

The Information Quality impact on Learning Platforms

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Abstract: Information quality (IQ) is a multidisciplinary area that can be understood as a measure of the value that information provides to its consumer. In order to obtain it, in the learning ecosystem, it is necessary to take into account the increasingly important role of learning platforms (LP). The purpose of this article was to analyze the IQ impact on LP. For this, an integrative literature review was conducted. Analysis of this field shows that IQ has a significant impact on LP, as it increases user satisfaction, favors the use, positively influences the intention of continuity and is an essential factor for the mobile learning acceptance.

Keywords: Information quality. Learning platforms. Mobile learning. Digital Technologies.

O impacto da Qualidade da Informação nas Plataformas de Aprendizagem

Resumo: Qualidade da informação (QI) é uma área multidisciplinar que pode ser compreendida como uma medida do valor que a informação fornece ao seu consumidor. Para obtê-la, no ecossistema de aprendizagem, é preciso levar em conta o papel cada vez mais importante das plataformas de aprendizagem (PA). Este artigo teve como objetivo analisar o impacto da QI nas PA. Para tal, foi realizada uma revisão integrativa da literatura. A análise desse campo mostra que a QI exerce relevante impacto nas PA, pois eleva a satisfação dos usuários, favorece o uso, influencia positivamente a intenção de continuidade e é um fator imprescindível para a aceitação da aprendizagem móvel.

Palavras-chave: Qualidade da informação. Plataformas de aprendizagem. Aprendizagem móvel. Tecnologias Digitais.

1. Introduction

Quality is a degree to which the information meets the user's needs, according to their external and subjective perceptions. According to Wang and Strong (1996), information quality (IQ) is a multidimensional concept, whose dimensions are combined to describe items of information by a set of resources. The IQ can be understood as a measure of the value that information provides to its consumer. The development of new technologies and the increased level of competition demonstrate the importance of information for innovation, decision-making, management of organizational processes and education.

Information of quality is considered a valuable asset and, in order to obtain it, it is necessary to take into account the human dimension of the phenomenon, as well as the increasingly important role of information systems (IS). A learning platform (LP) is an IS that integrates human entities, such as students and instructors, and non-human entities, such as learning systems (Al-Fraihat et al., 2019). The IQ is usually expressed as the quality generated by an IS, and is related to the content of e-learning platforms.

E-learning is a web-based learning ecosystem that integrates various stakeholders with technology and processes (Cidral et al., 2018). Learning using e-learning platforms has expanded rapidly around the world, as it offers people a flexible and personalized way to learn and enables on-demand learning at a reduced cost. In this perspective,

combining e-learning and face-to-face classes, blended learning offers opportunities for timely, continuous, and flexible learning.

The use of technology in education has become fundamental. Isaac et al. (2019) state that the online learning can improve administrative, communicative, and educational qualities, support learning using scarce resources and limited infrastructure, and encourage educational equity through the flexible use of place and time. As a learning tool in education, the use of smartphones is on the rise, causing a rapid development of mobile learning (m-learning). Its main features, such as mobility, ubiquity, and connectivity from anywhere and at anytime, improve its use in several ways (Arain et al., 2019).

In this context, this work aims to analyze the bibliometric characteristics of recent years on the relevance of the IQ on LPs, to identify trends and thematic gaps in publications indexed in international databases. Based on this analysis, this study seeks to verify how IQ impacts on LPs.

The following sections are organized as follows: section 2 presents the required background. Section 3 describes the methodology used. Section 4 presents the results found, discusses the approaches and trends. Finally, the final considerations are presented in section 5.

2. Background

This section presents the required background about the IS evaluation and technology acceptance models, which usually evaluate the IQ aspects of IS and LPs. Delone and McLean (1992) proposed the information systems success model (ISSM) to describe IS success measures and received substantial attention from IS researchers (Tsai et al., 2017; Cidral et al., 2018; Al-Fraihat et al., 2019). The ISSM was defined to comprehensively understand IS success by recognizing, describing, and explaining the relationships between six of the most crucial dimensions of success by which ISs are typically evaluated: IQ, system quality, use, user satisfaction, individual impact, and organizational impact.

About ten years later, Delone and McLean (2003) updated their model, introducing service quality as a new construct for the model. The use construct was divided into use/intention to use to measure the success of the systems in areas where the use of the system is voluntary and mandatory, and two constructs (individual and organizational impacts) have been merged into net benefits. In the ISSM, IQ measures the semantic success of the information provided by an IS, such as accuracy, timeliness, integrity, relevance and consistency. According to Cidral et al. (2018), researchers have adopted partial or total ISSM to better understand the success of a variety of ISs, including the LPs.

In the technology acceptance context, two evaluation models stand out from the perspective of LPs: technology acceptance model (TAM), and unified theory of acceptance and use of technology (UTAUT). The TAM, proposed by Davis (1989), presents two determinants, perceived usefulness and perceived ease of use, as the main determinants of the use and adoption of new technologies. Later, Venkatesh and Davis (2000) proposed an extended TAM, the TAM2, which adds social influence and cognitive instrumental processes to the previous model.

In 2003, Venkatesh et al. further developed the TAM and proposed the UTAUT, which combines eight models and can explain many behaviors related to the adoption and use of new technologies. The UTAUT explores the factors affecting behavioural intention and use behavior from the users' impact perception of oneself. Finally, Venkatesh et al. (2012) proposed the UTAUT2, identifying additional constructs (hedonic motivation,

price value and habit) to explain the intentions and behavioral use of consumers associated with the technology acceptance.

3. Methodology

This study is based on an integrative literature review about the IQ impact on LPs. In an integrative review, researchers objectively criticize, summarize, and draw conclusions about a subject. This occurs through systematic research, categorization and thematic analysis of previous qualitative and quantitative research on the subject (Lobiondo-Wood and Haber, 2017). The searches occurred in the Scopus and Web of Science (WoS) databases in May 2020. The inclusion criteria were full journal article as document type, and published from 2015 in the English language. The database searches used the keywords presented in Table 1. The search was realized by topic, that is, the title, the abstract and the keywords of the records were analyzed.

Table 1 - Search terms

Database	Keywords
Scopus	("information quality" OR "quality of information") AND (((virtual OR online OR e- OR ubiquitous OR u- OR mobile OR m-) W/3 learning) OR (learning W/3 ("management system" OR environment OR platform)))
WoS	("information quality" OR "quality of information") AND (((virtual OR online OR e- OR ubiquitous OR u- OR mobile OR m-) NEAR/3 learning) OR (learning NEAR/3 ("management system" OR environment OR platform)))

In the initial search 142 records were found in WoS and 234 in Scopus. Then, after applying the inclusion criteria, 61 records were selected from WoS and 89 from Scopus. The articles were grouped by database and imported into the Mendeley software, where 52 duplicates were removed totaling 98 articles. Figure 1 presents the flowchart of the research process and article selection strategy. As an additional quality and selection criterion, the journals in which the articles were published were checked and the articles were classified according to the indicators presented in Table 2 (JCR, 2020; Qualis, 2020; SJR, 2020), in their most recent versions available in May 2020.

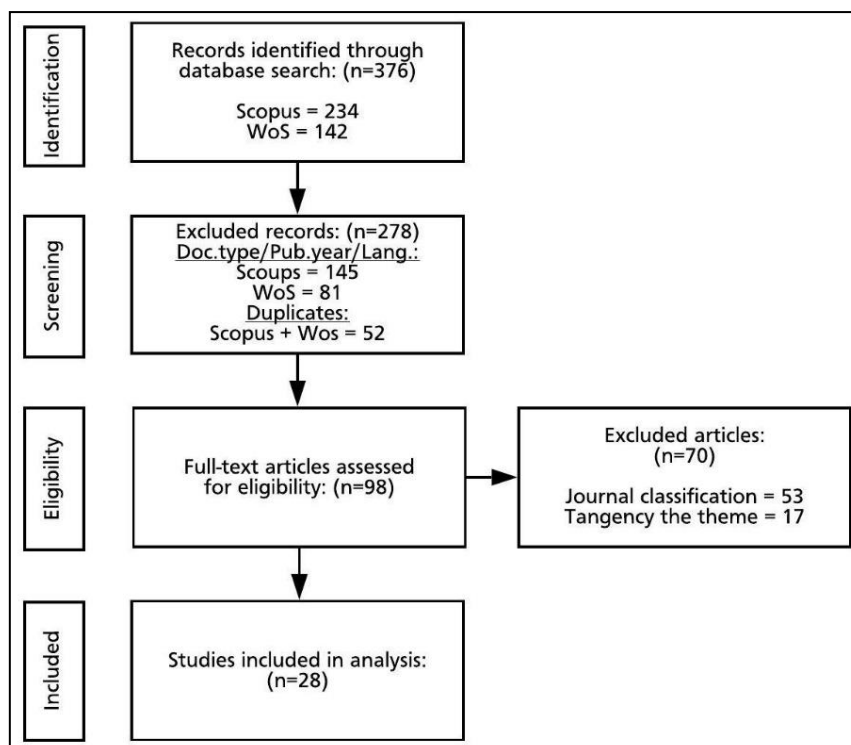


Figure 1 - Flowchart of the research process

Table 2 - Journals' indicators-based classification

Classification	Indicators
A	(JCR impact factor > 4) OR ((Qualis CAPES stratum = A1) AND (SJR index > 1.4))
B	(JCR impact factor > 1.4) OR (Qualis CAPES stratum \geq A2) OR (SJR index > 0.7)

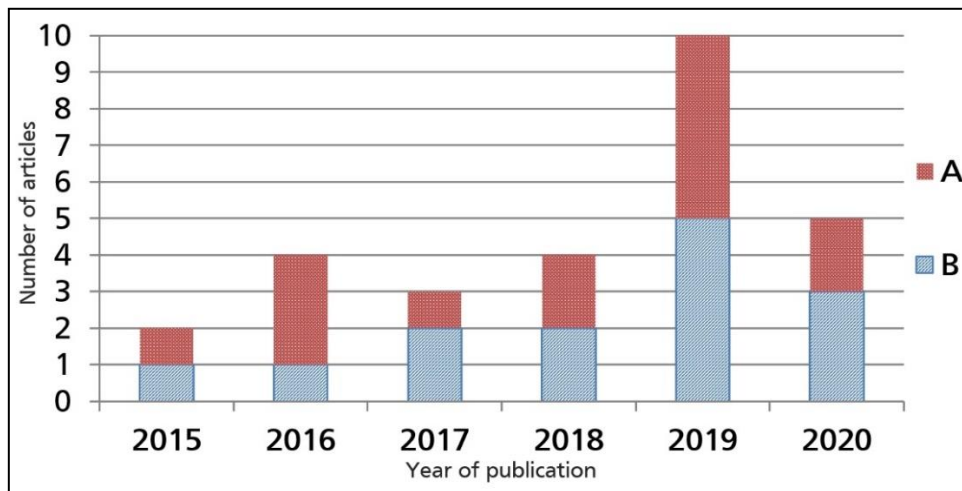
The abstracts of the articles were read and 17 studies were eliminated because they only tangency on the topic or were considered outside the scope of this review. Another 53 articles were excluded because they did not fit the established classifications (Table 2), remaining 28 articles for full reading, which represent the final sample of this work. Finally, the articles were tabulated in a synthesis matrix (Garrard, 2016), using a spreadsheet to identify similarities and categorize the articles based on the similarities found in the respective objectives, considering the IQ context in LPs.

4. Results and Discussion

This section presents and discusses the results found. The perspectives about the IQ impact on LP are highlighted at the end of this section.

4.1 Analysis of Results

The publications occurred in all the years researched. Figure 2 shows the number of selected articles for this study, distributed by the year of publication and the journal classification, presented in Table 2. It is possible to notice an escalation in the number of publications in the subject of this study, which had about 53% of the sample published in the last 17 months (from January 2019 to May 2020). The selected articles for this study analyzed predominantly populations from Asian, about 75%, and developing countries. Regarding the human development index (HDI), only eight studies, about 28.6%, had their population analyzed in countries included in the group of 50 countries best positioned in the HDI ranking (HDR, 2020).

**Figure 2** - Selected articles by year of publication and journal classification

The journal that most contributed to the sample was the Computers in Human Behavior, with 4 publications. The most cited article in the sample was written by Dağhan and Akkoyunlu (2016), which had 60 citations in Scopus and 46 in WoS. According to the classification presented in Table 2, half of the publications in the sample were classified as A, which qualifies the sample of this study. Based on the articles objectives, and considering the IQ context in LPs, four categories were identified, as shown in Table 3.

The first category is composed of studies that evaluate the users' satisfaction of LPs. Eight different studies were found since 2015. Studies on the determining elements

for the use of LPs are grouped in the second category identified. As in the previous category, eight studies were found. The third category presents studies that focus on mobile learning. Seven papers were selected that analyze this theme. Finally, in the last category are studies that evaluate the LP continuance intention by users. Five different studies were found.

Table 3 - Categories of selected articles

Category	Articles
User Satisfaction	(Chen et al., 2015; Mohammadi, 2015; Almarashdeh, 2016; Gay, 2016; Cidral et al., 2018; Al-Fraihat et al., 2019; Pérez-Pérez et al., 2019; Koh and Kan, 2020).
Determinants for Use	(Alsabawy et al., 2016; Ameen et al., 2018; Nejkovic and Tomic, 2018; Alshehri et al., 2019; Isaac et al., 2019; Salloum et al., 2019; Thongsri et al., 2019; Zhang et al., 2020).
Mobile Learning	(Gan and Balakrishnan, 2016; Almaiah et al., 2019; Arain et al., 2019; Barteit et al., 2019; Wang et al., 2019; Almaiah et al., 2020; Lee and Jeon, 2020).
Continuance Intention	(Dağhan and Akkoyunlu, 2016; Zhang et al., 2016; Sharma et al., 2017; Al-Samarraie et al., 2017; Tsai et al., 2017).

4.2 Previous Considerations

Based on the similarities found in the respective objectives and considering the IQ context in LPs, this section analyzes each category in more depth. Table 4 presents the studies by identified category.

Table 4 - Highlights of selected studies by identified category

#	Study highlights
User Satisfaction	<ul style="list-style-type: none"> ▪ Al-Fraihat et al. (2019) investigated the factors that influence e-learning success, and proposed an integrated model, using ISSM and TAM. The study revealed that IQ is a determinant of perceived satisfaction and perceived usefulness. The perceived satisfaction determinants by the user were analyzed by Cidral et al. (2018). According to them, IQ is considered a determining factor for perceived satisfaction by the LP user. Collaboration, IQ and system quality are the determining factors for the e-learning success. ▪ Students' satisfaction in using the learning management systems (LMS) were analyzed by Koh and Kan (2020). They extended ISSM considering the pedagogical dimensions of instructional quality, learning quality, and interaction quality, in addition to how the perceived frequency of use influences students' perception of quality. According to Koh and Kan (2020), it is important to improve IQ, as this factor positively predicted the students' satisfaction who considered themselves to be medium or infrequent users. ▪ Almarashdeh (2016) proposed a structure to measure the instructors' satisfaction in using the LMS. The study concluded that IQ, service quality, perceived usefulness, and system quality have a significant effect on users' satisfaction. In this perspective, Gay (2016) examined e-learning readiness through a university's online instructors and evaluated their levels of e-readiness and impact before, during, and after the course delivery. According to the author, the experience of instructors and the use of technological tools influence the IQ presented, the satisfaction, and the use of LP during the course delivery. ▪ An integrated model, including ISSM and TAM, was examined by Mohammadi (2015) to explore the effects of quality resources, perceived ease of use, and perceived usefulness on the intentions and satisfaction of users. Mohammadi (2015) identified the IQ as a key factor, as it positively affected the users' satisfaction of LP. In this perspective, using a LMS in a blended learning environment, Pérez-Pérez et al. (2019) used the ISSM and TAM to analyze the relative impact of pre-acceptance as a predictor of student satisfaction. According to Pérez-Pérez et al. (2019), IQ is the most relevant determinant of students' satisfaction. ▪ Finally, an integrated learning environment based on an electronic portfolio was presented by Chen et al. (2015). The results showed that the benefits perceived by the reader have in IQ and in system quality the critical factors for reader satisfaction. Readers who shared their knowledge or experience in a virtual community were able to collaboratively perceive and acquire knowledge.

#	Study highlights
Determinants for Use	<ul style="list-style-type: none"> ▪ Salloum et al. (2019) examined the impact of external factors for the adoption of e-learning by students, through the extension of TAM with these factors. According to Salloum et al. (2019), IQ, perceived enjoyment, and accessibility are determinants for the ease of use and perceived usefulness of LPs. Using a LMS designed to promote student-centered learning processes, through the UTAUT and ISSM, Thongsri et al. (2019) stated that IQ, system quality, performance expectation, and social influence had a significant effect on the intention to use the LP. The IQ was the determining factor with the greatest influence on the intention to use the LP. ▪ The factors that explain the adoption and effective use of a LP were analyzed by Ameen et al. (2018). According to them, IQ has a determining effect on students' behavioral intention to use the LP. In this perspective, Zhang et al. (2020) proposed an integrated model, including UTAUT and ISSM, to expand the understanding of students' behavioral intention. In contrast to the results of Ameen et al. (2018), Zhang et al. (2020) concluded that the IQ had no significant impact on behavioral intention. According to Zhang et al. (2020), social influence plays the most important role in students' behavioral intention, and this factor significantly affects the behavioral intention to use the LP, especially in mandatory blended learning environments. ▪ The impact of information technology (IT) infrastructure services and the IT quality on the usefulness perceptions of LPs was examined by Alsabawy et al. (2016). According to them, the IT infrastructure services plays a critical role in generating high-quality information, improving the LP's quality aspects. The roles of task-technology-fit (TTF) and compatibility as mediating variables in the ISSM were examined by Isaac et al. (2019). The TTF indicates that the individuals' performance is influenced by the fit between the tasks they perform and the LP functionality. The authors' findings comprised the following results: the overall quality (information, service and system) influenced the compatibility; the compatibility influenced the practical use and user' satisfaction; the actual use and satisfaction influenced the TTF; and the TTF showed positive influence performances. ▪ The factors that affect the effective use of information and online structures of digital content were examined by Nejkovic and Tosic (2018). According to them, the important factors for the LP success were the high quality of the information and the useful learning content, the ease of use, and the support for social presence. These drivers led students to feel the LP usefulness and to have fun using it. In this perspective, Alshehri et al. (2019) investigated the relative importance of the design criteria developed for evaluating the LP usability. Alshehri et al. (2019) stated that the IQ is the most important determining factor for the use of LPs.
Mobile Learning	<ul style="list-style-type: none"> ▪ Almaiah et al. (2019) applied an integrated model to examine the effects of different factors on students' acceptance of m-learning in higher education. The model integrated seven external factors with UTAUT. The IQ showed a significant positive effect on the actual use of LP. External factors such as perceived IQ, perceived trust, and technological self-efficacy were the most significant determinants of m-learning acceptance. Later, Almaiah et al. (2020) developed a model to study the effect of different factors in the m-learning development for the three main stages of use: static, interaction and transaction. The IQ was considered one of the most important factors in the static and interaction stages. ▪ Barteit et al. (2019) explored TAM2 and ISSM on an m-learning platform focused on the use of offline tablets in a resource-limited context. The results indicated the LP acceptance and showed higher scores for IQ and overall net benefits, for students, and ease of use and perceived usefulness, for teachers. In order to analyze m-learning acceptance, Arain et al. (2019) used UTAUT2 and also extended it to five other constructs: ubiquity, IQ, system quality, appearance quality and satisfaction. According to Arain et al. (2019), m-learning is useful for students, and accessing m-learning from anywhere and at anytime have greatly motivated students to use it. ▪ The effectiveness of using a message application in higher education classrooms was investigated by Gan and Balakrishnan (2016). According to them, the findings revealed students' readiness to use the LP in classrooms to interact with their teachers. Using the quality factors of ISSM, Lee and Jeon (2020) investigated the resources that affect the users' satisfaction of an m-LMS. The results indicated that IQ, system quality, and service quality have a positive effect on the user's satisfaction. Finally, considering the ISSM, Wang et al. (2019) developed a multidimensional model to evaluate the paid m-learning success. According to Wang et al. (2019), IQ, system quality, perceived satisfaction, and perceived fee have influenced the effectiveness of learning by mediating user satisfaction and the intention to reuse paid m-learning.

#	Study highlights
Continuance Intention	<ul style="list-style-type: none"> ▪ The main factors that impact the LP continuance intention by users was investigated by Al-Samarraie et al. (2017). The results produced five factors: IQ, TTF, system quality, perceived value and usefulness. The IQ obtained the highest score among the main factors for satisfaction with the e-learning continuance. In this perspective, Dağhan and Akkoyunlu (2016) proposed an integrated model to better understand the determinants of the students' intention of continuity in online learning environments. According to Dağhan and Akkoyunlu (2016), IQ, system quality, and service quality positively affected the satisfaction of the use and favored the continuance intention. ▪ An integrated model, using ISSM and TAM, was examined by Tsai et al. (2017) to explore the factors that affect nurses' behavioral intentions to continue using blended learning. The IQ, system quality, and service quality affected the perceived usefulness and perceived ease of use, being considered precedent factors that influenced the continuance intention (Tsai et al., 2017). Using ISSM, Zhang et al. (2016) examined the LP continuance intention determinants. According to Zhang et al. (2016), perceived IQ and perceived interaction quality directly affected perceived usefulness and perceived satisfaction and, finally, determined the users' continuance intention. ▪ Finally, Sharma et al. (2017) developed a model to understand the effect of individual characteristics and determinants of LMS quality on the continuous use of LMS by instructors. Sharma et al. (2017) concluded that IQ can be considered an important factor for the continuance intention of using LMSs, but not the main factor.

4.3 Perspectives and Trends

Highlighting some selected environments, within Table 5, this section analyzes how IQ impacts LPs and discusses perspectives and trends in current environments.

Table 5 - The IQ impact on LP and the digital trends in the learning ecosystem

#	Perspectives and Trends
Information Quality Impact	<ul style="list-style-type: none"> ▪ The IQ is a multidisciplinary area, since information, in various formats and with a variety of media, is used in all activities, and profoundly impacts the processes quality that use it. In educational context, it is a crucial resource that has a great impact in the LP user satisfaction (Delone and McLean, 2003; Mohammadi, 2015; Cidral et al., 2018; Al-Fraihat et al., 2019; Pérez-Pérez et al., 2019). Once users believe the LP provides clear, understandable, and relevant information for their learning activities, they are more interested in using it, which increases their satisfaction. ▪ The learning content quality plays a vital role in the m-learning success. The available IQ, with ubiquity offered by these platforms, have a direct and positive effect on the users' motivation and satisfaction. According to Almaiah et al. (2019), when the content quality and learning information underlying the LP is accurate, complete, timeliness, relevant, and efficient for students' learning, the m-learning acceptance should increase. ▪ The IQ is one of the most important determinants for the LPs' use. The intention of use, the perceived ease of use, and the perceived usefulness of LPs are factors strongly influenced by IQ. The IQ is considered precedent factor that influences the LP continuance intention (Zhang et al., 2016; Tsai et al., 2017). The LP's continuance intention is positively influenced by the IQ (Dağhan and Akkoyunlu, 2016). Thus, providing necessary, concise, up-to-date, and organized information with an attractive design are essential aspects for users to have a pleasant experience with the LP. ▪ The LPs increasingly require ease of use (Ameen et al., 2018; Cidral et al., 2018; Nejkovic and Tosic, 2018; Al-Fraihat et al., 2019; Barteit et al., 2019; Pérez-Pérez et al., 2019). Usability is a quality attribute related to ease of use. It evaluates how easy it is to use user's interfaces (Nielsen, 2012). According to Salloum et al. (2019), IQ positively impacts the perceived ease of use, and perceived usefulness by LP students. One of the main attributes of quality is utility, which is concerned with providing the resources that the user needs. Usability and utility are equally important and together they determine if something is useful (Nielsen, 2012). Therefore, such as IQ, usability is an important attribute and should be considered a critical factor for the successful use of LPs (Alshehri et al., 2019). ▪ Finally, according to Thongsri et al. (2019) and Zhang et al. (2020), the LPs require social presence support. The IQ plays a key role on these platforms, which information sharing is a key element. Determining which information is reliable is a challenge for LPs. The false information dissemination is a threat to IQ. Literacy about how platforms operate and the implications of how people share, process, and consume information can prepare users to become critical citizens.

#	Perspectives and Trends
Digital Technologies	<ul style="list-style-type: none"> ▪ The organizations' digital presence offers the characteristics of immediacy and ubiquity, and occurs by digital technologies. The digital technologies impact has transcended from the organizations to education and information. The increasing use of mobile technologies causes changes in the information behavior of developed world and is seen as an opportunity for progress in developing countries. The LPs facilitate many experiences with the form, structure, and substance of traditional education (Silva et al., 2020). ▪ In higher education, digital transformation can be understood as the process of using digital technologies to modify or create new teaching and learning processes, culture, and experiences of existing communities to meet the changing requirements of education and society. In this perspective, experimenting with new roles through new context frameworks and learning tools to achieve a new adaptation is very important. ▪ According to this trend, m-learning is an innovative idea that, by connecting humans and technology, offers huge opportunities, such as better learning experiences and technology acceptance (Arain et al., 2019). Therefore, it is recommended that higher education institutions further explore the potential of m-learning in classrooms to support teaching and learning activities (Gan and Balakrishnan, 2016; Almaiah et al., 2019). ▪ Ubiquitous learning (u-learning) represents an emerging paradigm that spreads education in different contexts, in which users are situated in authentic learning contexts to face immersive experiences, in order to achieve a meaningful learning (Cárdenas-Robledo and Peña-Ayala, 2018). The u-learning takes advantage of digital content, the physical environment, mobile devices, widespread components, and wireless communication to offer teaching and learning experiences to users anytime, anywhere and anyway. Therefore, it is recommended that higher education institutions and other stakeholders can implement ubiquitous technology so that students can use learning technology anywhere, anytime and anyway.

5. Conclusion

The more developed societies live on information, and the ITs keep them oxygenated. These societies are characterized as knowledge societies, due to the large production and dissemination of data and information. Therefore, the better the IQ shared, the greater the probability that these societies will prosper. This study highlights that the IQ has a relevant impact on LP, because it raises the satisfaction of LP's users, significantly affects the LP's use, positively influences the LP's continuance intention, and is one of the most significant factors of m-learning acceptance.

The IQ is necessary for education because information plays an essential role in achieving learning objectives. Problems resulting from poor IQ, such as lower LP reliability and lower user' satisfaction, indicate that educational organizations should ensure that LPs provide high IQ, in order to provide a better learning experience and promote continuous user' satisfaction. Learning contents should captivate the users' interest day by day. These platforms should be easy to navigate and well-structured in terms of content and functionality. The LP should enable user interaction, in a collaborative environment, supporting social presence.

Digital technologies must be increasingly understood, especially in terms of LPs, because they address the limitations of time, space and cost of education. During the COVID-19 pandemic, the traditional face-to-face educational system was interrupted and this could drive the creation of a new and more effective method of educating students, with LPs as part of their new normal. Online learning have played an important role at this time, so it is recommended to explore their full potential. Mobile devices can literally allow students to carry their classroom in their pocket.

Education using blended learning is no longer about memorizing facts and answering test questions, but about applying knowledge to real-life situations and knowing where to find reliable information. Teachers provide guidance and support, act as moderators of the discussion, and provide guidance and feedback to projects, but they are no longer the only source of knowledge. In today's world, knowledge is not a fixed set of facts that can be easily divided into independent subjects, but an interconnected

whole, in constant growth, which requires a high degree of independence, flexibility, and willingness to learn and improve well beyond the school years.

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