REVISTA CÁTEDRA

Saber, enseñar y cambiar. Aproximación a las tecnologías en la educación superior

Know, teach and change. Approach to technologies in higher education

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Resumen

Con el objetivo de repensar el rol del docente en función de los nuevos escenarios educativos, en el presente trabajo se analizan algunas tendencias tecnológicas que vienen afectando a la educación superior en la medida en que aquellas han venido evolucionando como parte natural del quehacer humano. Este tema cobra particular relevancia debido a la naturaleza de los cambios tecnológicos y su manifestación en el ámbito de la enseñanza. La metodología consistió en analizar algunas de las principales tendencias que se anuncian en diversas investigaciones e informes recientes sobre la presencia de las tecnologías en el ámbito educativo. Como resultado se presentan algunos desarrollos tecnológicos adoptados en el contexto de la educación superior, particularmente las tecnologías inteligentes que se han venido incorporando al proceso de enseñanza aprendizaje. Asimismo, se consideran las habilidades que demanda el desarrollo profesional y personal ante las nuevas tendencias tecnológicas. Y finalmente, se aborda el rol del docente en función de los nuevos escenarios que plantea la tecnología. El trabajo concluye poniendo de relieve que la formación docente debería orientarse a fortalecer el pensamiento sintetizador, creativo, respetuoso y conectado, pues se trata de asumir los retos que supone saber, enseñar y cambiar en la era

de las tecnologías inteligentes que hacen posible la emergencia de nuevos escenarios educativos.

Palabras clave

Educación superior, formación docente, habilidades, tecnología educativa, tecnologías inteligentes.

Abstract

This paper analyzes some technological trends that are affecting higher education in order to rethink the role of the teacher in terms of new educational scenarios. This context acquires particular relevance due to the nature of the technological changes and their manifestation in the field of education. The methodology consisted of analyzing some of the main trends mentioned in various researches and recent reports on the presence of technologies in the educational field. As a result, some technological developments adopted in the context of higher education are presented, particularly the smart technologies that have been incorporated into the teaching-learning process. Also, the skills demanded by professional and personal development in the face of new technological trends are considered. Finally, the role of the teacher is addressed in terms of the new scenarios posed by technology. The work concludes by pointing out that teacher training should be aimed at strengthening synthesizing, creative, respectful and connected thinking. It is about taking on the challenges of knowing, teaching and changing in the era of intelligent technologies.

Keywords

Educational technology, higher education, intelligent technologies, teacher training, skills

1. Introduction

> That had the effect that good books generally have. Fool people became dumber, intelligent people got smarter and thousands were unscathed
>
> —Georg Christoph Lichtemberg, *1742*

One of the subjects always in force in the academic field has to do with the training of the teachers since it is in synergy with the exigencies of the labor field. The technologies have been affecting and changing all the spaces of work and the university context.

It is worth highlighting, as mentioned by Partovi (2018) the emerging economies and the future curriculum, which according to McKinsey Global Institute's latest prediction, approximately 50% of existing work activities can be displaced, replaced or modified in any way by the automation. This will be caused by traditional software, robotics, artificial intelligence or new automatic learning algorithms.

In this sense, some of the issues taught today will no longer be relevant in 2030. The processing of large data will be increasingly under the control of the machines, and the Internet will continue to replace the need to structure and memorize many basic data.

In this context, the aim of this research is to revise and analyze some tendencies based on the technologies that are affecting higher education by demanding new competencies that lead to rethinking the role of the teacher according to the new educational scenarios.

It is believed in the idea that technology is not an extrinsic process to human activities, but has been naturalized as part of the daily activities of man. This trend has been clearly stated by Hardt and Negri (2017) who emphasize the digital dimension of the human existence. Both the soul and the body have adopted an immanent relationship with the technology that has accelerated in recent times.

Technology has gone from being an artifact to becoming a natural extension that amplifies, modifies and recreates reality. Although this does not necessarily mean that the presence of technology is conducive to innovation by itself if there are no cultural conditions that allow it to be adopted and developed.

This takes on particular relevance in the educational field because although technological developments are demanding new skills, the effectiveness of their use depends on their proper incorporation in the learning process, so that these guarantee the academic quality. An effective teacher should know, teachand change.

In order to address this issue, the methodology consisted of exploring and interpreting the main trends presented in various research and recent reports on the presence of technologies in higher education. In this sense, the technological context in higher education was analyzed. In the same way, the new skills and competencies demanded by the presence of technology were identified and characterized. Finally, the main obstacles and the successful experiences that point to the development of competencies and the new role of the teacher in the university context stand out.

The work is divided into three parts. In the first, some technological developments adopted in the context of higher education are presented. It will be stated how technologies, and particularly intelligent technologies, have been incorporated into the learning process.

In the second part, the skills demanded by professional and personal development will be considered for new technological trends. It is a question of revising these skills from the perspective of the student and the professor.

In the third part, the role of the teacher will be addressed according to the new scenarios generated by the technology. It seeks to examine these trends on the need to take on and promote a more complex, personalized teaching conducive to autonomy and lifelong learning.

2. Recent technological trends and their use in Higher Education

Technology has influenced higher education at various times and shows its transition to its incorporation as a fundamental part of the teaching learning process. In 2009 Cabero pointed out that "the incorporation of ICT to educational institutions will allow new ways of accessing, generating and transmitting information and knowledge, and will transform, change and extend the educational act" (p. 151). Indeed, the effects of ICT on educational settings have shown at various stages. At first, technology operates as a complement where the instructor and the institution control the social interaction and the content. To the extent that technology evolves, applications are developed for content management through teaching platforms.

This is followed by a process of accelerated development of various applications that are incorporated in multiple forms to the educational process. It increases the capacity to serve

a more diverse audience and there is a change in relation to schooling as long as short and open courses are offered, coursed that would meet the needs of training for the market.

Currently, we are in a process of technological transformation that is observed in the use of intelligent technologies with a strong impact on teaching and learning. García (2017) in his analysis of the report Horizon 2017, pointed out how technologies can generate disruptions in the ways of teaching and learning, and he said that the report "proposes technological-based trends in educational innovation referred to higher education" and refers particularly to "the most relevant technologies to be adopted in the future"(p.16. In this sense, it emphasizes the adaptive learning and the mobile learning as fundamental tendencies that can define the education of the future.

Revising the Horizon 2018 report are also identified some trends that are accelerating the adoption of technologies in higher education in the long term. In the same way, the progress of the innovation culture and the collaboration between institutions is highlighted. In the medium term, emphasis is placed on the adoption of open educational resources and the emergence of new forms of interdisciplinary studies. Finally, in the short term, it is called attention to both the boom in the measurement of learning to adapt more and more to a demanding and changing working market, as well as the redesign of learning spaces oriented to the development of more and more practical experiences (NMC Horizon Report Preview, 2018, pp. 10-21).

Is worth insisting on the advancement of intelligent technologies that have become increasingly present in different areas of higher education. Their impact could mean a break of the traditional training system and the development of new ways of assuming teaching and learning. The report mentions that among the most complex aspects that limit the use of technology in higher education are: the complexity of the role that younger educators must have to use multiple technological resources; apply innovative teaching methodologies; work collaboratively; participate in online dialogues; research, publish and work on a teaching methodology that is more and more adapted to the needs of the students.

Among the most important technological developments to be adopted in higher education are identified the analytical technologies that allow to visualize, represent and interpret a big amount of data and respond to the educational needs, such as personalized training and care for at-risk students. These technologies allow to make documented decisions and predictions. Similarly, Makerspace technology poses informal learning spaces to experiment with technology and learn through practice and exploration; these spaces are for self-directed learning and training that enrich research-based learning.

In the next two to three years, in the Horizon 2018 report is highlighted the development of technologies for adaptive learning. It seeks to adjust the teaching environment to the skills, styles and needs of the student by customizing the learning process. In this same period, it is mentioned the massive incorporation of artificial intelligence that has evolved in the development of simulation processes of human perception, decision-making and learning. It significantly emphasizes the simulation of the functioning of neural networks, which involves, among others, the recognition of the voice and the processing of natural language. This creates a wide range of applications to enrich learning and teaching (NMC Horizon Report Preview, 2018, p. 9).

On the other hand, in the next four to five years, the impact of mixed reality and robotics on higher education is anticipated. Mixed reality implies the combination of physical and virtual reality in the real world, which facilitates the study of multiple phenomena from

perspectives that have never been seen. For its part, the accelerated development of robotics implies the realization of various functions that will form a significant part of our environment as a natural reality. Many of these technologies are currently being applied in research centers and universities in the most developed countries and have been extended in a global way to the field of higher education.

Indeed, smart-calling technologies are recently impacting the educational experience. Its presence will certainly contribute to enrich the teaching environment, promote the autonomy and personalization of learning and the socialization of knowledge. All this will be shaping new facets of higher education that are now showing progressive changes insofar as it incorporates the complexity and versatility of these technologies.

Internet and the new technologies have spread with unimaginable speed a few years ago. The digital world permeates all economic activities and has global reach as connectivity and mobile technologies grow, but these processes of change are not occurring in a similar way in all countries. ECLAC (2015) reports that:

> The countries of Latin America and the Caribbean continue to move forward with large gaps, taking advantage of the ubiquity of the Internet, technological convergence, high-speed networks and the data revolution to expand access to the use of digital technologies (p. 8).

The Internet of things and the analytics of the big data are developed with an impact in higher education. "The world that is coming", using an expression of Oppenheimer (2014), is modifying the way we interact, present ideas, information and the way wecommunicate. The speed of the devices connected through the network acquires a dominant character.

This added to the proliferation of open concepts, open content, open data, open resources, coupled with transparency and easy access to data and information. The other dominant element is the personal, understood as the attention to the individual need in terms of content, place and time. We are heading towards the production of services and products more and more personalized.

In this way, new macro social tendencies are being formed, identified with the following denominations: "Contribution", which "consists in the evolution towards a high influence capacity of the individuals in the decision making, through its organization in groups with common objectives", "hybridization", which" involves mixing different worlds as the physical-digital, in-person-virtual, entertainment-professional, public-private, etc. "; "Hyper stimulation", which "consists of the evolution towards a constant reception and overload of external stimuli by individuals" and, finally, "experimentation", which "consists of the evolution towards participation in activities with a greater experiential involvement and the emergence of emotional consumption" (Fundación Telefónica, 2012, pp. XII-XIII).

Affected by these tendencies, education in general and in particular higher education is entering a period of radical transformation where its most relevant traits could be characterized as:

- Permanent: Lifelong learning throughout life, constituting a constant renewal process of the Learning.
- Personal: Programs adapted to the necessities and individual requirements. It is about the individual selecting his/her own training course

- Open: Open resources, open curriculum, demanding flexibility and versatility in the training offer.
- Mixed: Model convergence of formal and informal education, in-site and online with particular predominance of online education and convergence of different technologies.
- Ubiquitous: education in every place as a result of the idea that knowledge is disseminated in different spaces, objects, times.
- Social: learning with others thanks to the development of knowledge networks that allow the interaction and creation.

These traits are presented in educational institutions that face the challenge of adapting quickly or leaving the market. This, is made more evident in developed countries. However, educational institutions in developing countries are incorporating these trends at a slower pace and with inequalities.

3. Skills for professional and personal development to new technological trends

The changes that technologies cause in all fields are accompanied by the need for new skills to be able to respond to the Labor market demands. As indicated in the report 2018 of the Organization for Economic Cooperation and Development (OECD, 2018):

> Achieving greater equity in education is not only an imperative for social justice, but also a way of using resources more efficiently and increasing the supply of knowledge and skills that drive development and social and economic cohesion (p. 5).

In this sense, beyond the skills in the management of technology, tasks in the work field are demanding increasingly interactive and collaborative activities while retaking the old idea of learning as an essential principle for keeping workers updated. In this regard, Accenture (2018) points out:

> Thanks to advances in neuroscience and technology, the development of experiential learning techniques has progressed significantly in recent years. These techniques are dedicated to learning through practical application, rather than absorbing knowledge by listening or reading (p. 17).

Big corporations stand out as spaces for continuous training and work. The skills required in the field of work will continue to change and these will become increasingly complex as they combine technical skills with social skills. The Accenture report (2018) states that:

> Education and corporate lifelong learning systems must be accessible to all in order to truly close the skill gap. Workers who are vulnerable to disruption of technological change must be identified for targeted interventions (p. 25).

Given the rapid and permanent technological evolution, continuous updating is at the same time an individual responsibility, except in those most vulnerable populations, such as those quickly displaced by automation. The elderly and those with a disability who require the state's effort to ensure their productive insertion into the labor market.
That is why the culture of the 21st century has a multimodal character, with multiple supports, and is shown in a variety of formats or languages. It is mentioned the need for

various types of literacy: audiovisual, digital and informational. The current citizen should know how to communicate, collaborate, seek information, participate in public life and learn to learn. It is essential to take into account the scenarios that are entrenched in the 21st century (Monereo and Pozo, 2007, p. 16), i.e., the educational, the professional and the work, the linked to the community and the staff. It is the man facing the challenges of the "second modernity" (Beck, 2000; Shook and Knickrehm, 2018) considered in the context of globalization and the challenges of the technological revolution.

While the adult of the 21st century is an analogue migrant that must be adjusted to the own generation of digital natives, the educational paradigm moves to incorporate the audiovisual, digital and informational as important dimensions for teaching and learning, while distances are blurred and virtual education, mixed and collaborative learning becomes relevant. Indeed, "while distance education has been the most widely used term, the growing diversity of educational programs, the personalization of learning and the types of evaluation deserve the development of a more comprehensive and unified construction." (Siemens et al., 2015, p. 45).

In this context, among the skills required by technological development, in the first place there is the complex thinking, understood as the combination of critical reasoning, deductive, active learning, and in general, a set of higher-order cognitive abilities (Morin, 1999, p. 47). Secondly, the emotional intelligence that involves active listening, social perception, persuasion and negotiation. Thirdly, sensory perception and intelligence that incorporate a wide range of capacities that have been stimulating in an increasingly intimate interaction with technology is made relevant. Indeed, as Gardner (2015) points out, "the existence of a nuclear computational capacity anticipates the existence of a symbolic system that takes advantage of this capacity" (pp. 4-5).

These skills are also manifested in the context of higher education where relevance is given to the dominance of one or more disciplines along with the development of the aforementioned skills for successful performance in the academic or maket world (Fundación Telefónica, 2012). It is no coincidence that media literacy has been highlighted among the skills and technological competences. On the other hand, the skills related to critical thinking, and finally, the socialization of knowledge through networks.

In addition, social and self-management competencies, including flexibility and adaptability, initiative, social and collaborative skills, productivity, leadership and responsibility are socially coupled; and finally, as noted above, the competence for continuous training, which implies the acquisition of lifelong learning capacity.

As Dorfsman (2012) mentions, although there are four dimensions that must be strengthened in the teacher, i.e. academic-disciplinary, technical-pedagogical, reflective personal, and social and community critic, these dimensions must be restructured from the presence of the digital dimension that

> It considers the most specific components of the information society and its impact on teaching: the possibility of appropriating the technological environments, of building new spaces of work and cooperation, of leading communities, of publishing ideas and private, public and semi-public content, the multimedia potential at our reach (pp.17-18).

These dimensions comprise the domain and management of digital environments, the interaction in the world of networks, the processing, hierarchy and use of information, and the transformation of information into knowledge.

4. Readjust the teacher formation

Readjust the teacher´s role according to the current social and cultural scenarios supposes various aspects that allow to place it critically in the context of the new technological tendencies.

First, it is about understanding teacher training in the technological context from complex, divergent, critical thinking to processes that involve a permanent transformation. From this perspective, technology is seen as an extension of the human and as a generator of new spaces for learning and teaching, while taking into account its status as an instrument of dispersion, isolation and misinformation.

Secondly, stimulated teaching can be highlighted because the technologies allow the implantation and use of multiformat content to stimulate and get the attention of the students. The teaching is enriched to the extent that the enlarged and virtual reality converge, and where the processes of simulating, broadening the vision, manipulating reality, are just some of the training possibilities and transmission of knowledge.

Third, it extends the so-called "lattice learning" because of the proliferation of the world of networks. Although it should be noted that there is no such thing as a homogeneous structure for the development of the networks, but rather its interweaving in a spiral way is seen, especially if taking into account the presence of the inter and intradisciplinary investigation that considers the emergence of new connections in the various areas of research to be part of the teacher in the process of generation and socialization of knowledge (Astorga and Martínez, 2017, p. 72).

As stated by Pérez Gómez (2012), "it seems clear that the teaching-learning processes can no longer be understood where individuals are in contact with the information and knowledge available, without the powerful and friendly presence of ICT and the network of networks" (p. 69). Indeed, the key agents of the education system are organized in communities to share the learning process, while the teacher articulates the interaction with the peers, with the students, with the community. The networks are forming a complex network of exchanges that enrich the process of production and transmission of knowledge. The networks also facilitate the exchange of educational services ubiquitously, not restricted to a specific physical or geographical environment.

In fourth place, it is worth highlighting the personalized learning where education adapts to the needs and the rhythm of the student. It is talked about adaptive technologies that, based on artificial intelligence, allow the development of teaching platforms that follow up the student's pace and learning needs. The teaching is being developed in response to the interests, rhythm and needs of each one. While working on the creation of open resources and open-curriculum experiences, the possibilities for more and more personalized learning and teaching are broadened.

Fifthly, it is necessary to strengthen the so-called "learning in practice" that involves an accompaniment process during the teaching career, the offer of updated programs both in the didactic, technological, as well as in the specialty area. This is accompanied by the generation of spaces for collaborative and reticular work, as well as the creation of stimuli during the academic trajectory of the teacher.

Within this context, the teacher's training and especially the teacher in higher education are particularly relevant. This issue is complex to address because it involves the interaction of various aspects that do not always depend on the teacher itself. In this sense, it is advisable to remember Fullon (2002) when saying "The teacher formation has the honor of being, at the same time, it is the worst problem and the best solution of Education" (p. 122). Certainly the teacher training is presented as a complex and diverse phenomenon that has to take into account new and complex interrelations that involve the will of formation, the social dimension seen as peer learning, and finally the institutional dimension that demands new teaching contexts that favor the search for improvement goals in the organization.

Even though these dimensions have been part of the process comprehension of the teacher training, they assume to be aware of the main obstacles that hinder the development of the teaching career. This takes on particular complexity as technologies acquire greater presence in higher education. For example, in the personal dimension, individualism and isolation; resistance to change; low motivation; lack of stimulus and recognition. In the social dimension: absence of spaces for group work; absence of accompaniment in the teaching career; lack of programs to strengthen skills. Finally, in the institutional dimension: the poor endowment of resources; insufficient support for teachers' initiatives; disarticulation and fragmentation of teacher training; the little planning of times, spaces and resources that ensure the participation of teachers in accordance with the demands posed by the university.

Teacher training must be addressed as a process of reflection, construction and reconstruction of the practice from the personal, social and institutional dimension as a constantly growing spiral, as an ongoing process that favors the rethinking of the teaching action in correspondence with the demands that the context raises. It is a process of personal development that is being formed as an intelligent route that allows a holistic and flexible training and facilitates the mobility of the teacher according to their needs (Martínez and Amaro, 2008, pp. 56-59).

In correspondence with these dimensions, the society demands in turn new competencies to which teachers must be prepared. The aim is to orient the formation process towards the development of autonomous, critical and collaborative thinking in the new environments generated by the society. In this sense, the teacher's role follows a profound transformation process as a facilitator of the conditions for apprentices to build their own learning path.

Given this context, teacher training must be reconfigured in such a way as to contemplate the understanding of new educational scenarios beyond school boundaries. It is not only the learning of new communication codes, the incorporation of new artifacts or the creation of new relationships; rather, it is about getting ready to respond to the demands of a global context in permanent transformation.

In short, it can be argued that new technological trends are obligatory reference in the consideration of teacher training. Technology has become a transversal axis of teaching, research, linkage and management, and nowadays it is taken more and more frequently for the recognition of the teacher, but beyond that technology is creating new educational scenarios that cannot be clearly anticipated. In other words, what can be said is that the changes will continue, are unstoppable and continue to demand the permanent restructuring of the teacher´s role.

5. Conclusions

The evolution of technology into increasingly intelligent forms is exerting pressure to change the traditional role of the teacher. These technologies are being integrated as part of the individual's natural environment, propitiating the emergence of new frontiers for the development of knowledge, amplifying the modes of connection and contributing to the personalization of teaching.

Technologies are fostering new, increasingly open spaces for learning. We are in the presence of a rupture with the traditional spaces and formation models. This is forcing to create more versatile, interrelated and multi-way communication scenarios with all the folds of society, where the subject becomes an apprentice who dictates his/her own training in the midst of a growing network of points that do not depend in the use of a foundation but in the construction of a trajectory of infinite possibilities.

The environment is demanding changes in the ways of relating, this implies the need to develop adaptation with more emphasis. Adaptation had been considered as a natural process of man's relationship with the world around him. What is significant in these times is the immense power and transformation speed that technology provokes and the urgent need to assume changes from unprecedented situations that demand the emergence of new and increasingly complex skills.

Similarly, although the development of networks creates a stronger nexus between exchange and creation of knowledge, they gather attitudes and skills that propitiate empathy and at the same time the struggle for recognition that creates more affection. These are subjectivity aspects that are rapidly being modified to the extent that they are required by the work market. Technology isolates and at the same time connects; it makes people being alone and at the same time generates new forms of sociability, it strengthens autonomy and creates inescapable dependencies.

In the face of changes of this type, the teacher finds in the need to confront his/her own transformation process, since the professor is no longer the source of knowledge but is only a link, a point in the learning path of the other. This process certainly requires the permanent adoption of new resources and new communication codes, the openness to divergent and complex thinking that manages to confront the tensions that exist between the global and the fragmentary.

In this context, teacher training should be reviewed for the authentic and critical incorporation of technology in the learning process. The flexibility and creativity are essential aspects to face the commitment to work in order to converge the models of formal and informal education, to combine in-site and online in the strategy as in the management of the resources. This in response to the growing demand for an increasingly multimodal and personalized education where the learning process is articulated with the experience of being part of a community and acquiring skills to communicate and act.

In short, as Gardner (2010) said, teacher training in the demands of the new technological age should be aimed at strengthening a new way of thinking, understood as a synthesizing mind that analyses information. It is at the same time to promote the development of a creative mind that raises different questions and new answers. In the same way, it makes possible a tolerant mind that seeks to locate oneself in the place of the other, and an ethical mind that pursues not only excellence but also commitment. A connected mind that creates and shares through networks. It is about assuming the challenges of knowing, teaching and changing in the era of intelligent technologies.

It is worth closing this brief incursion on the teacher in the world of technologies with the suggestive words of Pérez Gómez (2012):

> All our knowledge, love and doing concentrate on helping each individual, every apprentice, to build himself/herself as a singular, unrepeatable, autonomous and admirable individual, an original combination of wisdom, solidarity and beauty. Our creation is reflected in helping to create, stimulate, accompany and orient the unlimited creation of others. Is there a more open, dignified, attractive and absorbent profession? (p. 314).

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