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Mobile devices as an educational strategy in the public university in face-to-face mode from the experience of students and undergraduate professors

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ABSTRACT

This essay presents the results of the analysis of the emergence of Information and Communication Technologies in the education process in Higher Education Institutions. An approach is about the new strategies that are used in the classrooms, such as the use of mobiles, inverted classrooms, or challenging collaborative tasks that are not linear, but rather the resolution of cases where they relate to the family and the community. The STEM movement is an approach. Critical Theory supports the ontological basis of the research on Educational Strategies, the general epistemological foundation is the Socio-Constructivism Theory and is nuanced with elements of Popular Education. Nicholas C. Burbules, Michael Fullan, and Carina Lion founded the specific epistemology of the study. Likewise, Complex Networks Theory, Graph Theory, and bibliographic research, among others, based the methodological approach. It ends with the perspectives of the attitudes and skills expected in professionals in the globalized

context and with an unprecedented pandemic, in addition to the contributions of the study to the field of education and society.

1. INTRODUCTION

This research aims to present a critical reflection on the analysis of the use of mobile devices as an educational strategy in the public university in face-to-face mode from the experience of students and undergraduate professors.

One of the areas in which Information and Communication Technology (ICT) has had a major impact in higher education. The incorporation of ICT in the educational field is increasingly necessary because the new generations are digital natives generating new challenges and promoting different scenarios where their use is a mechanism to support the process of acquiring new knowledge formally and informally.

The challenge posed by the use of ICT to support teaching-learning processes has generated the need to create new ways of carrying them out, which forces changes in the way of educating. That is why we have gone from traditional education that was carried out in a classroom to ubiquitous Education that aims to build a learning environment, which allows anyone to learn anywhere and at any time through the use of ICT.

The ontological basis of research on Educational Strategies is based on Critical Theory, the general epistemological foundation in Socio-Constructivism Theory, and nuanced with elements of Popular Education. The specific epistemology of the study was based on Nicholas C. Burbules, Michael Fullan, and Carina Lion. Likewise, the methodological approach is based on complex network theory, graph theory, bibliographic research, among others. It ends with the perspectives of the attitudes and skills expected in professionals in the globalized context and with an unprecedented pandemic, in addition to the contributions of the study to the field of education and society.

For the development of this research, a bibliographic type of research was applied, with which the context was clarified and ordered, the instruments of Analytical Research Summaries were used and adapted and files were made for textual citations in the fields of ontology, general epistemology, and specific to the subject.

2. MATERIALS AND METHODS

For the development of this research, a **bibliographic type** of research was applied, which is "capable of clarifying and allowing to order and better understand the empirical reality" (Ñaupas Paitán, Mejía Mejía, Novoa Ramírez, & Villagómez Paucar, 2014, p. 1609). Information was obtained from various authors and approaches related to philosophical, general pedagogical,

and specific pedagogical aspects. Consultations were conducted in books, these scientific articles, interviews, documentaries, and conferences. Documents were usually reviewed in Spanish and English.

The method of **Analytical Research Abstracts (RAI)** (Arana, 2016) was used and adapted, which consists of synthesizing key points of the referenced authors. It was developed in three steps: Literature counts in a certain topic, RAI Analysis, and Answers to some guiding questions[1]. Among others. Subsequently, an eight-column table was constructed for each document in which the item was referenced[2], Document Type[3], Location[4], Document Titles, Authors[5], Keywords, Description, and Conclusions. The above is to verify that the authors to be used are from academically recognized sources and media.

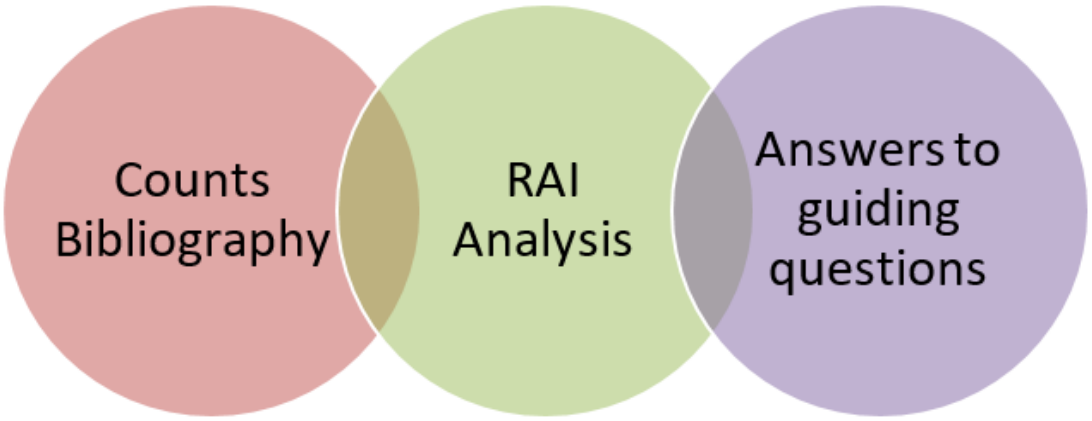

Illustration 1

Analytical Research Abstracts Technique

Source: Arana (2016)

For the selection of textual citations, some tabs were built with the help of PowerPoint where it was specified for each tab, category of knowledge (Ontology, General or Specific Epistemological), the Title, Location, International Standard Serial Number (ISSN) of the document or Digital Object Identifier DOI of (l) author(s), Search engine (Google or Mendeley), the textual citation, and an image of the article with general data from the document. The

1. In the case of this document, the guiding questions were: How does globalization impact education? What are the characteristics of oblique education?
2. Sequential number.
3. Research, book, interview, among others. For each document, it was verified that it had International Standard Serial Number (ISSN) or Digital Object Identifier (DOI).
4. Usually a URL
5. In the authors, the ORCID of the authors was verified through the Connecting Research and Researchers website: https://orcid.org/signin

previous exercise allowed us to visualize the position of each author on specific topics such as teachers, learners, educational institutions, pedagogies, among others. Analyze which authors were inclusive or exclusive according to the topic and research perspective.

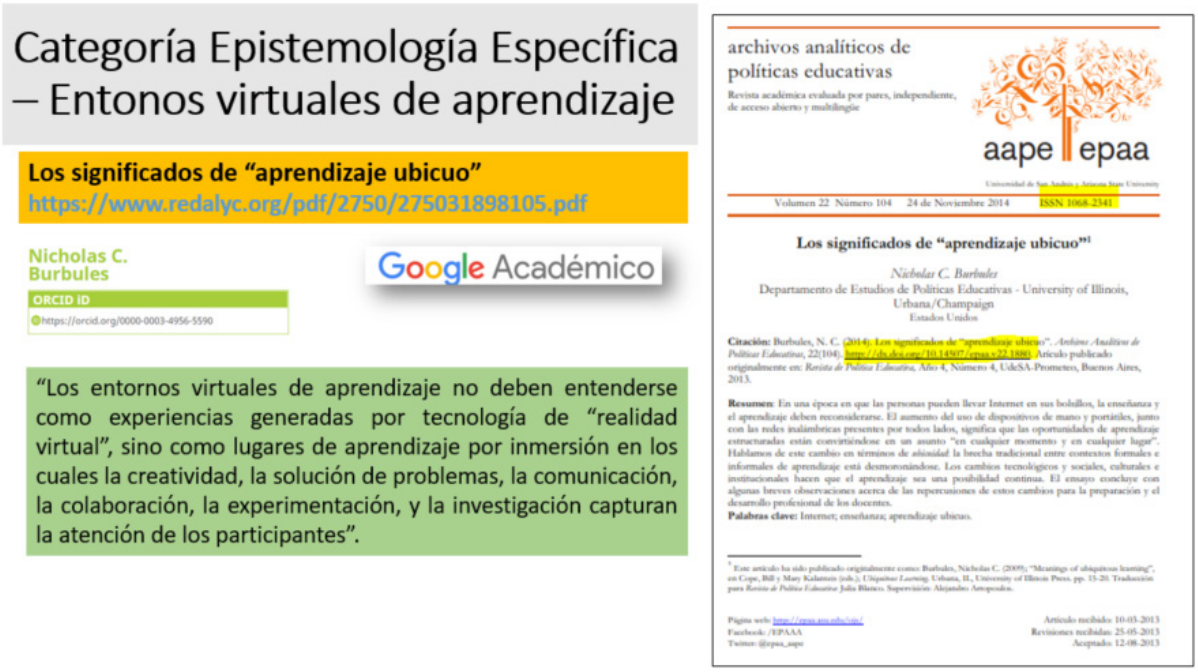

Illustration 2

Verbatim citation tabs by category

Source: Own elaboration – practice in the Module of Pedagogical Foundations of Social Education, Contemporary Theories and Models, in the Doctorate of Education and Social Intervention UNAN Managua, developed by Dr. María Soledad Álvarez Arzate in February 2021.

The limitations found in the conduct of the research were the lack of statistics on the implementation of information technologies in higher education in the national and international context, which prevents measuring progress, identifying bottlenecks, and/or extracting initiatives with potential for reuse.

3. RESULTS AND DISCUSSION

This section describes the philosophical, general, and specific epistemological approach to research, as well as the perspective of the learner, teacher, educational institution, and external perspective.

3.1. General philosophical approach

Understanding globalization is a necessary starting point to understanding education (Sánchez Delgado & Rodríguez Miguel, 2011). In this sense, in the praxis of a critical theory

", every form of critical knowledge must begin by being a critique of knowledge itself" (Santos B. d., 2005) because in the current context information and knowledge tend to duplicate each time in less time, technological developments are faster than pedagogical ones and usually, technology ends up determining many of the lines of research to continue (Torres Díaz, Infante Moro, & Torres Carrión, 2015).

Globalization has imposed itself in all fields and affects all areas because it has forced the majority of people, countries, or regions to integrate (Raventos & Enric Prats, 2012), amid cultural, ethical, financial, and political pluralism (Vásquez, 2018). Globalization recognizes "the activation of certain economic strategies and mechanisms that seek to dilute the borders between countries and economic blocs" (Fazio Vengoa, 2001, p. 328), as well as the "universalization of the Internet as a means of interactive communication, to the planetary extension of mobile communication" (Torres, 2014).

The process of globalization has had an impact on education leading to major problems such as inequalities in values, pedagogical approaches, social exclusion, among others. In addition, it has caused a low educational level in some regions of the world (Vásquez, 2018). The financial organizations of globalization that try to equalize education are Economic Commission for Latin America and the Caribbean (ECLAC), International Monetary Fund (IMF), World Trade Organization (WTO), World Bank (WB), and Organization for Economic Cooperation and Development (OECD) (Sánchez Delgado & Rodríguez Miguel, 2011).[6]

The changing and volatile environment of our current society and the recent global pandemic caused by the SARS-CoV-2 virus known as COVID-19[7], ¿ have forced educational systems and educators around the world to ask ourselves: How are we educating? Are we developing in professionals the skills that are demanded in the new XXI Century? Should we be concerned about digital gaps? These questions lead us to rethink the conception we had of education to give rise to new ways of understanding it within the knowledge society (Acevedo Mena & Romero Espinoza, 2019).

The relevance of critical theory in the current context is for its approach to "human emancipation based on the recovery and redirection of reason" (Briceño Linares, 2010). The knowledge society can be defined as an "economic and technological paradigm" (Binimelis Espinoza, 2010) that studies "the social transformations that are taking place and serves for the analysis of these transformations" (Karsten, 2006). Likewise, the notion can be understood as "a rupture and a discontinuity concerning previous periods" (Burgos Briones, Vélez Zambrano, & Pico Barreiro, 2019).

6. This entity promoted the Program for International Student Assessment (PISA) in some Latin American countries such as Mexico and Colombia in a spirit of standardizing the education in America Latin.
7. Acronym for coronavirus disease 2019

In the knowledge society arises the Knowledge-based Economy, which is a sector that uses information as a fundamental element to generate value and wealth through its transformation to knowledge, in this sense:

> Critical Theory has paid close attention to the emergence of mass culture and to the control of the means of production of that culture that has finally become the main agent of both socialization and definition of the real (Binimelis Espinoza, 2010, p. 217).

Habermas (1951) quoted by Fuch (2016) "conceives instrumental action and communicative action as the two fundamental aspects of social praxis", in this sense, it is necessary to review whether in the knowledge society the means of communication and production serve as a basis for maintaining political and economic structures of power if interactions in virtual contexts make possible a critical dialogue and an inclusive deliberative action for the majority, or it has become a new modern form of colonization.

In congruence with the above, José María Pérez Gay quoted by Cruz & Guadalupe (2013) describes that "the individual is an illusion" (Cruz & Guadalupe, 2013), the use of the media as an instrument of domination by the ruling class to manipulate society is a phenomenon studied and denounced by the thinkers of the Frankfurt School. In this sense, Information Technologies is a process of culture and a means of communication that make use of social networks to disseminate information, achieving the transformation of the individual into a mirage of cultural production.

In the context of the current pandemic (2020-2021), it is undeniable that the use of social networks[8] has served as instruments of youth empowerment (Jaynes, 2020), however, the use of information technologies has meant fewer opportunities for those people who lack access to the use of technologies and the empowerment of a social class with greater economic power because they can access a higher quality education (Castellón Zelaya, 2020), for the above Zuleta Medina & Chaves Torres (2009) affirm that:

> From the critical theory, it is affirmed that every educational system institutionalizes the specific characteristics of its structure and functioning because it is constituted to reproduce by the means of the institution, the conditions of the same that guaranteed by interchangeable agents continuously exercising absolute power to maintain cultural arbitrariness, which will prolong its existence (Zuleta Medina & Chaves Torres, 2009, p. 52).

The educational system through the hidden curriculum (López, 2015) and symbolic violence (Zuleta Medina & Chaves Torres, 2009) allow the hegemony of the upper classes, allowing inequalities and social exclusion, widening digital gaps and the deterioration of culture, through the institutionalization of a tyranny of meritocracy (Sandel, 2021), which is the false

8. Facebook, Twitter, YouTube, WhatsApp, Messenger, Instagram, among others.

belief that we all have, the same conditions in a society widely unequal in aspects of basic human rights such as education, health, environment, among others, where the sense of common welfare and the dignity of work have been lost.

Following this logic, Freire (1969) proposes that for the ruling classes there is no more right than theirs and once a situation of domination is established, it reproduces itself becoming an inheritance, both for the oppressors and for the oppressed, the former being aware of it and the latter unconscious (Freire, Pedagogy of the Oppressed, 1969). In this sense critical theory review the aspects and scope of emancipation and the principle of differences must be reanalyzed and constructed as proposed by Santos:

> We need to build emancipation from a new relationship between respect for equality and the principle of recognition of difference. In Western modernity, whether in conservative functionalist theories or critical theories, we have not treated this adequately until now, because – especially in critical theory – all theoretical emancipatory energy was guided by the principle of equality, not by the principle of recognition of differences. Now we have to try a theoretical construction where the two are present and know that a struggle for equality must also be a struggle for the recognition of difference because the important thing is not homogenization but equal differences (Santos B. d., 2006, p. 53).

In this sense, critical theory must be positioned in a perspective that understands knowledge from a dimension of emancipation, equality, and solidarity that allows societies with greater access to education and justice, as Oppenheimer (2014) points out, the quality of education is the key to the knowledge economy and the success of innovation is in people and a culture of acceptance of ethnic diversity, culture and sexual. Also, to tolerate failure due to which is a common experience on the path of innovation (Oppenheimer, 2014).

3.2. General epistemological approach

For many years the educational experience has been studied to improve the pedagogical transposition in the teaching and learning process. This led to the development of various learning theories: behaviorism, constructivism, socio-constructivism, popular education, among others. Each of them, based on their epistemology, encourages the development of the teaching and learning process in a specialized way (Mesén Mora, 2019). On the applicability of these theories at present, Onyesolu, Nwasor, Ositanwosu, & Iwegbuna (2013) propose that:

> Instructive, constructivism and socio-constructivism are the remarkable and practical theories of pedagogy today that still depend on the works of earlier philosophy on teaching and learning, although early education theorists are divided into different conceptions of teaching and learning (Onyesolu, Nwasor, Ositanwosu, & Iwegbuna, 2013, p. 40).

Information and Communication Technologies (ICT) are increasingly used in higher education institutes, they are being imposed as didactic elements in both face-to-face and

distance education. Higher education institutions have in ICT and socio-constructivism, key tools to fulfill their fundamental mission and advance universal knowledge (Domínguez Díaz, 2016).

Socio-constructivism is a very broad approach, understood from a pedagogical perspective can be defined from several characteristic features: construction of knowledge, individual dimension, social dimension, contextual dimension, and evaluation as a dynamic process (Bilbao, Perea, & Pogré, 2019).

Socio-constructivism is a theory of learning that raises in its dimension:

> The participation of the student within a collective learning project, where he will enhance his capacity to solve contextualized problems, which will allow him to develop a process of the social construction of knowledge, supported of course, in the means and technological tools at his disposal (Robles Altamirano & Barreno Salinas, 2016).

This current of thought places the learner at the center of the learning process, the protagonist for his ability to build his perspective of the world and its functioning. For socio-constructivism, learning is an original constructive process, which occurs from the inside out when the human being interacts with others and with his environment.

Other socio-constructivist perspectives that "do not limit themselves to giving the tutor the central part of the instructional process nor the student" (Barberá, 2006), conceptualize the construction of human knowledge by the interaction between the student, teacher and the teaching object.

In the social dimension of the socio-constructivist current of thought, it is understood "that, although part of the construction of knowledge occurs within the individual, it cannot be separated from social interaction" (Bilbao, Perea, & Pogré, 2019), knowledge and learning are transformed through the interaction of the individuals that make up a society. The commitment of Higher Education Institutions worldwide is to train professionals with the development of skills and abilities that allow learners to generate the services and products demanded by increasingly globalized and competitive markets.

Therefore, "socio-constructivism maintains that the individual in his cognitive and social-affective aspect is not a mere product of the environment, nor a simple result of his volitional dispositions, but his construction, resulting from the interaction of these factors" (Robles Altamirano & Barreno Salinas, 2016). Each teaching-learning process is unique in the individual and responds to multiple stimuli and demands from their environment. Also, to the conditions and tools, you have at the time of your teaching process.

"Teaching requires respect for the knowledge of the learner" (Freire, Pedagogy of autonomy: knowledge necessary for educational practice, 2004), therefore we must consider that young people who enter an undergraduate study, are digital natives and are constantly connected in their personal lives (Lion, 2015) and that technologies have been present since childhood and are perfectly constituted and adapted in the different activities of their daily lives (García Sánchez, Reyes Añorve, & Godínez Alarcón, 2017), so it would be essential to include them within the dynamics of daily learning.

A crucial aspect of Vygotskian conceptual theory is that it considerably supports collaborative learning through scaffolding strategies, according to Newman and Holzman (1993, p.73) cited by Hameed Panhwar, Ansari, & Ansari (2016):

> Vygotsky's strategy was essentially a cooperative learning strategy. He created heterogeneous groups of ... children..., giving them not only the opportunity, but also the need for cooperation and joint activity to give them tasks that were beyond the developmental level of some. (Hameed Panhwar, Ansari, & Ansari, 2016)

Undoubtedly, the presence of technology has been transforming how students play, access information, interact with each other and learn (create knowledge). Most young people who attend classrooms are constantly connected, in their personal lives on social networks and extend the use of information technologies to their homework and the fulfillment of their obligations in class (Fullan & Langworthy, 2014).

In this order of idea, it is important to make the curriculum of Higher Education Institutions more flexible from a cultural perspective of socio-constructivist, which:

> indicates the need to see curricula as culturalization companies that, therefore, are open to changes that are promoted from society, based on the recognition of our starting point: complexity as an emerging paradigm for the understanding of reality (Benavides Lara, 2014).

The forms of knowledge production have changed, they are more collaborative, active, and group, the validity of the contents is short, social networks, as a cultural manifestation and their use for teaching is imposed on our society, Higher Education Institutions can update their curricular programs to respond to the main problems facing society. A strategy to identify the requirements of students in a changing environment is what the Theory of Mediated Didactic Dialogue proposes:

> "The educational processes must be raised from the student as the protagonist, dynamic and active in their construction of knowledge, where the communicative spaces that are generated must seek a mediated didactic dialogue, in which an exchange is established between teachers and students that allows guiding the learning process, from the multiple interactions with the object of knowledge, peers, the environment and other educational agents" (Salas Quirós, 2016).

The transition from the industrial society to the knowledge society entails important demands from "people capable of constantly managing, analyzing and using the knowledge accumulated at a universal level" (Horta Castro, Pérez Bejarano, & Rodríguez Jiménez, 2019). In this way, to be able to generate new knowledge and synthesize a lot of information that is generated from different sources to solve specific problems that overwhelm our society: unemployment, remote work, new forms of production-friendly to the environment, among others.

3.3. Specific epistemological approach

The challenge posed by the use of Information and Communication Technology to support teaching-learning processes has generated the need to create new ways of carrying them out, which forces changes in the way of educating. That is why we have gone from traditional education that was carried out in a classroom to ubiquitous Education that aims to build a learning environment, which allows "anyone to learn anywhere and at any time" (Yahya, Arniza Ahmad, & Jlil, 2010), that is, to have access to documentation and class resources permanently.

Ubiquitous education can be defined as: "education that allows learning at any time and in any place, depending on the application environment and supported by digital tools that allow the inclusion of different actors within the training process" (Báez Pérez & Clunie Beaufond, 2019, p. 328). Under this paradigm we have the advantage of accessing information without geographical location and time being relevant (Burbules, Ubiquitous Learning and the Future of Teaching, 2012, p. 4) using mobile devices and technology, allowing unprecedented access to education.

Undoubtedly, a first chance to achieve ubiquitous learning is to "break with the spatial and temporal boundaries of traditional education to move to a new permanent presence of pedagogy" (Rodrigo Alonso & de Castro Lozano, 2013), both for formal or informal learning spaces, gamification can be taken advantage of through Gamification, which is a learning technique that transfers the mechanical part of the games to the educational-professional field.

It is interesting to mention that ubiquitous education constitutes "an educational paradigm that is present in societies to which knowledge is not restricted" (Novoa Castillo, Cancino Verde, Uribe Hernández, Garro Aburto, & Mendez Ilizarbe, 2020), therefore they are informed, fair and balanced societies, where education has an emancipatory power and fulfills the role of integrating the new generations into society and preparing them for their performance (Zuleta Medina & Chaves Torres, 2009).

"Electronic learning is virtualized distance education thanks to electronic means" (Flores Ortiz & García Martínez, 2017, p. 1), when a subject is provided through digital means it is necessary to follow a virtualization methodology where at least a curricular program must be

had or elaborated, didactic planning, digital resources[9], virtual learning environment, forms of evaluation, among others. The fact providing a virtual class requires the same or more preparation than doing it in person. In virtual learning environments, it should be considered with special attention that:

> Virtual learning environments should not be understood as experiences generated by "virtual reality" technology but as places of immersive learning in which creativity, problem-solving, communication, collaboration, experimentation, and research capture the attention of participants (Burbules, The Meanings of "Ubiquitous Learning," 2014).

Educational paradigms are shifting to implement quality online learning, blended or hybrid learning, and other mobile-mediated collaboration models that favor ubiquity. Institutions that adopt face-to-face, online, and hybrid learning models have the potential to leverage digital skills that students have already developed independently of their day-to-day lives.

According to Low (2006), learning through mobile devices facilitates student activities, usually in four categories: The student can create and capture their content; You can access educational resources; It uses a digital device to process learning stimuli, and it communicates with peers and tutors by establishing relationships useful for learning.[10]

According to Ogata & Yano (2004) for there to be a ubiquitous learning environment there must be certain ones such as permanence, accessibility, immediacy, interactivity, and situation of instructional activities (Ogata & Yano, 2004) (See figure 3).

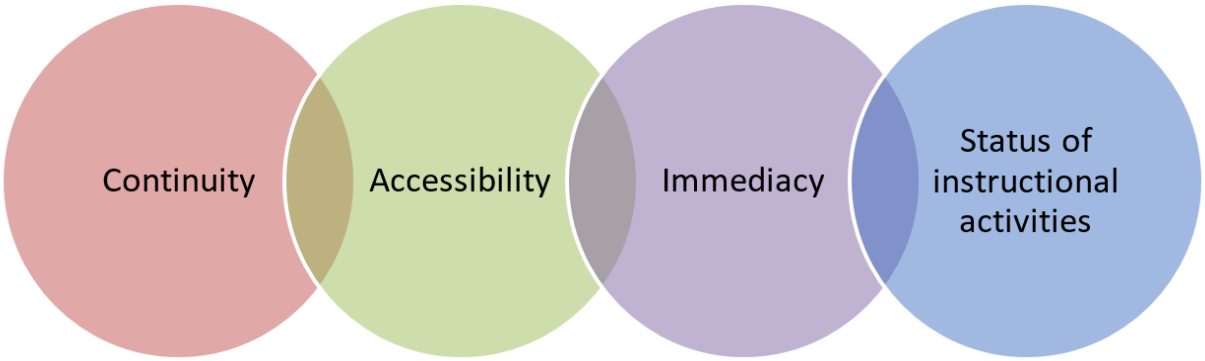

Illustration 3

Characteristics of a Ubiquitous Learning Environment

Source: Own elaboration

9. Manuals, Videos, Arts, Infographics, Among Others.

10. refers to the interaction that is established with the members of a learning network that includes teachers and students

The figures of the incorporation of technology into the educational world are in constant progression, although it does not seem so clear that the pedagogical model adapts to the possibilities it offers, nor to the speed at which it evolves, often making it a mere substitute for analog technology. In this sense, mobility and ubiquity refer to the possibilities that technology offers for the development of teaching-learning activities inside and outside the classroom (Vásquez-Cano, Fernández Batanero, & López Meneses, 2019, p. 7).

An important aspect to consider in ubiquitous education is the social networks of knowledge that are defined as:

> Networks arise from the communication that has occurred between human beings in telematic networks, those people have decided to group them in cyberspace and constitute a community within it. The physical network is an expression of the social network and the latter can emerge posteriori as a new phenomenon from physics. (Mena Diaz, 2012)

These social groups, usually academics, both individually and in educational entities form networks around educational projects, formed by multidisciplinary groups of people and institutions that have a way of sharing through technological means. In this sense, the Graph Theory generally used in mathematics takes on special relevance because it allows the "representation of a network as a model consisting of a set of actors and the ties between them" (Molina Espinoza & Rivero Hernández, 2012).

There is an interrelationship between complex and social networks. Complex networks are ubiquitous and social networks are a type of complex network. Graph theory is the natural framework for the mathematical treatment of complex networks and therefore its equations characterize the structure of social networks, this interrelation is shown in figure # 4

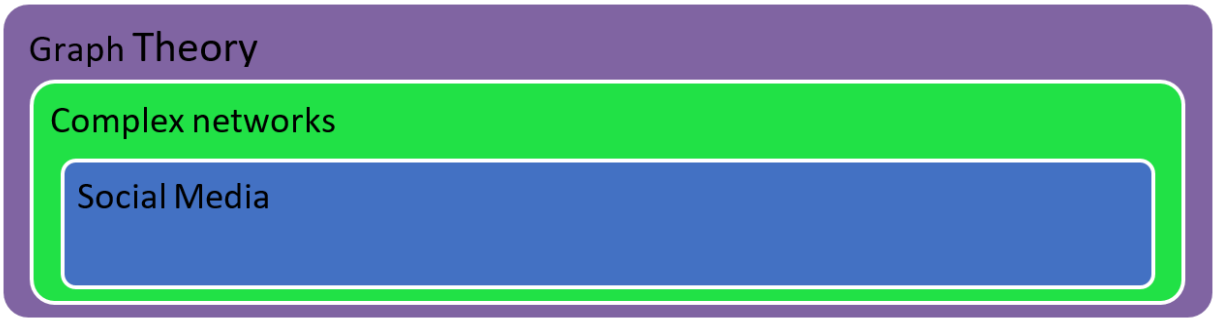

Illustration 4

Verbatim citation tabs by category

Fuente: Mena Díaz (2012)

3.4. Prospective of the learner

Mobile and ubiquitous learning is a new educational paradigm in which the student positions himself before learning from a more global perspective and where the physical space is not a determining variable for his learning (Vásquez Cano, Sevillano, & Fombona Cadavieco, 2016, pp. 63-77). Another relevant change is that education has changed from teacher-centered training to student-centered training, ceasing to be passive and becoming a student who generates his knowledge (Terán Modregón & Lino Humerez, 2019) based on his experience, available means, previous knowledge, among others.

An interesting concept is that of interconnection that generates an "extensible intelligence", in two aspects, technologically aspects such as knowledge, memory, and processing has been improved with the presence of mobile devices and computing. The second aspect is that the student has access to a networked intelligence, either technologically or socially distributed or both. He is in contact with others who complement his knowledge through the experience of collaboration (Burbules, Ubiquitous Learning and the Future of Teaching, 2012, pp. 3-4).

For learners, information technologies allow them to access multiple educational resources to study and work on certain content, learn in less time compared to traditional learning, the learning process is developed according to individual skills and qualities, greater closeness with the teacher through digital tools and access to materials in any time and place (Díaz Levicoy, 2013).

3.5. Teacher's Perspective

From the socio-constructivist perspective, the role of the traditional teacher changes to be a facilitator and mediator between the teaching object of studies using Information and Communication Technology so that each student achieves a significant experience of knowledge from their skills, resources, funds of times destined to research and self-study, among other relevant variables.

A weakness that the process of virtualization of classes has shown due to the COVID 19 pandemic is the fact that the experience of teachers in non-face-to-face strategies is scarce. Likewise, the process of adapting resources, materials, contents, and activities, both synchronous and asynchronous, consumes much more time and effort, which in general is insufficiently compensated with the corresponding salary. Likewise, governments ask for continuity in the pedagogical processes in virtuality, without taking into account the lack of Internet access for a significant part of the student population and even the non-availability of the necessary devices. (Canales Reyes & Herrera Carvajal, 2020, p. 18)

In the current context, teachers must provide a class full of unique creativity, generate a space where students and teachers themselves are questioned (Lion, 2015). The experience and professional preparation of the professor have always been very important, but in a reality full of volatility and speed it is required to be able to give answers to the educated from their multiple interests and knowledge.

One aspect that teachers must take care of is that the strategies of assigning tasks to students should avoid being a copy and paste, or memorize lessons, but should be challenging and that entails a didactic challenge, that involves the family and the community, that are the resolution of cases or complex problems, with the transfer of knowledge or experiences in non-linear or univocal practice, collaborative work with other students or with specialists, working more with images, trying to build images with knowledge or boards to deal with cognitive processes (Lion, 2015).

From the point of view of the teaching staff, the main advantages of Information Communication Technologies would be that they can access innumerable sources, both knowledge and methodological for the development of their chairs; It allows them to teach without the need for a physical space, it allows to maintain more fluid communication with the student because it can be accessed from different means such as Email, WhatsApp, Skype, others; the evaluation process is faster (Díaz Levicoy, 2013).

In the specific case of the learning platform, they are relevant for teachers, in the aspects of the design of the subject, achievement of objectives, distribution of time, management of the subject, classroom climate, interest and participation of students, application and review of exams, and student learning (Ramírez Valdez & Barrajas Villarruel, 2017).

As disadvantages for learning, teachers, and students can be mentioned more ease of plagiarism, a high background of time to classify and hierarchize information, distractions, and dispersion to have so much information available (Díaz Levicoy, 2013).

I believe that in the paradigm of Popular Education there are two attitudes, or rather values that Paulo Freire had pointed out in the past, in his work of Pedagogy of Autonomy, such as knowing how to listen and loving students well (Freire, Pedagogy of autonomy: knowledge necessary for educational practice, 2004).

Therefore, in the context of online and ubiquitous education, we find students with a lot of previous and curious knowledge, so we must be attentive in active listening and ask promptly to ensure that the participants of the process achieve significant knowledge and experience, also have an open and authentic attitude of joy when teaching, answer queries, provide feedback, among other activities that are part of the teaching process.

Since, being virtual classes, much of the human warmth of the teaching-learning process between the teacher and the students is lost. We must avoid turning the class section and the study process into a space devoid of empathy and mechanics.

3.6. Educational Institution Perspective

In the context of the ubiquitous education paradigm, universities are being challenged, as they are not regarded as single and even primary sources of learning. Extended classrooms acquire a special relevance because classrooms are no longer only the physical space, but what happens after receiving a class because students and teachers are still connected looking for information about the subjects or tasks assigned in this way the knowledge has feedback inside and outside the classroom, following a permeability of knowledge, classrooms become "porous classrooms" where knowledge and energy flow in and out of the classroom.

A novel aspect is that we all learn from everyone, the students of the teacher, the students of the knowledge available through technologies, the teachers of other specialists who are investigating similar topics. The study is continuous, not only in the case of postgraduate or adult studies but knowledge is regularly updated, due to the ease of access to knowledge and the demands of the labor market.

The market requires professionals with STEM skills that demands an approach to the fields of science, technology, engineering, and mathematics as a whole, which implies that higher education institutions consider their educational strategies and pedagogical approaches for this reason the Teaching Framework for Understanding (Bilbao, Perea, & Pogré, 2019) can be a bet for higher education entities because it is not a radically innovative proposal, but its bases on experts of the learning of the last century, especially of socio-constructivism.

The dynamics of universities must be analyzed around the Theory of Complex Networks and Graphs so that they can understand the flow of people, information, ideas, and innovation that is required, to respond to a globalized market, therefore, the environment and the university must change, in two dimensions: devising new and different tasks for the home and involving in-class resources that are not usually related to the school environment (Burbules, The meanings of "ubiquitous learning", 2014).

3.7. External perspective

The context of the XXI Century is different from the Agricultural or Industrial Society where "information became the vehicle of creation of prosperity and whoever owns it will have a new power" as established by Drucker (1993) cited by Osorio de Parra (1996). The globalization that has boosted competitiveness, standardization of products and services, new social spaces,

turbulent contexts exacerbated by the Covid 19 pandemic, requires professionals with attitudes and skills that respond to market demands.

Worldwide, traditional education designed in the industrial era has become an obsolete and ineffective system because the skills required in the new context are not being developed, known as the 6Cs: creativity, communication, citizenship, critical thinking, character, and collaboration (Fullan & Langworthy, 2014). Additionally, the way we understand the world in the face of the demands of the future is a valued, disciplined, synthetic, creative, respectful, and ethical mind (Maggio, 2018). For the skills and knowledge that are and will be demanded today, the use of ICT is relevant.

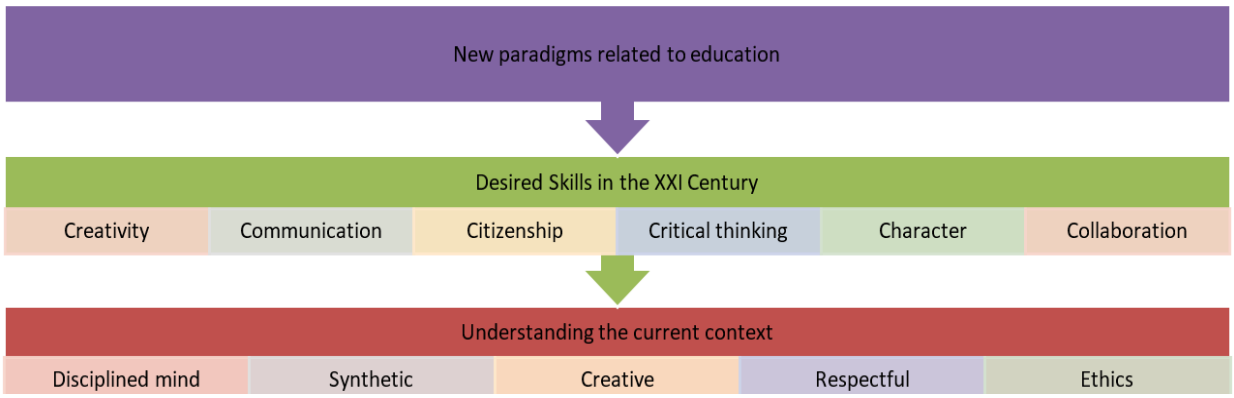

Figure 1

New paradigms of skills and understanding of the environment in the XXI Century

Source: Own elaboration based on (Maggio, 2018)

About values and attitudes, he must be an active professional in respect for cultural identity, integration, and social stability, seeking a more just society. Additionally, it must be able to dialogue with other people from different cultures, religious and political beliefs, respect discrepancies, and seek consensus and sustainable progress, especially for local rural enterprises that have an impact on the economy of the countries.

On the professional side, you must be skilled in the use of computers and the Internet because a gradual disappearance of physical workspaces is outlined, supplanted by working from home, with virtual meetings and conferences. Also, generate resources of infographics, arts, videos, among others. The mastery of languages is a very important part due to the new dynamics of the global market products of globalization, at least the requirement of one or two languages, in addition to the native one.

It is important to mention that professionalism must be expressed with a social and collective commitment, being closely related to aspects such as lifelong learning. It is expected

that, in the future, it will be common for people to develop in two areas or professional careers, not necessarily inclusive. Example: Medicine and Systems Engineering.

4. CONCLUSION

At present, many of the problems that were strongly addressed to provide a solution in the Critical Theory, Socio Constructivist and Popular Education are still valid, as is the case of illiteracy, excluded population, negative perception of teaching and planned education in series, among other issues. In some societies, these difficulties have been exacerbated by cultural or political situations such as migration or war, or by uncontrollable situations such as the Covid-19 Pandemic.

The research of "Mobile devices as an educational strategy in the public university in face-to-face mode from the experience of students and professors of degree" is very pertinent because, in the current context of the pandemic, the process of class virtualization increased, which entails as results an opening of spaces for the adoption of oblique and/or online education, with greater force in Nicaragua and Central America.

We are in a period of many changes, these are reflected in education, the roles of teachers and learners, as of the same institutions of higher education have changed, ubiquitous education arises, porous classrooms, STEM movements, Teaching Framework for Understanding as a solution proposal to the globalized world and the professionals that the market is demanding.

The didactic strategies of teaching must change to adapt to the new times, implementing mechanism of extended classrooms, search and classification of information, use of panels and images, the assigned tasks must be challenging and involve as far as possible several areas of the student's life such as family, community, experts, among others.

The theory criticizes allowed to visualize that although ICT has broken into education, bringing great advantages, the digital divide in a considerable percentage of the population, especially vulnerable groups is significant; likewise, social networks play an important role in maintaining the power structures of the ruling classes. Popular Education gives us elements that allow us to humanize and make a class welcoming, virtues that a teacher must try to protect.

While there are many studies on the subject of online education from its different categories and subsystems, this is the first study on "Mobile devices as an educational strategy" in higher education in Nicaragua and Central America that will provide reliable and truthful information on how to implement online education in conditions different from the societies of the United States and Europe contributing the knowledge and methodology of how to adapt the ubiquitous education.

One of the limitations of the study is the lack of statistics on the implementation of information technologies in higher education in the national and international context, which prevents us from measuring progress, identifying bottlenecks, and/or extracting initiatives with potential for reuse.

REFERENCES

Acevedo Mena, K., & Romero Espinoza, S. (December 2019). Education in the knowledge society. Revista Torreón universitario, 8(22), 79-83. doi:10.5377/torreon.v8i22.9032

Arana, W. (September 2016, 2016). Construction of a state of the art or state of the art. Retrieved February 13, 2021, from Dale Macarena: https://www.youtube.com/watch?v=F8WMdGtTyPI

Barberá, E. (2006). The theoretical foundations of face-to-face and online tutoring: A socio-constructivist perspective. Network education and Education Sciences, 151-168. Retrieved February 2021, 2021, from https://d1wqtxts1xzle7.cloudfront.net/59789675/fundamentos_tutoria_barbera20190618-19070-x0wz3u.pdf?1560912017=&response-content-disposition=inline%3B+filename%3DLOS_FUNDAMENTOS_TEORICOS_DE_LA_TUTORIA_P.pdf&Expires=1614208676&Signature=-QcQDuAqmDkxAYSPdcvA

Benavides Lara, M. A. (2014). To make the curriculum of Higher Education Institutions (HEIs) more flexible in an environment of complexity: an analysis of cases from the cultural perspective of socio-constructivism. Voices and Silences: Revista Latinoamericana de Educación, 6(21), 3-21. doi:10.18175/vys6.1.2015.02

Bilbao, N., Perea, F., & Pogré, P. (2019). Pedagogical background of the Teaching for Understanding framework. TesoPress. Retrieved February 23, 2021, from https://www.teseopress.com/antecedentesmarcoepc/

Binimelis Espinoza, H. (January-April 2010). Towards a knowledge society as emancipation: a look from critical theory. Arguments critical studies of society, 23(62), 203-224. Retrieved February 13, 2021, from https://www.redalyc.org/pdf/595/59515960009.pdf

Briceño Linares, Y. (2010). The Frankfurt School and the concept of cultural industry. Tools and keys for reading. Venezuelan Journal of Economics and Social Sciences, 55-71. Retrieved February 24, 2021, from https://www.redalyc.org/pdf/177/17731133004.pdf

Burbules, N.C. (2012). Ubiquitous learning and the future of teaching. Meetings on Education, 13, 3-14. Retrieved December 20, 2020, from https://dialnet.unirioja.es/servlet/articulo?codigo=4100463

Burbules, N.C. (2014). The meanings of "ubiquitous learning". Analytical Archives

of Educational Policies, 22(104), 1-10. doi:10.14507/EPA.v22.1880.

Burgos Briones, J., Vélez Zambrano, G., & Pico Barreiro, L. (2019). Education and Technology in the Knowledge Society. Manta, Manabí, Ecuador: Casa Editora del Polo. Retrieved December 03, 2020, from https://docs.wixstatic.com/ugd/31263e_7a36ed8417284d-779c76e4033a3000a9.pdf

Canales Reyes, R., & Herrera Carvajal, C. (2020). Access, democracy, and virtual communities (I ed.). Buenos Aires, Argentina: Latin American Council of Social Sciences (CLACSO). Retrieved February 14, 2021, from www.clacso.org.ar/libreria-Latinoamerica

Castellón Zelaya, L. (June 01, 2020). Subalternity in Costa Rica: Educational gaps and opportunities in a globalized and digital society. Intercedes, XXI(44). doi:10.15517/issuer.v21i44.43945

Cruz, A., & Guadalupe, D. (2013). From the Frankfurt school to the reception practice. Razón y Palabra Magazine. Retrieved February 24, 2021, from https://www.redalyc.org/pdf/1995/199527531024.pdf

Diaz Levicoy, D. (2013). ICT in Higher Education: Advantages and Disadvantages. Education and Technology(4), 44-50. Retrieved November 10, 2020, from https://dialnet.unirioja.es/servlet/articulo?codigo=5072156

Domínguez Díaz, Y. (December 2016). The use of information and communication technologies (ICT) in university learning. Revista Universidad y Sociedad, 8(4). Retrieved October 5, 2020, from http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S2218-36202016000400021

Fazio Vengoa, H. (January 2001). Globalization: Discourse, Imaginaries, and Realities. Revista Colombiana de Antropología, 37, 328. doi:10.22380/2539472x.1287

Flores Ortiz, A., & García Martínez, A. (May - August 2017). Ubiquitous learning system in virtual environments. Revista Cubana de Educación Superior, 36(2), 1. Retrieved December 20, 2020, from http://scielo.sld.cu/scielo.php?script=sci_abstract&pid=S0257-43142017000200003&lng=es&nrm=iso

Freire, P. (1969). Pedagogy of the Oppressed. Bogotá, Colomnia: Siglo Veintiuno Editores. Retrieved February 15, 2021, from https://books.google.com.ni/books?id=WECofTOdFJAC&printsec=-frontcover&hl=es&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Freire, P. (2004). Pedagogy of autonomy: knowledge necessary for educational practice. Sao Paulo: Paz e Terra S.A. Recovered on February 14, 2021, from https://redclade.org/wp-content/uploads/Pedagog%C3%ADa-de-la-Autonom%-C3%ADa.pdf

Fuch, C. (2016). Critical Theory of Communication. London, Inglaterra: University of Westminster Press. Recuperado el 25 de febrero de 2021, de https://library.oapen.org/bitstream/id/463977d8-5309-4fe6-8926-384e78ad37ae/619390.pdf

Fullan, M., & Langworthy, M. (2014). A rich vein, How new glues achieve in-depth learning. United States: Pearson. Retrieved January 01, 2021, from https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/about-pearson/innovation/open-ideas/ARichSeamSpanish.pdf

García Sánchez, M., Reyes Añorve, J., & Godínez Alarcón, G. (July - December 2017). ICT in higher education, innovations and challenges. Revista Iberoamericana de las Ciencias Sociales y Humanísticas, 6(22). doi:dx.doi.org/10.23913/ricsh.v6i12.135

Hameed Panhwar, A., Ansari, S., & Ansari, K. (2016). Sociocultural Theory and its Role in the Development of Language Pedagogy. Advances in Language and Literary Studies, 7(7), 183-188. doi:10.7575/aac.alls.v.7n.6p.183

Horta Castro, Z., Pérez Bejarano, M., & Rodríguez Jiménez, A. (2019). Intellectual skills in the training of professionals in the knowledge society. Atlantean Magazine. Retrieved November 5, 2020, from https://www.eumed.net/rev/atlante/2019/07/habilidades-intelectuales.html

Jaynes, V. (2020). The social life of screenshots: the power of visibility in the teen friendship group. New Media & Society, 22(8), 1378-1393. DOI: DOI:10.1177/1461444819878806

Karsten, K. (2006). The concept of the knowledge society. Bibliographic Journal of Geography and Social Sciences, 742-98. Retrieved December 02, 2020, from http://www.ub.edu/geocrit/b3w-683.htm

Lion, C. (November 17, 2015). Talking about ICT in higher education. (U. O. Uruguay, Interviewer) Institute of Education - Universidad ORT Uruguay. Montevideo. Retrieved November 20, 2020, from https://www.youtube.com/watch?-v=h2SVn_YWBLg

Lopez, W. J. (2015). Professionalism: Traces of a hidden curriculum? Revista Iberoamericana de Educación, 69(1), 147-166. doi:10.35362/rie691160

Low, L. (2006). Connections: Social and mobile tools for enhancing learning. The Knowledge Tree journal, 12, 1-10. Recuperado el 17 de diciembre de 2020, de http://robertoigarza.files.wordpress.com/2008/10/art-social-and-mobile-tools-for-enhancing-learning-low-2006.pdf

Maggio, M. (2018). Skills of the XXI Century, when the future is today. Buenos Aires, Argentina: Santillana Foundation. Retrieved November 12, 2020, from https://

www.fundacionsantillana.com/PDFs/XIII_Foro_Documento_Basico_WEB.pdf

Mena Diaz, N. (2012). Social Networks and Information Management, an approach from graph theory. Information Science, 43(1), 29-37. Retrieved February 22, 2021, from https://www.redalyc.org/pdf/1814/181423784005.pdf

Mesén Mora, L. (2019). Learning theories and their relationship in Costa Rican environmental education. Revista Ensayos Pedagógicos, 14(1), 187-202. doi:10.15359/rep.14-1.8

Molina Espinoza, M., & Rivero Hernandez, D. (May 12, 2012). Complex networks. Theory and Practice. Academic Journal of Research(11), 1-14. Retrieved February 22, 2021, from https://dialnet.unirioja.es/descarga/articulo/7323789.pdf

Ñaupas Paitán, H., Mejía Mejía , E., Novoa Ramírez, E., & Villagómez Paucar, A. (2014). Research Methodology (Fourth Edition ed.). Bogotá, Colombia: Ediciones de la U-Transversal. Retrieved February 13, 2021

Novoa Castillo, P., Cancino Verde, R. F., Uribe Hernández, Y.C., Garro Aburto, L. L., & Mendez Ilizarbe, G. S. (2020). Multi-Essays Magazine. doi:https://doi.org/10.5377/multiassay.v0i0.9331

Ogata, H., & Yano, Y. (2004). Knowledge Awareness Map for Computer-Supported Ubiquitous Language-Learning. (IEEE, Ed.) Wireless and Mobile Technologies in Education. doi:10.1109/WMTE.2004.1281328

Onyesolu, M., Nwasor, V. C., Ositanwosu, O. E., & Iwegbuna, O. N. (2013). Pedagogy: Instructivism to Socio-Constructivism through Virtual Reality. International Journal of Advanced Computer Science and Applications, 4(9), 40-47. doi:https://dx.doi.org/10.14569/ijacsa.2013.040907

Oppenheimer, A. (2014). ! Create or die! The hope of Latin America and the five keys to innovation. New York, United States: Vintage Spanish. Retrieved February 13, 2021, from https://www.iberlibro.com/servlet/BookDetailsPL?bi=22254463540

Osorio de Parra, N. (1996). Professional profiles for the XXI century and the curricular transformations. CEIBA, 37(1), 217-228. Retrieved February 15, 2021, from https://bdigital.zamorano.edu/bitstream/11036/4906/1/27.pdf

Ramírez Valdez, W., & Barrajas Villarruel, J. I. (June 2017). Use of educational platforms and their impact in pedagogical practice in higher education institutions of Sal Luis de Potosí. Electronic Journal of Educational Technology, 60, 1-13. Retrieved in 2020, from https://www.edutec.es/revista/index.php/edutec-e/article/view/798/pdf

Raventos, F., & Enric Prats. (2012). Knowledge society and globalization: new challenges for comparative education. Revista Española de Educación Comparada, 19. Retrieved February 13, 2021,

from http://revistas.uned.es/index.php/REEC/article/view/7592/7260

Robles Altamirano, A., & Barreno Salinas, Z. (2016). The teaching-research practice from educational technology and socio-constructivism. UNEMI Science Magazine, 9(17), 118-124. Obtained from http://ojs.unemi.edu.ec/index.php/cienciaunemi/article/view/258/243

Rodrigo Alonso, M., & de Castro Lozano, C. (2013). Today's digital information, a new model of educational content for a ubiquitous learning environment. Revista De Educación a Distancia (RED)(39). Retrieved February 23, 2021, from https://revistas.um.es/red/article/view/23419

Salas Quirós, N. (2016). Principles of feedback from the mediated didactic dialogue. Journal of Quality in Higher Education, 77-99. Retrieved February 24, 2021, from https://revistas.uned.ac.cr/index.php/revistacalidad/article/view/1377

Sánchez Delgado, P., & Rodríguez Miguel, J.C. (2011). Globalization and education: repercussions of the phenomenon on students and alternatives to it. Revista Iberoamericana de Educación, 5(54). Retrieved February 13, 2021, from https://rieoei.org/historico/deloslectores/3871Sanchez.pdf

Sandel, M. (February 3, 2021). The first problem with meritocracy is that opportunities are not the same for everyone. (H. Velasco, Interviewer) BBC. Retrieved February 13, 2021, from https://www.bbc.com/mundo/noticias-55825871

Santos, B. d. (2005). The orphaned millennium. Essay for a new political culture. Bogotá: Editorial Trota S.A.

Santos, B. d. (2006). Renew critical theory and reinvent social emancipation. Buenos Aires, Argentina. Retrieved February 14, 2021, from http://biblioteca.clacso.edu.ar/clacso/coediciones/20100825032342/critica.pdf

Terán Modregón, O. F., & Lino Humerez, P.M. (2019). Generation of digital skills in educators: Closing the Digital Divide. Brazilian Journal of Development, 5(6), 6589 - 6601. doi:10.34117/bjdv5n6-156

Torres Díaz, J.C., Infante Moro, A., & Torres Carrión, P. V. (January 2015). Mobile learning: perspectives. Universities and Knowledge Society Journal, 12(1), 38-49. doi:10.7238/rustic.v12i1.1944

Vásquez Cano, E., Sevillano, M., & Fombona Cadavieco, J. (2016). Analysis of the didactic use of tablets in the European Higher Education Area. Analysis of the educational and social use of digital devices in the university context, 34(2), 453-469. Obtained from https://www.redalyc.org/pdf/2833/283346043011.pdf

Vasquez, M. (2018). Educational globalization. Ontology of education. Retrieved February 10, 2021, from https://www.youtube.com/watch?v=45HtcoGFqo4

Vásquez-Cano, E., Fernández Batanero, J.M., & López Meneses, E. (2019). Innovation and Research on Ubiquitous and Mobile Learning in Higher Education. Barcelona: Ediciones OCTAEDRO, S.L.

Yahya, S., Arniza Ahmad, E., & Jlil, K. (2010). The definition and characteristics of ubiquitous learning: A discussion. International Journal of Education and Development using Information and Communication Technology, 6(1), 117-127. Recuperado el 20 de diciembre de 2020, de http://ijedict.dec.uwi.edu/viewarticle.php?id=785

Zuleta Medina, A., & Chaves Torres, A. (2009). Education under the lens of critical theory. Educational Pen, 6(6), 50-61. doi:10.30554/plumillaedu.6.558.2009