Knowledge Transfer Through Digital Education Technologies in Higher Education

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Abstract: Education is essential for the development of skills and talents that enable people to be productive citizens and active members of society. Traditional modes of education, on the other hand, are no longer enough to fulfill society's complex expectations, as people frequently change occupations, seek new educational possibilities, and struggle to manage life, work, and compete for educational demands (Houlden & Veletsians, 2019). The study's challenge derives from the foregoing: " What Information and Communication Technologies (ICTs) can be used in higher education to foster the learning-teaching process?" As a result of the findings of a literature study, it is now possible to identify information and communication technologies (ITCs) that may be employed in higher education to enhance the learning and teaching process.

Keywords: Knowledge Transfer, Digital Learning, Technologies, Higher Education

1. Introduction

Education plays a critical role in developing skills and abilities that enable individuals to become productive citizens and engaged members of society. Traditional forms of education, on the other hand, are no longer sufficient to meet the complicated demands of society, because individuals often change careers, seek other educational opportunities, and try to balance life, work, and conflicting educational demands (Houlden & Veletsians, 2019)

Thus, higher education has become increasingly important in today's world for scientific, social, and technological development (Morosini, 2014; Huang et al., 2020). However, with globalization and internationalization, universities must develop strategies aimed at improving their students (Cunha, 2014; Stevenson, 2010; Hedberg, 2017).

The use of Information and Communication Technologies (ITTs) has been directly impacting society. Thus, new global aspects emerge aiming at the engagement of individuals in a democratic way. Thus, digital technologies have become the main objective of educational policies in the European Union and are one of the main priorities of the 2020 Agenda (Gachago; Livingston, Livingston, 2010 Ivala, 2016).

The evolution of E-Learning over time represents the increasing integration of technology into the learning process to improve learning progress in light of the fourth industrial revolution 4.0 (Halili and Sulaiman, 2021).

In addition, they have played an important role in supporting the learning processes of classroom teaching and Ead of students in Higher Education (ES), based on active and autonomous learning processes of students developing primary skills for learning.

Amorim (2018) adds that these new perspectives for teaching will help in aspects beyond the classroom, that is, for living in society. However, "remote emergency teaching", which evolved in the strange environment of the pandemic, is not the same as E-Learning (Nuez-Canal & de Obesso, 2021).

In general, HEIs have invested in ITCs, in addition to having online services for students and teachers. Thus, several movements of technological inclusion are being seen in the didactic-pedagogical scenario. As a result, it

is becoming increasingly important for institutions to take proactive measures to promote the mental health of their students, such as hiring tutors to provide professional care (Sahu, 2020).

Based on the above, the problem of the study emerges: "What Information and Communication Technologies (ICTs) can be used in higher education to foster the learning-teaching process? Thus, the study aims to present information and communication technologies (ITCs) that can be used in higher education to foster the learning-teaching process. For a better understanding of the article, it is presented its roadmap, which begins with the literature review, followed by methodology, results, and conclusions.

2. Literature Review

2.1 Higher education institutions challenges

Digital technologies applied to education have transformed the learning process at all levels, with emphasis on higher education, which has experienced the modification of a traditional teaching structure to a dynamic digital environment mediated by information technologies (Castro, 2019; Nikou & Aavakare, 2021).

Higher education institutions are facing challenges related to digital education, such as the dispersal of knowledge on the web, massification, greater diversity of student learning styles, and decreased public funding (Arnold & Sangrà, 2018). Thus, there is a need to maximize school benefits and performance, while mechanisms are employed to foster student motivation and satisfaction (Nikou & Aavakare, 2021). The connection of a traditional classroom to virtual reality can be established through Open Educational Resources (OER) and are characterized as free open source educational tools from which it is possible to meet the personalized needs of users (Tang, 2021). Studies show that OERs can lower educational costs (Spector, Merrill, Elen, & Bishop, 2014) while they can favor the performance and learning of college students (Hilton, Gaudet, Clark, Robinson, & Wiley, 2013).

2.2 Technologies Applied to the Educational Field

The pandemic of Covid-19 has brought numerous challenges to maintaining the quality of higher education (Reis, Favretto, Favretto, Favretto, & Santos, 2022; Taglietti, Landri, & Grimaldi, 2021). Among these challenges, emerges the transition from teaching carried out on campus to technology-mediated learning, focusing on online education (Tang, 2021). The main technologies applied to the educational field involve interactive whiteboards, tools, and virtual learning environments such as Moodle, video conferencing, applications and software, games, tablets, and smartphones (Nikou & Aavakare, 2021).

2.3 Digital educational technology

Digital educational technology (TED) is a computer-based technology created or used in formal and informal teaching and learning activities (Castro, 2019). In this sense, e-learning was the predominant approach to distance education due to the use of information and communication technologies to improve learning and access to educational resources (Hamidi & Chavoshi, 2018). However, currently, e-learning has been replaced by what is called m-learning, or mobile learning. M-learning is an approach that differs from e-learning due to the intensive use of mobile systems, such as mobile phones and tablets, which become the main mechanism for access to educational information, including in higher education (Hamidi & Chavoshi, 2018; Sophonhiranrak, 2021).

2.4 M-learning

In m-learning, knowledge transfer is facilitated by connectivity between students (Hamidi & Chavoshi, 2018), so mobile devices allow immediate access to information, sanitation of doubts, access to podcasts and tutorials, videos and audios, educational games, e-books, document writing, participation in synchronous or asynchronous videoconferencing classes and lectures, and interaction in virtual learning environments (Criollo-C, Guerrero-Arias, Jaramillo-Alcázar, & Luján-Mora, 2021). Thus, mobile devices are not only means of access to resources but serve to connect students engaged in educational experiences and activities (Sophonhiranrak, 2021). Thus, mobile technologies allow universities to have flexibility and dynamism for students in the digital age (Criollo-C et al., 2021).

2.5 Hybrid teaching

In addition, there is hybrid teaching (blended learning), characterized by the combination of face-to-face, online and individualized learning, which in turn can accommodate different learning styles, and different individual

needs, from the incorporation of online teaching resources (Lazar, Panisoara, & Panisoara, 2020; Serrano, Dea-Ayuela, Gonzalez-Burgos, Serrano-Gil, & Lalatsa, 2019). The student population of higher education has increasingly diversified, adding to the demand for innovation and the requirement for digital literacy. This scenario fosters the search of students for higher education courses equipped with technological tools capable of preparing them for a dynamic, technological, global, and diversified labor market (Serrano et al., 2019; Smith & Hill, 2019). In addition to these potential benefits, research shows that blended learning is capable of having a greater positive impact on the performance of higher education students when compared to traditional education (Islam, Sarker, & Islam, 2022; Shu & Gu, 2018).

2.6 Developing skills and Sharing Knowledge

The training of competent professionals for the labor market is one of the roles of universities, and the technological environment has affected the way young people are trained and work in organizations (Au-Yong-Oliveira, Gonçalves, Martins, & Branco, 2018). In other words, social networks such as Youtube, Facebook, Instagram, LinkedIn, Google, Twitter, and platforms such as moodle, wiki, zoom, and TED affect the way professionals share information and knowledge, and it is necessary to build technical skills in higher education students (Nikou & Aavakare, 2021). From the acquisition of technological skills, higher education students are more likely to exchange and transfer knowledge for innovation (Al-Kurdi, El-Haddadeh, & Eldabi, 2018; Fischer, Guerrero, Guimón, & Schaeffer, 2021).

The transfer and sharing of knowledge through digital education in higher education are essential professional competencies (Al-Kurdi et al., 2018), which bring the need for sustainable management of resources (Abad-Segura, González-Zamar, Infante-Moro, & García, 2020). In this sense, the educational digitization of higher education is part of the fourth industrial revolution, which can attract more students, improve the experience of education, engender sustainability and facilitate access to teaching materials, among other benefits (Abad-Segura et al., 2020).

2.7 Emotions in digital learning

Discussions about educational technology in higher education need to favor the various learning needs, consider the emotions, feelings, identities, and affections of people (Castañeda & Selwyn, 2018), to highlight the need for social presence (Zou et al., 2021) and cognitive presence (Turula, 2018). In other words, the construction of digital craftsmanship involves digital literacy to confidently use ICTs for work, leisure, and communication (Spante, Hashemi, Lundin, & Algers, 2018).

2.8 Management of digital learning

A proper management of digital learning can facilitate the acceptance of learning technology by users in higher education (Fearnley & Amora, 2020), while allowing to expand the reach of the potentialities of the use of technology for learning (Castañeda & Selwyn, 2018; Hilli & Åkerfeldt, 2020). In this scenario, the role of higher education teachers is fundamental, given that a positive teaching attitude towards learning management systems is capable of increasing the acceptance of technology by users while enriching the teaching and exchange of knowledge among professionals (Fearnley & Blackberry, 2020).

3. Methodology

The methodology used in this research was qualitative in nature, with the exploratory objective to expand the discussions related to THE and ICT. Exploratory research is usually linked to a qualitative approach and its main characteristic is the lack of insufficient hypotheses or hypotheses (Aaker, Kumar & Day, 2004). The authors Bogdan & Biklen (1994) define qualitative methods as the observation and study of several documents that address the theme of research.

Exploratory research according to Gil (2008) aims to develop, clarify and modify concepts and ideas. This type of research is carried out especially when the theme under study is little explored, that is, to discover new ideas, explore alternatives, or diagnose experiences (Zikmund 2000). Scientific articles published in national and international journals were analyzed. Data were analyzed qualitatively using the content analysis technique (Vergara, 2009). For the external validity of the research, we reach a high sample of 133 articles to be analyzed using Microsoft Excel, and this allow generalizable results to populations. Also, the algorithm used for the search of articles were based on the keywords: Digital Higher Education + Technologies + Learning Software.

The articles were separated by software categories presented in the following table (Table 1).

Table 1: Categories of Software for Analysis

Categories of Software		Representative Software
Software for resources producing	PPT recording software Screen capture software The software for video production The software of original video producing The software of Multimedia learning resource-producing	PowerPoint and WPS in Windows, Keynote in IOS system Camtasia Studio, QuickTime, Adobe Premiere Huawei Course maker App Mobile phones, CamScanner Mystic raft, Adobe Captivate
Software for live teaching	All types of live streaming software, including software on interactive teaching, remote office, online-course	Remote office: ZOOM, TED Conversations Online course platforms: edX, Coursera, Udacity
Software for asynchronous teaching	All kinds of online teaching platforms at a national level, regional level, and university community level, as well as those launched by universities and enterprises	Course sharing platform edX, Coursera, Udacity
Software for self-regulated learning	Learning apps for all subjects	Youtube; Facebook; Instagram; Wikipedia; Linkedin; Google; Websites; Twitter
Software for knowledge construction	Cognitive tools, collaborative editing tools, virtual simulation tools, etc.	Cognitive tools: mind mapping, GeoGebra Collaborative editing tools: Knowledge forum, wiki, shimo.im, Tencent Document, Google Docs, Trello VR tools: PhET, Sandboxie, KRPano
Software for learning analytics	Apps, websites, and interactive class software supporting data analysis	Apps: Smart Partner
Software for practice and evaluation	All kinds of tools suitable for higher education and basic education	
Software for resources and class management	Apps for learning and class management, mini-programs in Wechat, as well as social software	Learning management systems: Moodle, Edmod, Schoolo, TalentLMS Class management apps: EasiCare, Mentimeter, Typeform. Social software: QQ Group, Wechat Group, Facebook, WhatsApp, Skype, and line.

4. Results

According to those premises, different types of tools and platforms were used in an integrated way to support online learning and teaching during the pandemic situation that the world faced since March 2020 and forced the Universities to go online. The analysis done, helped to identify the main technologies utilized for online education, which are summarized and classified into different categories based on their functions in Table 2.

Table 2: Software for knowledge transfer in Digital Education

Categories of Software		Representative Software	Links
Software for producing resources	PPT recording software	PowerPoint and WPS in Windows, Keynote in IOS system	PowerPoint:https://products.office.com/zh-cn/powerpoint keynote:https://www.apple.com/keynote/
	Screen capture software	Camtasia Studio, QuickTime, Adobe Premiere	Camtasia Studio:https://www.techsmith.com QuickTime:https://support.apple.com/quicktime Adobe Premiere https://www.adobe.com/cn/products/premiere.html
	The software for video production	Huawei Course maker App	https://coursemaker.org/

Categories of Software		Representative Software	Links
	The software of original video producing	Mobile phones, CamScanner	CamScanner:https://www.camscanner.com
	The software of Multimedia learning resource-producing	Mystic raft, Adobe Captivate	Mystic raft : https://en-vr.101.com Adobe Captivate:https://www.adobe.com/cn/products/captivate.html
Software for live teaching	All types of live streaming software, including software on interactive teaching, remote office, online-course	Remote office: ZOOM, TED Conversations Online course platforms: edX, Coursera, Udacity	ZOOM https://zoom.com.cn EdX https://www.edx.org Coursera https://www.coursera.org Udacity https://www.udacity.com/
Software for asynchronous teaching	All kinds of online teaching platforms at a national level, regional level, and university community level, as well as those launched by universities and enterprises	Course sharing platform edX, Coursera, Udacity	EdX https://www.edx.org Coursera https://www.coursera.org Udacity https://cn.udacity.com
Software for self-regulated learning	Learning apps for all subjects	Youtube; Facebook; Instagram; Wikipedia; Linkedin; Google; Websites; Twitter	Www. Youtube.com www.facebook.com
Software for knowledge construction	Cognitive tools, editing collaborative tools, virtual simulation tools, etc.	Cognitive tools: mind mapping, GeoGebra Collaborative editing tools: Knowledge forum, wiki, shimo.im, Tencent Document, Google Docs, Trello VR tools: PhET, Sandboxie, KRPano	mind mapping https://www.mindmapping.com Geogebra https://www.geogebra.org Knowledge forum http://www.knowledgeforum.com wiki http://wiki.com Shimo.im https://shimo.im/welcome Tencent Document, https://docs.qq.com/desktop Google Docs https://google-docs.en.softonic.com Trello https://trello.com Phet https://phet.colorado.edu/zh_CN/ Sandboxie https://www.sandboxie.com KRPano http://www.krpano360.com
Software for resources and class management	Apps for learning and class management, mini-programs	Learning management systems: Moodle, Edmod,Schoology, TalentLMS	Moodle https://moodle.org Edmodo https://api.edmodo.com Schoology

Categories of Software		Representative Software	Links
	in Wechat, as well as social software	Class management apps: EasiCare, Mentimeter, Typeform. Social software: QQ Group, Wechat Group, Facebook, WhatsApp, and Skype.	https://www.schoology.com TalentLMS https://www.talentlms.com EasiCare https://care.seewo.com Mentimeter https://www.mentimeter.com Typeform https://www.typeform.com/forms/ QQ https://im.qq.com WeChat https://weixin.qq.com Facebook http://www.facebook.com/ WhatsApp https://www.whatsapp.com/

Students used their smartphones to access most of these sorts of software because there was an emergency throughout the world, and many students didn't have PCs or laptops to attend online lessons. In this perspective, the relevance of MLearning (Mobile Learning) (Sungkur, et al, 2016), which is an extension of eLearning, should be discussed.

The use of mobile devices such as phones and tablets in the learning process has led to a rethinking of pedagogical techniques and learning aids, since mobile technology allows students to learn when and when they wish. Mobile learning is based on social constructivism and is student-centered (network learning).

These mobile technologies are a) portable: technology is available whenever the individual needs to learn; b) Individual: technology can be tailored to the individual's competencies, knowledge, and learning style; c) discrete: the student can capture situations and apply knowledge without the technology becoming overtly visible; d) Available: the individual can use technology anywhere to communicate with other individuals. e) adaptable: technology can be adapted to the context of learning and student's evolution skills and knowledge; f) persistent: the individual can use technology to manage lifelong learning, resources and knowledge will be immediately accessible, despite changes in technology; g) useful: the technology is adequate to the daily needs of communication, work, and learning; h) easy to use: the technology is easily understood and used by people with no prior experience. Because learning may be done anytime, anywhere, and with maximum portability, mobility, interaction, and connectivity.

Some of the main possible activities are presented in the following table (Table 3):

Table 3: Activities that enhance knowledge transfer and learning in Mobile Learning

Switch messages (SMS)	Browse Dictionary	Create and view glossaries	Exchange emails (Mobile Access)
Access graphics and images	Quizzes	Listen to audio lessons (Podcasts)	Make and view Videos
Access curriculum content	Record audio	Take a photo	Play

The use of Digital Education practices integrated into teaching-learning, consider several types of activity that potentiates the knowledge sharing among professors – students: students-professors, and students – students.

5. Conclusions

Digital Education offers greater control and autonomy over learning itself and enables learning in context, that is, in the place, time, and conditions that the student judges most appropriate (i.e., through eLearning platforms or even educational games (Sousa & Rocha, 2017). It can help users become more productive by optimizing downtimes with information. Because of the prevalence of mobile devices, time and space constraints are removed, allowing for greater effectiveness and efficiency in teaching and learning. Mobile learning has been viewed as favorable to informal learning, with Web-based information that is easily transferrable to the small screen, such as photos, audio, and video, readily available (Friend & Militello, 2014; Sousa et al., 2017). Mobile learning gadgets, in addition to their portability, mobility, flexibility, and autonomy, provide on-demand capabilities, allowing you to have what you want when you want it and when you have the time. For future research the study of the emergent pedagogies associated to these technologies need to be identified and analyzed. This research has several contributions for practice, namely, the systematization and dissemination of knowledge about educational technologies and software, which allows the academics and researchers to apply them in their classes and research.

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