

Technologies in Higher Education: Public Policies and Social Appropriation of their Implementation

Tecnologías en la Educación Superior: Políticas Públicas y Apropiación Social en su implementación
Tecnologias no Ensino Superior: Políticas Públicas e Apropriação Social na implementação

Diego Fernando Melo Fiallos* (<http://orcid.org/0000-0002-6707-3453>)

Carrera de Turismo y Hotelería, Facultad de Ciencias Humanas y de la Educación,
Universidad Técnica de Ambato, Ambato, Ecuador.

Judith Alexandra Silva Chávez** (<http://orcid.org/0000-0002-1033-7470>)

Centro de Idiomas, Universidad Técnica de Ambato, Ambato, Ecuador.

Luis Rene Indacochea Mendoza*** (<http://orcid.org/0000-0002-3220-8696>)

Carrera de Psicología Educativa, Facultad de Ciencias Humanas y de la Educación,
Universidad Técnica de Ambato, Ambato, Ecuador.

Jorge Humberto Núñez Campaña**** (<http://orcid.org/0000-0001-6062-8922>)

Carrera de Educación Básica y Parvularia, Facultad de Ciencias Humanas y de la
Educación. Universidad Técnica de Ambato, Ambato, Ecuador.

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ABSTRACT. This paper presents an analysis of the implementation of information and communication technologies in higher education with the aim to contribute knowledge on trends regarding their social appropriation. To that effect, documents of public policies and scientific literature containing guidelines developed by international organizations and explaining different alternatives to guide the process of integrating technologies in education were reviewed. Then, some research works on problems derived from the technology appropriation process without changes in the teaching-learning process are commented. For this, the learning theory of connectivism is discussed as the possible reference framework for this analysis. Findings point to focus attention on learning processes more than on investing in equipment, and highlight the importance of using technologies in education within the context of the fourth industrial revolution in the digital age.

Keywords:
Higher
Education,
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student,
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*E-mail: diegofmelof@uta.edu.ec, **E-mail: ja.silva@uta.edu.ec, ***E-mail: luisrindacocheam@uta.edu.ec, ****E-mail: jhnc_11@hotmail.com

RESUMEN. En el presente artículo se hace un análisis sobre la implementación de tecnologías de información y comunicación en la educación superior con el objetivo de aportar conocimiento sobre las tendencias en su apropiación social. Para ello se ha hecho una revisión de documentos de política pública y literatura científica, que contienen las directrices planteadas por organismos internacionales en las cuales se presentan diferentes alternativas para orientar el proceso de integración de las tecnologías en la formación. Seguidamente se comentan algunos estudios acerca de problemáticas surgidas en el proceso de apropiación tecnológica sin un cambio en el proceso de enseñanza - aprendizaje, para lo cual se discute la teoría de aprendizaje conectivista como posible marco de referencia. Las conclusiones apuntan a centrar la atención en los procesos de aprendizaje más que a la inversión en equipamientos, subrayando la importancia de las tecnologías en la educación, en el contexto de la cuarta revolución industrial en la era digital.

Palabras clave:
Educación Superior,
Tecnologías,
docente,
estudiante,
conectivismo

RESUMO. No presente artigo, uma análise é feita acerca da implementação das tecnologias da informação e comunicação no ensino superior com o objetivo de contribuir com conhecimento sobre as tendências em sua apropriação social. Para isso, foi feita uma revisão de documentos de política pública e literatura científica, que contêm as diretrizes apresentadas pelos organismos internacionais, as quais apresentam diferentes alternativas para orientar o processo de integração das tecnologias na formação. Seguidamente são comentados alguns estudos acerca das problemáticas surgidas no processo de apropriação tecnológica sem uma mudança no processo de ensino-aprendizagem, para o qual é discutida a teoria da aprendizagem conectivista como possível marco de referência. As conclusões apontam a centrar a atenção nos processos de aprendizagem mais do que no investimento em equipamentos, sublinhando a importância das tecnologias na educação, no contexto da quarta revolução industrial na era digital.

Palavras-chave:
Ensino Superior,
Tecnologias,
docente,
estudante,
conectivismo

New information and communication technologies (NICT) are not only a need in modern society but they lead the transition towards the fourth industrial revolution (World Economic Forum [WEF], 2016) based on connectivity; that is why competencies in their use are a fundamental requirement for accessing the job market (Organisation for Economic Co-operation and Development [OECD], 2016). Within this framework, this work addresses the importance of keeping in mind that the accelerated changes imprinted by market tendencies not always translate with the same agility and efficiency required by Higher Education, one of the fields in which, according to what was highlighted, it is of utter importance to undertake the appropriation and learning of technology.

This work focuses its attention on some of the disparities which, according to the bibliography reviewed, are present among the guidelines for public policies about the use of NICT in higher education and the difficulties that have arisen, on the one side regarding which should be the priorities on which to focus efforts (infrastructure or teachers) and, on the other side, the need to review which paradigm or theoretical framework sustain the teaching-learning process by means of NICT. Based on that, the objective of this article is to analyze by means of reviewing a series of studies coming from documents issued by international organizations together with research carried out on education technologies implementation processes, pointing out the theoretical proposal of Connectivism (Siemens, 2005) as a conceptual basis that tries to contribute to the construction of a reference framework before a done deal that leads to assume the relationship between technology and education as irreversible.

This document starts with a brief review of the suggestions issued by international organizations at the beginning of the twenty first century concerning NICT in Higher Education, pointing out some convergent and divergent aspects regarding what government work should be prioritized. Next, a series of scientific studies are presented that show the problems of technological immersion in which access to information through the Internet happens equally between teachers and students, verifying that teachers may be less prepared to insert NICT into their traditional teaching methodologies while students in non-formal spaces train themselves on the use of technological tools. Following the presentation, some characteristics of the “connectivist” proposal as a learning theory in the digital age are presented, which, although presenting some weaknesses, supposes a step from academia to lay the groundwork for a paradigm on teaching and learning in environments characterized by access to information via the Internet and the use of digital tools, which changes the relationship existing between teachers and students, taking into account that the consequences and evolution they may have in upcoming years are yet to be analyzed.

The conclusions of this review offer a discussion between guidelines of public policies and NICT appropriation processes in Higher Education, supplemented by a reflection on NICT appropriation in reference to the Connectivist model, aiming at the need of serving a population in which a digital gap may exist in two senses: generational between teachers and students and in the need of an education management model adapted to current needs.

PUBLIC POLICIES GUIDELINES FOR THE INTEGRATION OF NICT INTO HIGHER EDUCATION.

Technological development represents a tool of great impact on the economic development of countries and its integration into education is necessary, since they are indispensable in globalization and they facilitate citizen participation (Benavides & Pedró, 2007; Kozma, 2008). López de Mesa's work (2011) highlighted relevant aspects about recommendations from international organizations for the design of public policies regarding education and technology and in what aspects they placed the focus of the importance of developing their proposals. UNESCO and the World Bank placed the axis around the importance of the role of the teacher as responsible from the classroom for the inclusion of NICT in the traditional educational environment, noting that it should be a priority for governments to strengthen teacher training together with enabling equipment in educational institutions. On the other hand, institutions such as the OECD grant a more important role to

the students, due to the increasing intensive use of technologies that they realize outside the classroom and underlining the need to establish links between the non-educational use and the training aspects (OECD, 2006). In a vision complementary to the previous ones, the Inter-American Development Bank (IDB) emphasizes learning as the main objective of the integration of NICT into education, contributing an integrated vision (Claro, 2010).

With regards to such diversity in criteria, it is worth a prior reflection as to what is expected when introducing NICT to education. Benavides & Pedró (2007) placed the emphasis of educational policies on four needs to which the implementation of NICT in the educational system would contribute: (a) boost economic development; (b) promote equity and social justice, generating equal opportunities; (c) condition a change in the teaching model; and (d) aim at the quality of learning. Authors point out that the initial response before this panorama of government guidelines and acting needs was resolved mainly by investing on computer equipment, facilitating Internet access and financing content development so that these would result on the establishment of favorable conditions for the use of NICT in the classroom.

The priority of obtaining visible results in the political agenda has boosted investment in equipment purchasing, presupposing that the presence of tools in the classroom carries the change from a traditional educational approach to one by means of NICT, receiving criticism because of the need to work for a social appropriation of the medium to make its use effective (Martí Noguera, Nascimento et al., 2014). As pointed out in Lugo's work (2010), following recommendations from UNESCO and the World Bank about paying attention to teachers and from the IDB regarding learning processes, it would be required to define new roles to allow teachers to be qualified not only to impart virtual teaching under the same educational model but to develop a new technology that empowers the student's autonomy as an actor in his training, not only being a passive recipient. Not setting as a goal for teachers their understanding of technology use, filling classrooms with technological material resources is in vain.

For this, the strategies of the political agenda should emphasize, as indicated by UNESCO, an educational change to allow providing teachers with the competencies demanded by the model and do not narrow it down only to technological competencies. Based on that, assessment of the impact of IT policies on Education should not be limited to measuring progress results through device consumption rates and the degree of progress in Internet connections, for which Andrade and Campo-Redondo (2012) affirm that policies promoted in education development plans should focus on analyzing its social implementation.

NICT APPROPRIATION PROCESSES IN HIGHER EDUCATION

According to the OECD (2006), teachers are responsible for developing in their students competencies in the use of technology to increase their productivity; this should be analyzed from an educational approach and not only from an economic impact one. The implementation and success of the appropriation of NICT in education require an understanding of the adequate theoretical and methodological framework for learning in a new context, as well as work on the definition of teachers' professional profiles who

should implement changing technologies in the classroom, adapting contents to new media and defining interaction processes with students. In this sense, Martí Noguera, Nascimento et al. (2014) state that the understanding of NICT in Higher Education management require paying attention to two aspects. On the one hand, (a) policy guidelines that generate a methodological framework for implementation following recommendations of international experts, and on the other hand (b) knowing guidelines of NICT social appropriation in education as indispensable tools to relate to a global knowledge environment accessible from the Internet.

After commenting previously the statements of international organizations, in this section studies about the implementation process in the classroom are analyzed. According to Gallardo-Echenique, Minelli de Oliveira, Marqués-Molias and Esteve-Monet (2015), in the appropriation of NICT in the educational context one has to keep in mind the differences between pretending to develop the so called digital competency to know how to use technological tools and the orientation of policy towards digital literacy that requires to boost a paradigm adapted to present and future dynamics. This situation implies continuous digital training for teachers as well as research to allow assessing results, not limited only to actions to train but also strategies to understand a tool in constant change. Consequently, Rochefort and Richmond (2011) refer to the social demands of universities to take responsibility not only for creating a virtual environment that prepares students to enter the current job market but also guarantee a continuous access to up to date knowledge, as well as the competencies to interrelate concepts and apply them to a new scheme of knowledge management. However, the authors stress that the reality of technology appropriation in universities is far from being current with respect to said tendencies, pointing out that even though «it is possible that some teachers know the available technologies even get to use them, in general administrators and the teaching team are not aware of how powerful these tools can be for teaching.» (Rochefort and Richmond, 2011, p. 203)

Analyzing the interrelation process between training and technology, for Codina (2009) and Salavisa Lança & Fontes (2012), the appropriation of NICT in education needs a series of adaptation processes of the education center to the construction of a digital space which facilitates and accommodates the dynamics of technology use already present in most of the society connected to the network, where the citizenry participates in playful (Facebook, Twitter) or work related (LinkedIn) social networks, considering necessary to relate informal and commercial IT with educational ones in order to attend to the mixture of interests of the innovation and knowledge society in the 21st century. This informal technology appropriation was already indicated by Kozma (2008) when stating that the political agenda of NICT implementation in Higher Education should consider that technology is not something alien to society; an appropriation of NICT exists, with constant progress and evolution which facilitates its use in all population layers, regardless of the educational system, with policies having no room for reaction and adaptation.

According to Fuchs (2010), NICT are like a political ideology that empowers the user so that from generation of content expresses his opinion in a new environment of social networks that transcend the physical space to the virtual one, which makes that concepts such as the proximity in relationships become relative in terms of physical and time distance. Thus, it results in social appropriation of knowledge being an interactive, flexible, systemic, pensive and participatory process, oriented towards

the construction of knowledge by means of transforming learning, in which the educational space is the environment in which the symbiosis of NICT in the teaching-learning process is force to happen under the perspective of new models. For example, the development of new training models appear such as the Massive Open Online Course (MOOC) based in a tendency by which informal networks are created that cooperate with the learning process in a space that is not the university. Sangrà and Wheeler (2013) link the fast expansion of social networks with this phenomenon that they consider beneficial for learning by allowing the possibility of creating virtual networks and access to content and information exchange expanding the limits of the educational space and progressively changing the learning model.

Therefore, NICT appropriation by Higher Education, for Freire and Schuch (2010) faces a dilemma with two alternatives: to continue absent from informal educational processes where a great deal of learning takes place among the young or to assume that reality and take advantage of many of the experiences that normally are not considered part of education, transforming them in integral learning processes of the first level. This situation leads educational institutions to a different role than the traditional one, since it demands training teachers to become managers of knowledge as an urgency, in an environment in which, as pointed out by Martí Noguera, Nascimento et al., (2014) in the eyes of the student searching the internet, doubts could be generated about whether expert knowledge belongs to whoever has more scientific, validated references or whoever appears among the first results of those searches.

Aiming at a new educational paradigm, Gisbert and Esteve (2011) indicate that the technology appropriation environment should be understood as a generational transition in which persons born at the end of the last century and who are coined by different taxonomies, are not the same persons for whom the educational system, where current teachers were trained, was designed to teach, due to the fast dissemination of digital technology (Gallardo-Echenique, 2012). A generational gap exists between the main agents of the educational community, generated by conceptions, paradigms and visions belonging to each generation and, additionally, in this generation the world is involved differently, since their reasoning is different «utilizing different parts of the brain than persons from our generation and as a result have different learning styles and preferences» (Gallardo-Echenique, 2012, p. 9). The relationship between NICT and knowledge needs that students identify result as very different from the ones perceived by teachers as the use and handling they carry out with virtual devices and environments change their conception of time and space (Martí Noguera, Martí-Vilar, Vargas and Moncayo, 2014). This generation of students have developed new cognitive strategies made possible by the constant interaction with technological devices, unlike most teachers, making it difficult the understanding of an always changing environment in which new knowledge information or a recently created technological application may disappear, transform or regenerate in brief time lapses (Jukes, 2009; Romero, 2011).

In this aspect, one cannot lose sight the fact that the need to impose a different teaching model, in this case a digital environment, does not necessarily imply lessening the knowledge of teachers who do not have technological skills yet. As pointed out by Marín, Vázquez, Llorente and Cabero (2012) it is valid and should be promoted that the necessary digital literacy of teachers brings methodologies that

accommodate the knowledge they have in their respective areas to the methods demanded by the new environment. According to Gisbert and Esteve (2011), the relationship between teachers and students should be approached from two perspectives of change:

- At a methodological level, by teachers to learn to communicate with the language and media of their students, with their characteristics.
- In the content, reconsidering the suitability of the content received and rethinking what the future content should be.

To which a third one should be added, the technological, so that teachers can utilize the same tools as the students. The three positions can be observed critically since they presuppose the need for the traditional knowledge teaching-learning model to assume the requirements of the model proposed by NICT and start a process of adaptation of the training offer to the current demands. It is worth taking into account that, independently from the haste dictated by technological progress, the human capacity to adapt to change goes at a slower rhythm than the advances and possibilities offered by virtuality, for which providing technological means does not guarantee their efficient use (Aristovnik, 2012).

CONNECTIVISM THEORY AS A REFERENCE FRAMEWORK FOR VIRTUAL LEARNING

Facing the social changes brought upon the increasing access to the Internet and the appropriation of technology by broad sectors of the population, Freire and Schuch (2010) refer to this transition as a new cultural paradigm, digital, pointing out the need of a new theoretical approach to allow understanding the learning processes and the interaction relationships. The authors point out as a weakness that higher education institutions themselves being responsible for training teachers and researching, have not been fully adapted to give responses about the integration of NICT use, partially because the profile of the current teacher does not include training in the use of technology as means of either interaction or teaching. In this sense, the work of Ito et al. (2010) indicates that the theory of Connectivism, proposed by Siemens, would be appropriate as a framework for the understanding of the technology appropriation process in teaching, given the use of social communication media among the young over teachers' skills, which makes difficult its inclusion as a tool of the education process. Duke, Harper and Johnston (2013) analyze the discussions with respect to whether Connectivism should be considered a learning theory for the digital age, contrasting criticism with contributions that involve considering knowledge as an intangible distributed in a network of connections and considers learning as the skill to build knowledge and get about the different networks. In this line of argumentation, Martí-Vilar, Martí Noguera, Vargas and Llinares (2013) according to a review of research, concur regarding the theory of Connectivism (Siemens, 2005) as a theoretical-methodological framework pertaining to the understanding of the phenomenon of NICT appropriation and offer the guidelines for an adequate implementation of higher education models, contributing a basis for the understanding of learning by means of technology.

As suggested by Siemens (2005) in the face of behaviorist objectivism, pragmatism of cognitivism, and constructivist interpretivism, Connectivism sustains itself by facilitating an informal, proactive, social, connected and autonomous learning (Reig, 2010). For Siemens, learning is a set of individual

opinions that converge in a series of networks in which construction of knowledge can be reached, which implies analyzing learning from the point of view of interactivity, which supposes an atypical knowledge construction with respect to other traditional education models, in which knowledge comes from a reference source, the teacher and the textbook, as opposed to the current one that by accessing the Internet allows to find multiple more or less precise sources and even conflicting among them. On the basis of social appropriation of NICT in the classroom, Rochefort and Richmond (2011) frame connectivism as a reference to understand an interconnected learning by means of technological tools that foster connections/relationships among students, between students and teachers and even between a learning community and onsite or virtual learning resources, generating associations and links with information, persons and ideas. Connectivism, as per the authors, in an environment of students with increasing access to information on the Web, makes possible not only establishing relationships but also confronting and obtaining different references or sources of information, connecting ideas from different sources.

From a psychological perspective, Martí-Vilar, Martí Noguera et al. (2013) stress that the connectivist model has disassociated itself from previous theoretical-explanatory models, given the need of learning adaptation to the reality of a society increasingly technological in which the volume of information and the production of knowledge grow and is shared at an ever-faster speed. Then, NICT appropriation more than a training tool is a change in the knowledge creation paradigm through interactivity and concept connection, since technology facilitates working in a network allowing for a heightened capacity for collective action and project development not requiring physical structures, facilitating mechanisms for coordination, collaboration and exchange adapted to an economic model of globalization (Freire and Schuch, 2010). Anyway, Connectivism as a learning theory, as mentioned by Delgadillo Franco and Islas Torres (2016), is for the most part a documentary body of references that coincide in enunciating a background, definitions and assessment about this theory and studies like theirs are still needed to contribute empirical data to evaluate the relevance it may have as an application, interpretative or explanatory framework. Zapata-Ros's (2015) criticism highlights the weaknesses of considering connectivism as a theory, although it recognizes the questionings it presents, considers that current theories may respond to the challenges that NICT in education poses. Anyway, it is worth recognizing that when the theory of connectivism places the emphasis on the experience of integral learning, which takes place in formal and informal social contexts and generates a culture of collaboration, it results interesting nowadays to approach economic and social globalization processes (Ito et al., 2010).

RELATIONSHIPS BETWEEN PUBLIC POLICIES AND SOCIAL APPROPRIATIONS OF NICT.

International organizations of higher education, teachers and students are focused on transcendental changes on how to manage the ways of teaching and learning, barely having time to reflect (Castañeda, 2009). The speed of change, as well as the urgency of governments to achieve technology implementation in the education system have led to error in the logic of NICT incorporation; Severin (2010) highlights that there are several cases in which appropriation models have been imported not having clear in advance which should be the desired educational objectives, which strategies would be adequate to fulfill them and only then plan the investment on technology to support its fulfillment.

By which, the author points out that the result has been that NICT end up occupying a marginal space in educational practices, which continue being relatively the same as before the investment. According to proposals about policy discourse and argumentation about the implementation of NICT in education, Freire (2011) questions if from the approach of public policies for NICT and education, emphasis is put mainly on technology more than on education processes in the classroom. The author asks himself to what extent are technologies necessary and convenient since introducing technology on top of an obsolete educational system may show its shortcomings more.

Benavides y Pedró (2007), based on the presentation so far, propose that policies should respond to defining a new teacher profile and proceed with the availability of contents and application, favoring support networks and above all, supporting research. In this sense, Martí Noguera, Nascimento et al. (2014) indicate that the portal of the Latin American Network of Educational Portals¹ (Red Latinoamericana de Portales Educativos, RELPE), where several countries that have created portals with content facilitate access and allow to share educational applications, all with the fundamental objective of free exchange of educational resources among the contributing countries, maintaining a public and free of charge character. However, the authors point to the need for a model that would allow making operational both content contributions since the fact that the tool exists and is necessary requires a theory and a methodological practice of utilization and empowerment.

Several reports highlight that the prevailing practice in the processes to implement NICT in higher education have been based on trial and error. Different authors propose more research on methodological models and the conditions under which teachers and students find more incentives for adopting strategies applied to teaching and learning through NICT in differentiated socio-cultural environments (Benavides & Pedró, 2007; Durall, Gros, Maina, Johnson & Adams, 2012). In this sense, the report «Technology Outlook for Latin American Higher Education 2013-2018: An NMC Horizon Project Regional Analysis» (New Media Consortium, 2013) indicates that education centers around the world are reflecting upon, redefining and reworking most aspects of how students interconnect with the institution and among themselves for their virtual learning but the consolidation of these ideas, their validation by research and their widespread implementation are still in progress; meanwhile, technologies continue permeating students more than teachers. Following the report, a certain content maturity existed for learning in virtual environments and in information sharing. Johnson et al. (2016) indicate that still to do are the consolidation of teaching methods and the exchange of experiences to sustain a broad theoretical-methodological framework for its adaptation to different needs according to the region, the degree of development, and access to technology.

CONCLUSIONS

The magnitude of the change was highlighted in the Ibero-American edition of the Horizon Report 2010 which aimed at the importance of NICT since «from the perspective of teaching and research, these means allow sharing academic and professional information in different formats, opening the door to uncountable opportunities of social and educational research, as well as to experimentation

¹ www.relpe.org/

in the creation of new services in higher education» (García et al., 2010; p. 16). The main challenge for experts is associated with the lack of a collaborative culture in the work of teachers and students in the educational area and to the need of a change in mentality regarding the way of conceiving the learning process which leads to a high percentage of teachers not using NICT, neither for the training process nor to organize their research.

It is highlighted that together with the need for literacy in the use of NICT, a paradox occurs in that process systems in educational institutions are not established to foster innovation and, often, these processes and practices are the ones limiting a greater appropriation of NICT, redirecting the discourse to the will of understanding the new dynamic that conform the connectivity of teachers and students. (Martí Noguera, Nascimento et al., 2014). To which it should be added that, due to dynamics belonging to the generational differences between teachers and students, it is frequent among the latter their interaction in social networks and the use of new applications for telephony devices. For this, institutions of higher education should support their training programs with NICT, with research on tool tendencies and the adaptation to cultural environments typical of the area in which the institution is (García Martínez & Fabilaechauri, 2011). It is important to keep in mind in the management of higher education the extended playful use of interactivity and technologies, to use this as the basis of the training and development of competencies with projection into the work environment.

Research becomes indispensable to have statistics to allow data analysis to orientate policy decisions throughout the education system as well as qualitative research to know how and for what one learns. Analysis of the evaluation of NICT use in students and teachers should guide the construction, adaptation and correction of methodological models, because, as indicated by Nascimento, Martí Noguera, Carvalho and Martí-Vilar (2015), the expected results of implementation processes show high variability. In this sense, Sangrà and Wheeler (2013) point out that training processes by means of NICT face the challenge of giving guarantees that in fact a process of learning and knowledge generation is given, which not necessarily occurs due to the fact of having access to information, reinforcing the idea of a holistic model that would allow learning the processes and their assessment in different levels: content development, technology use and educational utilization.

On the positive side, Rozo, Peña, Prada, Cárdenas, and Sáenz (2010) indicate that students trained in environments with NICT acquire autonomy in their work while they develop flexible thinking since they have to choose from lots of information and subsequently validate it, for which they should develop critical judgment skills. Access to technology facilitate the expression of their opinions and at same time exposes to a larger audience opining about works published, strengthen learning in searching through a network of experts and establish communication, allowing specialization in some contents or participation in projects. For which, indicate Martí-Vilar, Palma, Martí Noguera and Company (2013), NICT implementation make students develop self-control competencies in learning, sharing what is being learnt, summarizing information and updating their knowledge, modifying their mental schemes, incorporating the virtual environment, developing reasoning and classifying contents and new schemes in the digital environment, establishing the collective construction of knowledge in a collaborative manner.

In summary, the panorama of virtuality represents a consummating fact before which, in a progressive manner, a particular model for understanding the function of the university as an interactive institution is generated and conditioned due to being the catalyst of multiple expressions of knowledge creation produced by the virtual environment. The above forces the main missions of the university such as research, training, and transference, to adapt to the virtual environment and admit to be an active part in the age of interactive participation, supporting mainly the definition of the new role of those who are part of it, such as the faculty and research staff, because, as stated previously, understanding the needs that it should face for NICT implementation in Education changes its focus to learning processes, more than on the means that are in constant change (Ito et al., 2010).

In addition to guidelines from international organizations, Martí Noguera, Nascimento et al. (2014) point to academic initiatives of non-governmental organizations or companies that are emphasizing generating educational content in digital form, such as the MOOC. Some cases that have acquired a prominent role in driving and managing these training resources are Coursera² and Udacity³, that have agreements with prestigious universities; EdX⁴ born of a consortium between Harvard University and the Massachusetts Institute of Technology to make available educational contents from different disciplines managed from their campuses and at an Ibero-American level, MiriadaX, driven by the Universia-Banco Santander network.

In conclusion, it is worth pointing out the potential of NICT is implemented within and without formal educational spaces; virtual environments that allow public policies can be worked and debated in social networks by the whole society, not only at a national but at an international level. That is, with NICT public policies are not only given vertically, but, as mentioned by Benavides and Pedró (2007), an equality of opportunities is produced that allows for constant feedback from society and an optimization of the design of policies based on the interaction and collaboration between one another, policy agents and teachers, students and society in general at a horizontal level. As pointed out by Martí Noguera, Nascimento et al. (2014), facing the immediate deadlines pursued by public policies regarding the execution of projects conditioned by mandate, the speed of technological change and the teaching and learning transformation between two generations that is taking place (Adell & Castañeda, 2012). This situation will require that education as a process of content assimilation, should evolve conceptually to consolidate a new learning paradigm by which society is formed, and the learning theory of Connectivism could be a reference as a framework and a call for attention to train those dedicated to teaching on appropriating NICT and keeping up to date continuously through research.

To finish, NICT are a reality and being competent in their use in the 4th Industrial Revolution is determinant, for which its learning throughout education becomes a priority, with particular emphasis in Higher Education across any profession to be in line with the job market demands. Although critical discourses exist around the instrumentation of higher education to train professionals oriented to satisfying the demands of the job market, which extends to the use of technology (Martí Noguera, Martí-Vilar et al., 2014). Technology and the digital immersion should be a tool for personal development and

² www.coursera.org/

³ www.udacity.com/

⁴ www.edx.org

the contribution to a sustainable socio-economic development, for which the teaching function has the challenge of not only incorporating NICT but also train, considering ethical and moral criteria, since knowledge is not neutral and the evolution of society will depend on how we use these new environments for the common good and not straying from reality into the virtual.

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