T I E Journal
Volume 4 Issue 2, 2026
http://ijtie.com/v402/n40264
ISSN: 2820-7521

The International Journal of Technology, Innovation, & Education

Bridging Tradition and Innovation: University Teachers' Views on E-Learning Adoption in Moroccan Engineering Education

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Received: April 20, 2026; **Accepted**: May 25, 2026; **Published**: June 07, 2026

Abstract

The integration of pedagogical and technological innovations has significantly reshaped teaching and learning practices in higher education (HE). E-learning, as a modern educational approach, has gained increasing prominence in engineering education and has become a central area of research in educational technology over the past decades. This study explores Moroccan university teachers' attitudes towards the integration of e-learning technologies in engineering departments. A qualitative research method was adopted, employing semi-structured interviews to gain in-depth insights into participants' perceptions and experiences. The data focused on concrete experiences related to the adoption of e-learning in Moroccan engineering education, specifically targeting participants' attitudes toward its application, as well as their perceptions, opinions, and preferences regarding learning technologies. The collected data were analyzed using content thematic analysis, which enabled the identification of key themes and recurring patterns in teachers' views. The findings indicate that teachers generally hold favorable attitudes towards e-learning. However, several challenges were reported that hinder the effective use and integration of these technologies in engineering education.

Keywords: e-learning, ICT, Moroccan higher education, engineering education, teachers' attitudes

1. Introduction

In recent years, the world has rapidly evolved into a global digital village, with Information and Communication Technologies (ICTs) playing a central role in this transformation. The development of these modern communication tools has led to significant changes across various

Hanni, K. (2026). Bridging tradition and innovation: University teachers' views on e-learning adoption in Moroccan engineering education. *The International Journal of Technology, Innovation, and Education, 4*(2), 266–293. https://ijtie.com/v402/n40264

sectors, including education. The traditional modes of teaching are increasingly seen as insufficient to meet today's learners' needs and to keep pace with social and academic developments (Selwyn, 2012).

The profound impact of globalization and the information revolution has positively influenced teaching perspectives. These factors have made the integration of ICTs a necessity in educational curricula to ensure the quality of the teaching-learning process and to adapt to rapid changes. According to Bates (2015), since the late 20th century, higher education worldwide has undergone a major shift, positioning ICTs as essential for academic and professional success, especially as many employment opportunities in the modern economy require digital literacy.

This era of rapid evolution is viewed differently by various groups; some perceive it positively, while others focus on its challenges. Thus, education remains a crucial driver of this change (Selwyn, 2016). Among the important ICT tools is e-learning, a contemporary teaching approach described by Clark and Mayer (2016) as "learning delivered or enabled by electronic technologies, which has the potential to transform how content is delivered to learners." (p. 8). In response, many developed countries have begun preparing their societies for the digital revolution by integrating e-learning into their education systems to enhance teaching and learning quality. However, a key question remains: Is e-learning truly effective? Evaluating its effectiveness is closely linked to understanding participants' attitudes, perceptions, expectations, and satisfaction. To explore this, the present study adopts a qualitative research approach, employing semi-structured interviews to gain in-depth insights into Moroccan university teachers' perceptions and experiences regarding e-learning adoption in engineering departments. The study focuses on teachers at the National School of Applied Sciences (ENSA) and the Moroccan School of Engineering Sciences (EMSI) in the city of Marrakech.

1.1. Statement of the Problem

The research problem addressed in this paper was to determine the successful implementation of e-learning to attain high standards in teaching engineering education within Moroccan HEIs, seeing that the 21st century is characterized as being the age of modern information technology (IT), in which learning has begun relying on the employment of digital tools. The study needs diverse elements to be taken into consideration, involving those linked to technology, institution, and culture. Thus, students at higher educational institutes are assumed to be armed with the basic digital skills to comfortably use e-learning in engineering education.

This study aims to offer a comprehensive portrayal of the issue of e-learning adoption and application among the departments of engineering within Moroccan higher educational institutions. Moreover, it tries to identify the potential benefits of employing e-learning technology for the students and the educators so as to realize high standards of educational outcomes, which prepare students well for success in the future.

1.2. Rationale of the Study

Due to the continuous growth of ICTs, this research aims to examine the current state of e-learning technology in Moroccan tertiary education. More than that, it aims at shedding light on the latter's effects on scientific education, particularly in the fields of engineering, between those who support the adoption of e-learning and those who refuse educational technology.

This study attempts to evaluate the impact of implementing e-learning in higher education. It highlights the significance of e-learning by following the previous efforts of some prominent countries in the educational arena so as to enhance its quality. In addition to that, it presents a guideline for integrating e-learning in Moroccan higher engineering education. Also, it puts emphasis on the aspects that require development and advancement within HE, with more emphasis on the instructors' awareness of e-learning technology. Actually, the research findings may provide relevant groundwork for better application of e-learning, which results in a high quality of the Moroccan higher education system.

1.3. Purpose of the Study

The study aims to investigate the integration of e-learning in Moroccan higher education institutions as a mechanism that enhances the quality of engineering education. Notably, the present study attempts to identify the barriers that impede the use and adoption of e-learning technology by the lecturers, and thus to determine the major impediments that hinder its effective implementation. The general purpose and motive for this study stem from the fact that research in the field of e-learning in higher education is quite restricted in Morocco. Therefore, the present study seeks to develop a comprehensive framework that will eventually lead to the effective implementation of e-learning in HE settings. Moreover, the study also focuses on the benefits and drawbacks of adopting e-learning for teaching and learning engineering. The principal objectives of the present research are:

- To identify the usefulness of implementing e-learning technology in the departments of engineering in Moroccan HEIs.

- To assess the lecturers' levels of employing technology for learning objectives.
- To investigate the current state of ICT and e-learning in some Moroccan higher engineering institutes.
- To determine the factors influencing the successful implementation of e-learning.

1.4. Research Questions

To ensure a clear analytical framework, the study is driven by a series of research questions that explore the core dimensions of the phenomenon under investigation.

- **RQ1:** How do Moroccan university teachers perceive the integration of e-learning technologies in higher engineering education?
- **RQ2:** What educational benefits and opportunities do teachers identify in the implementation of e-learning in engineering teaching and learning?
- **RQ3:** What challenges or limitations do teachers associate with the adoption of e-learning in higher engineering education?

2. Literature Review

2.1. E-Learning in Higher Education: Concepts and Context

The emergence of e-learning has fundamentally transformed educational practices by expanding access to knowledge and reshaping the roles of both instructors and learners. While e-learning is widely used in various contexts, scholars continue to debate its exact definition due to its evolving nature and multifaceted applications (Moore, Dickson-Deane, & Galyen, 2011). One broadly accepted definition is that e-learning refers to the use of digital technologies, particularly the internet, to facilitate learning beyond the traditional classroom (Anderson, 2008).

Garrison and Vaughan (2008) define e-learning as a model that enables both synchronous and asynchronous learning interactions, emphasizing flexibility and learner autonomy. In this model, the digital environment supports a learner-centered pedagogy where the role of the instructor shifts from knowledge transmitter to facilitator and guide (Laurillard, 2012).

E-learning is particularly significant in higher education, where it is often used to supplement or replace conventional methods. According to Salmon (2013), online learning environments offer numerous advantages, including self-paced learning, resource accessibility, and increased interaction through collaborative tools. These environments also present challenges, such as

digital divide issues, the need for technological literacy, and the risk of reduced engagement without proper instructional design.

In the context of engineering education, the integration of e-learning technologies supports interactive simulations, remote labs, and collaborative design projects, which align with the practical and problem-solving nature of the discipline (Ullah, 2016). Rather than replacing traditional methods, e-learning complements them by creating more dynamic, inclusive, and adaptable learning experiences.

The shift to e-learning has also prompted a reevaluation of instructional roles. Bates (2015) emphasizes that the educator in digital settings must design learning pathways, select appropriate technologies, and continuously adapt to the learners' needs. In this framework, the teacher acts as a co-learner and facilitator, promoting learner agency and critical thinking.

Ultimately, e-learning is not merely a technological advancement but a pedagogical innovation that reshapes how knowledge is constructed, shared, and applied in the digital age. Understanding how university teachers perceive and adapt to this innovation is crucial, particularly in engineering education, where technological fluency is both a teaching tool and a learning outcome.

A central issue in current educational discourse is the growing recognition of e-learning as a promising complement—or in some cases, an alternative—to traditional methods of instruction. E-learning promotes learner-centered approaches by encouraging active engagement, collaboration, and autonomy. Rather than relying solely on instructor-led delivery, this model allows learners to take greater responsibility for constructing knowledge and developing essential competencies such as critical thinking, communication, and problem-solving. In this context, the teacher's role shifts toward that of a facilitator who supports and guides learners in navigating digital environments and managing their own learning trajectories.

2.2. Core Dynamics and Functionalities of E-learning Environments

E-learning is characterized by its flexibility, accessibility, and interactivity, making it a powerful tool for enhancing teaching and learning in higher education. One of its defining features is the capacity to deliver content asynchronously or synchronously, allowing instructors and learners to engage with materials and each other across time and space (Hrastinski, 2008). Platforms such as Moodle, Canvas, and Microsoft Teams support a wide range of functionalities—from sharing lecture content and administering assessments to

enabling real-time collaboration through video conferencing and discussion forums (Al-Fraihat et al., 2020). These platforms are designed not only to replicate classroom dynamics but also to enrich them. Teachers can use built-in tools for grading, feedback, and communication, while learners can access course materials, submit assignments, and interact with peers and faculty. This facilitates a more learner-centered environment where autonomy and self-regulation are emphasized (Littlejohn & Pegler, 2007). Additionally, learning analytics tools embedded in these systems allow instructors to monitor student engagement and adapt instruction accordingly, making the teaching process more responsive and personalized.

Effective e-learning environments integrate pedagogical strategies with technology to foster engagement and support diverse learning styles. Features such as adaptive content delivery, multimedia integration, and collaborative tools contribute to a richer educational experience, particularly in technical fields like engineering, where simulation, design software, and interactive models are essential (Zawacki-Richter et al., 2019).

2.3. Navigating the Promises and Pitfalls of Digital Learning in Higher Education

E-learning offers a variety of pedagogical and logistical benefits for both learners and instructors in higher education. For teachers, it enables flexible scheduling, the ability to deliver content remotely, and the opportunity to engage with students across multiple modalities. Instructors can facilitate learning from different locations, integrate multimedia resources, and tailor feedback to individual learners, which enhances the overall quality of instruction (Bozkurt et al., 2020). For learners, e-learning provides continuous access to course materials, self-paced learning, and opportunities for collaboration in digital environments. This flexibility is particularly beneficial in disciplines such as engineering, where students often balance rigorous coursework with project-based activities. However, the shift to digital instruction also brings a set of challenges. One major concern is the digital divide: access to reliable internet and adequate digital devices is not always guaranteed, especially in under-resourced educational contexts (OECD, 2021). Moreover, some instructors may lack the necessary training to effectively integrate digital tools into their pedagogical practices, which can hinder the potential of e-learning environments (Baran, Correia, & Thompson, 2011).

Additional limitations include reduced opportunities for spontaneous interaction, the absence of nonverbal cues, and the potential for feelings of isolation among both learners and educators. These issues can affect motivation, engagement, and the perceived “human” aspect of teaching

(Cleveland-Innes & Wilton, 2018). Technical difficulties, whether related to platform usability or connectivity issues, can also disrupt the teaching-learning process and contribute to frustration.

Despite these challenges, most educators agree that the thoughtful integration of e-learning can enhance the effectiveness of instruction when it complements rather than replaces face-to-face interaction. Addressing its limitations through professional development, investment in infrastructure, and pedagogical support is essential for maximizing its benefits.

3. Materials and Methods

This study employed a qualitative approach to investigate the perceptions of university instructors regarding the use of e-learning in Moroccan engineering education. Sixteen faculty members from two engineering institutions in Marrakech, the National School of Applied Sciences (ENSA) and the Moroccan School of Engineering Sciences (EMSI), were purposively selected based on their experience with e-learning.

Data were gathered through semi-structured interviews, which were conducted in person, recorded with consent, and transcribed for analysis. Thematic analysis was used to identify recurring patterns and insights related to the perceived benefits, challenges, and pedagogical impacts of e-learning integration in engineering courses. Correspondingly, interviewees were required to answer the following set of questions:

- **RQ1.** Would you mind if we talk about your experience of employing modern computer technology in teaching engineering?
- **RQ2.** What kind of benefits can professors receive from employing e-learning in teaching engineering?
- **RQ3.** What are the challenges and obstacles that hinder the successful integration of e-learning in higher education?
- **RQ4.** Do you suggest additional recommendations or propositions about the practicality of electronic learning in the department of engineering?

4. Results

The researchers conducted interviews with sixteen university instructors from both public and private engineering institutions in Marrakech, Morocco. Participants are referred to as T1, T2, … T16, while “Pub” and “Pvt” denote public and private institutions, respectively. Participants were selected purposively to provide diverse perspectives on the use of e-learning in

engineering education. The sample included faculty members with varying levels of experience and different academic ranks to ensure a comprehensive understanding of the subject. Responses from these semi-structured interviews were analyzed qualitatively through thematic content analysis to identify key themes emerging from the participants' perspectives.

4.1. Key Factors Affecting ICT Adoption in Engineering Education

The first question aims at exploring the participants' experience of Information and Communication Technologies (ICTs) in teaching engineering. Indeed, talking about their experiences is of paramount importance since teachers are the driving force in creating change in education by the effective and efficient integration of ICT into classroom settings. During the coding and data analysis process, the researcher recognized that faculty experience with ICT is characterized by factors that emerged as themes. These themes were synthesized, and three significant themes were developed as follows:

- Lack of ICT skills
- Lack of training
- Attitudes towards ICT

4.1.1. *Lack of ICT Skills*

Participants' responses in terms of their experience with ICT demonstrated a lack in terms of digital skills, which is a critical component in the effective implementation of e- learning in education. Although the majority of the interviewees (87.5%) claimed to be able to use a computer and surf the Internet, they still do not know how to integrate technology to transfer the pedagogical content. A male university teacher referred to his low level of ICT skills as follows:

> *While I was trained to be a teacher back in the 1990s, I was never taught how to use ICT in teaching. I do not possess the right skills to incorporate ICT tools in my lessons. Lack of digital competence is my problem.* (PubT#2)

The respondent clearly stopped at the main reason behind his disability to incorporate ICT in his teaching process. For him, the teaching, training, and practicums were an opportunity to learn pedagogies and strategies, not ICT. In the same vein, a female respondent added:

> *My ICT skills are very basic to the extent that I lack the self-confidence to apply them in my pedagogical practices. However, I do really believe that it is a potential tool to improve the quality of education.* (PubT#6)

Due to the lack of technological competence, university teachers find it hard to use ICTs in the classroom and therefore contribute to the effective implementation of e-learning in education. However, although they lack adequate skills to use ICT tools in their lessons, some teachers showed their willingness to adopt e-learning if they receive training that enhances their digital skills and performance. In this regard, one of the interviewees explained:

> *I do not mind using ICT in the classroom. In fact, ICT enhances interaction and increases students' engagement and motivation to learn. However, I do not possess the necessary skills to incorporate it into my classes. I would like to be trained so that I can be 100% confident and then use it as a teaching tool.* (PvtT#11)

This is an indication that the teachers' skills relate directly to their self-confidence, which implies that teachers' lack of technological skills becomes a critical barrier preventing them from using ICT in educational settings.

4.1.2. *Lack of ICT Training: A Real Hindrance*

Some interviewees (35%) referred to their negative experience with ICT due to the lack of training and workshops on ICT use in teaching. They explained that they have not been trained to use developed technology in the classroom, and that they need to be equipped with the digitally based teaching competencies and experience. Three teacher participants responded as follows:

> *I do not have enough skills to use ICT, and I need training on how to use the tools or something like that.* (PvtT#13)

> *Yes, I know how to use a computer, but so far, I have not yet been trained to use it for educational purposes.* (PubT#7)

> *I need to be trained first and then use ICT tools to impart knowledge. To be honest, I do not feel confident using technology, especially when dealing with the Net generation.* (PubT#4)

Obviously, the reason for not integrating ICT in their pedagogic practices was due to the absence of practical training sessions and workshops, which, accordingly, results in a lack of knowledge on the application of digital resources and a lack of self-confidence.

4.1.3. *Attitudes towards ICT: Perceptions and Insights*

Integrating e-learning in education depends crucially on the teachers' attitudes and perceptions towards ICTs. In this interview, the participants' responses were classified into two categories:

teachers with positive and satisfactory attitudes towards ICT and others with negative beliefs. 244 It is worth noting that the teachers' attitudes are among the factors that influence the adoption of ICT in teaching. Some interviewees (81.25%) showed strong positive attitudes towards ICT and its role in facilitating both teaching and learning processes. One of the interviewees explained:

> *Though some of my colleagues find that using ICT in the classroom is time-consuming, I find myself very comfortable when I embed technology in my teaching practices. I no longer take the role of the knowledge producer, but a facilitator and mentor, since the learners take control of the lesson.* (PubT#8)

The interviewee, in this regard, obviously demonstrated the effectiveness of ICT incorporation in changing the teacher's role from a producer of knowledge to a facilitator and advisor. These alternative roles make the learning process more student-centered; the students are more encouraged to participate in the knowledge construction, and they show less consumerism. This implies that using ICT tools as a strategy to execute learning content and components in teaching makes it dynamic for both lecturers and learners. A further comment was elicited from another male interviewee:

> *Actually, as an academically qualified person, the university teacher is expected to embed ICT in teaching since we are living in a world that is determined by technology. For me, ICT makes the learning process easier and more attractive.* (PvtT#10)

Like the previous interviewee, the respondent plainly encourages the use of ICT in academia. He believes that technology has become unavoidable among the 21st-century e-generation, and it has become a prerequisite in both teaching and learning processes, thanks to the advantages it has. Responding to the interview question, another male interviewee claimed:

> *From my point of view, ICT helps teachers teach more confidently. Personally, I can present materials better to my students.* (PubT#3)

ICT has several benefits. According to the interviewee, it helps the teacher audiovisually present materials to the students. It also enables the teacher to gain more self-confidence, self-esteem, and control over the material. In the same context, another interviewee added:

> *Well, I use ICT from time to time when I face problems explaining a new, difficult scientific concept. I actually search for explanatory videos, I choose one that is suitable, and I use it to demonstrate the concept to my students. I believe it is much easier to use ICT in teaching physics.* (PvtT#12)

That is to say, positive attitudes towards e-learning technology directly promote its integration and application in the teaching practice and vice versa. In other words, if lecturers constantly employ ICT facilities to upload their lecture notes, PowerPoint presentations, and assignments, it will positively influence their attitudes towards e-learning technology. That is, positive attitudes of lecturers towards technology significantly affect their use and implementation of ICT tools in their pedagogical practices.

Nonetheless, other teachers prefer to use old traditional approaches due to their lack of motivation, willingness, and readiness towards educational technology. Based on the interview data, some interviewees (18.75%) showed negative attitudes towards the use of ICT in education, which negatively influenced its integration in their classes. Some of them expressed a lack of interest, while others are just resilient to change and not ready to use technology as an educational tool. Lack of interest is echoed across the following cases:

> *Being a teacher, teaching with ICTs is not an easy task; I am not only required to keep myself updated with the rapidly evolving technologies, but I also need to choose and use the appropriate strategies to make sure students are on task when using technology in class.* (PubT#7)

Consistent with the above comment, a teacher of mathematics explained:

> *As a teacher of mathematics, I do not think it is necessary. The nature of the subject I teach contains problems that need clarification through step-by-step solutions. Therefore, the interaction between the teacher and the student is highly recommended. Despite using the traditional "chalk-and-talk" method, I sometimes find it challenging to explain the techniques used in solving these problems… (Pause) I wonder how it would be if I used ICT tools…* (PvtT#16)

A further comment by a teacher who seemed resistant to change:

> *I do not trust digital technology; what if the device I use breaks down? Don't you think that this may affect the lesson time and flow? Technology is great, but it is more of a double-edged sword.* (PvtT#9)

From the responses provided, it seems that the interviewees holding negative attitudes towards educational technology do not believe that ICT has any advantages, neither for them nor for their students. These teachers keep employing traditional methods despite being informed of the importance of ICT in the teaching and learning processes. Unquestionably, teachers'

attitudes are one of the major determinants that promote or deter the integration of ICT in education. Therefore, teachers should develop a positive attitude to contribute to the innovative use of ICT.

Based on these insights, one can deduce that the majority of participants (81.25%) are aware of the importance of ICT, and they even stress its use in education. Besides, many of them can easily use different ICT resources in their teaching practices, particularly when it comes to delivering complex and difficult concepts. Whereas some interviewees emphasize the importance of digital literacy and the way it affects the use of ICT in teaching and learning. They also value the importance of teachers' training for building and improving self-confidence when using such modern tools. Nevertheless, another group of interviewees (the non-user teachers) believes that using ICT for educational purposes is useless and pointless. They think that implementing ICT needs much effort and time; technical issues and effective operation of educational software are also among the concerns of this category of interviews.

4.2. Spectrum of the Benefits of E-learning

The second question examines the benefits that educators can receive from adopting e-learning in teaching engineering. Therefore, the coding and the data analysis process of the interviewees' responses resulted in the emergence of two main themes and sub-themes within each:

4.2.1. *Advocates of E-learning: Appreciation and Adoption*

The participants' responses indicated great appreciation for e-learning technology and its ability to enhance teaching and learning. The categories that were used to develop this theme were flexibility in the teaching process and enhancement of student-teacher interaction.

- ***Student-Teacher Interaction: Rapport-Building***

Student-teacher interaction is an essential prerequisite for a successful e-learning environment. The use of e-learning by faculty members is considered an advantage since it provides them with the necessary tools to smoothly impart knowledge to their students. A teacher participant supports this claim, stating that:

> *The most important benefit of embedding e-learning in education is that it adds vitality to instructor-student interactions. The teachers should not be overly reliant on traditional lecture-based teaching methods. We are dealing with a digital generation that has different expectations about education.* (PvtT#13)

The new role of the instructor is determined by students of the millennial era, students who consider information technology (IT) as a component of their culture and appreciate being taught employing technology-based learning. Consequently, teachers are required to adopt new digital instructional methods to meet their students' needs. One of the interviewees revealed:

> *Well! When I use multimedia learning tools, I notice that my students become more enthusiastic, which allows them to control and manipulate the course content and thus become fully engaged in knowledge construction. Therefore, the teacher becomes a facilitator and a monitor rather than a source of knowledge.* (PubT#2)

The same motivation for using e-learning tools as innovative pedagogical methods to meet the needs of 21st century learners is expressed as follows:

> *Honestly, e-learning requires substantial planning, preparation, and implementation to ensure effective learning. To do so, teachers are required to adjust their instructional practices on a regular basis in order to meet the learners' needs. For me, though it is time-consuming, I find it interesting to know new things and discover new teaching approaches, and share them with my students.* (PvtT#15)

> *The emphasis on the power of e-learning to involve students more in the learning process was echoed by another interviewee, who stated: In fact, I heartily believe that a picture is worth a thousand words. As a teacher, I rely a lot on visual aids simply because they arouse the interest of students as they help the teacher explain the concepts easily and clearly.* (PubT#1)

Based on the responses above, digital content enables teachers to achieve the educational objectives; it also enhances the students' learning outcomes since it has the power to facilitate dynamic learning that is more entertaining than traditional methods.

- ***Flexibility of Course Delivery: New Prospects***

Another benefit of e-learning, according to the interviewees makes both the teaching and learning processes more effective through its flexibility of course delivery. E-learning provides teachers and learners with easy access to educational resources regardless of time and space constraints. This is evidenced by two teacher participants who claimed:

> *E-learning has the power to make learning occur anytime, anywhere. Its adoption grants flexibility of time and place for content delivery.* (PubT#8)

> *Actually, the adoption of e-learning enhances the efficacy of knowledge via ease of access to a broad amount of up-to-date resources and relevant materials.* (PubT#4)

E-learning tools, according to this category of teachers, are an effective instrument for extending educational opportunities due to their power to transcend typical time and space barriers.

4.2.2. *Opponents of E-learning: Rejection and Refutation*

Based on the data collected, only two interviewees did not see any benefit of e-learning in teaching engineering. This negative attitude is mainly due to the fact that some faculty members rely a lot on old instructional methods, or simply due to a lack of interest in using e-learning tools in their teaching. Two teacher participants expressed their unwillingness to use educational technology as follows:

> *Honestly, I cannot state the benefits of e-learning simply because I do not rely on it for my teaching practices. I prefer conventional face-to-face instruction.* (PvtT#16)

> *Advantages! Hmmm. I do not see any advantage in using e-learning for teaching purposes.* (PubT#7)

Based on the responses to the second question, it should be noted that the majority of participants favorably perceive e-learning as it offers various opportunities for interactive learning. According to them, e-learning enhances students' engagement, participation, interaction, and involvement in the educational process, a learning environment that promotes self-regulated and self-directed learning.

Others, however, appreciate e-learning tools since they view them as pedagogical resources that facilitate teaching and help teachers easily convey meaning. On the other hand, some interviewees (a minority=12.5%) see no advantages of e- learning simply because they have never experienced it or because of their negative attitudes towards it. After analyzing the participants' answers, they were coded and classified into two main categories: advocates of e-learning who view e-learning as a valuable teaching strategy (the predominant category, 87.5%) and opponents of e-learning who stick to the traditional face-to-face education, representing a minority (N=2).

4.3. Stumbling Blocks to E-Learning Implementation

The third question in the interview aims to explore the factors and obstacles that hinder the integration of e-learning in higher education. In this regard, interviewees were asked to list the

main obstacles that hamper the effective use of e-learning in higher education settings. Based on their responses and after the coding and data analysis process, the researcher identified two main themes and sub-themes within each.

4.3.1. *External factors: Infrastructure, Training, and Technical Support*

The first theme, which many interviewees (87.5%) referred to as a potential barrier to the implementation of e-learning in higher education, pertains to external factors. The categories that were employed to develop this theme, based on the interviewees' responses, were lack of ICT infrastructure and facilities, lack of teacher training, and lack of technical support.

- ***Lack of ICT Infrastructure***

Almost all teacher participants (93.75%) pointed a finger at the lack of appropriate ICT resources as a major obstacle to not using e-learning in their teaching practices. In fact, access to ICT infrastructure is a prerequisite for the integration of e-learning in education. Successful e-learning depends largely on the availability of ICT facilities. Interviewees referred to the lack of infrastructure as a major issue that should be given considerable attention. This is illustrated by the following statement:

> *One of the barriers that prevents teachers from adopting e-learning in instruction is the lack of appropriate facilities. As a teacher in the public sector, I would say that our institution has an inappropriate and insufficient ICT infrastructure. For instance, if I want to use some e- learning activities in the classroom, I need to book a projector at least two days in advance due to the limited resources. Imagine…!* (PubT#5)

The next comment confirms the teachers' dire need for ICT infrastructure and equipment:

> *The successful implementation of e-learning into teaching relies mainly on the availability and accessibility of ICT infrastructure. I would appreciate it if all teachers at our institution at least own a personal laptop that is connected to the Internet. Unfortunately, we still lag far behind in the so-called "digital revolution.* (PvtT#13)

A teacher from the public sector added:

> *We do not have access to the Internet in our institution; the chalk and the blackboard are the only materials available. Guess what! I just bring the chalk with me since it is not always available in the classroom …laughter.* (PubT#8)

From these comments, it can be noted that the lack of adequate technology resources and facilities is the main factor discouraging teachers from adopting e-learning in instruction.

- ***Lack of Training***

Interviewees also complained about the lack of training programs that help them develop their digital skills in order to meet the needs of today's technology-driven age. Actually, both a lack of formal training and support for digital skills lead to poor e-learning adoption by faculty members. A female teacher of mathematics explained:

> *I believe various factors are impeding the integration of e- learning in the higher education system. For instance, the teachers are not trained to use such new technologies in teaching. Thus, there should be some training programs, including seminars and workshops on the use of ICT in education. I would be very grateful if they showed me how to use ICT to teach mathematics!* (PubT#16)

Based on this comment, the interviewee acknowledged her inability to embed e-learning tools in her teaching practices because she has not been trained to use technology for instructional purposes. She also expressed her willingness to integrate such tools in teaching mathematics if she is well-equipped with the necessary skills and competencies. That is to say, teachers are willing to improve; however, they still do not have support, training, and access to adequate ICT resources and facilities.

- ***Lack of Technical Support***

The participants' responses indicated that a lack of technical support is one of the obstacles that prevent them from adopting e-learning in teaching. The interviewees claimed that a lack of assistance is one of the top barriers that influences their attitudes towards the use of technology in class. One of the teacher participants recounted his frustration:

> *Without adequate technical support, teachers are not expected to surmount the obstacles that impede them from using ICT. I admit that once I used the projector to deliver a lecture, and guess what! 10 minutes later, it was no longer working! I tried to fix it, but in vain, since I could not detect the source of the problem.* (PvtT#10)

Lack of technical skills might potentially impede e-learning integration. Not being able to deal with technical issues, teachers will be discouraged from using e-learning tools due to the fear of equipment failure. Consequently, they become disappointed, resulting in their unwillingness to adopt e-learning in their pedagogical practices.

4.3.2. *Internal Factors: Skills, Attitudes, and Commitment*

The second theme, which many teacher participants (75%) referred to as a potential barrier to the application of e-learning in higher education settings, relates to internal factors. The categories that were used to develop this theme, based on the interviewees' responses, were teachers' lack of digital skills, instructors' negative attitudes towards technology, and students' commitment.

- ***Lack of Digital Skills***

The majority of interviewees (93.75%) revealed that a lack of the necessary digital skills is the reason for not integrating technology in the classroom. They pointed out that the fact of not having the appropriate digital skills is the reason why teachers do not opt for educational technology. One teacher participant expressed his frustration by stating that:

> *Lack of digital skills is a serious obstacle to the implementation of e- learning. Not all teachers can use e-learning tools; I never thought that one day I would embed technology in my classes.* (PvtT#11)

Emphasizing the lack of technological competence as a critical factor that hampers e-learning integration in education, another interviewee stated:

> *I believe that the lack of digital competence is the major barrier. Not all teachers possess technology-related knowledge. Teachers need specific training programs to develop their skills before they engage in the design of technology-based lessons.* (PubT#1)

Taking into account this comment, we understand that teacher training and digital literacy development cannot be separated since they greatly depend on each other. Therefore, the lack or absence of one of them leads to poor e-learning integration in education.

- ***Teachers' Attitudes***

Teachers' attitudes might shape whether and how faculty teachers eventually embed e- learning in their teaching practices. Actually, attitude is an important predictor of teachers' intention to integrate e-learning in education. One of the interviewees referred to the teachers' negative attitudes as one of the obstacles that hinder the use of e-learning:

> *I want to add that teachers' attitude is a main enabling/disabling factor in the effective and successful integration of e-learning into classroom instruction. Some teachers (I*

> *personally know) resist change and have no plan on using technology in education, although they might be capable of using it; they just stick to the old traditional values.* (PvtT#11)

The narrative in the above quotation evidently emphasizes that teachers' negative attitudes towards technology and resistance to innovation and change become a potential barrier to technology-based learning environments.

- ***Students' Commitment***

Some teacher participants (12.5%) termed students' commitment and engagement to be a very important factor for the success of e-learning programs. According to them, an effective e-learning integration depends largely on students' motivation and acceptance of electronic learning. This is highlighted through the following statement:

> *As far as I am concerned, I believe that students' commitment is a basic prerequisite for effective e-learning. Like teachers, students are undoubtedly seen as key components for successful learning. Being motivated and willing to use education technology results in a successful e-learning application.* (PvtT#15)

The above comment exemplified views that students' engagement is a key factor for the success of technology-enhanced instruction. Students' high motivation, willingness, and acceptance contribute to an operative and successful e-learning environment. The participants' responses to this question were coded into response categories; they were primarily classified into various response patterns: the first category underlines the importance of adequate ICT infrastructure to the success of e-learning programs. This category, which represents the majority, believes that the unavailability and inaccessibility of appropriate ICT facilities are a complex barrier that discourages teachers from embedding new technologies in their pedagogical practices.

The second category stresses the importance of professional training programs to promote teachers' knowledge and digital skills to be able to apply them in teaching engineering education. Another category highlights the significance of teachers' attitudes as having a strong impact on technology integration in teaching. Moreover, other participants pointed out further critical factors impeding the integration of e-learning, such as students' commitment and engagement. Accordingly, participants hope and expect to find solutions to the external and internal barriers that prevent or delay the implementation of e-learning in higher engineering education.

4.4. Guidelines for Successful Integration of E-learning Initiatives

The last question of the interview aims at examining the participants' recommendations and suggestions for an effective integration and implementation of e-learning in higher education. Therefore, participants were required to identify the factors that need to be considered in the implementation of e-learning. During the coding and data analysis process, the researcher recognized that faculty recommendations and suggestions are characterized by factors that emerged as themes: technological readiness factors, pedagogical readiness factors, and human readiness factors.

4.4.1. *Technological Readiness Factors*

According to some participants (81.25%), an effective and successful e-learning environment depends heavily on technological support. For them, the technological factor is one of the critical aspects of e-learning readiness. Thus, without the appropriate technology equipment, the main objective and purpose of e-learning cannot be achieved. They stated:

> *E-learning can open new horizons for both teachers and learners. A solid technology infrastructure can absolutely lay the ground for such a dramatic shift.* (PvtT#14)

> *E-learning may serve as a solid starting point for maintaining high-quality education. Yet, the government should empower teachers and students by providing accurate training programs and ICT infrastructure.* (PubT#3)

> *For me, funding is the biggest challenge here. To provide students and teachers with adequate material (computers/Internet) to access e- learning activities is a necessity.* (PubT#6)

In light of these comments, we can say that the benefits of e-learning are fully attained only when both instructors and learners have easier access to technology facilities and equipment. That is to say, the lack of technology infrastructure results in the failure of the e-learning application.

4.4.2. *Human Readiness Factors*

Another factor that, according to the participants, plays a vital role in the success of e- learning environments is the human aspect. They referred to teachers' attitudes and students' motivation and acceptance of e-learning as an integral component of successful e-learning systems. Two teacher participants addressed the human factor as follows:

> *I believe that change starts from within; teachers and students should develop positive attitudes towards e-learning and technology as a whole. We must change ourselves first!* (PubT#2)

> *E-learning is no longer a choice; it is part of reality now. We should create environments for our students to learn by themselves; environments that will improve the self-worth of every learner.* (PvtT#11)

Based on these comments, it can be concluded that the individual's willingness and acceptance of e-learning are crucial for its effective and successful practice.

4.4.3. *Pedagogical Readiness Factor*

According to some teacher participants, successful integration of e-learning is not just about uploading existing teaching materials. Nonetheless, it is a process that requires a set of skills and arrangements that are different from those used in traditional instruction. One of the interviewees stressed that:

> *One should bear in mind that teaching online is not the same as teaching face-to-face; the teaching methods used in traditional classroom settings should be reconsidered and adjusted to meet the requirements of online instruction.* (PubT#1)

In this respect, the teacher's instructional strategies may vary according to the educational context. Thus, creating successful e-learning environments requires a better understanding and preparedness from the teachers in order to create flexible learning environments for students of the 21st century.

5. Discussion

The overall findings revealed that the level of instructors' awareness of the importance of e-learning is very high. Due to the emergence of a high culture and the increasing exposure of students to technology, interviewees who participated in this study believed in the value and effectiveness of e-learning. Over the past few years, faculty members have had a skeptical attitude towards educational technologies; nevertheless, now things seem to have changed. University teachers interviewed in this research revealed a favorable attitude towards e-learning and its significance in the teaching-learning process. Likewise, teacher-participants reported their challenges and motivations towards adopting e-learning into their teaching practices. As Abbot (2003) states in the introduction of his book *ICT: Changing education*, the high rate of

technological progress, the explosion in information technology, the fast-paced expansion of the computer, and the increased demand for educating students to meet the future requirements are what evoked the development of educational technology. Teachers involved in this study demonstrated their familiarity with the concept of e-learning technology and showed their understanding of its role in promoting students' outcomes.

Based on the findings, the majority of faculty members have positive attitudes towards incorporating e-learning into their teaching, aiming at raising their students' awareness towards educational technology. The relevance of integrating e-learning in the educational setting, as reported by teacher participants, consists of enabling the learners to construct knowledge and a deep understanding rather than being passive receptors. The teachers indicated that using e-learning in HE settings enables students to actively construct meaning from the sources they encounter and take charge of their own learning. At the same time, it allows them to develop a critical reflection to express their opinions and support their beliefs. E-learning technology, according to the interviewed teachers, is a pedagogical strategy set to create new pedagogies and mechanisms, aiming at enabling students to be independent learners by choosing their learning path. Therefore, such a high level of awareness about educational technology can absolutely support the implementation of e-learning in Moroccan HEIs. Nonetheless, research findings revealed that although being recognized as a priority in the teaching-learning process, e- learning is still not promoted as an official component of the educational program in Morocco. According to lecturers, e-learning is applied in theory and not yet in practice.

In fact, since achieving independence, promoting quality in education in Morocco has been the main focus; nevertheless, despite the significant efforts made in launching various reforms at the level of curricula and pedagogical approaches, the education system still faces a series of challenges that hinder the achievement of its role successfully. Education should highlight the importance of helping learners fully develop their inherent potential so that they can autonomously explore the world and manage the learning process. Lecturers reported that teaching in Morocco still adheres to the old values of traditional pedagogical techniques and does not help students enhance their critical thinking skills in order to achieve high standards. Thus, most of the instructors confirmed that e-learning is by no means integrated into the curriculum.

The implementation of e-learning in higher education aims at meeting two primary objectives. The first goal focuses on quality in education, whereby the introduction of ICTs in teaching

enhances learners' learning outcomes through innovative and modern approaches. It aims at developing accurate settings for learning, instead of relying solely on the conventional strategies. The second objective focuses on enhancing students' digital skills so as to engage them in the workplace environment that heavily relies on new and modern technologies (Danaher, Gururajan & Hafeez-Baig, 2008). Nonetheless, as far as the current Moroccan higher education curriculum is concerned, the research findings revealed that e-learning does not appear in the national syllabi, neither as an independent unit nor as a cross-curricular one. E-learning technology has for so long initiated long and complex debates among scholars about whether it should be integrated as an independent subject or incorporated into teaching other disciplines (Hobbs, 1998). Research in the field asserts that the adoption of e-learning across the curriculum develops learners' performance and involves them in multiple learning intelligences (Hui, 2007; Kelly, 2008; Krishnan, 2012; Li, 2013). With respect to the Moroccan higher educational program, only some teacher respondents reported that e-learning is a component of some disciplines. However, they claimed that what the curriculum addresses in terms of e-learning is poor and insufficient.

Apart from the curriculum design, experts in the field of education stated that the successful integration of e-learning technology has faced a series of obstacles due to a lack of adequate operational policies in education settings (Naidoo, 2016). Anene et al. (2014), while investigating the implementation of e-learning in Nigerian universities, Anene, Imam & Odumuh (2014) claim that the main barriers to adopting e-learning are due to first-order (institutional) barriers and second-order (cultural) barriers. The institutional hindrances involve access to ICT equipment and facilities, teacher professional development and technical support, while cultural barriers encompass teachers' attitudes and students' commitment. In the same vein, this study confirmed that the integration of e-learning in Morocco encounters all the previously stated obstacles. According to the research findings, the lack of ICT facilities and e-resources is the first barrier that hinders the adoption of e-learning in the Moroccan HEIs. Developing curricula alone is not sufficient for a strategic education reform.

In fact, it is of considerable significance to provide universities with the necessary didactic and technological equipment and facilities, as well as to offer extensive professional training for lecturers (Ministry of National Education, 2002). Nevertheless, the majority of public teacher participants explained that educational settings are still equipped with marginally

unsophisticated technological resources and inadequate infrastructure. They even stressed that the school where they teach suffers from basic resources and facilities. Scholars in the e-learning arena consider the poor investment in teacher professional development as another challenge that impedes the effective integration of e-learning systems in education settings (Badrul, 2005; Baporikar, 2013; Dauguenti, 2013). Although lecturers involved in this research expressed positive attitudes towards the pivotal role of e-learning, the majority (58%) affirmed that the education system does not provide them with the appropriate training and pedagogical support to incorporate e-learning into their teaching effectively. This is consistent with the findings of Donnelly & McSweeney (2008), which established that many lecturers and learners do not have adequate ICT skills because most of them have not been trained to understand, operate, and apply e-learning successfully.

In-service and pre-service education allow instructors to understand their needs and enhance their skills associated with teaching their students how to successfully get involved in the e-learning environment. In this sense, training support and teacher professional development are primary for the success of e-learning initiatives. In other words, incorporating e-learning technology into classroom practices involves training strategies to promote teachers' motivation, preparedness, confidence, interest, and knowledge. Indeed, teachers' lack of ICT skills and knowledge is one of the main barriers to integrating e-learning into classroom settings. Although (42%) of the teacher-respondents received training on e-learning, they still believe that their digital literacy is not at the level it should be to incorporate e-learning into their teaching. This is consistent with several research studies, such as Beisser & Sengstock (2018), Boswell, 2016 Cookson (2015), which confirmed that successful e-learning depends heavily on the instructor's digital competencies and professional development. Accordingly, faculty need more training on ICT integration approaches and ICT skills to effectively adopt the e-learning tools into their lessons. On the other hand, experts in the field of e-learning confirm that the fulfillment of an effective e-learning environment is not only a matter of skills and training, but it is also linked to the engagement and motivation of the teacher and students (Garrison, 2011). Graham & Hewett (2009) state that the most serious impediments for most instructors to adopt e-learning into their teaching practices are linked to a lack of ICT resources, a lack of technical support, and a lack of teacher training. Besides, the same study reveals that teachers' positive attitudes and motivation to teach using e-learning are among the primary factors that may promote the integration of this approach in educational contexts.

6. Conclusion

In general, the research findings showed that the integration of e-learning in the Moroccan higher education system is a process where organizational, systematic, professional, and attitudinal factors are involved. Participants claimed that adopting e-learning enhances the quality of the teaching and learning processes as it promotes student-centered and autonomous learning. They emphasized that e-learning strategies are one of the critical aspects that the education system should recognize in order to empower and equip students with the necessary skills to live and work in the information age, and thus help them become lifelong learners and active participants in society.

The research demonstrated that the Moroccan educational system, in general and higher education in particular, does not offer the necessary tools that allow students and teachers to effectively use e-learning in teaching and learning. In fact, e- learning integration is faced with poor curriculum reforms, inappropriate infrastructure and resources, as well as weak professional training for faculty members. Accordingly, teacher-participants recommended that the Ministry of Education, alongside other stakeholders, should establish national policies and take serious actions and procedures for e-learning to grow and become an integral part of the education system, at the same time investing in offering equipment and advanced training programs for teachers and students to improve their skills and performance.

This study attempted to raise several issues relevant to the integration of e- learning in Morocco. It tried to offer a thorough understanding of the implementation of digital learning from institutional, curriculum, and educator variables. The following is an overview of the major findings from the teachers' interview:

- University teachers value the role of e-learning technology and its effectiveness in enhancing learning outcomes.
- The integration of e-learning in the Moroccan higher engineering education is still in its initial stages. Curriculum constraints, lack of adequate infrastructure, and lack of vocational training sessions for teachers are the fundamental factors that hinder the successful implementation of e-learning in education.
- Moroccan university teachers have positive attitudes towards educational technology. They believe in the potential of e-learning technologies in enhancing learners' critical thinking skills and academic performance.

Overall, this study offered results related to the teachers' attitudes and experiences in depth regarding the integration of e-learning in education. Teachers complained about the unavailability of technology infrastructure, the absence of professional training programs, and the lack of technical support, and if implemented, could increase their proficiency in e-learning usage.

In fact, among the issues raised by the interviewees, inappropriate ICT infrastructure emerged as one of the main themes in the interview. They identified technology infrastructure as a critical barrier in e-learning integration, as it negatively affects their attitudes and discourages them from using e-learning in many respects. On the other hand, they highlighted the importance of vocational training sessions as another underlying factor that influences teachers' readiness to use e-learning in teaching. For them, IT training would absolutely promote the knowledge and the needed requisite skills and therefore enhance their readiness to use e- learning in teaching engineering education. Eventually, most of the responses indicated the teachers' desire to integrate e-learning in teaching and learning in order to meet the changing needs of teaching the digital generation.

Disclosure Statement

The author declares that there is no conflict of interest regarding the publication of this article. No financial, personal, or professional relationships have influenced the research, analysis, or conclusions presented in this work.

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