Repositório ISCTE-IUL

Tracking e-learning through published papers: A systematic review

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ARTICLE INFO

ABSTRACT

Electronic learning (e-learning) is a broader approach to learning that brings new opportunities for learning and teaching in many fields of education far from the traditional classroom environment. Over the past decades, research in the field indicates a proliferation of e-learning contents and discrepancies that affect interoperability patterns in education for students and teachers; however, little has been done to assess the usability of e-learning systems. From a different perspective, this study aims to provide information on the numerous findings relating to the cumulative results of e-learning in education. This systematic review uses a full protocol with the aim of standardizing and specifying all the procedures adopted to collect and code 99 academic articles from 2010 to 2018 with keywords: education and e-learning. The text analysis as conducted using the qualitative software Leximancer to extract meaning from the large number of articles retrieved. The results highlight four dominant themes, namely *education* systems and *learning* issues that in turn promote *student* behaviours and the *use* of online learning tools.

This research contributes towards providing research propositions that can be used in a cogent theoretical framework and, based on the analysis, we also propose a new definition of e-learning.

1. Introduction

E-learning, also known as electronic learning, has gained wide acceptance in all educational fields and academic institutions. There has been extensive debate about a common definition of the e-learning concept. As a construct, it covers a range of learning methods, applications, processes and academic areas (hubalovskya, Hubalovskab, & Musileka, 2019). It is therefore difficult to find a commonly accepted definition for the term (Arkorful & Abaidoo, 2015). In this article, we review the existing literature about the discrepancy of e-learning contents; synthesize what is meant by e-learning in different academic areas and present a research agenda for future debate to allow greater consistency in the e-learning definition among researchers.

Previous work has not focused exclusively on establishing a conceptual framework of the definition of e-learning in different academic areas. Some studies have focused only on the basic definitions and differences between m-learning (mobile learning) and e-learning (Korucu & Alkan, 2011; Mehdipour & Zerehkafi, 2013; Ozuorcun & Tabak, 2012), pointing out the different characteristics between them in a general way. Other works have centered their attention on examining the obstacles or advantages of the implementation of electronic technologies - such as facebook usage - in higher education (Ainin, Naqshbandi, Moghavvemi, & Jaafar, 2015; Arkorful & Abaidoo, 2015; Baran, 2014; El-Hussein & Cronje, 2010; Guri-Rosenblit & Gros, 2011; Naqshbandi, Ainin, Jaafar, &

Shuib, 2017), paying little heed to the need for a common definition of the e-Learning construct. Finally, some studies have examined the characteristics of the online learning environment and the influences of the tools and techniques that lead to differences in learning outcomes (Arafat, Aljohani, Abbasi, Hussain, & Lytras, 2019; Moore, Dickson-Deane, & Galyen, 2011; Paechter & Maier, 2010).

The originality of the systematic literature review herein lies in the fact that it attempts to establish a common definition of e-learning in a field where the discrepancy between e-learning contents affects the work of practitioners and researchers, who have not yet agreed on common definitions and terminologies for e-learning and its components. In light of the constant evolution in learning technology and its associated fields, a solution must be found to the contradictory findings on distance learning, e-learning, online learning and m-learning so as to empower the work of academic staff, teachers and students. Our originality can also be seen in the design/methodology chosen for this systematic review. We used Leximancer software, a tool that adopts a quantitative approach, to conduct a qualitative analysis. Leximancer utilizes a blend of procedures, for example, Bayesian measurements that record the event of a word and associates it to the event of a progression of different words. It at that point evaluates those yields by coding the fragments of content, from one sentence to gatherings of sentences.

Our objective is to examine how studies have analyzed the e-learning concept in the last eight years, the contents of e-learning that are included, and the elements that have been studied and why. Specifically, we carefully analyzed 99 peer-reviewed articles published since 2010 from different academic areas, in order to provide information on various types of findings relating to the cumulative results on e-learning in education. To gain a comprehensive view of what is meant by e-learning in different academic areas, we conducted a broad search of the academic literature through two databases: ABI-Inform and Academic Search Complete EBSCO. Our research seeks to contribute to improving the quality of future studies on the e-learning concept and the application of technologies in various academic areas. We intend to contribute to the consolidation of the main findings of the e-learning construct into a comprehensive framework that might serve practitioners and researchers at different levels. Given the challenges when implementing new technologies in the academic field, universities should invest extensively in planning wide-scope studies that provide crucial information about the potential of mobile technologies in universities (Guri-Rosenblit & Gros, 2011; Naqshbandi et al., 2017).

This process reveals weaknesses in the e-learning phenomenon. The immaturity of this relatively young phenomenon is reflected in an aggregation of terms that are often interchanged without meaningful definitions (Ali, Uppal, & Gulliver, 2018). Our aim is to consolidate the numerous definitions of e-learning into a coherent conceptual theoretical framework. The article proceeds as follows. The literature review will present research on e-learning and education; explain the meaning of e-learning in different academic areas; and access the usability in the context of e-learning and research on students' opinions of e-learning. The following section presents methodology, results and discussion; conclusions, limitations and future research opportunities are addressed in the final section.

2. Literature review

2.1. Research across e-learning and education

Internet use in education and especially higher education has led to significant changes in how learning takes place and is communicated. The internet has become one of the most important ways for students and professors to share and acquire information (Arkorful & Abaidoo, 2015); it is used to produce materials for learning, to teach and to regulate courses in the university. The application of e-Learning for teaching and learning has increased rapidly in the last years and has been influenced by the development of the technical support associated with the implementation of e-learning courses in universities (Paechter & Maier, 2010). The European Commission (2001) defines e-Learning as the use of new multimedia technologies and the Internet to increase learning quality by easing access to facilities and services as well as distant exchanges and collaboration. However, as learning technology evolves and researchers utilize these emerging technologies, agreement on a common definition and terminology for the e-Learning construct has become increasingly difficult.

2.2. Addressing the topic

The multiple terminologies tend to vary according to the researchers' specialization and interest and it is therefore difficult to find a commonly accepted definition for the term e-learning (Arkorful & Abaidoo, 2015). E-learning, distance education, online learning and web-based education are concepts that have been used in the literature; in this section, we review relevant literature to address and search for a common definition of e-learning. The incorporation of information and communication technologies into the learning process has its origins and pedagogical foundations in the concept of distance education (Sangrà, Vlachopoulos, & Cabrera, 2012). E-learning can be considered a natural evolution of distance learning, and although some authors understand e-learning to be a new generation of distance education (Guri-Rosenblit & Gros, 2011; Sangrà et al., 2012); they are not synonymous terms. This distance learning tool is a much newer phenomenon than distance education, associated with the development of the Internet in the 1990s (Guri-Rosenblit & Gros, 2011). Distance education implies physical separation between the learner and the instructor, but this is not a defining characteristic of e-learning (Ali et al., 2018). The term distance education evolved to describe other forms of learning, such as online learning, e-learning, online collaborative learning, virtual learning, web-based learning (Moore et al., 2011). In fact, all of these have some common features: they are a form of instruction that occurs between a learner and an instructor and are held at different times and/or places, using several forms of material (Moore et al., 2011). Some authors have proposed four general categories for the elements of e-learning: 1) technology-driven (includes definitions that emphasize the technological aspects of e-learning); 2) delivery-system-oriented (the focus is on the accessibility of resources and not the results or achievements); 3) communication-oriented (considers e-learning to be a communication, interaction, and collaboration tool); and 4) educational paradigm

(defines e-learning as a new way of learning or as an improvement on an existing educational paradigm) (Arkorful & Abaidoo, 2015; Guri-Rosenblit & Gros, 2011). Depending on the author's profile (e.g. more educational or technological), papers usually define e-learning focused on each of these four general categories (Sangrà et al., 2012). Nonetheless, most of the e-learning definitions found in the literature convey the idea that e-learning refers to the use of information and communication technologies to enable access to online learning/teaching resources (Arkorful & Abaidoo, 2015). Certain characteristics considered desirable for e-learning courses were also proposed by some studies (Paechter & Maier, 2010). The first characteristic relates to the course design, the learning materials and the electronic course environment. The curriculum components of the e-learning courses should be coherent and well-structured in order to facilitate meaningful learning. Another characteristic relates to the learning outcomes: students must achieve some competences, such as factual, conceptual and methodical knowledge and social and personal competences. Interaction between students and the instructor is another important characteristic: instructors must support students by providing the structure of the learning content and feedback on accomplishments and also stimulate students' motivation to process and reflect on content (Paechter & Maier, 2010). E-learning courses must also provide interaction with peer students, allowing them to exchange information on the learning contents and socio-emotional information (Paechter, Maier, & Macher, 2010). The last characteristic concerns the individual learning processes: e-learning students must be given many opportunities to practice and apply what they are learning, choosing the time, place, and the regulation of the learning process (Paechter et al., 2010). A university faces many challenges when it decides to implement innovative learning methods such as e-learning. Introducing technological tools in educational settings can often fail because of the lack of investment in human resources training and also because of inconsistencies between student expectations and the adoption of the new learning habits (Persico, Manca, & Pozzi, 2014).

2.3. Accessing the usability in the context of e-learning

The introduction of a new learning system involves a complex process of change, and the usability of e-learning is a critical issue. While e-learning quality is also a prominent topic in the literature, some authors highlight the lack of research on usability in e-learning (Alexander & The Disciplined Reading and Learning Research Laboratory, 2012; Zaharias, 2009). Although the adoption of e-learning can provide stimulating new possibilities for students, professors and university staff through new forms of training and learning innovations (Sandars & Lafferty, 2010), e-learning experiments sometimes have a very high dropout rate. According to some authors, an efficient e-learning intervention implies an alignment of the learner, the technology and the software design with the educational context (Alexander, 2012; Lin, Lu, & Liu, 2013). The learner is a key element in an e-learning intervention because he or she interacts with the educational context and the technology innovations (Limayem & Cheung, 2008). The needs of the learner/e-learning user must be the main focus of usability. Thus, usability is vital in e-learning as it reduces/mitigates problems such as high dropout rates, lack of student satisfaction and the heavy workload of university staff due to student problems associated to e-learning (Hargittai, 2010; Persico et al., 2014). Authors also note the importance of usability at an early stage of the e-learning intervention. Since the reasons for high dropout rates in e-learning range from the poor design of the e-learning applications to the lack of learner motivation, the user's involvement from the start of the process can have a marked impact on learning outcomes (Liaw, Huang, & Chen, 2007). Regarding the usability practice in e-learning environments, a learner-centered approach is usually considered essential in the literature (Ardito et al., 2006). The focus must be on the pedagogical aspects and not the technology in order to develop useful and functional tools. These pedagogical aspects must be at the core of the e-learning usability design and its evaluation (Zaharias, 2009). Aligning the ease of use with the pedagogical quality of the e-learning design is therefore a key concern in developing useable e-learning tools that assure the needs and expectations of the user/learner (Zaharias, 2009). Usability is one of the most important aspects for students using an e-learning tool because their learning is prejudiced if it is not useable enough (Ardito et al., 2006). The following usability features are desirable in e-learning courses: users should be able to efficiently manipulate the software and the features should be appropriate for the intended learning task (King & Boyatt, 2015). Nevertheless, the e-learning system must also be aligned with teachers' pedagogical objectives.

These usability features should always be in keeping with the educational goals of the courses; however, researchers note that there is still no consolidated evaluation methodology of e-learning applications (Sandars & Lafferty, 2010; Zaharias, 2009). While some usability evaluation techniques exist, choosing which one offers a balance between cost and effectiveness is a challenge (Ardito et al., 2006). For some examples, please see Lin et al. (2013) and Persico et al. (2014). Traditional usability design and evaluation methods of e-Learning do not put the user at the center of the learning process. Instead, they neglect the role of the user proposing generic usability parameters (Zaharias, 2009). The most mentioned problems of the e-learning platforms are the lack of pedagogical support and the difficulties learners experience when using the systems (Zaharias, 2009). For instance, some platforms give users less control and do not allow them to upload materials or communicate with their instructors and classmates (Limayem & Cheung, 2011).

Overall, the following usability features should be included in an e-learning system: users should be able to navigate and organize educational contents according to their individual cognitive styles and should allow fruitful communication with colleagues and teachers (Limayem & Cheung, 2011).

2.4. How do students view e-learning?

Students' perceptions of e-learning can be a crucial indicator of the quality of the learning experience and its outcomes. Despite the many benefits of using e-learning cited in the literature, such as communication, interaction between students, group development and better access to knowledge (see Benta, Bologa, & Dzitac, 2014; Lahti, Hätönen, & Välimäki, 2014; Wu,Tennyson, & Hsia, 2010), students' satisfaction with their e-learning experience is a recurrent topic in the e-learning literature (Cole, Shelley, & Swartz, 2014). Below we present the main conclusions on how students view e-learning. Since new technologies have altered the way students interact with

instructors and classmates, student satisfaction can be an important indicator of the quality of e-learning experiences (Kuo, Walker, Belland, & Schroder, 2013). In a longitudinal study, Cole et al. (2014) presented the results of a three-year study of graduate and undergraduate students' satisfaction with online instruction. The authors defined student satisfaction as the learner's perceived value of their educational experiences in an educational setting. Their results show that positive interaction with classmates and with the instructor was a determinant of satisfaction with e-learning. The reason given most frequently for students' satisfaction was "convenience", while "lack of interaction" was the most mentioned reason for students' dissatisfaction (Cole et al., 2014). It is also relevant to point out that authors found that partially online courses were rated as more satisfactory than exclusively online courses. Kuo et al. (2013) listed some key factors for student satisfaction in distance learning environments like e-learning. The predictors of student satisfaction most mentioned in the literature are interaction, internet self-efficacy and self-regulated learning. Interaction is one of the most important components in e-learning due to the isolation of instructors and learners (Kangas, Siklander, Randolph, & Ruokamo, 2017), and a number of studies have shown that it has a positive influence on students' satisfaction in distance education. The findings of Kuo et al. (2013) indicate that the design of the online content may be an important contributor to interaction and to student satisfaction. As e-learning students spend most of their time reading and processing learning content, aspects of the online content such as the organization, document layout, and ease of access may influence learners' interaction with course content (Kuo, Walker, Schroder, & Belland, et al., 2013). Internet self-efficacy is the belief in one's capability to organize and execute internet-related actions to accomplish assigned tasks (Kuo, Walker, Schroder, & Belland, 2014). Internet self-efficacy has been positively correlated with entertainment, social, and informational outcomes, as well as student satisfaction with online courses (Lahti et al., 2014); this confirms the need for institutions to provide appropriate training on internet skills to improve students' internet self-efficacy before implementing online courses. Lastly, self-regulated learning refers to the motivations and learning strategies used by students to achieve their learning goals (Kuo et al., 2014). Students' success in e-learning demands much more self-directed effort than traditional classroom environments. However, future research should focus on the effect of self-regulation on student satisfaction in e-learning settings. Regarding students' other behavioral reactions to e-learning, a study by Benta et al. (2014) investigated improvements in the learning outcomes following the implementation of an e-learning platform in a European university. The authors used two groups of students: one that attended courses, used the e-learning platform with electronic resources and submitted homework using e-learning and another that attended courses, used classic paper/listed resources and submitted homework by e-mail in the traditional manner. Results revealed that the use of the e-learning platform improved professor-student communication and increased students' satisfaction with the courses. Students who used this platform also showed changes in the perception of some learning outcomes (such as homework and attendance) in the educational process (Benta et al., 2014). With this online platform, homework submission was better than when using the traditional means. Results are very significant: 84% of total homework was submitted when using e-learning compared with 38% with classic homework submission (Benta et al., 2014). Similarly, the attendance was significantly higher in e-learning courses (96% versus 83% in traditional teaching). Overall, this case study provides important information on the behavior of students when engaged in an e-learning educational experience: e-learning platforms in higher education can help increase homework submission and student attendance (Benta et al., 2014). Other studies investigating students' experiences and preferences in e-learning (Law, Lee, & Yu, 2010; Venkataraman & Sivakumar, 2015) indicate that students most appreciate e-learning's potential to provide clearly and coherently structured learning material, the support of self-regulated learning, and the distribution of information (Paechter & Maier, 2010).

There have been a range of studies on students' satisfaction in e-learning settings and there is general agreement that both online and traditional learning environments have characteristics that can help improve students' learning outcomes (Cole et al., 2014). Above all, there should be a good fit between the student and the course in both learning environments; in some instances, students may be more comfortable participating in an online course while in others students' ability to understand course material is improved when they have in-person contact with the professor (Cole et al., 2014).

Table 1 identifies the main dimensions and sub-dimensions of the results of the literature review.

3. Method

The systematic review conducted gathered previous research that included the keywords e-learning and education. The relevant published articles selected included 1) those with the keywords education and e-learning found from a simple search of peer review publications 2) academic journals, in English since 2010 were applied as filters due to the large number of studies 3) in the final stage, the search was narrowed by introducing exclusion criteria; the title, abstract and key-words of all the articles retrieved had to be read to ensure that they were within the scope of our study, 4) all articles were read and summarized in a table with all the study references and characteristics 5) the final step consisted of communicate the results and interpretation of the findings.

3.1. Literature search and selection of studies

The search was designed to be inclusive, combining keywords using the Boolean operator AND (i.e., education AND e-learning). The electronic bibliographic databases included ABI-Inform and Academic Search Complete EBSCO due to their broad coverage of peer-reviewed academic journals in English; both are commonly used in Systematic Reviews and include publications which deal extensively with the topic. The inclusion criterion included not only mainstream journals, but also all publications dealing with the topic. Books are not included in this review as they are not peer-reviewed; moreover, practitioner documents were beyond the scope of our research protocol and document quality was not easy to access. Based on the research questions, the list of key words was selected by gathering information from preliminary reading on the topic. It is important to note that there are two groups of terms: the first includes education that is found in found in a large number of academic works, and the second group includes e-learning.

Table 1
Dimensions and sub-dimensions of the literature review.

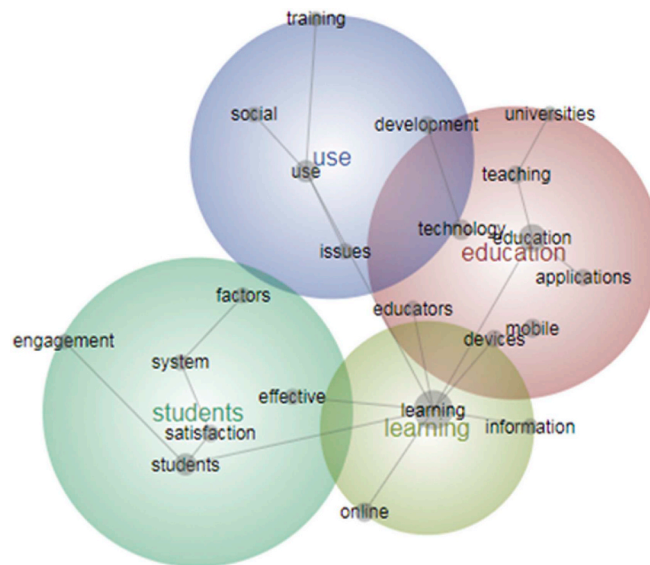| Dimension	Sub-dimensions	Descriptions	Citations
Education	**Educational technology trends**	Gamification	De-Marcos, Domínguez, Saenz-de-Navarrete, and Pagés (2014); Merchant, Goetz, Cifuentes, Keeney-Kennicutt, and Davis (2014); Muntean (2011); Torrente, Del Blanco, Marchiori, Moreno-Ger, and Fernández-Manjón (2010); Urh, Vukovic, and Jereb (2015)
		Mobile learning	Ally and Prieto-Blázquez (2014); Baran (2014); Cheon, Lee, Crooks, and Song (2012); El-Hussein and Cronje (2010); Korucu and Alkan (2011); Mehdipour and Zerehkafi (2013); Ozuorcun and Tabak (2012); Rossing, Miller, Cecil, and Stamper (2012)
		Cloud computing	Bora and Ahmed (2013); Ghazizadeh (2012); Masud and Huang (2012);
		Augmented reality	Yuen, Yaoyuneyong, and Johnson (2011)
		Technology clustering (Social Web, Semantic Web, Learning Objects and Open content, Augmented reality, Immersive environments, Mobile devices, Geo-everything and ubiquitous technologies)	Liu and Hwang (2010); Martin et al. (2011); Yahya, Ahmad, and Jalil (2010)
	Online tools	Dashboard applications	Verbert, Duval, Klerkx, Govaerts, and Santos (2013)
		Microblogging platforms	Ebner, Lienhardt, Rohs, and Meyer (2010)
		Google	Cheung and Vogel (2013)
		Geoportals	Sigala (2012)
	Social media	Social networking	Brady, Holcomb, and Smith (2010); Cheston, Flickinger, and Chisolm (2013); Kassens-Noor, E. (2012); Zaidieh (2012)
Learning issues	**Learning innovation in educational fields**	Health education	Abu-Rish et al. (2012); Button, Harrington, and Belan (2014); Frehywot et al. (2013); Haidet et al. (2012); Lin and Wang (2012); Moule, Ward, and Lockyer (2010); Pinto, Brunese, Pinto, Acampora, and Romano (2011)
		Engineering education	Borrego, Froyd, and Hall (2010); Violante and Vezzetti (2014)
	Online platforms	MOOCs (Massive Open Online Courses) and cMOOCs (Connectivist Massive Open Online Courses)	Clarà and Barberà (2013); Knox (2014)
	Learning	Learning styles	Abrami, Bernard, Bures, Borokhovski, and Tamim (2011); Al-Qahtani and Higgins (2013); Dabbagh and Kitsantas (2012); Huang, Lin, and Huang (2012); López-Pérez, Pérez-López, and Rodríguez-Ariza (2011)
Students	**Behavioral issues**	Engagement	Gikandi, Morrow, and Davis (2011); Johnson et al. (2010); Kahu (2013); Nagel and Kotzé (2010); Venkataraman and Sivakumar (2015)
		Satisfaction	Cole et al. (2014); Kuo et al. (2013); Kuo et al. (2014); Lahti et al. (2014); Wu, Tennyson, and Hsia (2010)
		Awareness	Yacob, Kadir, Zainudin, and Zurairah (2012)
		Motivation	Law et al. (2010)
Usability	**Distance learning**	Online learning environments	Arkorful and Abaidoo (2015); Baeten, Kyndt, Struyven, and Dochy (2010); Bell and Federman (2013); Boling, Hough, Krinsky, Saleem, and Stevens (2012); Feng et al. (2013); Liaw and Huang (2013); Mikołajewska and Mikołajewski (2011); Moore et al. (2011); Paechter and Maier (2010); Paechter et al. (2010); Thistlethwaite et al. (2012)
	E-learning systems	Usability testing	Hassanzadeh, Kanaani, and Elahi (2012); Nawaz and Kundi (2010); Ossiannilsson and Landgren (2012); Sandars and Lafferty (2010)
		Personalized learning	Essaid El Bachari & El Adnani (2011); Klašnja-Milićević, Vesin, Ivanović, and Budimac (2011)
		Defining a conceptual framework	Guri-Rosenblit and Gros (2011); Sangrà et al. (2012)
		Implementation and adoption	Al-Adwan and Smedley (2012); Akaslan and Law (2011); Al- Harbi (2011); Bhuasiri, Xaymoungkhoun, Zo, Rho, and Ciganek (2012); Chen (2010); Chen and Tseng (2012); Iqbal and Ahmad (2010); Journell (2010); King and Boyatt (2015); Lee (2010); Njenga and Fourie (2010); Persico et al. (2014); Šumak, Heričko, and Pušnik (2011)
		Challenges	Laurillard (2006); Oye, Salleh, and Iahad (2011)
		Usability intentions	Lin (2011); Lin et al. (2013)
	Learning analytics	Learning Management System's use	Benta et al. (2014); Costa, Alvelos, and Teixeira (2012); Dietz-Uhler and Hurn (2013); Lara, Lizcano, Martínez, Pazos, and Riera (2014); Macfadyen and Dawson (2012); Terkowski et al. (2010); Terkowski et al. (2011)

Fig. 1. Systematic review: concept map.

4. Results

The results enabled us to interpret the large number of articles included in this Systematic Review. The four topics are represented in Fig. 1. The concept map includes the concepts—grey dots inside the circles—that are grouped to create the topics—relevant topics are represented by worm (Wu, Wall, & Pearce, 2014). The prevalent topics in number of hits with the most connectivity and significance are as follows: *education* (314 hits) related concepts areeducation, technology, mobile, teaching, devices, applications, educators, universities; *learning* (208 hits) learning, online, information; *student* (119 hits) students, satisfaction, system, effective, factors, engagement and *use* (109 hits) use, development, issues, social, training.

5. Discussion

The results of our literature review and subsequent analysis allow us to examine our research questions in more detail. After grouping the 99 peer-reviewed articles from the literature review, their main contents and e-learning features in a general map, we were able to identify four dimensions and sub-dimensions (see Fig. 1). These data allow us to make some proposals that will contribute to future literature outputs on e-learning.

5.1. Contents and elements of e-learning

According to the results of this study, the contents related to *learning* (314 hits) and *education* (208 hits) show a greater connection and significance, followed by *student* (119 hits) and *use* (109 hits) contents.

Learning innovation is one of the contents addressed in the articles analyzed. Implementing innovation in learning is indicative of a growing interest in finding new ways for students to learn, and at the same time creating a vision for change and empowering others to participate in this change process (Niederhauser, Schoessler, Gubrud-Howe, Magnussen, & Codier, 2012). Furthermore, the use of online platforms (like MOOCs and cMOOCs) and a set of learning styles is expected to foster non-traditional learning environments and provide greater learning opportunities, and thus improve students' educational outcomes, facilitate enrollment and increase the level of commitment. However, the design of learning management systems, including online platforms and learning styles, should take into account learners' individual differences, needs and personal characteristics such as prior knowledge, cognitive abilities, and motivation (Graf, Liu, & Kinshuk, 2010).

Previous research has analyzed the applicability and classification of learning styles by exploring a set of instruments aimed at identifying individual learning styles (e.g. Grasha-Riechmann Student Learning Styles, Honey & Mumford Learning Styles, Kolb's Learning Style Inventory, McCarthy's 4MAT Learning Styles Model, Schellens & Valcke Learning Styles, Soloman & Felder's Index of Learning Styles) through individual personality traits (Graf et al., 2010; Sabry & Baldwin, 2003; Santo, 2006). Associated with learning styles, constructs of cognitive style, learning preference and learning strategies have also been widely used and discussed in the education literature as they can influence the process and outcomes of learning.

Defined as a psychological construct which represents the way individuals organize and process information, the concept of cognitive style can thus be understood as a bridge which links cognition and personality (Messick, 1984; Sternberg & Grigorenko, 1997). Although some authors referred to cognitive style and learning style as the same construct, evidence has shown that learning style is a broader concept that encompasses both individuals' feelings and psychological behaviors (Shi, 2011).

The visualizer-verbalizer dimension is mentioned in studies on cognitive styles. It derives from dual-coding theory which states information can be processed and mentally represented both verbally and visually. According to some authors, mixing these two mental representations leads to better learning outcomes (Koc-Januchta, Höffler, Thoma, Prechtl & Leutner, 2017; Mayer, 2014).

As learners react differently when facing a learning situation, the suitability and adaptability of learning strategies to learners' needs and their learning differences is relevant both for teaching and learning. If teachers know students' different learning styles, they will be able to use corresponding teaching methods while "students can choose appropriate learning strategies if they know their own cognitive styles, which can promote their autonomy and help them become successful learners" (Ya-Ju, 2008: 63).

Although further research is needed to clarify the influence of innovative learning environments in educational context, we propose:

P1. Creating an effective and innovative learning environment that provides a better fit with learners' differences and needs by studying the implementation of learning styles and strategies and understanding how they can affect students' behavior.

The education dimension involves educational technology trends, online tools and social media.

According to some researchers, technology-based learning provides students with more interactive and engaging learning material and information in different formats from the ones used by teachers (Martin et al., 2011; Winn, 2012). Many technology-based learning environments are also able to simulate some aspects of natural environments to make learning as authentic as possible and thus enabling students to connect with real world problems more easily. Social interaction is an important part of the learning process and it is present in this kind of learning environment. The content of social interaction functions as a useful data source allowing a better understanding of learning processes and outcomes (Winn, 2012).

In line with the findings of Bodnar, Anastasio, Enszer, and Burkey (2016), innovative pedagogical methods such as game-based learning obtain good results and provide students with greater motivation and opportunities to develop skills when compared to the classroom transmission model.

Mobile learning, cloud computing and augmented reality also play an important role in today's learning process, empowering the e-learning procedure. Portability is the main feature of mobile learning as students can take devices wherever they want and thus allowing learning to take place anytime and anywhere. However, the use of this innovative learning tool raises some questions, mainly related to (a) the way students control and monitor their learning; (b) whether they are able to define what, when, where and how to learn; and (c) whether they are interested enough to engage behaviorally and cognitively in learning. On the other hand, cloud computing and augmented reality also enable students to access information in a more innovative way giving them a better perception of the real world and offering unusual forms of interaction (Frohberg, Göth, & Schwabe, 2009; Sha, Looi, Chen, & Zhang, 2011). These considerations are also applicable to other learning tools such as dashboard applications, Ubiquitous-learning (U-learning), microblogging platforms, Google, geoportals and social networking. Online education tools reflect the transition from an exclusively teacher-centered classroom model to a more open and student-centered model in which the student is at the core of learning process and the teacher becomes a learning mentor whose main goal is to help stimulate the students' intellectual skills in the treatment of different types of learning content. In this kind of transformation, the complementarity and interdependency between teachers and students continue to be crucial to ensure positive outcomes.

Regarding the role of technology in education, we propose:

P2. Given the effects of a technology-based learning environment on students' outcomes, it is important to provide empirical evidence of the level of students' satisfaction with online learning tools and their preferences in terms of innovative pedagogical methods.

Due to the increasing use of innovative learning environments, a growing body of research has highlighted the influence of learning systems on students' behavioral traits and academic outcomes. According to research findings from Kangas et al. (2017), novel learning environments based on digital technology, creativity, collaboration and active participation not only help stimulate students' interest but also increase their engagement in and satisfaction with learning and boost student motivation. Applying novel tools and technologies in learning is therefore useful because it fosters a sense of pleasure when engaging in learning activities. On the other hand, the process of knowing how to deal with these novel tools and technologies in learning can negatively influence both students' engagement and their academic achievement if their online skills do not fit the technological demands (Boiselle, 2014, pp. 1–14). The integration of new technologies to improve learning and instruction can be challenging given strong resistance to the use and adoption of new technologies and thus a high level of resistance to change. On one hand, some people "will resist integrating new technologies as doing so may seem to threaten practices that have become comfortable routines. Others may resist new technologies as they worry that students will be more adept with those technologies than they are. Still others may simply believe that what worked for them and famously successful people of their generation should be good enough for everyone" (Spector, 2013, p. 28).

Previous studies have drawn attention to the strong relationship between students' motivation and satisfaction; the latter is influenced by content, location and facilities, teaching skills and individual characteristics of the teachers, and students' active participation (Kangas et al., 2017). In particular, active participation shows that students are engaged and invested in striving for academic success. In recent years, engagement has become a popular research topic and there is strong evidence of its relevance to learning and academic success. The research findings of Fredricks (2011) show that higher levels of engagement are achieved when: (a) students develop strong relationships with their teachers and peers; (b) teachers support students' autonomy; (c) teachers have high expectations and give clear feedback to students; and (d) tasks are challenging and interesting.

In terms of learners' motivation, humor, variation, participation and breaks are techniques that can hold students' attention and increase their motivation. Evidence shows that students who use e-learning as a learning tool are more intrinsically motivated than students who attend traditional classes (Liaw et al., 2007).

In light of the influence of online learning environments on students' academic outcomes, we define the following proposal:

P3. Analyzing students' perceptions about the level of influence of e-learning tools on their interaction with their teachers and peers and how it affects their learning engagement and motivation.

Usability refers to the general usage and ease of use of distance learning, e-learning systems and learning analytics. Online learning environments are a revolutionary pathway to the acquisition of knowledge but, like all revolutions, it also leads to change and new principles in the way students learn and communicate with their teachers or tutors, and the delivery of instructional content. Using new learning environments means new forms of learning and new educational challenges.

Factors such as system quality, information quality, perceived ease of use and perceived usefulness determine whether or not the user decides to use a product or service again. Findings from Limayem & Cheung (2008) research showed that habit, continuance intention, satisfaction and prior behavior also influence users' decisions.

The implementation and adoption of e-learning represents a world full of changes, challenges and skill requirements. It brings significant transformations to traditional educational environments as it requires teachers and students to be very adaptable to new forms of learning, interaction and interpersonal communication. Moreover, people must develop digital media literacy, which includes psychosocial and socio-contextual knowledge and skills (Alexander, 2012). More specifically, both teachers and students have to be able to perform certain tasks such as finding and gathering relevant information, understanding various texts and integrating textual and graphic information from inter-connected sources. As people increasingly develop digital knowledge and skills, it will become easier to use learning management systems.

The idea that young people have more knowledge of and find it easier to use new technologies is not entirely true. Research findings show that there are significant differences between students' self-evaluation and their effective knowledge and performance (Hargittai, 2010).

However, the 2018 NMC Horizon Report notes that the adoption of technology in higher education depends upon: (a) providing students with authentic learning experiences, (b) adapting organizational designs to the future of work, (c) advancing digital equity, (d) economic and political pressures, and (e) rethinking the roles of educators.

According to this report, advancing digital equity is necessary for the adoption of technology in higher education institutions; in other words, technology cannot be adopted effectively if individuals' access to technologies is not.

Given the importance of technology in individuals' private and professional lives, including educational institutions, their knowledge needs to extend beyond the basic skills of using digital literacy tools and information. Studies from Liaw and Huang (2011), Rhema and Miliszewska (2014), Jan (2018) acknowledged that a student's digital ability is a significant predictor of attitudes towards Information and Communication Technologies (ICT) and better ICT skills have a positive impact on student's motivation and attitude.

In line with the above analysis, we propose:

P4. Applying performance tests to determine the level of digital literacy and to reduce the differences between self-evaluation outcomes and effective knowledge and performance.

5.2. E-learning demands

The challenges and transformations in work and social life due to online learning environments are a major issue in the 21st century.

The rapid growth of ICT entails improving procedures, rethinking strategies and reformulating dynamics. In education, as in other social domains, technology has shaped peoples' lives and changed work environments by providing new ways of communicating, working and learning. In response to challenges posed by technological transformations, some schools implemented learning management systems such as e-learning that led to the transition from a traditional learning model to a more innovative and flexible one that allows students to learn in a pedagogical but recreational environment.

However, the successful adoption of e-learning requires adequate infrastructures, an ability to accept change, appropriate digital skills and a suitable program design which meets the students' learning needs. According to the 2018 NMC Horizon Report, it is crucial to provide students with experiences that teach them how to deal with real-world problems and with tools that make them better prepared to solve unexpected problems. This report also draws attention to the relevance of the following topics: (a) a deep understanding of digital environments, a responsible and appropriate use of technology, (b) a redefinition of educational roles and institutional hierarchy of organizations, (c) an equitable access to the broadband internet and (d) increased financial aid to educational institutions.

In short, the process of e-learning adoption requires above all: (a) growing acceptance of innovation cultures, including technology as a working tool and a proliferation of open educational resources, (b) the redesigning of learning spaces, (c) the introduction of new ways of measuring learning, (d) a redefinition of educational roles, and (e) the implementation of online learning programs with a design oriented to meet students' educational needs. Thus, based on the above mentioned challenges and developments, we define the following proposal:

P5. Exploring what has been done in higher education institutions to promote and implement online learning environments, the main institutional changes and the level of resistance to change.

5.3. Examining online education

As previously mentioned, the digital era has brought transformations with great impact on social and professional lives that challenge people's ability to adapt.

In an educational setting, the school of the future is an innovative paradigm with new forms of education and interactive creativity with new technology and new forms of action. Online education needs to provide students with relevant skills that enable them to respond to unexpected real-life situations and to solve specific types of problems in a rapidly changing world (Natriello, 2007; Tuomi, 2007). Designing a more stimulating and enjoyable educational environment for students and teachers as well as ensuring that instruction from technology-based education is as good as that given by a teacher are the initial steps towards boosting the implementation and adoption of online education across the globe.

However, emphasis must be given to the fact that the application of ICT in education makes it necessary to reassess the educators' role, the appropriateness of the design of online learning environments and their impact on students' academic outcomes, teachers' and students' ability to adapt to these new environments and consequently to the use of learning management systems such as e-learning.

The transition from a traditional learning model to an online learning model should ensure that online learning is of high quality and includes learning elements such as a significant component of social interaction and collaboration with peers, a connection between new knowledge and past experience, self-reflected and self-regulated learning, an immediate practical application of exercises and frequent assessment (Cercone, 2008).

Furthermore, factors related to learners' individual characteristics such as learning styles, learning motivation, learning behavioral types and prior knowledge can influence online learning effectiveness. Therefore, the design of online courses should fit the psychosocial characteristics of learners and meet their needs and expectations. Suitable online courses will contribute to more motivated and engaged students (Ren, Dai, Zhao, Fei & Gan, 2017). According to the analysis of online education, we propose:

P6. Explaining the implementation of online learning programs in higher education institutions over the last few years based on their impacts on the daily performance of teachers and students.

Extending theory, this article contributes by presenting research propositions to study the topics and concepts that emerged from the lexical results and that can be conceptualized.

From a practical point of view, this research also provides the opportunity to incorporate gamification techniques such as usability or ease of use and learning rewards in educational technologies.

Based on the literature gathered for this systematic review, we also propose a recent definition of e-learning:

E-learning is an innovative web-based system based on digital technologies and other forms of educational materials whose primary goal is to provide students with a personalized, learner-centered, open, enjoyable and interactive learning environment supporting *and enhancing the learning processes.*

6. Conclusions

This research places special focus on e-learning and education activities as a self-oriented tool for electronic learning for all educational fields and educational systems covering different training needs and students. Since the beginning of the 21st century, different research fields have disclosed information about multiple and isolated elements of e-learning and education rather than developing a holistic perspective and research propositions for future studies. We have classified all the references in one single diagramthat outperforms other systematic reviews and offers a holistic understanding of e-learning. Our study provides research propositions for future research or for a conceptual framework. Finally, we contribute with a new definition of e-learning. This study also comes with some limitations due to the qualitative nature of the analysis; we therefore also propose that future research could explore other data bases to conduct a meta-analysis.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.compedu.2019.03.007.

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