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Factors Impeding E-Learning Implementation in Moroccan Higher Education Institutions: Engineering Departments as a Case Study

Facteurs Entravant La Mise En Œuvre De L'apprentissage Electronique Dans Les Etablissements D'enseignement Supérieur Marocains : Les Départements d'Ingénierie comme Etude de Cas

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Abstract
The E-learning revolution has grown faster and occupied a significant position in the field of education, particularly Higher Education Institutions (HEIs). Nevertheless, these advancements were not completely successful because HEIs have faced several challenges and barriers in implementing e-learning; for example, the absence of financial and technological assistance, inadequate ICT infrastructure, teachers' lack of digital skills, and the learners and teachers negative attitudes were the basic factors why many HEIs could not incorporate e-learning into its educational programs. Therefore, this study studies the major factors influencing the implementation of e-learning technology in the Moroccan education system, which is considered a modern teaching approach that can be adopted to improve and enhance students' learning outcomes. The research study was conducted using quantitative surveys. The quantitative data were collected through a paper-based questionnaire designed for 228 students from the engineering departments as well as an online questionnaire conducted with a sample of 80 university teachers.
The data was gathered from engineering students and teachers from two higher education institutions at the city of Marrakech (ENSA School & EMSI School). The study results indicated that these participants face various factors that impede the use and implementation of such new tools.

Keywords: E-Learning; External and Internal Factors; Moroccan Higher Education; Engineering Education.

Résumé
La révolution de l'apprentissage électronique s'est accélérée et a occupé une place importante dans le domaine de l'éducation, en particulier dans les établissements d'enseignement supérieur (EES). Néanmoins, ces progrès n'ont pas été entièrement couronnés de succès car les établissements d'enseignement supérieur ont été confrontés à plusieurs défis et obstacles dans la mise en œuvre de l'apprentissage électronique ; par exemple, l'absence d'aide financière et technologique, une infrastructure TIC inadéquate, le manque de compétences numériques des enseignants, et les attitudes négatives des apprenants et des enseignants étaient les facteurs de base pour lesquels de nombreux établissements d'enseignement supérieur ne pouvaient pas intégrer le e-learning dans leurs programmes éducatifs. L'étude a été menée à l'aide d'enquêtes quantitatives. Les données quantitatives ont été recueillies au moyen d'un questionnaire papier conçu pour 228 étudiants et un questionnaire en ligne mené auprès d'un échantillon de 80 professeurs.
Les données ont été recueillies auprès des étudiants et d'enseignants de deux établissements d'enseignement supérieur de la ville de Marrakech (Ecole ENSA & Ecole EMSI). Les résultats de l'étude ont indiqué que ces participants sont confrontés à divers facteurs qui entravent l'utilisation et la mise en œuvre de ces nouveaux outils.

Mots clés : E-learning; Facteurs Externes et Internes; Enseignement Supérieur Marocain; Enseignement Supérieur de L'ingénierie.

Introduction

ICTs are developing at a fast pace, influencing various parts and domains including economy, education, industry, policy and health. In this regard, man functioned in effective and rapid styles of life, and employed less time to accomplish different missions and performances, the thing that was hard if not unachievable only some years ago (Daugenti, 2009). The use of e-learning in education boosts the standard of learning and teaching by prompting learners to ameliorate their performances and to be self-directed learners both inside and outside the classroom; reciprocally, by encouraging instructors in HE settings to fulfil their tasks in better conditions. The integration of ICT in education as a whole becomes a necessity in the information age where teachers and learners require newest teaching strategies for an effective and modern pedagogy (Elhassani et al., 2016).

Electronic learning involves teaching and learning through the integration of educational technology (Freitas & Jameson, 2012), it has reconstructed teaching and learning by making them more suitable and convenient to both students and teachers, mainly that e-learning is not constrained by the concepts of time and place. The recent progress in ICTs has promoted the implementation of e-learning in many higher education institutes (HEIs) around the globe. Actually, in the past few years e-learning has faced a substantial evolution; on the one hand, it is due to the growth of ICTs and technologies, on the other hand it is because of humans' demand for an appropriate instrument for professional directions and not just for pedagogical objectives (Gay, Salomoni, & Mirri, 2007).

In this regard, the primary objective of this research is to identify the different factors that affect the implementation of e-learning in the Moroccan setting and to determine the remarkable role of e-learning in enhancing the standard of higher education, particularly in engineering fields. For this reason, this study was undertaken as an attempt to examine the extent to which e-learning is manifested in engineering departments at the National School of Applied Science ENSA (a public school) and the Moroccan School of Engineering Sciences EMSI (a private institution). The research was conducted using quantitative surveys which were distributed during the first semester of the academic year 2018-2019. This study was guided using three different questions:

- RQ1: To what extent e-learning is manifested in Moroccan higher engineering education?
- RQ2: Is there any difference regarding e-learning readiness between public and private Moroccan HEIs?

- RQ3: What are the factors affecting the adoption of e-learning technology in learning engineering higher education?

This paper discusses the methodological approach adopted and describes the findings of the quantitative approach which examines the extent to which e-learning is manifested in Moroccan higher engineering education. In this regard, Rogers (1983) claims that in order to measure the rate of adoption of an innovation, it is significant to take potential adopters' attitudes and perceptions as a determinant predictor.

- **Research Project Organization**

The current research study attempts to investigate the major factors affecting successful implementation of e-learning in Moroccan higher engineering education. Therefore, this paper is divided into five major sections. The first section examines the literature from various angles. Section two is dedicated to the research method and design. Section three and four discuss and interpret the main research findings. Lastly comes the conclusion of the research study which epitomizes the main findings of the research study.

1. Review of the Literature

1.1 Definition of E-learning

There are many definitions for e-learning since the term has been used within a broad range of educational contexts. Thus, a precise definition of e-learning is not determined yet as many scholars have diverse views on e-learning discipline, particularly on its field of application (Bartuskova & Krejcar, 2014). The first definition is that e-learning is learning using technological tools as a mean to support the teaching learning process outside of a conventional classroom; it mainly refers to an education or training delivered entirely online (Dron, 2007). The second definition is covered in Bourlova and Bullen's quote (2005), they state "e-learning is defined as the use of the Internet and Internet-based communication technologies to deliver education and training" (p. 397). Accordingly, the fusion of learning and technology has led to the rise of electronic learning as a mode of disseminating knowledge. In general, e-learning is characterized by the use of Internet technologies in order to support student learning and to enable knowledge without constraints of time and place (Singha, 2009).

E-learning environments are distinct from the conventional classroom where knowledge is originated from the teacher. Nonetheless, it does not mean that e-learning alters the way teachers teach engineering education and the manner learners learn; it is just a sort of technology that strengthens students' academic achievements, and eliminates obstacles and hindrances that might occur in the traditional classroom instruction (Baporikar, 2013).

Moreover, the e-learning course permits trainers to be fully engaged in the learning process, and thus become the central core of emphasis. Banathy (1991) acknowledges that "the learner is the key entity and occupies the nucleus of the systems complex of education" (p.96). Additionally, e-learning is a flexible form of building knowledge; it forms opportunities for learners in terms of where and when to learn (Khan & Ally, 2015). Therefore, learners are the ones who construct knowledge with the help and assistance of the teacher. In other words, the teacher becomes more "facilitator" than "provider" or "judge" (Clarke & Madaus, 2012).

The key question is that e-learning has become a promising alternative to conventional instruction methods; it emphasizes learner-centered activities, as it helps students develop a wide range of diverse skills including interpersonal, cognitive, and communicative skills. The students work together to form ideas, construct knowledge, direct and regulate their own learning.

1.2. Characteristics of E-learning

E-learning is distinguished by its rapidity, dynamism, and high level interaction of the learner with the content. There exist various software platforms like Blackboard, Moodle, MOOCs and wikis that encompass teaching materials to improve the student learning experience (Elyaacoubi & Bennani, 2022). College students are provided with passwords that allow access to information from anywhere. By logging into their accounts, the students are able to use the online materials, connect with their instructors or colleagues, and complete homework assignments, quizzes, and tests. Likewise, the students stay connected to their classmates and faculty members as if it was in real classroom situations. Bahri (2016) states that "shifting instruction and content online, helps students fill in their knowledge gaps since online learning assists students 'to know', the face-to-face class helps students 'to do and to be'" (p.58). In this sense, there exist four factors leading to students' willingness to use e-learning including the convenience of instruction, the degree of interaction, the degree of combining hybrid methods and e-learning tools, and the equilibrium between life and learning (Penavlo, 2007).

Once the educational context is apparent, components of e-learning and its features must be examined. Badrul (2005) clarifies "components are integral parts of an e-learning system. Features are characteristics of an e-learning program contributed by those components. Components, individually and jointly can contribute to one or more features" (p. 7). The e-learning elements are the tools that constitute the e-learning system. For instance, e-mail is "an asynchronous communication component" that is utilized by learners and teachers to

communicate and engage in learning activities. Thus, with convenient pedagogical approaches, e-mail can be implemented in an e-learning course to establish "an interactive feature" between learners and educators. In fact, a well-organized e-learning system can offer various characteristics beneficial to teaching and learning. Nevertheless, these characteristics should be significantly incorporated into the e-learning structure to meet its learning objectives. By adding further components, additional learning characteristics are presented too. As components of e-learning develop as an outcome of the emergence of the Internet and e-learning systems and technologies, actual e-learning attributes will develop and further characteristics may be accessible to us (Badrul, 2005).

1.3. Advantages and Disadvantages of E-learning:

As far as higher education is concerned, e-learning provides multiple benefits for learners such as free access to the e-learning material from anywhere and anytime by using the Internet as a medium, which is the only condition. At any moment, students can access already existing materials and complete classroom assignments; they can readily revise lessons, follow a series of activities independently, download documents, verify their messages, and share their screens permitting their colleagues to see their work and receive feedback, etc. All in all, e-learning cancels the obligation of physical attendance which permits students to carry out their activities in a more flexible way and proceed at their own pace (King, 2009). Besides, there are various benefits linked to the instructor who gains additional space with the students, the kind of attitudes of being embarrassed to talk in front of a whole class or being humiliated by saying something silly or making mistakes will no longer happen. Feedbacks are provided separately to each learner; therefore, the instructor can readily evaluate their personal work and thus focus on their weaknesses. Educators too choose when and from what place they will join their online classes. They can maintain interaction with learners while they participate in academic conferences, carry out research, or take part in professional trainings (Cookson, 2015).

On the other hand, e-learning has got some drawbacks which, however, do not hinder the consistency of its goals, including the absence of nonverbal language use, the absence of visual contact, the absence of physical presence, the lack of access for some groups of students and high cost in certain contexts (Bates, 2005). Moreover, "despite the best efforts of setting minimum technical competencies for incoming students, and providing excellent training and online information resources, technical problems will inevitably arise" (Ruhleder & Twidale, 2004). Since it is a new technology for instructors and learners, they may face technical

problems with the hardware or software, and Internet connection issues, which can take away from class time. In addition to that, teachers and learners may lack appropriate trainings that pave the way to an effective use of an online platform, and sometimes it is hard to identify convenient programs for certain subject areas. Another limitation expressed by several instructors is that learning via technology is a "calm and impersonal way to teach and can result in a lack of humanness in the instruction delivered" (Terry & Folk, 2012, p.141).

2. Research Methodology

The aim of this research is to explore the extent to which Moroccan public and private higher engineering institutions provide necessary resources that promote the use of e-learning in teaching and learning engineering education. To fulfill this, two higher education institutions in Morocco (public and private) were selected to carry out the study; Cadi Ayyad University National School of Applied Sciences Marrakech (ENSA) and the Moroccan School of Engineering Sciences (EMSI Marrakech). A printed questionnaire was directly distributed to 228 students from the chosen educational institutes as well as an online questionnaire conducted with a sample of 80 university teachers during the first semester of the academic year 2018-2019.

In this research, the researcher adopted a simple random sampling method to select the suitable population to take part in this study; mainly students and teachers from the departments of engineering in higher educational institutions in the Moroccan city of Marrakech; namely the National School of Applied Sciences (ENSA) and the Moroccan School of Engineering Sciences (EMSI).

For the survey questionnaires, the Statistical Package for Social Sciences (SPSS) was adopted as the basic tool for statistical analysis. SPSS is an effective and powerful tool for manipulating and deciphering survey data. Both descriptive statistical techniques (percentages, standard deviation, means, frequencies, reliability analysis) and inferential statistics (Chi-Square tests, Spearman's Correlation tests, ANOVA tests, Multiple Correspondence Analysis (MCA), to cross tabulate and compare the results) were employed in this study.

3. Results

This section attempts to examine the extent to which e-learning is manifested in Moroccan higher engineering education and to introduce the major factors impeding its successful integration particularly at two Moroccan Higher engineering institutions ENSA and EMSI.

3.1. Description of Respondents

3.1.1. Description of Student Respondents

The survey was distributed to 240 students from public and private higher engineering institutions during the first semester of the academic year 2018-2019. The institutions were both located in the Moroccan city of Marrakech. A total of 228 surveys were retrieved which combines 95% response rate, which reveals that the sample size is still functional to be representative for the population. The following table shows the distribution of students according to the research sites:

Table N°1: Distribution of Frequency and Percentage of Respondents by Institution

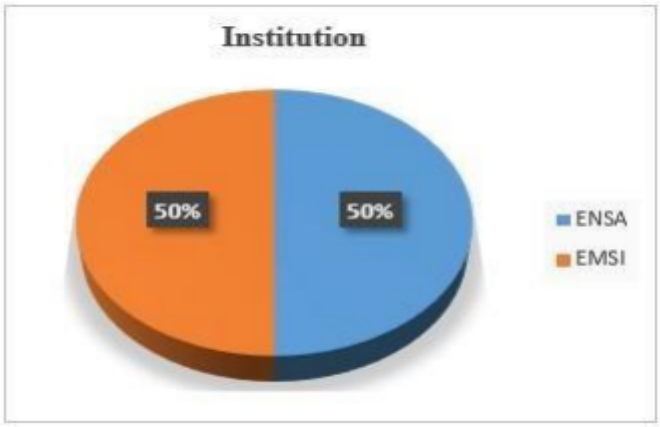
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	EMSI	110	48,2	48,2	48,2
	ENSA	118	51,8	51,8	100,0
	Total	228	100,0	100,0	

From table 1, it appears that the sample population is composed of 48% of students from the Moroccan School of Engineering Sciences (EMSI) with a number of 110 respondents, which represents the private sector, and 52% of students from the National School of Applied Sciences (ENSA) with a number of 118 respondents, which represents the public sector.

3.1.2. Description of Teacher Respondents

The questionnaire was sent via electronic mail to 100 teachers from two Moroccan public and private higher engineering institutions ENSA & EMSI respectively during the first semester of the academic year 2018-2019. The institutions were both located in the Moroccan city of Marrakech. A total of 80 surveys were retrieved which combines 80% response rate, which reveals that the sample size is still functional to be representative for the population. Figure 1 below is a bar chart that shows the distribution of teachers according to the research sites:

Figure N°1 : Distribution of Respondents by Institution



3.2. Respondents' Gender

3.2.1. Student Respondents

The first question the respondents were asked to identify is their gender. As table 2 illustrates, the total number of respondents was 228 from the two research sites. They were distributed between 132 males and 95 females; the number of male respondents represents 58%, which is higher than the number of females, which only represents 41, 9%.

Table N°2: Distribution of Frequency and Percentage for Respondents' Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	132	57,9	58,1	58,1
	Female	95	41,7	41,9	100,0
	Total	227	99,6	100,0	
Missing	System	1	,4		
Total		228	100,0		

3.2.2. Teacher Respondents

The first question that the participants were asked is to identify their gender. From table 3, it appears that the majority of the participants in this survey were males 67, 9% (N=53) whereas females were less in number (N=25), they represent 32, 1% of the sample size.

Table N°3: Distribution of Frequency and Percentage for Respondents Gender

What is your Sex? Male or Female

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	53	66,3	67,9	67,9
	Female	25	31,3	32,1	100,0
	Total	78	97,5	100,0	
Missing	System	2	2,5		
Total		80	100,0		

3.3. The Current Practice of E-learning in Higher Engineering Institutions

This section attempts to identify the extent to which e-learning is manifested in higher education institutions (HEIs) to enhance teaching and learning processes. Therefore, it tries to answer the first research question that examines the current practice of e-learning in Moroccan higher engineering institutes.

♣Q1: To what extent e-learning is manifested in Moroccan higher engineering education?

To answer this question, the respondents were first asked whether the academic curricula include any modules, units, or subjects that require the use of e-learning particularly (online learning /distance learning)

Table N°4: Frequency and Percentage for the Institution Inclusion of courses that Require the Use of E-learning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	23	29,5	29,5	29,5
	No	55	70,5	70,5	100,0
Total		78	100,0		

Based on table 4, 23 out of the 78 respondents who answered this question confirmed that the academic program includes courses that need the use of e-learning; they represent 29.5% of the sample. On the other hand, the vast majority of the surveyed respondents (70.5%, N=55) claimed the opposite. Moreover, the respondents were also asked if the institution they belong to has ever organized an event that aims to raise students' awareness and develop their critical thinking regarding e-learning. Table 5 presents the respondents' responses:

Table N°5: Frequency and Percentage for the Institution Organization of Events to Raise Students' Awareness towards E-learning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	11	16,18	16,18	16,18
	No	57	83,82	83,82	100,0
Total		68	100,0		

A study of the results shows that 57 out of the 68 respondents who answered this question denied the fact that their institutions have ever organized events that aim to raise students 'awareness towards e-learning; they represent 83.82%, while only 16.18% (N=11) claimed the opposite.

Another question that the surveyed participants were required to answer is whether the Moroccan education system has made any efforts to incorporate e-learning into higher education. Table 6 presents a distribution of the respondents' responses:

Table N°6: The Efforts Made by the Moroccan Education System to Integrate E-learning into Education

Has the Moroccan System Made any Efforts to Integrate E-learning in Education?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	52	68,42	68,42	68,42
	No	24	31,58	31,58	100,0
Total		76	100,0		

Based on the findings, we notice that the majority of the respondents (68.42%, N=52) confirmed the efforts made by the Moroccan education system to implement e-learning in higher education, while 24 respondents believed that no efforts have been made to; they constitute 31.58% of the sample studied.

3.3.1. E-learning Readiness in Public and Private Engineering Higher Institutions

As e-learning is witnessing significant growth in higher education, an assessment of the institutional readiness is of paramount importance for its effective integration in education. Thus, this section attempts to answer the second research question that explores the level of e-learning readiness in both public and private institutions for a successful implementation of e-learning strategies.

♣ RQ 2: Is there any difference regarding e-learning readiness between public and private Moroccan HEIs?

In order to answer this question, the researcher first cross-tabulated the two variables namely "does the academic curricula include any modules, units, or subjects that require the use of e-learning" and "has your institution ever organized any event that aims to raise students' awareness and develop their critical thinking regarding e-learning" with the variable "institution". In order to make this correlation of variables more relevant, the researcher has on the one hand opted for a regrouping of the first and second variables on the SPSS software; on the other hand, she took into consideration only the "yes" answers of the two questions.

Table N°7: Correlation between the Institutional Readiness and Establishment

The Institutional Readiness * Establishment Cross-tabulation

			Establishment		Total
			ENSA	EMSI	
Institutional readiness	Does the academic curricula at your establishment include any modules, units, or subjects that require the use of e-learning (online learning / distance learning)?	Count	13	10	23
		% in the institutional readiness	56,5%	43,5%	
		% in institution	76,5%	83,3%	
	Has your school organized any event that aims to raise the students' awareness and develop their critical thinking regarding e-learning?	Count	7	4	11
		% in the institutional readiness	63,6%	36,4%	
		% in institution	41,2%	33,3%	
Total		Count	17	12	29

a. Dichotomy group tabulated at value 1.

Table 7 shows that 56.5% of the respondents who answered "yes" to the first question belong to the public institution (ENSA) while only 43.5% of them belong to the private sector (EMSI). As for the second question, almost 64% of the respondents who provided a "yes" answer to this question belong to the public school (ENSA) while only 36% of them teach in the private sector (EMSI). Therefore, we notice that there exist a considerable difference between private and public e-learning readiness.

3.3.2. Barriers and Facilitators to the Adoption of E-learning in Higher Education

The purpose of this section is to identify the factors that enable or impede the implementation of e-learning in higher education (HE). Thus, the last research question of the present study examines the various factors that promote or hinder the adoption of e-learning systems in Moroccan higher engineering education.

♣ RQ 3: What are the factors affecting the adoption of e-learning technology in learning engineering higher education?

3.3.2.1. Critical Success Factors for E-learning Integration

The last research question aims to highlight the perceived facilitating factors that support the integration of e-learning in HE. For this reason, the researcher selected four explanatory variables of this research construct (facilitating factors), namely the efforts of the Moroccan educational system, the events that aim to raise students' awareness organized by the institutions under investigation, the participation of professors in training programs and their role in raising students' awareness towards the importance of e-learning. The correlation table 8 below reveals positive associations between the explanatory variable.

Table N°8: Summary Results of a Multivariate Analysis Relating Different Variables

	Has the Moroccan education system made efforts to raise	Has your school organized any event to raise the?	Have you participated in a training on e-learning technology?	Have you tried to help students be aware of e-learning?
Has the Moroccan education system made any efforts to integrate e-learning?[a]	1,000	-,052	,074	,101
Has your school organized any event that aims to raise the students' awareness and develop their critical thinking regarding e-learning?[a]	-,052	1,000	,020	,218
Have you ever participated in a training, which concerns e-learning technology?	,074	,020	1,000	,106
Have you ever tried to help your students be aware of the importance of e-learning technology and comprehend its role?[a]	,101	,218	,106	1,000
Dimension	1	2	3	4
Proper Value	1,268	1,077	,922	,733

The results do not show a significant influence between the variables studied. Nevertheless, the discrimination measures (see table 9 below) reduces the four explanatory variables mentioned above into two main explanatory dimensions.

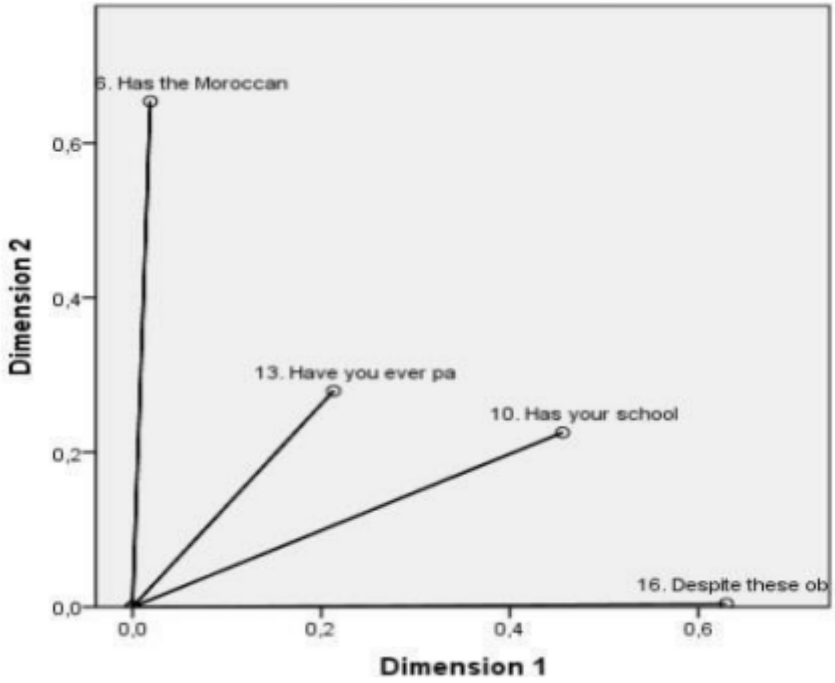
Table N°9: Results of the Measures of Discrimination

Discrimination Measures

	Dimension		Mean
	1	2	
Has the Moroccan education system made any efforts to integrate e-learning into higher education?	,019	,654	,337
Has your school organized any event that aims to raise the students' awareness and develop their critical thinking regarding e-learning?	,456	,226	,341
Have you ever participated in a training on e-learning technology?	,213	,280	,246
Despite these obstacles, have you ever tried to help your students be aware of the importance of e-learning technology and comprehend its role?	,629	,004	,317
Active Total	1,318	1,163	1,240

According to the discrimination table 9, and figure 2 below, we retain two main dimensions. The first dimension corresponds to the teachers' role in raising students' awareness towards the importance of e-learning technology with 62.9% of explanation. While the second dimension is related to the efforts made by the Moroccan educational system to integrate e-learning in HEIs with a contribution of 65.4%. In other words, the two fundamental factors that according to the teachers facilitate the integration of e-learning in higher engineering education are the government policies for e-learning, and the support, advice, and recommendations that professors provide to their students in order to raise their consciousness towards the importance of e-learning technology.

Figure N°2: Dimensional Plot of the Discrimination Measures



3.3.2.2. Challenges Facing the Adoption of E-Learning

As previously discussed, many developing countries expressed their interest to integrate e-learning solutions in their education systems but faced major challenges that impeded its successful implementation. In fact, e-learning is still in its infancy in developing countries due to many obstacles. This section, however, tends to shed light on the teachers' perceived critical factors that hinder the adoption of e-learning in Moroccan higher engineering education. To answer this question, we selected six explanatory variables of this research construct (barriers to e-learning integration) namely the lack of resources (material, human, and of time), efforts of the Moroccan educational system, the events that aim to raise students' awareness organized by the institutions under investigation, and the participation of professors in training programs.

Table N°10: Summary Results of a Multivariate Analysis Relating Different Variables

	Has your school organized any event…?	Have you participated in a training …?	Role of the Moroccan university vis-à-vis e-learning…	Lack of qualitative tools and materials	Lack of training for teachers	Lack of time
Has your school organized any event that aims to raise the students' awareness and develop their critical thinking regarding e-learning?[a]	1,000	,024	,193	,159	-,118	-,047
Have you ever participated in a training which concerns e-learning technology?[a]	,024	1,000	,582	,123	-,055	,222
What role does the Moroccan university play vis-à-vis the integration of e-learning?	,193	,582	1,000	,526	,015	,379
Lack of qualitative tools and materials[a]	,159	,123	,526	1,000	,118	,197
Lack of training for teachers[a]	-,118	-,055	,015	,118	1,000	,099
Lack of time[a]	-,047	,222	,379	,197	,099	1,000
Dimension	1	2	3	4	5	6
Proper Value	2,097	1,170	1,028	,750	,700	,256

As table 10 indicates, there exist no significant influence between the variables examined, except for the relationship between the role of the Moroccan university and the training carried out by the professors in terms of e-learning, which reaches 58.2% of explanation. Thus, we can say that a very moderate relationship exists between these two variables. However, the discrimination table below reduces the six explanatory variables mentioned above into two major dimensions.

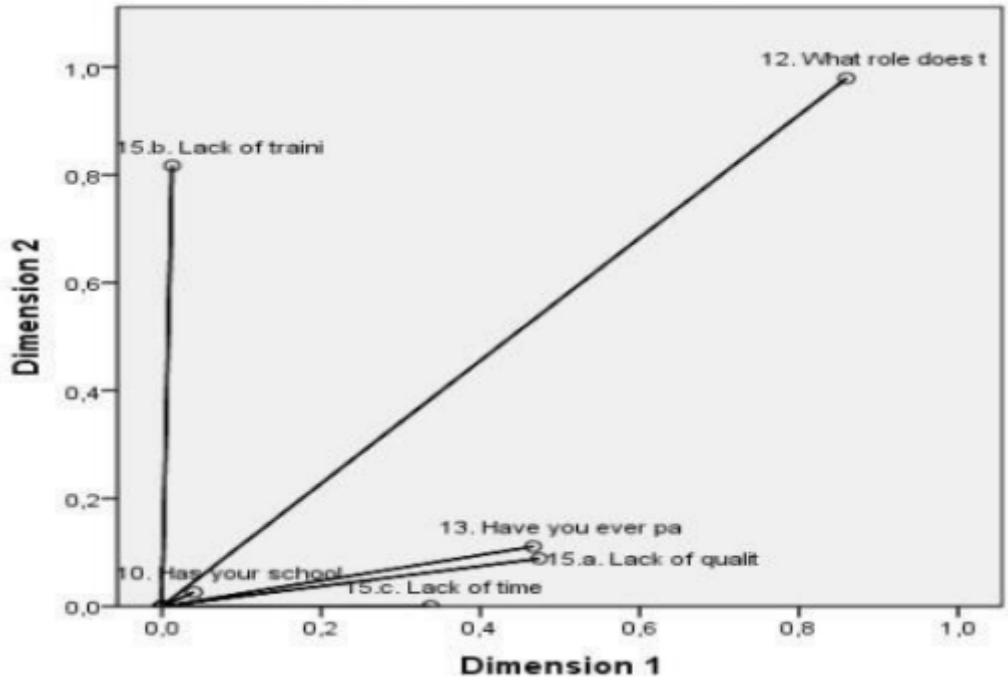
Table N°11: Results of the Measures of Discrimination

Discrimination Measures

	Dimension		Mean
	1	2	
Has your school organized any event that aims to raise the students' awareness and develop their critical thinking regarding e-learning?	,040	,026	,033
Have you ever participated in a training on e-learning technology?	,466	,111	,289
What role does the Moroccan university play vis-à-vis the integration of e- learning?	,860	,979	,920
Lack of qualitative tools and materials	,474	,088	,281
Lack of training for teachers	,013	,817	,415
Lack of time	,338	,001	,169
Active Total	2,191	2,022	2,107

From the discrimination table 11 and figure 68 below, we retain two main dimensions. The first dimension corresponds to the unfulfilled role of the Moroccan university vis-à-vis the integration of e-learning into education with 86% of explanation. While the second dimension relates to the absence of training programs dedicated to teachers in order to enhance their digital skills, with a contribution of 81.7%. In other words, the two fundamental factors that according to the teachers impede the integration of e-learning in higher engineering education are the lack of support and training for teachers and the lack of government initiatives to develop e-learning resources as seen in the figure below:

Figure N°3: MCA Dimensions Discrimination Measures



4. Discussion Of Findings

4.1. Discussing of Findings in the Light of the Research Questions

Both the teachers and students' findings divulged that e-learning is still in its infancy and early stages in Morocco. The investigated institutions still heavily rely on traditional methods of face-to-face instruction. In fact, faculty use computer-enhanced tools to support their teaching; however, there is no official e-learning strategy adopted by Moroccan HEIs. Digital learning is still not incorporated into the educational curriculum as a basic component. The findings demonstrated that both research sites lack the infrastructure conditions and e-resources that lead to a successful e-learning integration. For instance, the Internet as a vital element of e-learning allows students and professors to stay constantly involved in the e-learning process; yet, it is not accessible to students. When it comes to other e-learning infrastructure such as e-learning platforms, e-learning centers, and the interactive white board, they are poorly evaluated at both research sites, which implies that the adoption of e-learning is slow and still at its infancy stage in Moroccan higher engineering institutions.

♣ RQ1: Is there any difference regarding e-learning readiness between public and private Moroccan HEIs?

The research findings showed that there are two main differences; technology-related and organization-related aspects. As far as the technology-related aspect is concerned, it seems that EMSI, a private HEI offers "to a certain extent" better technological facilities to its students.

This may suggest that private HEIs in Morocco may be IT-driven compared to public HEIs. Nevertheless, although private HEIs may be better situated in the use of e-learning facilities, financial challenges in Morocco hardly allow either the private or the public sectors to hugely exploit the full advantages of e-learning. In fact, satisfaction with technology infrastructure was low among all participating students and instructors from both public and private HEIs. Yet, most of them expressed interest in providing courses that implement e-learning technology. Regarding the organization-related aspect, the findings demonstrated that ENSA, a public HEI was "to some extent" the one that tried to launch training support initiatives to engage the teachers with e-learning technology to ensure that they master its use and application over time. Besides, the findings also showed that ENSA School was the one that tried to organize more events aiming at raising students' awareness on the importance of e-learning in education compared to EMSI School. Generally, the funding of e-learning initiatives, training and retraining of educators, development of software packages and promotion of adequate ICT facilities are hard to achieve due to insufficient funding.

♣ RQ 2: What are the factors affecting the adoption of e-learning technology in learning engineering higher education?

Although initial introduction to e-learning initiatives in Moroccan HEIs seems to be progressing, there are still many barriers that might prevent the effective integration of e-learning. The study findings revealed that Moroccan HEIs are facing big challenges to benefit from emerging technological innovations and advents of e-learning to further enhance its teaching programs and to improve the quality of education, especially in engineering fields. Based on the findings obtained from this study, lack of ICT infrastructure and e-resources emerged as the main barriers behind not using and adopting e-learning in engineering education. Although the study showed that both the teachers and students have positive attitudes towards e-learning use in education, availability and accessibility of ICT equipment are very limited. The teachers and learners are willing to improve, but they still do not have support, training, or the accessibility to basic technology. Another barrier that hinders the effective implementation of e-learning in engineering departments according to the research findings is lack of the teachers' professional training. ICT training opportunities for faculty members are too erratic and sporadic, which implies that many teachers lack the appropriate knowledge and skills to use e-learning technology and are not motivated to adopt it in their teaching practices. In addition to that, the study identified technical support as a serious obstacle to e-learning integration. Technical assistance helps teacher to use ICT in teaching without wasting time

through having to fix software and hardware issues; therefore, its lack might discourage teachers from adopting e-learning in the teaching process because of the fear of equipment breakdown during a lecture. The findings also demonstrated that unwillingness, resistance, lack of motivation, and unawareness as other potential stand as barriers that impede e-learning integration in Moroccan education. Some lecturers just resist educational change and any new experience, which in turn leads to negative attitudes towards e-learning integration. For example, some interviewees reported that the preparation of the e-learning content takes more time than the traditional mode of instruction and that e-learning will reduce their roles and may even substitute them; these negative perceptions in turn will result in lack of appreciation and understanding of e-learning and its benefits. Likewise, students' demotivation is another challenge that prevents the general adoption of e-learning in HE; a high level of frustration emerges when an e-learning activity is poorly organized by faculty members. Ambiguous expectations or changing learning goals frequently during the lecture demotivates learners and generates confusion about the course objectives.

4.2. Discussion of Findings From Literature Review

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 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 assert 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 dissertation confirmed that the integration of e-learning in Morocco encounters all the previously stated obstacles.

According to the research findings, 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 respondents explained that educational settings are still equipped with marginally unsophisticated technological resources and inadequate infrastructure. They even stressed that the schools 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 who were involved in this research showed their positive attitudes towards the pivotal role of e-learning, majority of them, (58%) affirmed that the education system does not provide them with the appropriate training and pedagogical support to effectively incorporate e-learning into their teaching. This is consistent with the findings of Donnelly & Mc Sweeney (2008) which established that many lecturers and learners do not have the adequate ICT skills because most of them have not been trained to understand, operate, and apply e-learning successfully.

Indeed, teachers' lack of ICT skills and knowledge is one the main barriers of not 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 in order to incorporate e-learning into their teaching. This is consistent with several research studies such as (Beisser & Sengstock, 2018; Boswell, 2016; Cookson, 2015) that confirmed that successful e-learning depends heavily on the instructor's digital competencies and professional development. Accordingly, faculty needs 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 lack of ICT resources, lack of technical support, and 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.

Conclusion

This study examines the use of e-learning in the Moroccan context. It aims to investigate the extent to which e-learning is manifested in the Moroccan higher education institutions (HEIs). Likewise, this research paper aims to detect the major factors impeding its successful implementation for teaching and learning higher engineering education. The findings of the both surveys indicate that the practice of e-learning in Morocco remains in its early stage. Although Morocco has launched many initiatives and made several efforts in recent years to promote the role of information and communication technologies (ICTs) in the teaching and learning processes, the country has not yet succeeded in considering the integration of e-learning as an official academic component. Based on the respondents' testimonies, the HE curriculum follows some conventional and rigid paradigms that impede the educational advancement and prevent both educators and learners from being prepared to meet the challenges of the 21st century.

According to the research findings, a number of obstacles deter the adoption of e-learning. The major impeding factors are the lack of ICT infrastructure, absence of technical support, and lack of digital skills and training. Such results confirm former studies, which claim that the successful integration of e-learning requires a solid base in HE settings by providing the necessary equipment and resources. Moreover, it is imperative to equip lecturers with adequate ICT skills to perform proper e-learning practices by offering ongoing professional training programs. On the other hand, despite the lack of convenient and supportive learning conditions to adopt e-learning, university teachers showed positive attitudes and strong motivation to use this modern approach in their pedagogic practices. They showed high awareness towards technology usage in teaching and learning in order to produce high skilled learners ready to join today's modern workforce. E-learning is manifested in HE settings due to the teachers' willingness to integrate this approach as a modern tool that improves students' outcomes and performances. The implementation of e-learning as an entirely new learning environment increases students' engagement by becoming active learners and more independent than in the traditional educational setting.

There are some other conclusions that were also identified as a result of carrying out this doctoral dissertation. Overall, based on the research findings, the practice of e-learning in Morocco involves the participation and contribution of different operators, organizations, and institutions. Therefore, policy-makers and stakeholders in the field of education should prepare action plans to meet the necessities of the digital age. Based on the assumption that ICT in general and e-learning in specific prove effective in enhancing the learning outcomes of students, its use in a country like Morocco is advisable and recommended.

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