

Artificial Intelligence and its Implications in Higher Education

Inteligencia artificial y sus implicaciones en la educación superior

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Summary

The new challenges of the information society demand from the university a severe change in its rigid canons of education. The artificial intelligence-based formats promise a very substantial improvement in education for all the different levels, with an unprecedented qualitative improvement: to provide the students with an accurate personalization of their learning according to their requirements, managing to integrate the different forms of human interaction and information and communications technologies. The great challenge of the university of the new millennium lies in the urgent need to plan, design, develop and implement digital skills in order to train better professionals capable of understanding and developing the technological environment according to their needs, as well as implementing the universalization of a digital language supported by programs developed under artificial intelligence formats.

Keywords: Artificial Intelligence; Virtual Tutoring; Intelligent Environments; Digital Language; Information and Communications Technologies.

Resumen

Los nuevos retos de la sociedad de la información demandan de la universidad un severo cambio en sus rígidos cánones de formación. Los formatos basados en inteligencia artificial prometen una muy sustancial mejorar en la educación para todos los diversos niveles, con una mejora cualitativa sin precedentes: proporcionar al estudiante una certera personalización de su aprendizaje a la medida de sus requerimientos, logrando integrar las diversas formas de interacción humana y las tecnologías de la información y comunicación. El gran desafío de la universidad del nuevo milenio estriba en la urgente necesidad de planificar, diseñar, desarrollar e implementar competencias digitales a fin de formar mejores profesionales capaces de entender y desarrollar el entorno tecnológico en función a sus necesidades, así como implementar la universalización de un lenguaje digital sustentado en programas desarrollados bajo formatos de inteligencia artificial.

Palabras clave: Inteligencia artificial; Tutoría virtual, Entornos inteligentes, Lenguaje digital, Tecnologías de la información y comunicación.

Introduction

In today's context we are immersed in a society that is increasingly oriented towards the process of mass technification. From time to time, and with enormous advances, all the sectors that structure it are, to a certain extent, being submitted in some cases or adapting in others to the advances of technology and, according to their level of development reached, adapting to such an inevitable trend. The education area (susceptible to the society's changes because both of them progress simultaneously) is also going through this ineluctable tendency of adaptation to the new communities of technological interaction. This process is oriented to new tendencies and profiles in relation to the new proposals in the sector. But there is a crucial question: Up to what extent is technology capable of revolutionizing the education universe?

The structural acceptance of such a novel and vertiginous parameter requires an increasingly powerful applications development, just as there is an increase of discrepancies and fears that arise from the application of artificial intelligence (AI). This mechanism must be a key point during the transcendent discussions on new higher education proposals. Its parameters

must also be taken into account in order to allow a better administration of this important mechanism, as well as the applicability of effective and increasingly appropriate policies that enhance the AI possibilities in a balanced way, according to the needs of the most representative institutions of society (such as universities), therefore benefiting citizens through these successful measures.

From the earliest education levels such as the infant education level, to the highest postgraduate levels, one of the key mechanisms by which the AI will impact the education field will be the mechanism of individualized learning applications. This is not a new process, since at the level of information and communication technologies, it is the development and implementation of simulators and tutorial programs, in addition to various interactive games software developed under an increasingly user-friendly interface, what drives its development. These system instruments try to adapt to the students' diverse needs, for which the new technologies development makes the purposes more viable.

As for the process of personalized education, the AI application can, in a certain way, be considered as a viable solution, since the automated assistance in relation to the students' help (regardless of the level) allows a new and attractive perspective in relation to the learning dynamism, since the virtual interaction, regulated by the AI parameters, facilitates the learning process. This is because the support mechanisms will be available when necessary, regardless of the user's time and space. The foregoing leads us to rethink about the teaching-learning process, whose impacts of an adaptive education scenario, create a great impact on conventional learning. As new and better applications based on AI are developed, it will be more likely that the new *curricula* will be versatile and susceptible to an accelerated adaptation in relation to the new and parsimonious ways of understanding educational tasks in this century.

As stated by Saavedra (2016), the last decade has been characterized by a path of major changes. Many of these changes are imperceptible by the majorities, but their impact encompasses and will continue to encompass an endless number of activities since technological advances are unprecedented in history, since they have promoted the management of knowledge in a timely manner at the highest decision-making levels, not only in the government but also in the private business sector. The intelligence role, as an element of public policy at the national and strategic level, is undergoing major changes within today's global and interdependent society (p. 79).

AI and its Profound Impact on the Globalized World

The AI is a major subject as it supersedes many aspects of current trends, but only a minimum average of the population understands it. In this regard, Mialhe and Lannquist (2018) mentioned that the enormous mass of citizens of the so-called "world village" are in an unprivileged position with respect to the AI technologies and are notoriously unaware of the possible effects. Therefore, they are unaware of the risks to which they would be exposed as a result of this ineluctable advance that is emerging at an increasingly accelerated pace. This not only may imply a the social-economic risk, or possible debacles by "machine independence", as some possible apocalyptic futurists tend to lucubrate, that is, the dystopian points of view on AI; but also it may imply that the impacts of the AI technologies do not require a future to impact this globalized world in different ways. This is because one of the consequences and dynamic axes of this process is based on technologies that optimize many and diverse activities: in the world of real-time interactivity, the consequences of possible alterations resulting from the application of AI will give rise to new and transcendental challenges (Diéguez, 2017); making it clear that the impacts caused by

industrial revolutions, and others of the 20th century, are minimal compared to what is being developed as a result of the AI, which poses enormous crossroads and associated problems due to the scope and speed of those possible impacts (Mialhe and Lannquist, 2018).

The AI applicability criterion is very diverse and is currently being used primarily by areas such as computing and robotics (Vázquez, Jara, Riofrio, and Teruel, 2018). However, its possibilities extend also to multiple areas such as social sciences and their potentialities as support in business sciences where the boom of real-time estimate of values and the enormous amount of data to be processed requires the implementation of systems based on AI (Mialhe, 2018). It should also be mentioned that the current development of artificial neural networks and processing systems based on genetic algorithms are technologies that are increasingly spreading and are rigorously used in the field of research and stock market dynamics (Badaró, Ibañez, Agüero, 2013).

As for the financial sector and its enormous global index implications, the so-called leading companies have well-established objectives regarding the development of AI. Their tendency is to position themselves in the world market, but under a subtle but very convenient scheme of unrestricted access to the data generated in the digital world, to the development of a computing power that allows them to take maximum advantage of the data generated every second and, to the management of highly qualified talents in order to achieve this objective, that is, programmers and technicians experts in the design and implementation of automatic learning algorithms and all the technologies that can be derived from these applications. This is what is called the “fourth industrial revolution” (Corvalán, 2017) or the “fifth domain” (Saavedra, 2016). The foregoing is evidenced by Mialhe and Lannquist (2018) who state that the most powerful corporations in the market “collect more data from consumers, hire more talented professionals, and have the resources to build a large, dedicated hardware and have cloud supercomputer capabilities” (p. 224). This issue of lengthy development leads these companies to better position themselves with respect to their direct competition, which evidences the changes indicated.

According to Saavedra (2016), based on the perception of strategic intelligence, the changes are and will be more than evident under the formula of a fertile amalgam between robotic, digital and computational technology based on AI, which will become the catalyst for the most fertile changes in human history. The crucial aspect in all this aspect is the regulation mechanism, the effective scope limits, in which the population is not vulnerable in relation to a bad practice or application of the enormous data generated by human groups and their trends. Trends that, as information in the cloud, can process, determine or orient consumption trends or, as previously seen in other cases, political trends. For this reason, it is urgent to apply local and global policy regulations, since the limits of the digital environment are not yet defined.

Human Intelligence and Artificial Intelligence

According to Corvalán, the Human Intelligence is the sum of those cognitive abilities that give the human being a relative autonomy, which can be categorized as “intelligence profiles” or “multiple intelligences” (2017). From the anthropological point of view, other researchers such as Barrio (2018), have a different perspective on such an intricate aspect by considering the differences between artificial and human intelligence. According to the researcher, the computer (regardless of its capacity or power) is limited to what he calls “signifiers” (logical programming language) with a memory capacity superior than human intelligence; but which, unlike the latter, is not capable of interpreting meanings. Therefore, the operational or computational intelligence

of a computer is limited to the information processing, but does not possess the capacity to understand what they process.

Between the diversity of the “intelligence” aspects, it is the transversal axis which is the capacity to process the information of the surrounding world oriented to the solution of problems. By essence the brain, specifically the cerebral cortex, controls the capacity to process information, from the environment and from the same organism that must be used immediately to evaluate and choose the action mechanisms based on a platform of decisions and options that may seem the most useful or appropriate.

Artificial intelligence (AI) refers to the way of simulating the intelligence capabilities of the human brain (Badaró, Ibañez, Agüero, 2013). It is also assumed that AI is a part of the Computer Science that deals with the design of intelligent systems, i.e. systems that exhibit characteristics that we associate with intelligence in human behaviors. Mariño and Primorac (2016) further discuss the issue by stating that AI is conceived as a part of the Computer Science that provides “a diversity of methods, techniques and tools to create models and solve problems by simulating the behavior of the cognizant subjects” (p. 232). From another perspective, AI can be understood, as described by Herrera and Muñoz (2017), as a science oriented towards the search for a profound understanding of intelligence, taking into account its delimitation, its possibilities and characterizing it as a challenge of enormous complexity. In order to go further into the AI context, we must go back to its beginnings. This means that we must refer to Alan Turing as one of the pioneers in this aspect when he designed the famous “Turing machine”. Through a data processing scheme in a binary system, it was capable of processing any possible type of calculation. At the end of his life he challenged himself by developing what was called “the Turing machine test”. Through this test, it was possible for the machine to have the possible thinking attribution under one condition: that the observer could not clearly distinguish his conduct from that of a human being, i.e. a sort of mimetic independence. For this reason, the implicit and explicit paradigm of the AI is established and it is worth highlighting the great pioneers of this branch of knowledge from its genesis; pioneers such as McCulloch, Turing, von Neumann, Wiener and Pitts, Gardner, among others (Ramos, 2014).

Is it possible to attribute human capacities to a machine? The possible answer to such a diatribe is centered in the cognitive science field. Historically, its beginnings originated in 1956 in a Congress on Information Theory carried out by the Massachusetts Institute of Technology (MIT), where the name of Noam Chomsky stands out. He established the parameters of what we know as language, referred to a whole system systematically structured under a formal scheme, similar to that of mathematics. Thus, to some extent (with a certain assumption of scientific accuracy), it justified the attribution of human capacities to a machine, a process conceived as a form of mechanical thinking in a computer. Two ways of understanding AI were created based on the analysis of these proposals: (1) a weak AI, which is only restricted to the use of computers to study the cognitive possibilities of the human being; and (2) a strong AI, which is oriented to linking the AI and human intelligence, and seeking ways to link them even more (Ramos, 2014).

The Traditional University versus the New University

It is common to believe that universities have strategically dedicated to the conservation and integration of the cultural heritage of knowledge, ideas and values generated by the development of humanity in the various scientific, technical and humanistic fields. Virtue by which, and according to the context, universities have remained strategically conservative and they could

not be questioned for this because a university, seen as a representative institution throughout the world, has an autonomous regime, which empowers it to confirm this premise. To shed some light about this, Morin (2018) exposed the conservative sense of the university mission through two opposing profiles:

- (1) Vital conservation, which is aimed at preserving and safeguarding, depending on the development process that sustains the future settled on the basis of a past conserved and passed on under the standards of academic faculties. This is because it considers that the future, understood as such, may not be materialized if it is not umbilical linked to a safeguarded past.
- (2) Sterile conservation, an aspect that would not be so negative if it wasn't because, historically referenced, the university, for a long time and due to its origins, has been kept under the influence of an obsolete and very conservative dogma. This is because, in its cloisters, rigidity and ostracism were the guiding parameters for much of its existence, as in the case of the oldest known universities. All this without even considering the rigid clerical adoption foundations of many of them in the old continent. This point has also been discussed in Peru, such as in the case of the Peruvian university reform. At that time, the reform was vitally urgent, as the "Amauta" (José Carlos Mariátegui, 1980) stated when saying that the university was conceived as "the Bastille of Reaction."

The contrasting relationship between the conservation of the society strata and its culture, and the new challenges that society faces, place the traditional university in a serious dilemma. This causes a problem in terms of which of the two parameters the university should take into account when implementing its aims and objectives. If the conservation option is chosen, the university will remain in a fossilized role of reluctant perpetuity. It may certainly apply some circumstantial and necessary changes, but these will not be transcendental. Therefore, it would be translated into keeping its role of eternal guardian of the *status quo* of the environment in which it is immersed. On the other hand, if the second option is chosen in a radical way, which is very appealing, it would be faced with a diffuse path of confrontational edges, as well as ethical and social dilemmas regarding the *ad libitum* application of new technologies. Technologies that, in the light of the current scenario, continue to generate intense controversies worldwide about the risks and dangers of the AI and its misuse, or about the paradoxical future of the independent intelligent machines that could lead to the risk of species extinction, whose similar arguments of science fiction and those of renowned scientists have a glimpse of alarm in this regard, although some try to label them as "digital chauvinisms" (Rao, 2018). Then, the question is: can we opt for a suitable model that manages to balance these conflicting parameters? The answer will be found in the series of mechanisms on how the new university will apply the dialectical principle of transformation from quantity into quality, in a process of struggle of opposites (and in this particular case, of opposing points of view; but related to each other). The requirements of the present time would be met by opting for the technological development policies oriented towards the multiple challenges deriving from the adequacy of new technologies (Mialhe, 2018), and that these answers are properly adjusted to respond in a correct and opportune way to society, without ignoring the acute problem of ethics and citizen participation, as well as the consensual digital empowerment of wide spectrum (aspect that the authors propose in view of the crucial aspect we are dealing with). However, we

are also aware that the more complex technologies are, the more viable and participatory the adjustments will have to be.

In university education, emphasis is placed on the design of professional profiles within the framework of work and the knowledge generation. Up to now this century, university higher education has turned to a new socio-cognitive paradigm, where the learning process is in constant evolution, and its contents and methodologies must be in accordance with the specific needs of each reality, with the need to implement metacognitive strategies, logical reasoning based on new styles of communication and digital interactivity (Mariño y Primorac, 2016).

Digital Skills

The revolution of the different technologies in the last decades has generated a series of important impacts and of great repercussion with regard to higher education, since it has not only allowed the generation of procedures supported by the modern processes of knowledge management, but it has also allowed the generation of new environments and new training modalities proposals (Gisbert and Esteve, 2016).

It is well known the new challenges faced by the information society, database ecosystems and intelligent environments, which demand a greater attention from the university in the current context (Morin, 2018). However, due to the vertiginous advance of science and technology, as well as their availability to the end user and with it, their acceptance or proximity to technological resources, it generates a marked bias towards their acceptance, which is not perceived by everyone as an icon of a generation, since Gisbert and Esteve (2016) stated that the particular characteristics of individuals, with respect to new technologies, have a poor relation with the individual's age and their respective characteristics as a generational factor, but with the approximation they have to information and communication technologies or ICTs. Another relevant aspect to highlight from the aforementioned researchers is that the research carried out in several US Colleges, which showed that despite the fact that the overwhelming majority of students have a laptop, who are considered digital natives, they only use traditional resources of information and communication technologies. This shows that access to virtual information and diverse contents of the Internet do not have any correlation with training in regard to significant learning. This aspect is discussed by the authors who agree that, due to the modalities, particularities and needs of the diverse students' groups there was no significance to be taken into account.

Now, in regards to the university education revolution, is it structurally oriented to the great changes in massive information technologies? Is there a clear aspect in the contexts of higher education that focuses on the changes arising from the new challenges based on digital education? What is the profile and what skills should be developed by the student immersed in the virtual world? It is well known that the teaching of AI poses diverse challenges, ranging from ethical aspects, such as how it should be taught or disseminated in the early stages of the undergraduate studies, to the most crucial challenge of how to make it more interdisciplinary (Eaton, *et. al*, 2018).

A basic point in such an intricate dilemma lies in the field of the new literacy of the university student: digital literacy. Some time ago, the European Commission (2007) proposed other aspects related to the area of digital skills based on AI. It stated that digital skills should be understood as one of the key skills highly needed for a continuous learning process. It defined it as an amalgam of attitudes, skills and knowledge, thus ensuring an adequate critical use of

technology in the field of information societies, which will be used in various activities ranging from work, communication and leisure. According to the aforementioned entity, these requirements are rooted in basic skills of information and communication technologies, the use of computers to obtain, evaluate, store, produce, submit and exchange information and communicate, in addition to participation in interactive virtual communities through the Internet. Thus, it could be said that digital skills tend to be the sum of all the knowledge, attitudes and skills in technological, informational and virtual areas generated in the higher education environment, and grounded in a new and very complex technological literacy of a functional nature, since it includes the use of tools productively, which would cover much more than a strictly operational use (Gisbert and Esteve, 2016).

On the above-mentioned regard, it can be added that there is an enormous boom of new interactivity forms regarding the current systems. For most people it is based on social networks such as Facebook, Instagram, Skype, YouTube, among others. But the question is: Is the AI related to these changes in the new interactivity forms at a global level? The answer is very simple: yes, if interactivity is the feature of the new digital skills, and its most attractive side is its presentation form within the reach of virtual communities. Therefore, the AI systems developed under the new literacy is their core essence, the code writing or programs would be stem cells in constant renewal, which, with an added plus, they can be continuously improved. If we talk in terms of intelligent systems evolution it is something similar to the mass extinction processes that evolutionary biologists talk about, since the development of increasingly powerful and fast systems has exceeded the estimations of some novice doomsayers decades ago. In the light of the present technologies, these estimations were not predicted until more than a century ago; but which are now patent, and their rapid development is very promising in this regard. For this reason, it is urgent to review the form and content aspects of the university education, which need to be prone to a plastic adaptation to the new formats and also need that the new forms of curricular planning be the most permissible and adequate possible to face the future in relation to AI. The latter is mentioned because of the fallibility criterion since even so-called expert systems are susceptible to being fallible. They are susceptible because they might have been developed under a system with strengths as well as weaknesses. Nevertheless, "in general terms, due to their flexibility, reliability and scalability, they can be considered as a technology of proven effectiveness and mature enough to entrust decisions of considerable significance" (Badaro, Ibañez and Agüero, 2013).

In the current context, according to Vázquez, et. al (2018), the impact of the development of the famous social networks has exceeded the local use, since many university institutions use this technology in their favor, such is the case of the chatbots (bots) and intelligent or virtual agents. A chatbot can be defined as a robot capable of interacting with one or more users by means of a chat program emulating an operator or an individual interacting in real time. When used, it generates an excellent optimization of the user's experience, request management and possible solutions to the users' doubts or problems (McTear, Callejas, & Griol, 2016). On the other hand, the so-called virtual agents are a sort of "intelligent personal assistant" that has the capacity to execute tasks, as well as to offer services; it is generally voice controlled (Pant, 2016).

The major challenge of the new millennium university is the urgent need to plan, design, develop and implement (based on digital skills) training processes and accurate accreditation, that allows it to demonstrate the skills levels required in order to train better professionals and people who are fully capable of understanding and developing the technological environment according to their needs.

A New Literacy is More Than a Necessity

Literacy is one of the substantial functions that support the instruction process. It is a process by which the individual is trained to be able to access and understand the symbolic contents and structures, through which the baggage of knowledge and access to culture are transmitted, and to master the tools and various codes that will allow the individual to express himself and communicate in his context. During the last century, the literacy process was about teaching to read and write using textual codes in printed materials.

Today's digital environments, based on market competitiveness models, are subject to the use of increasingly refined, boosted and enhanced technologies, both in quantity and quality, facts that result in the leading position held by the world's main universities and research centers. These are referred to by Pandiella, Moreno, Garcia, and Sanz (2018) when they reported on the revision of the parameters estimated according to the Model for estimating Academic Ranking of World Universities (Shanghai Ranking) scores.

Digital language, understood as the sum of different languages, brings together a series of diverse skills:

(1) Computational Thinking. It is already defined that the members of this new generation or digital natives have certain advantage due to their early proximity to digital resources and the use of new technologies. Resources, equipment, applications, social networks, interactivity, and real time communication are very common situations for digital natives, who, under the approximation parameters, develop a form of computational thinking that facilitates their continuous use of these resources. Many of their activities are subject to the constant use of digital equipment that allows such interactivity, so they are more akin to the computational or digital notions.

(2) Programming. The so-called programming languages are the basis of the implementation and development of trends based on programming languages from their simple evolution known as first generation to languages based on universal intelligence that under certain parameters is the new language in ICT. The implementation of technological equipment and devices, the speed of data transmission and the new forms of storage requires a whole new logistics to provide support for the implementation of the interaction interface between users and the equipment, from a simple interaction (data consumption by means of a network search) to the quality of data transmission in color, high-definition video and audio. In this regard, how is this support type possible? The answer is based on how the software support is structured in its execution. It is undeniable that the AI support is based on new programming languages, whose advances are already publicly used, such as the development of social networks, which is based on more powerful programming languages such as Python or Ruby, whose interface is much more accessible.

(3) Computing Skills. It is absolutely evident that one of the most substantial challenges in the current context of educational policies lies in the integration of information and communication technologies (ICTs) in higher education, as stated by Ocaña and Valenzuela (2018). Such policies shall be based on a solid foundation of generalization among the teaching teams. Their actions should be oriented towards the development of a pedagogical model that justifies and gives meaning to the teaching and learning practices that allow the use of computers (in most classes) so that the new technologies are used in an innovative perspective from a

techno-educational point of view.

(4) **Information and Audiovisual Skills.** Facing the challenges of new technologies will require a series of changes, ranging from logistics, teacher preparation, new curricular structures, new teaching-learning modalities, assessments within e-learning contexts and, in a pejorative way, national and regional education policies. All this will be required if we wish to coexist in this rapid context of the new IA-based technologies implementation, and not to become some type of *techno-fossils* that will be seen as aberrant relics of a failed experiment regarding the evolutionary adaptation of the digital environments that followed their inevitable route of extinction; and as a result of being away from them, led to the irreconcilable paradox of the no-return point by keeping a passive position in the face of changes. However, in order to prepare our young people to face the world in which they will have to live, we need a fourth block that we could label as digital language. This block would incorporate the necessary skills to successfully navigate the digital world, with programming as a way of solving problems and computational thinking as a work paradigm. There is a new literacy which we can call digital literacy, necessary for new societies and in which the future citizens must be trained.

Intelligent Tutoring Systems (ITS) and Online Learning

The recent years have witnessed considerable advances in artificial intelligence in the education field. Many applications are widely used by today's educators and students, with some variations between the K-12 model and the configuration required by the university. Although a high quality education will always require an active commitment on the part of human teachers, AI-based formats promise a very substantial improvement in education for all levels, with an unprecedented qualitative improvement: providing the learner with an accurate customization tailored to his needs, thus solving the process, to some degree paradigmatic, of how to achieve a better integration between the various forms of human interaction and face-to-face learning with the promising new technologies based on AI. The material achievement of such a titanic process is still a key challenge at the moment.

Robots, or automated systems, have long been popular educational devices (such as the Lego Mindstorms developed by the ITM Media Lab in the 1980s). Intelligent tutoring systems (ITS) are based on automated tutors used for teaching science, mathematics, languages and other disciplines. In many cases, they are based on interactive technologies. Human natural language processing systems, especially combined with automated learning and crowdsourcing, have boosted online learning. This has had a positive impact on the teaching work by significantly expanding the dimensions of conventional classrooms and, at the same time, addressing the students' diverse learning needs and styles. Large data sets of online learning systems have driven a rapid growth of the analytical learning.

The context reality shows us that Peruvian universities have slowly adopted the IA-based technologies. This may be due, among other reasons, to the lack of funding and the lack of solid studies that demonstrate the predominant relevance of these technologies, as it occurs in other places where students are helped to achieve significant learning objectives. On the other hand, North America is betting for the next fifteen years on the use of intelligent tutoring and other IA-based technologies to help teachers in the classroom; and it is very likely that these experiences will expand significantly, as well as learning based on virtual reality applications.

Currently, applications such as apps, a considerable amount of free downloadable programs and online teaching systems such as Carnegie Speech or Duolingo, provide training in foreign languages using Automatic Speech Recognition (ASR) and NLP (neurolinguistic programming) techniques to detect language mistakes and help users correct them. All of the above is possible with new programming tools based on AI, as well as powerful programming tools based on the same format such as Ruby or Python whose algorithms allow generating a more effective interface. Also, the cost of verifying and correcting code design errors is considerably reduced. In this regard, Dodson, Mattei and Goldsmith (2011) stated the following: Our system produces natural language explanations, generated from domain specific and domain independent information, to convince end users to implement the recommended actions. Our system generates arguments that are designed to convince the user of the “goodness” of the recommended action. (p. 43).

The development of the interaction interface between the machine and the human being is becoming more accessible. It is even possible for the machine to offer suggestions. Colloquially speaking, suggestions to the end user, i.e. to generate a persuasive change of the individual's attitude so that he tends to carry out a certain activity that the program has already decided to be the most relevant and effective, because it interacted with various data matrices that allow the AI-based system to recommend a certain action. Now, the reader will wonder how it is possible to generate such a context. The answer is in the development of the Markov Decision Process (MDP) model, which is a mathematical formalism that allows the planning of long range in probabilistic environments whose algorithms allow generating a series of scenarios, with multiplicity of actions to recommend to a user, which can be given step by step. In this regard, the reader can further review this information by reviewing the work of the aforementioned researchers.

Cognitive tutors developed for virtual platforms under the IA approach are developed under algorithms supported by requirements analysis and an object-oriented design. These are the basis of software engineering to simulate the role of an acceptable human tutor, for example, providing tips when a student is stuck with a math problem. The intelligent tutor will offer context-specific comments depending on the tip and the answer provided. In a certain way, intelligent tutoring systems are not new. They have offered supportive assistance on several topics from their modest origins; topics such as training in geography, circuits, medical diagnosis, computing and programming, genetics and chemistry, as in the case of some American schools that have already been using these tools.

New Trends towards a Globalized Social Learning. Use of MOOCs

The new tools that are emerging in the AI field include different levels of human interactivity, and their impact on the university education world is more than a correlative fact of progress, it is part of the new trends in learning/teaching models.

Within the current Latin American context, and the light of what has been achieved and based on a general perception, the reality puts us in front of a model of unattainable utopias. Even in the industrialized capitalist countries, the equality of educational opportunities in their population (covering all levels, including university) dramatically distances them from a democratization of education through processes of empowerment of the population, which would be considered as a confusing and very naïve ambition (Caride, 2016). In this regard, the university, as one of the most representative institutions of the social environment, is not unaware of such failed references. Despite the multiple reforms to which it has been subjected and the series of structural setbacks it has suffered, the current comparisons contradict the core

of the reforms since they have not met the objectives of a democratization of higher education as it is part of the social gap in its real dimension, and since its achievements and admirable awards have always been subordinated to the prevailing economic model, a nexus that transfers to it automatically, and even subliminally, the wishes and private interests of the prevailing power groups (Sotris, 2013).

When discussing the growth of teaching in virtual environments, it is necessary to refer to the topic of MOOCs (Massive Online Open Courses), which has been brightly presented in the context of university education in recent years and, according to the perspectives it offers, it is heading for a very promising future and, at the same time, shows up with some excitement, due to the unpredictable, and, according to the opinion of many researchers, the advances are so overwhelmingly so that it is starting to undermine the traditional structure of university teaching (Cano, Rey, Graván, and López-Meneses, 2015). But, what is meant by MOOC? The so-called MOOC is an online mode of study that is characterized for being an online-delivered course of a specific subject, which is massive and available to users, that is, it is designed and implemented to be delivered (and shared with) to a large number of students at once, and generally free.

What is so special about MOOCs? MOOCs are a recent invention, but they have revolutionized the concept of higher education and distance learning (Segura and Vences, 2014, pp. 803). MOOCs are based on the conception of the democratization of knowledge (socialization of knowledge or social learning) with the aim that as many individuals as possible can increase their knowledge and/or education. Within the universe of MOOCs we can distinguish two fundamental types:

- (1) The cMOOCs are implemented based on the connectivism perspective (Downes and Siemens) since learning is supported by multiple opinions where the interactivity has an impact on the continuous learning shared by a group of users, who share and interact with each other. Under this mechanism, the user's creativity, autonomy and learning are developed as, according to Cano et al. (2015), an interactivity that makes it possible to assess the learning ability of each participant through more accessible practices. Therefore, this modality gives the opportunity to apply collaborative self-learning and also, to some extent, it provides for self-evaluation. Therefore, the application of cMOOCs offers certain advantages such as:
 - Free access and unlimited number of participants.
 - An instructional design based on audiovisual technology supported by written text.
 - To develop a user (student) collaborative and participative methodology with minimum teacher involvement.

- (2) The xMOOCs are delivered in a similar platform, so the adoption of the student profile is much more specific, which is usually closely linked to the university environment. Unlike cMOOCs, which are based on horizontal collaboration, xMOOCs creates a more vertical nexus between teacher and student (s). Similarly, as far as the evaluation mechanism is concerned, it is more oriented to closed exams (tests or closed questions) where the dominant axis will be the results of the individual progress of the participating individuals. The xMOOCs are organized under the principle of structuring the learning environment to the traditional methods of distance education

where the teacher plays the role of thematic expert, and the learning process is individual.

With respect to MOOCs in Latin America, Sanagustín, Maldonado, and Morales (2016) mentioned that the incorporation into the use of MOOCs is almost recent, being defined in 2015 as a new phenomenon, on which existing information is scarce and very different. What these researchers do establish is that these attempts were based on the imitation of certain parameters similar to those developed in Europe (Oliver, Hernández, Daza, Martín, Albó, 2014), where the implementation of massive courses is in full swing. From such analysis, it is emphasized that despite the fact that the incursion of the region into the use of these technologies is new. It achieved increased support in the old continent and that, according to the estimations made, the clear Latin American trend in this aspect gives a very positive balance. As a result of this, there is a very accurate presumption about the use of these new technologies in higher education especially, even though as in the European case few universities are focused on such implementation, a democratization of their dissemination is foreseen.

Conclusions

The generational confrontational dilemma today is more evident than ever before. If the sixties, seventies and eighties were marked by a large number of events that caused several repercussions at the time, today this confrontation is marked by a conflict whose horizons go beyond what has been observed up to now. The generational gaps go beyond the temporal scale because it has a more radical character that goes beyond those conceptual boundaries. The gap is technological, virtual, digital, and it is completely new to the human development. This gap keeps a very significant dialectic of getting us closer, and at the same time, it distances the civilizations from the overwhelming pace of the new technologies based on AI, which have configured two opposing camps generation after generation (Sobel and Shiraev, 2016). In this regard, Gisbert and Esteve (2016) compiled information related to this topic and referred us to address this new era or generation of students who are labeled as "digital natives", who are privileged individuals who coexist with changing technologies, new data transmission formats and new interactive platforms. Platforms where these students, due to their continuous proximity to these technologies, process and are more related to a digital language. And, on the other hand, there are those that are not circumscribed within such parameters and can be classified as "digital immigrants". That is, any individual who is close and adapted to the use of new technologies could be included in this classification. Here it is even possible to make a feasible distinction based on the characteristics of that process, since digital immigrants could be classified as: (1) early (those who due to certain circumstances, favorable or unfavorable, or perhaps spurred on by the imperative needs of the context had to resort to the new technologies), or (2) late (all those who in the course of their lives have been approximated to the use of new technologies or, among other things, because it was appealing to them in the long run. This group might be where the large part of the immigrant population towards the digital dimension is placed). The peculiarity of this qualitative separation, focuses on the use of their own codes of each group. The natives will exhibit their greater versatility with respect to the technological world, as well as the access to greater and better tools of interactivity; while the immigrants will always be following the saga of the first ones with respect to the technological vanguard.

Regarding the above aspect, it results in a very vertiginous strident path within the educational aspect because today's students are not conceived under the standard format, and they have biases from the generation that preceded them. For this reason, the challenge is to structure the new *curricula* based on the new demands of the interconnected world, digital platforms, Smart support systems and the availability of mass, quality and real time data transmission. Therefore, the context urgently and mercilessly demands a very decisive renewal, and perhaps, a complete transformation of the stereotyped standards of university educational models in order to position themselves in a range of digital empowerment. This is what this new generation requires, but the majority of those in charge of this task, that is, teachers, are immigrants to the new technological world. In many cases, these immigrants wage a titanic battle to try to educate a new generation that is immersed in a model far from theirs, which is why the following question may be asked: Are the programs and curricula of the various schools taking into account these significant needs?, have the possibilities and impact of the implementation of the digital language massification in higher education been evaluated?, are the current and past efforts adapted to the changing world of new technologies?, are the upcoming changes going to be fully embraced by both strata (immigrants and natives)?. And if the process continues (as is inevitably foreseen), will the digital gap in academic environments affect the structure of the university? And if so, will the impact generated lead us to increasingly radical changes?

Are the higher education centers, the research institutes attached to them, and their personnel ready for the qualitative leap in the use of AI-based systems? The systems appear to be very accessible, but the question is not how to acquire or use them, is how to develop and adapt them to the different realities of multivariable environments. An example of this is the case of the developing countries' reality whose needs for improvement would be affected by the so-called digital-technological gap.

Many times, and to a certain extent, due to the passion that users have for the use of one or another technology, they feel guided towards a certain aspect of that technology and stop looking at the underlying aspects of it. But, we do not have to put an apocalyptic quote about these processes, because many times the development of such changing events (for example, the development of increasingly powerful and affordable systems) inevitably leads us to neglect the core aspects of new technologies such as their applicability to other activities beyond the academic or commercial world, which in some way, will have an impact on society that could be a global impact.

The various platforms and trends promised by the future of the AI development in the education field are extremely appealing, and in some cases, they are even unattainable for some realities. However, it is unlikely that computer-based learning systems are fully capable of replacing human teaching in schools.

In the particular case of Latin America, is it appropriate to implement and invest in AI? The answer is affirmative, just as Pounder and Liu (2018) stated, such technologies are the key pieces to solve the long-term growth in the region, in order to catalyze the competitiveness and productivity aspects to achieve a real potential transition with new and better opportunities in the global market.

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