African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28 Février 2025

The evolution of e-learning and its challenges in higher education: A theoretical review

L'évolution de l'e-learning et ses défis dans l'enseignement supérieur : Une revue de littérature.

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Déclaration de divulgation : **L'auteur n'a pas connaissance de quelconque financement qui pourrait affecter l'objectivité de cette étude.**

Conflit d'intérêts : **L'auteur ne signale aucun conflit d'intérêts.**

Pour citer cet article : **OULAMINE .A, EL GAREH .F, HATTABOU .A & ELMENSSOURI .A (2025). « The evolution of e-learning and its challenges in higher education: A theoretical review», African Scientific Journal « Volume 03, Num 28 » pp: 0174 – 0196.**

Date de soumission : Janvier 2025

Date de publication : Février 2025

DOI : 10.5281/zenodo.14777792

African Scientific Journal
ISSN : 2658-9311
Vol : 03, Numéro 28, Février 2025

Résumé

L'objectif de cet article est d'examiner l'évolution de l'apprentissage en ligne, en soulignant son importance croissante dans l'enseignement supérieur et les défis associés à son intégration, en particulier dans les pays en développement. Une revue des recherches existantes est présentée, analysant les étapes clés de l'évolution de ce mode d'apprentissage, depuis les premières formes d'enseignement en ligne jusqu'aux innovations récentes telles que l'intelligence artificielle. L'adoption des technologies numériques a été accélérée par l'avènement de la pandémie, qui a révélé des lacunes en matière d'infrastructure, de formation et de résistance à l'innovation. L'article identifie des obstacles spécifiques dans des contextes où les ressources technologiques sont insuffisantes, et propose des moyens de renforcer l'intégration durable et inclusive de l'apprentissage en ligne dans l'enseignement supérieur. Les conclusions de cette revue, bien que théoriques, enrichissent la littérature existante en offrant une analyse détaillée du concept d'e-learning et de ses enjeux, tout en ouvrant la voie à de futures études sur la question de l'adoption et de la résistance à ces technologies.

Mots clés : E-learning, Enseignement supérieur, Pandémie COVID-19, Technologies éducatives, Pays en développement.

Abstract

The objective of this article is to examine the evolution of e-learning, emphasizing its increasing significance in higher education and the challenges associated with its integration, particularly in developing countries. A comprehensive review of extant research is presented, analyzing the key stages in the evolution of this mode of learning, from the earliest forms of online teaching to recent innovations such as artificial intelligence. The adoption of digital technologies was accelerated by the advent of the pandemic, which revealed gaps in infrastructure, training, and resistance to innovation. The article identifies specific barriers in contexts where technological resources are insufficient and proposes ways to strengthen the sustainable and inclusive integration of e-learning in higher education. While the conclusions of this review are theoretical, they contribute to the existing literature by offering a detailed analysis of the concept of e-learning and its issues. Furthermore, they serve as a foundation for future studies on the question of adoption and resistance to these technologies.

Keywords: E-learning, Higher education, Pandemic COVID-19, Educational technologies, Developing countries.

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ISSN : 2658-9311
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Introduction

For the past two decades, higher education institutions (HEIs) around the world have been undergoing a profound transformation, catalyzed by rapid advances in information and communication technologies (ICTs). This process gained unprecedented momentum with the COVID-19 pandemic, which accelerated the adoption of digital tools to ensure academic continuity on a global scale (Bozkurt & Sharma, 2020; Whittle et al., 2020; Loglo & Zawacki-Richter, 2023; Wahas and Syed, 2024).

This massive transition toward online learning has redefined traditional educational paradigms and highlights the need for a comprehensive assessment of the opportunities and challenges presented by online education. Recent data illustrate this transformation, demonstrating exponential growth in participation in online courses, with millions of students worldwide now engaged on various platforms. For instance, the number of students taking at least one online course increased by 7.2% in public institutions and 12.7% in private nonprofit institutions in the United States (Allen & Seaman, 2015).

The integration of e-learning into higher education extends far beyond the adoption of technology; it embodies a profound transformation at the educational, organizational, and social levels. This evolutionary process aligns with the objectives of management science, which seeks to analyze and optimize organizational practices through an interdisciplinary lens (Aggeri, 2006). Within this framework, e-learning emerges as a significant pedagogical innovation. However, ensuring its sustainability requires a thoughtful examination of its implementation, the obstacles and resistance it may face, its inherent limitations, and the conditions necessary for its long-term integration.

Before the emergence of COVID-19, e-learning was mainly perceived as a complementary educational tool, reserved for specific training or adult education. The pandemic transformed this perception in a matter of months, making e-learning a central element of global education systems (Mishra et al., 2020). Faced with the emergency, educational establishments massively adopted digital platforms such as Zoom, Google Classroom and Neo, which proved crucial for maintaining pedagogical activities. However, this rapid transition has highlighted major challenges: lack of teacher preparation, often inadequate infrastructures, and inequalities of access, particularly accentuated in developing countries (Simamora, 2020; Ray et al., 2022; Oulamine et al., 2024).

The challenges posed by e-learning go far beyond technical aspects. Indeed, limited mastery of digital skills, reduced pedagogical interaction in virtual format and socio-economic disparities

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represent major obstacles, particularly in less favored regions (Xia et al., 2022 ; Bashitialshaaer et al., 2021). In regions such as Africa and Southeast Asia, where infrastructure remains limited, institutions have had to innovate to maintain educational continuity. For example, countries such as Kenya and India have accelerated the implementation of mobile learning solutions and digital literacy programs to overcome these obstacles. Furthermore, case studies from Morocco and Africa show that many students do not have access to adequate equipment or a stable Internet connection, limiting their engagement with online courses (Oulamine et al., 2024).

These findings reinforce the necessity for the development of bespoke strategies to overcome these limitations and to optimize the potential benefits of e-learning in a variety of contexts, with a view to facilitating inclusive digital transformation in a multitude of educational settings. This article examines the complex issues surrounding e-learning from a historical and critical perspective. This article traces the evolution of e-learning from its beginnings to its current status, with the aim of enriching academic discourse on the digital transformation of higher education. In particular, it will highlight the specific challenges faced by developing countries and propose strategies to improve the effectiveness and inclusivity of e-learning in these contexts. Ultimately, this analysis can serve as the basis for targeted recommendations and strategies aimed at maximizing the positive impact of e-learning, particularly in developing countries.

1. The historical development of E-learning

E-learning, now central to contemporary education, has evolved significantly since its origins as alternative distance education (Sangrà et al., 2012). This transition to a flexible and accessible teaching method has been largely facilitated by the integration of information and communication technologies (ICT), which have become key drivers of pedagogical innovation (Regmi & Jones, 2020). However, despite significant advances, contextual and technological challenges, particularly in developing countries where infrastructure constraints remain, still limit the potential of e-learning (Bashitialshaaer et al., 2021; Andersson, 2009).

The roots of e-learning go back to the first forms of distance learning in the 19th century, with correspondence courses in Berlin for language teaching (Attademo, 2006). In the 1920s, the integration of media in education, such as radio and later television, opened up new prospects for reaching learners in remote areas (Wagner et al., 2008).

1.1. The rise of technology and e-learning

The advent of digital technologies in the 1960s marked a pivotal moment in the evolution of modern e-learning, giving rise to the emergence of computer-assisted learning (CBT) programs.

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The PLATO (Programmed Logic for Automated Teaching Operations) project, developed by the University of Illinois, represents a pioneering example from this era, enabling students to access interactive courses via terminals connected to a central computer (Njenga, 2011). In the 1970s, the concept of distance learning began to emerge, most notably with the establishment of the Open University in the UK, which offered distance education programs primarily via television and radio.

The advent of the Internet in the 1990s represented a further significant advance for e-learning. During this period, the first Learning Management Systems (LMS) were created, including Blackboard and WebCT. These platforms transformed online course management by enabling institutions to organize, distribute and track online courses centrally, facilitating access to educational resources for a wider audience (Nouib, 2022).

1.2. The MOOC revolution and the expansion of Mobile Learning

The 2000s witnessed a proliferation of mobile technologies and the advent of Massive Open Online Courses (MOOCs). MOOCs have the potential to bridge the digital divide by providing access to educational resources for students in developing countries where the quality and accessibility of these resources is often insufficient (Ma and Lee, 2019). The proliferation of smartphones and tablets has resulted in the emergence of m-learning (mobile learning), which enables learners to access educational content at any time and in any location.

The advent of platforms such as Coursera, edX, Fun Mooc and Udacity has led to a significant increase in the number of learners worldwide who are able to access high-quality education at no or low cost (Sun et al., 2008). The current decade has witnessed a significant shift in the accessibility of education, accompanied by the emergence of new challenges pertaining to the standardization and quality of online teaching.

Figure 1: Evolution of e-learning

Source: Adapted by the authors

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ISSN : 2658-9311
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Figure 1 illustrates the evolution of e-learning, which originated in the 1960s-1970s. Subsequently, the 1990s saw the advent of learning management systems (LMS) and the Internet, which opened up new prospects for distance learning. In the early 2000s, the emergence of mobile learning enabled learners to access educational resources directly from their mobile devices. The subsequent decade, the 2010s, was distinguished by the expansion of MOOCs (massive open online courses), which significantly increased access to education on a large scale. Subsequently, from 2020 onwards, the integration of artificial intelligence (AI) commenced a further transformation of the e-learning landscape, introducing advanced technologies to personalize and enhance the learning experience.

1.3. Evolution of digital technologies

The last decade has seen a massive adoption of e-learning, exacerbated by the COVID-19 pandemic. This global crisis led to the widespread interruption of various activities, particularly in the field of education. This period highlighted inequalities in access to digital technologies, exacerbating educational disparities between different regions of the world (Abad-Segura et al., 2020). Nevertheless, e-learning today is moving towards more personalized and adaptive learning methods, integrating advanced technologies such as artificial intelligence (AI) to deliver tailored educational experiences. The automation of educational tasks and the analysis of learner data now make it possible to tailor educational content to individual needs, while identifying potential barriers to the adoption of these technologies.

The advent of modern technologies, including artificial intelligence (AI) and adaptive learning, has transformed e-learning, making it more personalized and accessible. Nevertheless, the implementation of these technologies in the education system has not been without its difficulties, not least because of the resistance they have encountered. Despite the rapid integration of these technologies, facilitated by their potential to improve learning outcomes, the transformation still faces considerable challenges. These include inequalities of access and the reluctance of users to fully embrace these innovations (Sun et al., 2008; Mhlongo et al., 2023; Srivastava and Dey, 2018).

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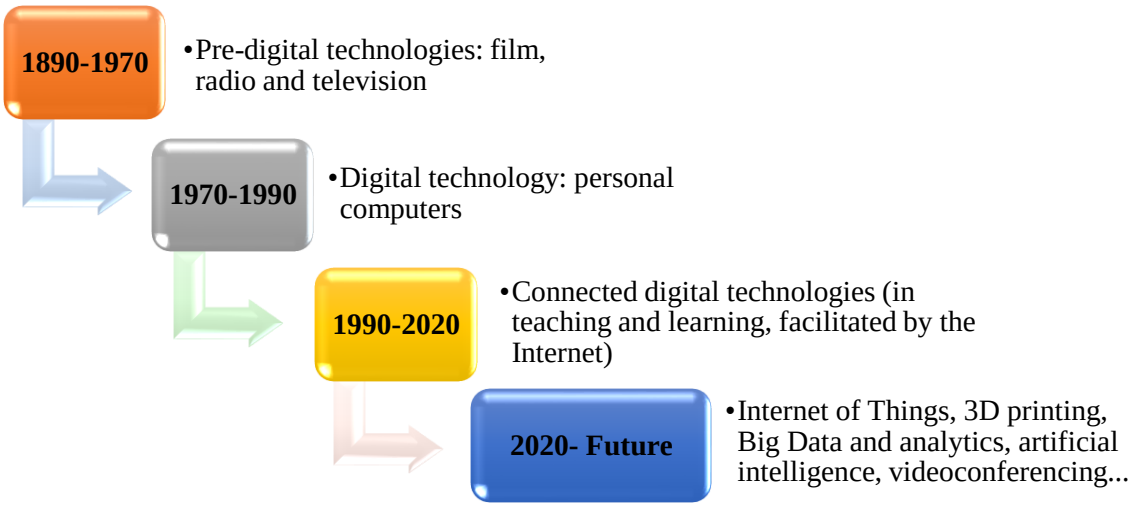
Figure 2 : Evolution of digital technologies



Source : Developed by the authors

Figure 2 provides a visual representation of the evolution and trends in digital technologies, with a particular emphasis on developments in the 2020s and beyond. Nevertheless, it is notable that innovations have been observed throughout the other periods. In the transition to emergency distance learning, digital learning platforms have played an important role as tools supporting distributive cognition, synchronous teaching, communication and storage of digital learning resources for asynchronous access.

The evolution of digital technologies, as illustrated in Figure 5, has progressed from pre-digital technologies (such as film, radio and television) to digital technologies (such as the personal computer), to connected digital technologies (facilitated by the internet), and finally to niche and emerging technologies (such as the Internet of Things (IoT), 3D printing, big data and analytics and artificial intelligence (AI)). The advancement and development of these technologies has been driven by a number of key catalysts, including:

- The contextual challenges that have necessitated the adoption of smart digital technologies in education to address societal issues.
- The potential opportunities that can be unlocked by integrating smart digital technologies into the discourse of teaching and learning.
- The likely adoption of these opportunities to improve student understanding and academic performance.
- The prospects for creating and sustaining an ecosystem of ubiquitous, high-quality, affordable and accessible education.

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2. Key definitions of E-learning

E-learning represents a contemporary form of distance learning, whereby training or learning materials are conveyed via the Internet or an intranet to learners situated at a distance. E-learning is defined as a pedagogical process that provides online learners with access to a diverse range of resources, including teachers, fellow learners, and a variety of content such as readings and exercises, regardless of time and location (Xu & Jaggars, 2013).

The term 'e-learning' is defined as 'learning using electronic technologies'. It can be used as a medium for the distribution of teaching materials or as a complex tool for the creation of interactions between students or between students and teachers. In the academic context, e-learning is typically regarded as a means of delivering courses at a distance via the Internet (Poelmans et al., 2008; Sguassero, 2013).

The concept of e-learning has evolved significantly over the past few decades, and the definition of e-learning varies considerably depending on the context, the author, and the discipline in question. The objective of this section is to examine the various definitions and perspectives on e-learning, with a particular focus on the key aspects of the concept.

2.1. Historical and fundamental definitions

E-learning is generally defined as the use of information and communication technologies (ICT) to provide distance learning programs, allowing flexibility in terms of time and place.

Cisco Systems (2001) describes e-learning as “Internet-enabled learning”, where components include content delivery in multiple formats, management of the learning experience, and an interconnected community of people for learning.

According to Kelly & Bauer (2003), e-learning is web-based learning using communication, collaboration, knowledge transfer and web-based training to add value to individuals and organizations. Anderson, quoted by Moore and Ojedokun (2003), points out that e-learning tools enable learning to be accessed anytime, anywhere, accelerating productivity gains by making education more accessible. This definition highlights the temporal and geographical flexibility offered by e-learning, which is particularly relevant in a global context where distance learning is increasingly necessary.

Engelbrecht (2005) defines e-learning as the delivery of learning materials via electronic media such as the Internet, intranets, extranets, satellite broadcasting, audio/video tapes, interactive television and others. Sun et al (2008) state that e-learning is based on the use of telecommunication technologies to provide information for educational and training purposes.

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This definition highlights the importance of technology in the dissemination of knowledge and interaction between learners and teachers.

According to Boateng et al (2016), e-learning facilitates access to educational resources, thereby enhancing teaching and learning. It is often used interchangeably with terms such as "web-based learning", "digital learning", and "computer-assisted teaching" (Ruiz et al., 2006). Barteit et al. (2020) define e-learning as the use of computer technology to deliver training, including technology-supported learning, online or offline. This view emphasizes the flexibility and accessibility of learning, essential features for modern educational environments.

Online learning is transforming higher education through the use of disruptive technologies (Jones-Esan, 2023). This teaching modality has become increasingly important in recent decades. It has been a differentiating tool for many universities because it is student-centered, uses technology-based interactive methods and gives students easier access to information (Zhang et al., 2023). E-learning enables synchronous or asynchronous learning, anywhere, simply by having access to the Internet (Fabriz et al., 2021). E-learning has evolved in different ways in different countries around the world (Martinez-Garcia et al., 2023).

2.2. Typologies and variations in terminology

The literature presents a multitude of terms associated with e-learning, each with specific nuances that warrant further examination. For example, the term "m-learning" (mobile learning) is used to describe learning facilitated by mobile devices, such as smartphones and tablets. This approach enables users to access educational content from any location (Sun et al., 2008). MOOCs (Massive Open Online Courses) represent a further form of e-learning, offering free courses accessible to a wide audience via the Internet (Sun et al., 2008). Furthermore, definitions may vary according to the context of application. For instance, e-learning is frequently linked with asynchronous and synchronous methods of interaction with students, which help to overcome temporal and geographical constraints (Hung et al., 2024).

Despite several decades of e-learning practice and development, the landscape of stakeholders remains highly diverse, encompassing individuals with varying levels of experience and expertise. Indeed, in recent years, numerous acronyms and anglicisms have emerged and become confused with one another. This diversity is reflected in discussions, where clichés, preconceived ideas and sometimes complex theories are frequently intermingled, often characterized by the use of English neologisms that are not always accessible to all (Poncin, 2022).

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Despite the proliferation of trade shows devoted to the digitalization of training, it remains challenging for a training manager to navigate the multitude of terms and solutions on offer. This situation serves to illustrate the diversity of definitions and practices that are in evidence within the e-learning field. In order to clarify the diversity of terminology employed in this field, the following table provides a comparison of the most commonly used terms and their specific definitions.

Table 1 : Comparison of the main e-learning definitions and terminologies

Semantic used	Definition	Reference
E-learning	Learning using digital devices, mainly via the Internet. Often synonymous with online or electronic learning.	Alam et al. (2023), MDPI
E-training	Training based on Information and Communication Technologies (ICT) and the Internet.	Asatsop-Nganmini (2009)
Distance learning	Knowledge transmission without direct physical interaction between teachers and learners.	Park et al. (2014), Emotions, Technology, Design, and Learning
Open training	Training system allowing continuous enrollment and completion, with no constraints other than technical ones.	Patru et Khvilon, (2002). Document de programme et de réunion. UNESCO.
Distance education	Training allowing individuals to learn without the physical presence of a trainer, often synonymous with remote learning.	Merchant et al. (2014), Computers & Education
Open Distance Learning (ODL)	Combination of open and distance training, offering flexibility in access and learning methods.	Plateau, J.-F. (2018). Revue Doctorale
LMS Platform (Learning Management System) or e-learning platform	Software integrating a set of features used during distance learning. Some solutions are open source (e.g., Moodle, Claroline), while others are proprietary and paid (e.g., 360Learning, Crossknowledge).	Poncin (2022)
Mobile learning	Training designed for learning on a smartphone or tablet.	Poncin (2022)
Massive Open Online Course (MOOC)	Online courses open and accessible to all. MOOCs are hosted on platforms such as FUN.	Poncin (2022)

Source : Developed by the authors

2.3. The impact of the COVID-19 pandemic on e-learning

Martin et al (2019) define e-learning as the use of the Internet to access learning materials; interact with knowledge and learners; obtain support in the learning process; and create personal

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meaning and successful learning experiences. Online teaching and learning is part of an educational process that takes place via the Internet, which is the medium of distance teaching and learning for teachers and learners in various locations (Kim & Asbury, 2020). Prior to the COVID-19 pandemic, e-learning was often perceived as a non-formal activity. However, as soon as containment began, it became a necessity to maintain the continuity of the education system virtually (Mishra et al., 2020).

This rapid transition led to the emergence of numerous online educational applications, such as Neo, Zoom, Google Classroom, and many others, which played a crucial role during and after the pandemic (Mishra et al., 2020). However, this move towards e-learning has not been without its challenges. Many teachers have had to adapt their traditional face-to-face teaching to an online environment, often without adequate preparation or sufficient technological support, raising additional challenges for learners and instructors alike (Simamora, 2020; Hixon et al., 2012).

Table 2 : An overview of the evolution of scientific production on E-learning

Period	Main Themes and Focus	Key Findings and Developments	References
1970s-1980s	Initial exploration of distance and computerized learning.	Focus on teaching processes and the role of technology in education.	Hofstetter (1985)
1990s	The emergence of the internet enhances e-learning capabilities.	Research on instructional design and usability of online courses.	Webster and Hackley (1997), Haynes and Dillon (1992)
Early 2000s	Expansion of e-learning topics to include efficiency and satisfaction.	Growth in the number of publications and broadening of research themes.	Rodrigues et al. (2019), Bai et al. (2021)
Late 2000s	Shift in focus towards pedagogical approaches and learning outcomes.	Identification of critical factors for e-learning success.	Sun et al. (2008), Tzeng et al. (2007)
2010s	Influence of social media, mobile learning, and virtual reality.	Rising influence of social media and mobile learning on e-learning.	Hwang et al. (2022), Tzeng et al. (2007)
COVID-19 Era	Forced adoption of e-learning strategies due to the pandemic.	Significant increase in e-learning research due to the effects of the pandemic.	Brika et al. (2022), Fauzi (2022)

Source : Martinez-Garcia, A., Horrach-Rossello, P., & Mulet-Forteza, C. (2023). Evolution and current state of research into E-learning. Heliyon, 9, e21016. Disponible en ligne le 13 octobre 2023.

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2.4. E-learning in a context of innovation

The adoption of online learning is predicated on an innovation-driven logic and is regarded as a novelty that offers significant benefits to potential users (Njenga, 2011). Its success is contingent upon a learning culture that is both individual and organizational, integrating innovative pedagogical practices, continuous teacher training, and active support for the integration of ICT across disciplines. This culture also fosters interdisciplinary approaches, redefined evaluation methods, and extensive collaboration with external partners (Schulz-Zander, 2004). However, this transition entails significant challenges, particularly in terms of quality, delivery modes, accountability, and required competencies.

Teachers are expected to actively engage learners to prevent isolation and discouragement, but this involvement increases their workload (Connolly & Stansfield, 2007). Moreover, resistance to change, frequently encountered in the face of transformations perceived as disrupting the status quo or potentially impacting individuals, represents a significant barrier that can undermine the success of initiatives, despite their advantages (Lippert & Davis, 2006).

3. E-learning challenges in higher education

B The adoption of e-learning in higher education institutions presents significant opportunities, but also many challenges, particularly in developing countries. Understanding these challenges is essential to adapting implementation strategies to these specific contexts. The essential components of e-learning, such as computers, electricity and technical skills, are often lacking in these countries (Babu & Reddy, 2015 ; Heeks, 2002 ; Rajesh, 2003). What's more, the active, participative student, essential for interactive learning, is rare in contexts where teaching remains largely didactic (Andersson et al., 2009 ; Evans, 2005; Sehrt, 2003 ; Eastmond, 2000).

- **Lack of technical and institutional support:**

Teachers in higher education institutions frequently report technical problems, such as unstable Internet connections and the absence of technical staff dedicated to digital content creation (Bouyzem and Al Meriouh, 2019). Added to this is insufficient institutional support, which translates into a lack of valorization of digital educational production, a deficit of incentives for teachers, as well as a lack of ethics to protect intellectual production (Garrison and Kanuka, 2004).

In addition, inadequate management and the absence of clear policies within higher education institutions are significant obstacles. In countries such as Iran and Namibia, problems of corruption and mismanagement hamper the effectiveness of e-learning (Shahmoradi et al.,

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2018). For e-learning to truly flourish, it is crucial to establish robust educational policies and strengthen the management of technological resources in institutions.

- **Communication issues and resistance to change:**

The lack of communication around e-learning manifests itself in the absence of a clear strategy and adequate awareness (Ajhoun and Daoudi, 2018). This gap is exacerbated by a resistance to change among teachers, who find it difficult to modify their professional habits to integrate new pedagogical technologies (Garrison and Kanuka, 2004).

- **Lack of regulation and sharing culture:**

The lack of a legal framework for the adoption of e-learning further complicates its integration into schools (Nguyen et al., 2020). In addition, the culture of sharing remains weak, with teachers reluctant to make their courses available online, often for fear of losing control over their teaching materials (Kenan et al., 2013).

- **Lack of training and IT skills:**

Lack of teacher training is another major obstacle. Many teachers have not received the training they need to use e-learning systems effectively (Tarus et al., 2015). This lack of skills, combined with poor computer literacy, limits their ability to adopt these tools effectively (Bouyzem and Al Meriouh, 2019).

- **Challenges specific to students and the e-learning culture:**

Student-related issues include a lack of awareness of the benefits of e-learning and high rates of massification and repetition (Owens and Price, 2010). Lack of e-learning culture is also a concern, with misinformation about online pedagogical practices and confusion between e-learning and mere digital content distribution (Mulhanga and Lima, 2017).

- **Infrastructure and economic challenges:**

Infrastructure challenges are particularly pronounced in countries such as Ghana, where insufficient technological infrastructure hinders e-learning adoption (Boateng et al., 2016). Finally, economic challenges such as the high cost of software and irregular power supply represent significant barriers to equitable access to the tools and infrastructure needed for effective e-learning (Aboderin, 2015).

- **Cultural and social challenges:**

Cultural and social constraints also play a crucial role in the adoption of e-learning, particularly in developing countries. Computer illiteracy, language barriers and a lack of e-learning resources all limit the use of ICT in education (Mulhanga and Lima, 2017). These challenges

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are particularly pronounced in Africa, where economic and social inequalities exacerbate difficulties in accessing online education (Kenan et al., 2014).

- **Lack of in-service training and pedagogical support:**

The lack of in-service training for teachers remains a major challenge to the effective integration of e-learning. Teachers need regular training to familiarize them with new technologies, as well as to develop pedagogical skills adapted to online teaching. This need is particularly crucial in a context where educational technologies are evolving rapidly and traditional teaching methods need to be adapted to meet the demands of e-learning (Tarus et al., 2015).

- **Economic challenges and unequal access:**

Economic challenges are pervasive in many developing countries, where high software costs and irregular power supplies pose significant problems (Aboderin, 2015). These factors contribute to widening inequalities in access to educational technologies, making e-learning unequally available to students from disadvantaged backgrounds. As a result, investing in robust infrastructure and ensuring equitable access to digital tools is essential to enable all students to reap the full benefits of e-learning.

- **Educational equity and inclusion:**

Educational equity represents a crucial challenge in the adoption of e-learning, particularly in contexts where economic and social disparities are pronounced. Not all students have equal access to the technologies needed to take online courses. Differences in access to the Internet, computers and online educational media create profound inequalities, compromising teaching and learning for the most disadvantaged students (World Bank, 2020). This situation underlines the importance of inclusive policies that guarantee equitable access to educational technologies for all students.

- **Impact of the COVID-19 pandemic on e-learning:**

The COVID-19 pandemic has amplified existing challenges and created new ones. Educational institutions were forced to move rapidly to e-learning, often without adequate preparation or sufficient resources (Murgatrotd, 2022). This sudden change has highlighted the inadequacy of infrastructures and the lack of preparation of education systems for large-scale adoption of e-learning. In Morocco, for example, technological infrastructures and teachers' digital skills have been put to the test, revealing significant gaps in training and institutional support (Ajhoun & Daoudi, 2018).

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Table 3 : E-learning challenges by country

Country	Challenges	References
Morocco	Inadequate technological infrastructure, lack of technical and institutional support, insufficient IT skills	Ajhoun et Daoudi (2018) ; Bouyzem et Al Mériouh (2019) ; Oulamine el Al. (2024 et 2025).
Vietnam	Technological and infrastructure limitations, insufficient training for teachers and students	Nguyen et al. (2020)
Spain	Difficulty in using online platforms, low confidence in technology	Dulsat and Alvarez (2020)
Ghana	Insufficient technological infrastructure, need for adequate training for teachers and students	Boateng et al. (2016)
Saudi Arabia	Limited adoption of ICT despite government investments	Qahmash And Jabli (2013)
Nigeria	Technological infrastructure issues (unstable Internet, power outages, lack of equipment)	Aboderin (2015)
Africa	Cultural, political, and economic constraints, computer illiteracy, language barriers	Mulhanga and Lima (2017); Kenan et al. (2013)
Iran and Namibia	Issues of corruption and mismanagement hindering e-learning effectiveness	Shahmoradi et al. (2018); Mwandosya et al. (2018)

Source : Developed by the author

4. E-learning in Moroccan higher education

The evolution of e-learning in Morocco can be delineated into three principal phases. The initial phase, spanning from 1997 to 2004, saw the advent of e-learning, characterized by a multitude of disparate initiatives, frequently in collaboration with international partners. These included the PRICAM, EUMEDIS and AVICENNES projects, which sought to integrate ICT as a conduit for communication and the dissemination of knowledge (Ajhoun et Daoudi, 2018).

The second phase, spanning the period from 2005 to 2010, witnessed the emergence of numerous nationwide initiatives, including the Moroccan Virtual Campus (CVM) and the Pedagogical Resource Centers (CRUs). These projects were conceived with the objective of facilitating the production of educational content and fostering the long-term sustainability of e-learning. During this period, collaboration with international organizations, such as the AUF, enabled Hassan II University to launch a Master's degree program in Education and Training Engineering and Technology.

The third phase, spanning the period from 2010 to 2016, saw the maturation and professionalization of e-learning, with increased adoption and growing interest in blended learning approaches. The National Distance Learning Barometer indicates that in 2016, 18% of

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Moroccan institutions adopted blended learning, signifying a notable transformation in training practices. Despite the advancements in e-learning, it continues to encounter administrative and human constraints, particularly the reluctance of educators to embrace MOOCs (Ajhoun et Daoudi, 2018). Table 4 indicates the main phases of e-learning in Morocco.

Table 4: Phases of E-learning in Morocco

Phase	Description	Projects/Initiatives	Results
Birth of E-learning (1997-2004)	Initial integration of ICT with scattered initiatives.	PRICAM, EUMEDIS, AVICENNES, FORCIIR	Improvement in education and production of pedagogical resources
Project Proliferation (2005-2010)	Structuring and creation of CVM and CRUs, and reinforcement of international collaborations.	CVM, CoseLearn, Hassan II Diploma	Promotion of e-learning, establishment of pedagogical resources
Moving Towards Maturity (2010-2016)	Exponential growth, adoption of MOOCs, and strategic initiatives to enhance education.	MOOCs, ITQANE, GENIE	Adoption of MOOCs, large-scale training of educators, improvement of technological framework

Source: Ajhoun and Daoudi (2018)

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Conclusion

This article has established the theoretical foundations essential to understanding the complex dynamics associated with the adoption of e-learning, particularly in the context of higher education. We have examined the historical evolution and expansion of e-learning, as well as the challenges and resistance encountered when integrating these technologies into educational environments.

Examining the evolution of e-learning revealed the significant impact of the COVID-19 pandemic, which acted as a catalyst for the mass adoption of e-learning technologies. This global crisis highlighted not only the opportunities offered by e-learning, but also the many shortcomings and challenges associated with this rapid transition. Educational institutions, forced to adapt to a new reality, have seen e-learning evolve from a mere adjunct to a central pillar of modern education.

This preliminary exploration sets the scene for a more in-depth analysis of the specific obstacles to the adoption of e-learning. Understanding the theoretical underpinnings and resistance identified will enable us to address the challenges facing higher education institutions in a more targeted way. It is imperative to reinforce educational policies and surmount resistance to change in order to guarantee the effective integration of digital technologies, particularly in countries where resources are limited. These findings provide a foundation for future research into the sustainable and equitable adoption of e-learning.

Funding

This study was not funded.

Conflict of Interest

The authors declare that there is no conflict of interest.

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