of learning as framework for understanding learning process and designing teaching practices. However, the appropri-

ate implementation of socio-constructivist learning theories demands an adequate use of ICT and emerging technologies and devices. But most importantly: how do institutions cope with this demand, when their organizational and curriculum structures are rooted in the traditional behavioral understanding of learning? What shapes the understanding of teaching and educating? How is this competencies-based approach implemented? Which teaching competences are needed to successfully implement it? And what does faculty staff development look like in a competences-based era, settled in a subject or fields-centered institutional structure? These are questions that are still waiting for practical answers.

The transformation of teaching and learning in professional education nowadays certainly depends on the effective implementation of well-selected suitable technologies according to each educational situation. Although, innovation is the only clear learning outcome from the past 20 or 30 years of attempts to transform education by implementing different technologies. For achieving the dramatically different results that the educational community has longed for, innovators should change the rules, fundamentally altering the environment in which learning occurs. Particular technologies and technology standards are a key part of this process, however *no technology or standard has value in itself*. Value comes from what is done through the implementation of those standards in the creation and use of effective and affordable learning materials; based on coherent and consistent implementation of learning theories, which will reflect how the learning processes is really understood.

1.1 Demand for transformation of Higher Education

The interplay between science and technology, which intensified during the 90 s and is constantly increasing due to the ICT revolution, has accelerated industry advancements exponentially. This advancement generated an escalation in demand for Higher Education, since it led to growth in occupations for which secondary school was no longer enough to fulfil the requirements of industry. The increase in technological skills demanded by the labor market [1], along with the increase in demands for professionalization, meant that access to Higher Education institutions was no longer reserved for an elite. In most Western countries, student numbers started to increase rapidly at the end of the 1960 s and this tendency has not stopped until today. This phenomenon is the result of social and in-

dustrial structural changes, and has implications for the organization of modern services and activities offered by Higher Education. Throw [2] has identified three phases in the evolution of Higher Education: elite system (participation less than 15% of the age group), massive system (participation between 15 – 50%) and universal system (participation of more than 50%). The OECD reported in 2009 [3] that since 1998, tertiary attainment levels among young adults have increased significantly, to 34% among 25–34 year-olds on average across OECD countries.

Massification of Higher Education has an effect on almost all institutional aspects: financing, governance and administration, recruitment and selection of students, academic career programs and particularly on curricula and forms of instruction [4]. The phenomenon of massification also has implications related to funding. Covering the expenses of Higher Education at mass level is a serious burden on a public budget. Although in most countries public funding in the period of massification increased, it did not keep up with the escalation of student numbers. As a result, funding per student dropped and staff per student ratio declined. Higher Education today is expensive, being one of the largest cost items for most national budgets. Education is the only major sector in society that has shown no increase in productivity in the past 50 years. On the contrary, costs have risen while the quality of output has remained the same (at best). Higher Education is of low quality regarding value for money that students receive, and has low relevance in terms of how prepared new professionals are to face the labor market demands; results expected of the formal curriculum do not correspond to labor market requirements.

Educating modern professionals for the high-tech industry and society is not the only demand that these institutions are facing. The fierce industrial economy demands scientific advancements and research to spearhead market innovation. The new EU framework program for research and innovation Horizon 2020 [5] echoes another demand of the desired transformation of Higher Education. This new EU framework program focuses on innovation, „by helping to bridge the gap between research and the market". This emphasis on innovation as a driver for product development is more evidence of the stronger market orientation Higher Education is facing nowadays. Public education institutions have to learn to compete with research and development departments in the private sector.

As described by Ernst & Young [6], Universities are „a thousand years old industry on the cusp of profound change". Higher education in general

is nowadays facing tremendous challenges, fostering an historical demand for transformation. Most of these challenges emerge from heterogeneous demands of different sectors belonging to a society undergoing constant transformation and innovation. Different sectors are looking for solutions in Higher Education institutions, sometimes bringing into question the position they should take in the current and future societal and economic panorama. Still a core societal organization, when generating strategies, these institutions have to find an adequate balance between the different interest groups and their representatives, namely:

– *Science/research/innovation*: Higher Education institutions are still seen as a source for the generation of new scientific knowledge and independent research.

– *Administration/business*: the administrative heads of the institutions have to react to a more competing environment and ensure their success. The definition of success is a problem of its own. For instance, traditionally there is a big difference between universities and universities of applied science. While the first assesses indicators from the scientific field (publications, award, grants), the latter is concerned with the number of students. But this difference is vanishing nowadays, since high research quality is usually perceived as an argument to attract more students.

– *Students/professionals*: are approaching Higher Education to build their personal future. The demands of students might be their longing for knowledge, but more often it is the demand for employability.

– *Economy/market*: the economy requires employees and the market pursues innovations to keep up with competitors. How close this could be linked to the strategy of Higher Education depends on its goals and the local or global market.

– *Society/Citizens*: ask for responsible citizens and political subjects. Because Higher Education is still a public task, this debate is not to be underestimated.

Higher Education challenges no longer belong to the academic hegemony. Important actors of the economic sphere are also concerned with the future of this important institution. Economic values and interests evidently drive this vision. To sum up, Higher Education institutions, pulled by strong external and internal forces, have to make strategic decisions to defend or redefine their position in the societal and economical playground. One of the major challenges in Higher Education is to generate a new view on what its main purpose is.

1.2 Epistemology of learning in the knowledge revolution

A clear task for Higher Education institutions is to educate modern professionals, including researchers and scientists that are able to cope with the industrial demands. Not only do adequate curricula and career programs have to be developed, but it is also necessary to prepare faculty staff to manage their time and resources to meet the demands of increasing teaching quality and scientific productivity

The major driver of big European reforms is supplying the labor market with highly qualified professionals [7] already mentioned that educators need to rethink their basic assumptions about organizational structure and curricular programs. The Bologna agreement is the EU reform with the greatest impact in European Higher Education system [8]. This reform has the focus on increasing the mobility of researchers, students and professionals around Europe. Facilitating the mobility of the 'users' of Higher Education aims to broaden the access to resources for education and research. Another aim of this reform is to increase professionals' availability in Europe. The standardization of the career path from undergraduate to PhD studies in all the participant institutions was designed to that end. This way it can be ensured that students and scientists have similar quality standards when they move around countries. This reform was created with the goal of providing responses to issues such as values and roles of Higher Education and research in modern, globalized, and increasingly complex societies with the most demanding qualification needs.

Departing from a labor market demands analysis, the Bologna process introduced one of the most relevant reforms regarding professional education: it represents a shift in the focus of curriculum design from subject-centered to competences-based. This is, with no doubts, the cornerstone of the professional education transformation [9], but also the source of a rainbow of questions on how to implement this curriculum development change and surrounding the role of the teacher. The emphasis on the development of skills and competences has become a headache for those charged with curriculum implementation.

In order to be able to implement competencies-based curricula, it would be necessary to make some fundamental institutional and organizational changes. The main problem faced in this regard is the inconsistency between the objectivist epistemology behind the current formal edu-

cational structures and the relativist socio-constructivist foundations that frame the design of the competences based curricula.

But why would the demands of society and industry need such deep changes in their education systems at all levels? Stephen Byers, former UK Trade and Industry Secretary, described it to the Confederation of British Industry (CBI) in 1999 [10]:

„The first industrial revolution was based on investment in capital and machinery. The revolution we are going through now requires investment in human capital – skills, learning and education."

The current educational structure was created in response to the demands of an industrial society, which, alongside workers, needed an elite of highly educated professionals. These professionals had the role of experts in their subject matter and were a small part of the workforce. The knowledge society instead requires highly qualified professionals, who are able to find solutions, quickly and efficiently, with skills for applying new knowledge to new situations. This new knowledge has to be found or acquired by modern professionals and it most probably will extend its limits out of the scope of their initial field of expertise.

Access to scientific and practical knowledge is no longer a privilege of a few. The massive growth of free education offerings, online resources and open knowledge is not a secret. Knowledge and information are freely available and accessible out there for anyone operating a simple Internet connection or who can afford a smartphone. This is one of the main changes in the epistemology of our society. Higher education institutions are no longer the one central source of knowledge generation, which implies that it is no longer the unique owner and distributor of knowledge either.

2. KNOWLEDGE REVOLUTION

The fast evolution and expansion of ICT has progressively and dramatically steered the evolution from an industrial to a knowledge society. The knowledge revolution that steers the knowledge society is the result of an incremental reciprocal influence between technological developments and scientific advancement. The development of sophisticated ICTs from the 90 s on allowed the general public and non-scientists to progressively collect, share and create their own knowledge (via online communities, social networks and lately the use of cloud computing for sharing and collaborating). Scientists also use the same tools used by the non-scientific general

public to expand their borders and generate scientific knowledge. Besides ICT, other technologies are also emerging as a product of this rapid knowledge access at all levels of society. The more technology evolves, the greater the number of tools there are for scientific exploration. New technologies are allowing all scientific fields a deeper and better understanding of natural and societal phenomena. The better scientists understand their fields, the more refined are their technical demands so as to answer more complex scientific questions. This interplay between Science and Technology (S&T) is enabling the unprecedented creation of new materials and processes, which allows the design and implementation of ever more sophisticated technological tools at the service of science and society. The rapid dissemination of existing knowledge and know-how, coupled with the possibility to exchange ideas virtually with everyone everywhere, speed up the generation of new knowledge and know-how beyond the limits of the context in which it was originally created.

This expansive wave of knowledge generation is broadening the boundaries of the scientific field to such an extent that it intersects with the expanded limits of other fields. This phenomenon is creating new interdisciplinary territories of research and developments, giving rise to strong demands for inter- and multidisciplinary work. Researchers no longer have the image of the isolated scientist in a lab. The scientific fields are becoming so complex and vast that teamwork and networks are necessary. Hence, even in the academic area new skills are required even from junior researchers so as to be able to deal with economy's strong demands better and make the most of the knowledge and technology revolution.

The marriage between S&T is also creating new markets and generating new economic niches. Many of the technological developments created to resolve specific industry demands find their way to other markets. Thus, new professional profiles are also required, either by the new academic research fields or by the new economic niches. But in any case, these new professionals should have the competences to be able to go beyond one specific knowledge field.

The aforementioned expanding S&T dynamics currently have an incremental momentum, which is very difficult for old and static organizations like big Higher Education institutions to follow. This is because the entire educational and administrative structure of these extremely traditional institutions has been historically rooted in the division of scientific fields and disciplines. Therefore, their internal organizational structure does not pre-

pare them for meeting the increasing demand for interdisciplinary professionals (either academics or industrial professionals). The strong fields and discipline structures, which currently function as the skeleton of their research activity and their career offers, it is one of the most challenging situations to be resolved when implementing competences-based curricula.

2.1 Technology, epistemology of learning and curriculum development

We understand curriculum development as a framework that helps to structure instruction in formal educational contexts, and design that instruction pursuant to structuring a learning process in order to achieve determined learning goals. Hence, how instruction is conceptualized, designed and implemented has a direct relation with how the learning process is conceived, and has strong impact on how curriculum is developed. The relation between learning and knowledge depend on the epistemology taken. This is a fundamental conflict faced by curriculum development in the knowledge society, since the knowledge revolution has fundamentally modified the epistemology of our society.

On a theoretical level, epistemology of learning (and thus of teaching) has changed with the evolution of Web 2.0 and social media. With the transition from individual and private exchange to social and public co-creation, new generations are changing from an objectivist epistemology to a more relativist one. The current division of scientific fields and disciplines as the backbone of career programs and curriculum development is based on the epistemological belief that knowledge is an object, which is transferable from the head of the 'expert' or teacher to the head of the 'learner'. Learning is understood as the process of transmitting and receiving that knowledge in an individual and fragmented way. It is also based on the idea that knowledge can be segmented and separately delivered. Even the evaluations in the form of tests where the learner must be able to repeat the received information (the received object), reflect this 'knowledge as transferable object' epistemology. In this context, it is difficult to differentiate information from knowledge. The learning metaphor associated to this approach is known as „acquisition metaphor" [11], reflecting the idea that knowledge can be acquired from another one who has it. That is the reason why the curriculum design based on this metaphor of learning was subject-centered, since the learning process consisted of the transmission of the subject's content. When our current Higher

Educational structures were designed, at the service of the industrial revolution (end of XVIII, beginning of XIX century), behaviorism could best explain how learning processes worked, since at that time the technology that nowadays helps us to understand what happens inside the Skinner Box did not exist. No major attention was paid to cognitive processes, because there were no mechanisms or technologies to implement them, in terms of learning assessment. Thus, the only way to evaluate at that time was implementing summative assessment, which is based on the behavioral principle of punishment and reward.

During all these decades, cognitivist and socio-constructivist theories of learning have had the opportunity to be explored more deeply, since technology is at the hand of social and human sciences. When technology first started to approach learning enhancement, the educational systems first tried to reproduce the role of experts in the learning processes of the learners, having their instructional design based in the classical behavioral methods of punishment (when answer is wrong) and reward (when answer is right). The microcomputer revolution in the late 70 s and early 80 s helped to revive computer-assisted instruction, where cognitivist approaches were implemented. Learning was about creating internal cognitive conflicts in the learner, to modify their internal cognitive structure resulting in learning. Thanks to the development of more advanced ways of combining multimedia interactive educational systems it was possible to create more complex learning scenarios with a broader range of interactions between the learner and the system. Due to the technology available at that time, educational technology was still thought as to be used in an individual way, because learning was also still understood as an individual process, more cognitive than only behaviorist, but still individual. It is at the end of the 90 s when the concept of „Computer-Supported Collaborative Learning" or CSCL appears in the scientific scene [12]. It is not coincidence that this corresponds to the first boom of Internet based ICT (email, chat, web 1.0, first eForums, etc.). Behaviorism, cognitivism and constructivism describe learning theories that are by no means new in the educational psychology field, they exist before the creation of current emergent technologies. Unlike behaviorism, where knowledge is something to be acquired from another one who has it, in constructivism knowledge has to be created. Here is where 'social learning' comes into play. Why is social learning more than just getting students to work together? Why is the learning activity so important in order to reach learning goals? There are

two general ways of understanding the social construction of knowledge. On the one side, the socio-cognitive constructivism explains that an individual needs the social interaction with the environment or others, in order to generate and resolve socio-cognitive conflicts and this way modify his/her cognitive structure, i. e. learn. From this perspective, although social contact is needed to foster learning, the knowledge creation process remains individual. Sfard [13] called this the „participation" learning metaphor, where a dialogic process is needed between individuals in order to foster and support knowledge construction. On the other side, socio-cultural constructivism describes learning as a social process of co-creation of knowledge, where the knowledge created is distributed among the ones who participated in its creation, this approach talk about the existents of a 'distributed cognition'. It doesn't belong to one individual and it is represented by so called 'conceptual artifacts', which are common understandings that allow the group to apply this knowledge and extend it in different situations. This process is called the „knowledge creation" learning metaphor. In both cases of constructivist approaches, what is needed to produce 'learning' is either generating the context where the individual-cognitive conflicts are created, or designing the appropriated activity where students are able to co-create knowledge. But, in spite of how the learning process is understood, or which learning metaphor is used to describe it, in both cognitive and socio-cultural constructivism, the learner needs to develop social competences or capabilities in order to create knowledge. Hence, even when content is important, the competences to be developed are what defines the most suitable design for the learning activity to be implemented. New pedagogical approaches are producing radical transformation at curriculum development and programs in Higher Education. that allow new professionals to develop the social and knowledge creation competencies needed in the networked knowledge society and

Although the technologies exist for implementing more constructivist approaches, there is a need for changing fundamental structures of Higher Education systems in order to be able to use social learning technologies in an adequate way.

3. CURRENT SITUATION ANALYSIS

Universities have for a long time struggled with the use of digital technologies for educational purposes [14]. One of the biggest problems faced

is that technological changes are happening faster than the reaction capacity of the educational institutions. The trends of technological development with potential educational uses are changing faster than the institutions' capacity to make decisions regarding cost investments and technological infrastructure. Institutional administrations do not really know the implications of adopting any given technology besides its economic implications. It is out of their scope to analyze pedagogical models and their relation to the institutional business model or goals. Hence a new trend is set before the institution had time to define which would be the most suitable technology for their institutional goals and strategies.

Unfortunately, most Higher Education institutions are trying to define their future business models in terms of what technology they will adopt. It has become more a marketing issue than a question of enhancing learning. Introduction of emerging technologies in Higher Education has broader implications than just selecting the kind of technology to be used. In first place, institutions have to make decisions on their role in the societal scene and define educational models accordingly.

One clear example is the complex decision making process on the arising trend of Massive Open Online Courses (MOOC). This could mean opening up distance learning units. This might be a way to approach new target groups. The idea seems to be simple: the content as well as the didactics are already developed, thus the university has to adapt it to these new technologies. Nonetheless, what that exactly means for the institution is to re-think their educational model, to make decisions on the possibility of offering distance learning besides their regular practice (which differs from the blended learning model). Not all organizations have the enormous structure that MIT has regarding availability of technology and human resources to support the production and distribution of MOOCs. Educational organizations have to make the decisions on where and how they invest their resources (economic, infrastructural and human resources) before defining if they will ride the MOOCs wave and, if so, how they will do it.

It is evident that massification of education challenges the education system in terms of accommodating alternative study needs and providing more flexible teaching modes, such as online learning activities, individualization of education, self-study activities and so forth. It is also clear that MOOCs seem to be a good alternative to face this challenge, but as in many other potential solutions, the implementation of MOOCs is

going beyond the acquisition of technical infrastructure to produce and/or host massive online courses, it also has strong implications on the education model adopted by the institution, which of course has implications for curriculum development and teaching. The study Open Education 2030 – Part III Higher Education (2013) [15], looks at open education as a way of to overcome the weaknesses of Higher Education today, and maintain its relevance in society, economics and science. The study points out that open education is, at the moment, to be considered a strategic development of modern Higher Education organizations and suggests an inclusion of open education practices as part of a strategic transformation and not the complete transformation of Higher Education institutions into open education ones. Nevertheless, open education has challenges of its own, for example how to incorporate always-emergent ICTs in their daily practice or how to deliver certifications in the online world (a problem related to online assessment).

Over the last few years, we can also see an rapid increase in the use of social computing applications for blogging, podcasting, collaborative content (e. g. Wikipedia), social networking (e. g. MySpace, Facebook), multimedia sharing (e. g. Flickr, YouTube), social tagging (e. g. Deli. cio. us) and social gaming (e. g. Second Life) among Internet users. Use of online tools and digital media is considered one of the possible opportunities for renovating education and training as well as for contributing to re-skilling and continuing professional development. Social computing applications (Web 2.0, Social Web) have a profound effect on behavior, particularly that of young people whose medium and métier it is. They inhabit it with ease and it has led them to a strong sense of communities of interest linked in their own web spaces, and to a disposition to share and participate. The challenge for educational institutions is to locate relevant communities of interest since many of these communities of interest will operate across national borders [16].

There are many more projects trying to integrate Web 2.0 applications into the overall Higher Education institutional architecture. However, most of them are still at the pilot stage, which makes it difficult, at this point in time, to assess factors for failure and success. Drawing on the analysis of several UK universities' experiences with Web 2.0 applications, [17] point out that universities have to address a wide variety of issues in integrating Web 2.0 tools.

Several studies conducted in research project „Learning 2.0" (2008–2009) by the Institute for Prospective Technological Studies (IPTS)[1] suggest that the high take-up of social media applications outside of formal educational settings provides new opportunities for innovating and modernizing Education and Training institutions and prepare learners for the 21st century. The study „Learning 2.0: The Impact of Web 2.0 Innovations on Education and Training in Europe" [18] investigates the ways in which social media are and can be used in formal educational settings and illustrates that social media can be, and are, used by Education and Training institutions to:

– facilitate access by current and prospective students to information, making institutional processes more transparent and facilitating the distribution of educational material;

– integrate learning into a wider community, reaching out to virtually meet people from other age-groups and socio-cultural backgrounds, linking to experts, researchers or practitioners in a certain field of study and thus opening up alternative channels for gaining knowledge and enhancing skills;

– support the exchange of knowledge and material and facilitate community building and collaboration among learners and teachers;

– increase academic achievement with the help of motivating, personalized and engaging learning tools and environments;

– implement pedagogical strategies intended to support, facilitate, enhance and improve learning processes.

The second study of IPTS„Learning 2.0 – The Impact of Social Media on Learning in Europe" [19], relates learning to informal (online) learning networks and communities, concluding that social media applications provide easy, fast and efficient ways to access a great diversity of information and situated knowledge. Research on informal learning activities in online networks and communities further suggests that informal Learning 2.0 strategies facilitate the development of key competences for the XXI century.

While the evidence collected in both studies confirms that social media applications have not yet been exploited widely for learning purposes, the research identifies a substantial number of Learning 2.0 opportunities outside and inside formal Education and Training institutions, indicating

[1] https://ec.europa.eu/jrc/en/institutes/ipts

that Learning 2.0 approaches facilitate the acquisition of key competences and foster technological, pedagogical and organizational innovation.

Nowadays, with ICT being used in learning, classrooms are converted into „virtual" social spaces for learning, where students socialize when experimenting, reading, reflecting, discussing, creating and peer reviewing. Moreover, teaching spaces are becoming learning spaces and use of ICT in courses has become more natural. In practice both „distance" students and campus students are in the same courses. In the authors' opinion there is no suitable definition of the current process that is happening in Higher Education today. „Blended learning" is one of the few expressions that can be used to describe the current process in Higher Education, allowing new teacher-created, bottom-up interpretations, using both the online environment and the physical surroundings [20]. Most University courses today are a mix of „face-to-face" and online learning, focusing on online distribution of content and teaching in classrooms as a kind of „half-distance" education.

Even when technology is available, as for example in online courses, social networks analysis for learning analytics, or diversity of social media applications, there are still open questions about how to use it in an efficient and effective way. There is even the question of „what does successful deployment of technology mean when talking about teaching and learning processes in the knowledge society?" We try to answer these questions below.

3.1. Factors for a successful deployment of technology in Higher Education

Digital technologies available to education have already expanded dramatically in recent years, but it takes more than technological infrastructure to transform a profession. Teaching staff of Higher Education organizations are trying to understand their new working context. On the one hand, they have to align their practice with institutional requirements like implementing competence-based curricula and using pre-defined institutional learning environments and technologies. On the other hand, they are trying to understand what teaching and learning in the knowledge society means, where students have free access to the information that they are supposed to deliver. Moreover, their knowledge can be put into question by any student on the basis a different perspective found in an expert online community. For a member of Higher Education teaching staff, the

question should not be „How should I use the institutional technology?" or „What kind of technology should I look for?", but „What is my role in the learning process?" or better „What does teaching in the knowledge revolution mean?".

The current problem that teachers face is, they simply do not know what they should expect from technology. Hence, they have to develop a vision of what they want from it. Furthermore, if we consider the rapid evolution of technologies, they should be able to make strategic decisions on what pedagogical models they will go for, and which kind of technologies will be the most suitable for it. This capability could also be called „foresight thinking".

While educational researchers will better understand what teaching in the knowledge society means, teachers could use those findings and their foresight thinking to imagine new technologies and pedagogical models. Scenario building seems to have a high potential to allow teaching staff also to make better choices about the combination of digital technologies and pedagogical models.

But teachers are not unattached to the organization, and they must be in line with its strategic plan. At the same time, organizations are not able to go forward without considering the teachers' ideas. This needs a good combination of top-down and button-up strategies, in order to better master the future of Higher Education organizations [21]. Therefore participatory methods are necessary in the case of Higher Education institutions, including not only experts but also teaching staff and technicians of the organization. The ultimate goal of the foresight process, besides supporting the strategy development process, would be bringing about a foresight organizational culture [22].

3.2. Future trends

A shift in the conception of education has already begun to occur: from being largely governed by the intuitions of individual practitioners to a technology-enabled science of individualized learning. In its 2011 Joint Research Centre Report, „The Future of Learning: Preparing for Change" the European Commission endorses a model „shaped by the ubiquity of Information and Communication Technologies (ICT)" as its „central learning paradigm" [23]. It predicts that embedding assessment in the learning process and pedagogy will rely increasingly on interaction, including the

interaction with rich technological environments, which will be responsive to learners' progress and needs.

Using technology in ways that individualize learning will not only serve the educational needs of traditional school-age populations, but the lifelong and life-wide needs of adults as well as they seek flexible options for upgrading and expanding their knowledge, skills, and employment credentials. Life-long learning and „distance education" had been the University „project idea", driven by technology or political discourses, and its use of ICT focused as „transportation of education" to a broader range of students. Distance learning made some motivated students happy to finally access education, but other students ended up lonely and lost with half-completed courses, ensuring they would never try again. Teaching on campus went on like before, but with shrinking resources and with ICT as an „add-on" for rationalizing tedious functions in traditional courses. People with older educational conceptions, meaning that relevant information should to be memorized, had almost all drowned in information already, but the associated teaching methods were still there, with the teaching classroom as the natural home. This model failed to succeed since Higher Education institutions did not come through these challenges.

With the rise of Open Educational Resources (OER) movement and MOOCs new possibilities for life–long learning outside of universities, self-directed and in communities, are produced. The new usage of the education material proposed by the Open Education model and the new associated facilities questions the traditional model of knowledge delivery and in particular the usual flow of material produced by the experts (from the academia or the practitioners) and delivered to the users (students or participants). This raises issues of quality but also changes the current landscape and relations *in* teaching and learning as new actors now appear within the science. The Open Education movement breaks down traditional barriers, which have favored the consolidation of the closed education system, based on top-down provision and built around teacher-centered and classroom-based concepts of learning. The future of life-long learning will not be about MOOCs as they are today. But as MOOCs already show, new dimensions of flexibility and non-linearity are already within reach today.

More and more parts of what we today call „tacit knowledge" are being made explicit in metadata, and have to be shared with others. This means the discipline so essential to learning will be pervasive in all our activities.

The authors of this paper argue that the learning activities we will do in the future will be self-explaining, like most software today which has become so user-friendly that even complex image enhancement can be done on a smartphone by virtually anyone taking a photo. This requires immersive learning approaches.

For instance, many people already use social media as informal learning settings or have created trusted networks of professionals using the Internet and other social tools to communicate, collaborate and share resources, experiences, knowledge and ideas. People can also use various online tools and their own devices (ranging from pen and paper to cameras and smartphones, iPads, etc.) to address their own learning and performance problems – particularly where access to formal education and public social sites has been blocked. As Floridi [24] argues, we are the last generation to make a clear difference between online and offline worlds.

Mobile learning, in some form, is a trend that will span Higher Education across much of the world within the next year. Researchers in three Advisory Boards are in consensus about learning analytics being positioned two to three years away from widespread adoption. However, the Internet of Things is in the far-term, except for the Higher Education group where this technology is more imminent and is predicted for adoption within two to three years. Current concrete examples of the Internet of Things are mainly taking place in research departments at four-year universities. Further we see that games and gamification did not have clear implications for teaching and learning in the STEM group. Online learning, whether in the form of MOOCs or other opportunities, is positioned on the near-term horizon. Also, there is a clear and mounting emphasis on online learning and more pervasive access to learning opportunities at two-year institutions.

A number of technologies distinguished the viewpoints expressed by the 2013 Horizon: BYOD, social media, badges, next-generation LMS, virtual assistants, and virtual and remote online laboratories, although mostly considered by other recent panels, were seen as likely developments for two-year institutions over the next five years. As online learning gains more traction, Higher Educational institutions will have to find ways to engage learning analytics in order to recognize student accomplishments and skill acquisition.

Meanwhile, virtual and remote laboratories are taking the pressure off of colleges to purchase and maintain expensive, high quality lab equip-

ment, and allowing learners to conduct experiments with greater flexibility. We can say that a key trend is ubiquitous learning allowing learners to have the freedom to work and study from any location and on any device they choose. With the rise of mobile learning and social computing applications, educators will need to develop educational models that make learning experiences more personal.

For a long time, Universities used technology to record, broadcast, and recreate classroom practices and structures in virtual learning environments (VLE), streamlining them. But in future, the traditional teaching space may not be the central metaphor for education, and not meaningful to augment with technology. What is the place for future „open" Higher Education if we have to call it something? It won't be the „teaching place" any longer, nor the „classroom as learning place" (that was long ago), not only a „student collaboration place", not really all in the „cloud" but probably there will be a sort of „ICT-supported social information sphere" between teachers and learners, always using places as tools as well as books, OER, and social computing applications as tools

4. CONCLUSION

Education in the 20th century was mainly oriented towards socialization as it is the „universal" gate to citizenship and social inclusion. While socialization dominated, individualization and professionalization were also important in a steadily growing economy. Nowadays education policy might be requested in the short-run to turn to professionalization and „employability" as its primary short-term goal. In the second decade of the 21st century, schools and education policy-making are trying to enhance their means to meet this challenge, by focusing somehow more on the autonomy of the learner and ownership of the learning process, preparing pupils to become autonomous, creative and critical learners (and thus citizens) rather than good re-producers of knowledge. Self-expression of the learners, in view of encouraging autonomy and creativity, is to be stimulated in classrooms; with multi-cultural integration representing the big challenge on the socialization side.

The knowledge society requires education to raise autonomous (lifelong) learners and critical citizens rather than recipients of content. It pushes towards more learner-centered processes – able to support individual differences and autonomy in learning. This includes active learning

strategies, challenge and problem-based learning and collaborative learning experiences.

A university curriculum for the future should emphasize differentiation, flexibility and quality, it should provide students with the capacity for lifelong learning which will become more and more important in the competitive knowledge society of the future, it should develop key skills like critical thinking as well as specialized knowledge and it should combine theory and practice.

Education is rapidly approaching the time when educators of limited vision will be weeded out and instructors dedicated to life-long learning and educational advancement are left to design future curricula. In order to impact students in an effective manner, strategies must be developed which coincide with real-time and relevant information systems. Life-long education is the key for future successful educational delivery. The future is steeped in virtual pedagogy and educators must be able to integrate technology with curricular design in order to be successful contributors to the future of education. Addressing web-based curricula is quickly becoming the new trend in educational mainstream thinking.

As mentioned in the Open education 2030 – Part III Higher Education (2013) report „Higher education may seem to be undergoing disruptive change, but is not yet undergoing radical innovation, at least not at scale" [17] (p. 5). The analysis of emergent trends or scenario building seems to not have been exploited sufficiently for supporting organizational strategic development in Higher Education.

Future careers will require new levels of education compared with the past. That future education must enable individuals to discover what they need to know rather than just having static knowledge. Society will need college graduates with meta-cognitive skills, agility and adaptability to changing society needs.

If this is the goal of education, colleges and universities must re-examine how that goal is achieved. In current educational technology training for university teachers, theory is separated from practice, curriculum lacks a certain pertinence, means of evaluation are few and other such problems are prevalent. There are so many directions, disciplines, methodologies, and interpretations, the implications are staggering. The integration of technology pedagogically is the true future of curricula and all prospects associated with educational direction. Educators are challenged with the necessity to keep pace or perish. There is actuality no choice in the di-

rection for future educational doctrine, in the authors' opinion. Teachers need to become proactive participants referencing their continued life-long education. There is no room for complacency, as the educational world now developing in cyberspace becomes the main delivery system for our very near future. So educational planners need to heed the obvious implications presented, and actively entertain a new era for pedagogical presentation.

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VISOKO OBRAZOVANJE U DOBU REVOLUCIJE ZNANJA

Rezime

Postojeći sistem obrazovanja nastao je kao odgovor na zahtijeve industrijskoj društva u kojem su radna snaga i kapital dominirali kao ključni činioci društveno-ekonomskog razvoja. Sa globalizacijom svjetskog tržišta i razvojem informaciono-kounikacionih tehnologija, znanje postaje temelj konkurentnosti i najznačajniji resurs. Proces globalizacije, stimulisan razvojem informatičke epohe, doprinosi promovisanju otvorenih obrazovanih resursa i unifikaciji opštepoznatog i profesionalnog znanja. Suština društvenog i privrednog razvoja zasniva se na novom, otvorenom znanju koje je generisano obrazovanjem u globalnom ambijentu. U procesu globalizacije mijenjaju se ne samo forma organizacije i društvene potrebe u obrazovanju već i procedura stvaranja i primjene novog znanja. Univerziteti moraju izmijeniti tradicionalni pristup obrazovanju i usvojiti tehnološke promjene koje donosi globalizacija sa ciljem produkcije novog, otvorenog znanja. U ovom radu razmatraju se ključni faktori koji utiču na primjenu novih tehnologija u viskoškolskom obrazovanju. Pored analize postojećeg stanja" u radu su definisane ključne potrebe za restrukturiranjem obrazovanja saglasno uticaju globalizacijskih procesa.

Ključne riječi: globalizacija, obrazovni sistem, otvoreni obrazovni resursi, otvoreno obrazovanje, e-učenje 2.0