Revue Internationale du Chercheur
ISSN : 2726-5889
Volume 3 : Numéro 2

Evaluation of Students' Attitudes towards E-Learning in Moroccan Higher Education Institutions: Engineering Departments as a Case Study

Evaluation des Attitudes des Etudiants envers l'Apprentissage Électronique dans les Etablissements d'Enseignement Supérieur au Maroc: Les Départements d'Ingénierie comme Etude de Cas

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Date de soumission : 07/03/2022
Date d'acceptation : 28/05/2022
Pour citer cet article :
HANNI K. (2022) « Evaluation of Students' Attitudes towards E-Learning in Moroccan Higher Education Institutions: Engineering Departments as a Case Study », Revue Internationale des Sciences de Gestion « Volume 3 : Numéro 2 » pp : 218 - 245

Abstract

The use of pedagogical and technological innovations in education have altered the ways in which teachers and learners can interact. E-learning as a modern form of education is increasingly adopted in higher education (HE) and has been one of the main research lines of educational technology in the last decades. In this regard, this study attempted to investigate Moroccan university students' attitudes towards the implementation of these new technologies in engineering education. The research study was conducted using a quantitative survey. The data were collected through a paper-based questionnaire designed for 228 students from the engineering departments**.** The data was gathered from undergraduate engineering students from two higher education institutions at the city of Marrakech (ENSA School & EMSI School). The study findings confirmed that the participants have highly favorable attitudes towards e-learning practices. However, the survey results indicated that these participants face various factors that impede the use and implementation of such new tools.

Keywords: E-Learning; ICT; Attitudes; Moroccan Higher Education; Engineering Education.

Résumé

L'utilisation des innovations pédagogiques et technologiques dans l'éducation a modifié les modes d'interaction entre les enseignants et les apprenants. L'apprentissage électronique en tant que forme moderne d'enseignement est de plus en plus adopté dans l'enseignement supérieur (ES) et a été l'un des principaux axes de recherche au cours des dernières décennies. A cet égard, cette présente communication présentera les résultats d'une étude quantitative menée auprès de 228 étudiants afin d'évaluer leurs attitudes envers la mise en œuvre de ces nouvelles technologies dans les départements d'ingénierie de deux établissements d'enseignement supérieur.

Les données ont été recueillies au moyen d'un questionnaire papier conçu pour les étudiants en ingénierie de premier cycle de deux établissements d'enseignement supérieur de la ville de Marrakech (ENSA & EMSI). Les résultats de l'étude ont confirmé que les participants ont des attitudes très favorables envers les pratiques d'e-learning. Cependant, les résultats de l'enquête indiquent que ces participants font face à divers facteurs qui entravent l'utilisation et la mise en œuvre de ces nouveaux outils.

Mots clés : E-learning; TICE; Attitudes; Enseignement Supérieur Marocain; Enseignement Supérieur de L'ingénierie.

Introduction

In recent years, the world has known a rapid transition into being a global digital village; Information and Communication Technologies (ICTs) have taken a great role in this transformation. In fact, the development of such modern tools of communication has helped in creating a lot of changes in the community. One of these changes is the educational system that is trying hard to cope with the significant change in todays' educational needs, especially that classical modes of teaching are no more convenient to the learners' requirements and to the social and academic evolution (Harry, 2002).

The dramatic influence of globalization and the information revolution have positively affected the perspectives of the teaching process. Those factors have made of ICTs a necessity in educational curricula to assure the quality of the teaching-learning operation and to cope with changes that are taking place at a rather rapid rate. Merril (2011) claims that starting from the late 20th century, there has been a worldwide shift in HE which made of ICTs a necessity for academic and professional success, especially that most job opportunities proposed in the business market are linked to modern technologies.

The modern age witnesses a prominent shift and fast evolution; one category of people believes it is positive, whereas the other concentrates on its gloomy side. This shift can begin from education, since it is the most significant instrument of change (Harpe & Peterson, 2009). One of the important tools presented by ICT is electronic learning, which is a modern teaching approach and "an excellent alternative.… basically stands for all learning using electronic technologies to access a curriculum outside of a traditional classroom…. it has the potential to transform how content is delivered to learners" (Duran & Gonzalez, 2018, p. 310). Accordingly, developed countries have started to prepare their societies for the digital revolution through the integration of e-learning in their education system so as to support and enhance the quality of teaching and learning. However, the most important and problematic question is whether e-learning is effective or not. Therefore, measuring its effectiveness is strongly related to measuring learners' attitudes, perceptions, expectations and satisfaction. For this reason, this study was undertaken as an attempt to examine Moroccan university students of the engineering departments at the National School of Applied Sciences (ENSA) and the Moroccan School of Engineering Sciences (EMSI). The research was conducted using a quantitative survey which was distributed during the first semester of the academic year 2018-2019. This study was guided using three different questions:

- RQ1: How do college students perceive e-learning technology in learning higher engineering education?
- RQ2: What are the perceived educational benefits and opportunities of implementing e-learning technology in teaching and learning higher engineering education?
- RQ3: What are the perceived disadvantages of integrating e-learning in higher engineering education?

This paper discusses the methodological approach adopted and describes the findings of the quantitative survey which aims at investigating students' attitudes and perceptions towards e-learning integration in 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 college students' attitudes and perceptions towards the implementation of e-learning in Moroccan higher engineering education. Therefore, this paper is divided into five main sections. Section one briefly examines the literature from various perspectives; it discusses the e-learning evolution, definition, features, strengths and weaknesses. 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, implications, limitations, and suggestions for future research.

1. Review of the Literature

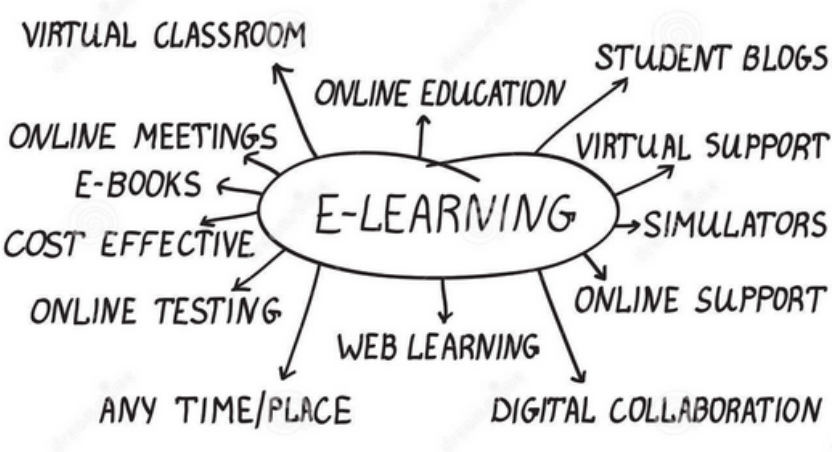
1.1 E-Learning: A New Approach

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). As a result, e-learning offers many ways to communicate between learners and teachers and among learners as shown in the figure 1 below:

Figure N°1: Features of E-Learning



Source: website (E-learning Concept, 2017)

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. E-learning: Key Features

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). Different characteristics that are offered by e-learning components are introduced in table 1 below:

Table N°1: Features and Components Associated with E-Learning Environments.

E-Learning Features	E-Learning Components	Relationship to Open, Flexible, and Distributed Learning Environment
Ease of Use	A standard and point click navigation system.	A well designed e-learning course can anticipate learners' needs and satisfy their natural curiosity to explore the unknown.
Interactivity	Internet tools, Hyperlinks, Browsers, Servers, etc.	Interactivity in e-learning is one of the most important instructional activities. Engagement theory based on online learning emphasizes that students must be meaningfully engaged in learning activities through interaction with others.
Multiple Expertise	Internet and WWW	E-learning courses can use outside experts to guest lecturers from various fields from all over the world
Collaborative Learning	Internet tools, instructional design and so on	E-learning creates a medium of collaboration, conversaion, discussion, exchange, and communication of ideas.
Authenticity	Internet and WWW, instructional design and so on	The conferencing and collaboration technologies of the Web bring learners into contact with authentic learning and apprenticing situations.
Learner-Control	Internet tools, authoring programs, hyperlinks, instructional design and so on	The filtered environment of the Web allows students the choice to actively participate in discussion or simply observe in the background. E-learning puts students in control so they have a choice of content, time, feedback, and a wide range of media for expressing their understandings.

Source: Adopted from Badrul (2005, pp. 11-12)

1.3. E-learning: Potential Benefits and Drawbacks

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 and Design

The aim of this research is to examine learners' attitudes towards the use of e-learning in 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 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 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 questionnaire, 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 introduce the findings on the experiences and attitudes towards e-learning from 228 students at two Moroccan Higher engineering institutions. An analysis of relationships between learners' attitudes and their demographic characteristics, familiarity with technology, adoption of technology for learning, digital skills, awareness, satisfaction, expectations for future classroom technology, and perceived advantages and disadvantages of e-learning is also considered

3.1. Description of 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°2: 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 2, 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.

3.2. Respondents' Gender

The first question the respondents were asked to identify is their gender. As table 3 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°3: 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		

3.3. Students' Digital Skills

The third set of questions in the questionnaire was designed to explore students 'use of digital tools in their everyday life. Therefore, the first research question of the present study examines the different digital skills and e-learning tools that students possess and benefit from.

♣Q1: What type of information and communication technologies (ICTs) do the students possess and benefit from?

To answer this question, participants were first asked to talk about their comfort level with technology, whether they consider themselves as technology savvy, and the degree of their use of some online tools.

3.1.1. Students' Comfort Level with Technology

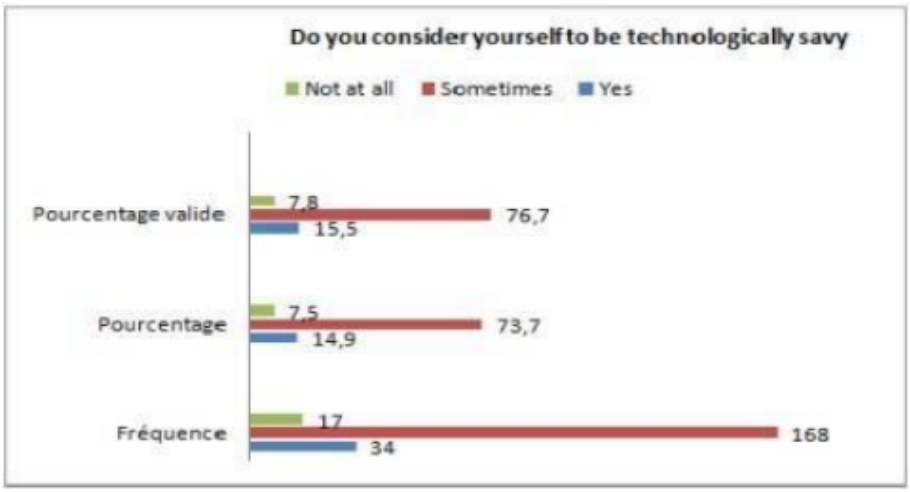
Table N°4: Students' Comfort with Technology-Frequency (Percentages)

Are You Comfortable with Technology?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	194	85,1	97,0	97,0
	No	6	2,6	3,0	100,0
	Total	200	87,7	100,0	
Missing	System	28	12,3		
Total		228	100,0		

As table 4 indicates, 97% of the respondents (N=194) feel comfortable with technology while only 3% (N=6) claim the opposite. On the other hand, we notice from the figure 2 below that 76.7% of the respondents sometimes consider themselves technology savvy with a total number of 168 participants, 15.5% (N= 34) qualify themselves as experts, and 7.8% (N=17) of the sample population do not consider themselves as technology savvy.

Figure N° 2: Students' Experience with Technology



3.1.2. Students' Use of Digital Tools

Table N°5: Frequency and Percentage for Respondents Use of Social Networks

I use Social Networks

		Frequency	Percentage	Valid Percentage	Cumulative Percentage
Valid	Every day	199	87,7	87,7	87,7
	A few times a week	16	6,7	6,7	94,4
	Occasionally	12	5,3	5,3	99,7
	Rarely/Never	1	,4	,4	100,0
	Total	227	100,0	100,0	

Respondents were asked to report the degree of their use of social networks. As indicated in the table 5, 199 participants use their social networks on daily basis representing87.7% of the sample studied. On the other hand, 6.7% and 5.3% of participants use social websites a few times a week and occasionally respectively. However, only 0.4% claimed that they rarely or never use social media with a total number of 1 participant.

3.4. ICT and E-learning Use in Learning Engineering

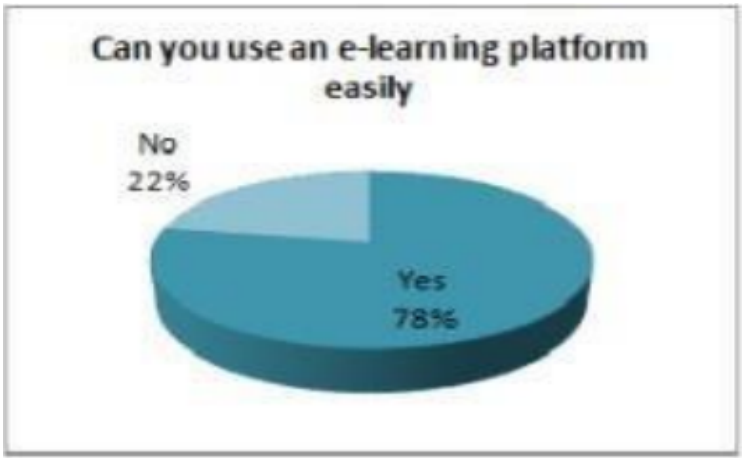
As mentioned in the review of the literature, e-learning enjoys a very important status; it is implemented in curricula, employed in various domains, and practiced in numerous countries like United States, China, India, Jordan, Libya, Kenya and many other countries. Nevertheless, it is still poorly implemented in Morocco.

At this level, the researcher wants to examine the skill level of engineering students in making meaningful use of digital tools in learning. Therefore, the third research question investigates how skilled are engineering students in using ICT and e-learning for learning purposes.

♣ RQ 2: How skilled are the learners in using e-learning?

To answer this question, participants were first requested to talk about their ability to use e-learning platforms, and whether they need further trainings to develop their digital skills.

Figure N° 3: Distribution of Percentage for Respondents' Ability to Use E-Learning Platforms



Regarding the participants' ability to use an e-learning platform, the figure 3 shows that 78% (N=178) of the respondents consider themselves capable of using such a platform; they represent the majority, while only 22% (N=50) claimed not to be able to use it. Those results clearly explain the data presented in the figure 4 below in which the majority (75%, N= 171) of respondents do not think they need a specific training while 25% of participants (N=57) expressed their need for further training programs to be able to use e-learning platforms.

Figure N° 4: Distribution of Percentage for Respondents' Need for further Training

3.5. Students' Attitudes towards the Use of Technology in Class

As mentioned in the review of the literature, students tend to have positive attitudes towards technology for learning. Rhema & Miliszewska (2014) point out that "university students in

developing countries have varying attitudes towards e-learning but generally their attitudes are positive" (p. 170). This section, thus, aims to answer the fifth research question that examines students' perceptions and attitudes towards the use of ICT and particularly e-learning in learning engineering.

♣ RQ5: How do college students perceive e-learning technology in learning higher engineering education?

In order to answer this question, respondents were first questioned about their attitudes towards using technology in class. At this level, the researcher cross-tabulated the two variables namely, are you for or against the use of technology and why.

Table N°6: Correlation between the Use of Technology in class and Why.

Are you for or against the use of technology in class * Why Cross-tabulation

		Are you for or against the use of technology in class?			
		For	Against	Neutral	Total
Why		79	8	32	119
	Amusing	3	0	0	3
	Constructive	13	0	1	14
	Ease and accessibility	85	0	1	86
	Necessity	2	0	0	2
	Waste of time	0	4	0	4
Total		182	12	34	228

Table 6 shows that 182 from the 228 participants surveyed (79.82%) are for the use of technology in class in which 79 respondents did not specify the reason. For those who are neutral they constitute 14, 91% with a total number of 34 participants, while respondents who are against technology use in learning represent 0,05% with a total number of 12 participants. However, the most used argument by those who agree on the use of technology for education purposes is based on speed and ease of access to more resources.

3.6. Students' Perceived Benefits of E-learning

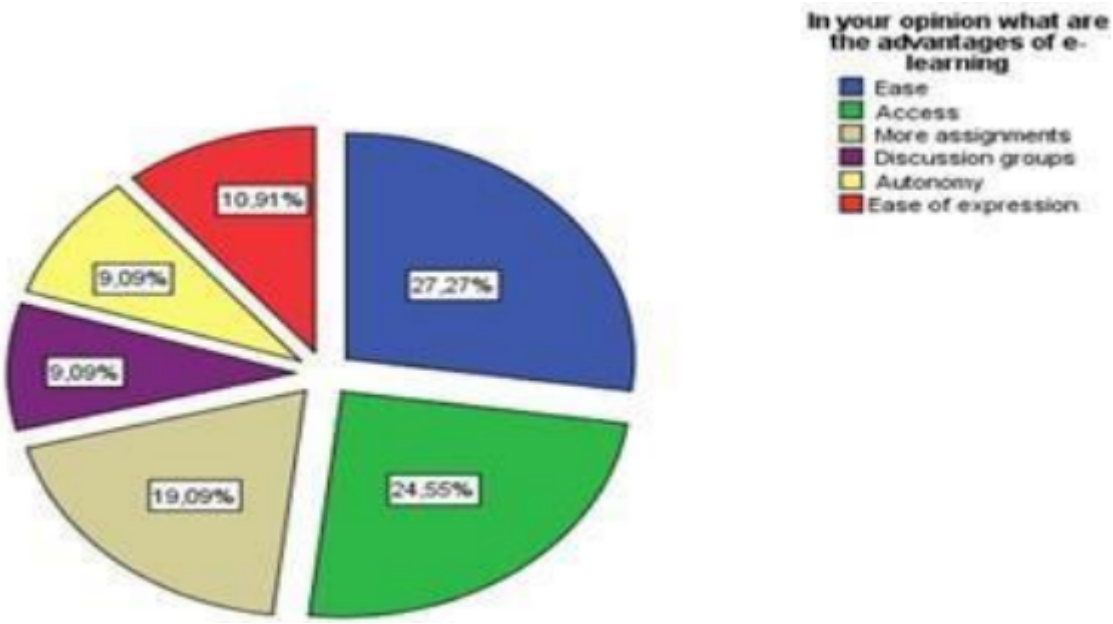
After examining the students' attitudes and perceptions towards the use of e-learning in learning engineering, this section deals with the benefits of electronic learning as perceived by students. Actually, the integration of e-learning in education, especially for higher educational

institutions has many advantages. Several studies in the field of e-learning advocated its effectiveness in teaching and learning and its ability to enhance the efficiency of engineering education. Thus, the sixth research question in the current study examines the perceived advantages of integrating e-learning in tertiary engineering institutions.

♣ RQ6: What are the perceived educational benefits and opportunities of implementing e-learning technology in teaching and learning higher engineering education?

To answer this question, the researcher first, went through an exploratory phase through open-ended questions that asked participants about the advantages of integrating e-learning in higher education and more specifically in engineering departments. This investigation allowed her to determine the most frequent items, which according to the students, constitute the benefits of e-learning. In a second step, she opted for a quantitative analysis of these variables in order to generate more preciseness. The items that she was able to extract thanks to the exploration step are as follows: ease of use, accessibility, expression of thoughts, autonomy, discussion among learners, and challenging assignments. As for the confirmation stage, it showed that the main benefit perceived by students is the one associated with the ease of use followed by an appreciation of the ease of accessibility as indicated in the figure 5 below:

Figure N° 5: Frequency Percentage in Relation to the Benefits of E-learning



3.7. Students' Perceived Disadvantages of E-learning

As discussed in the literature review, although e-learning can improve the speed of learning and simplify its process, some researchers believe that its inappropriate use disrupts the teaching and assessment process. Therefore, the seventh research question investigates the disadvantages of adopting e-learning in higher education as perceived by students.

♣ RQ7: What are the perceived disadvantages of integrating e-learning in higher engineering education?

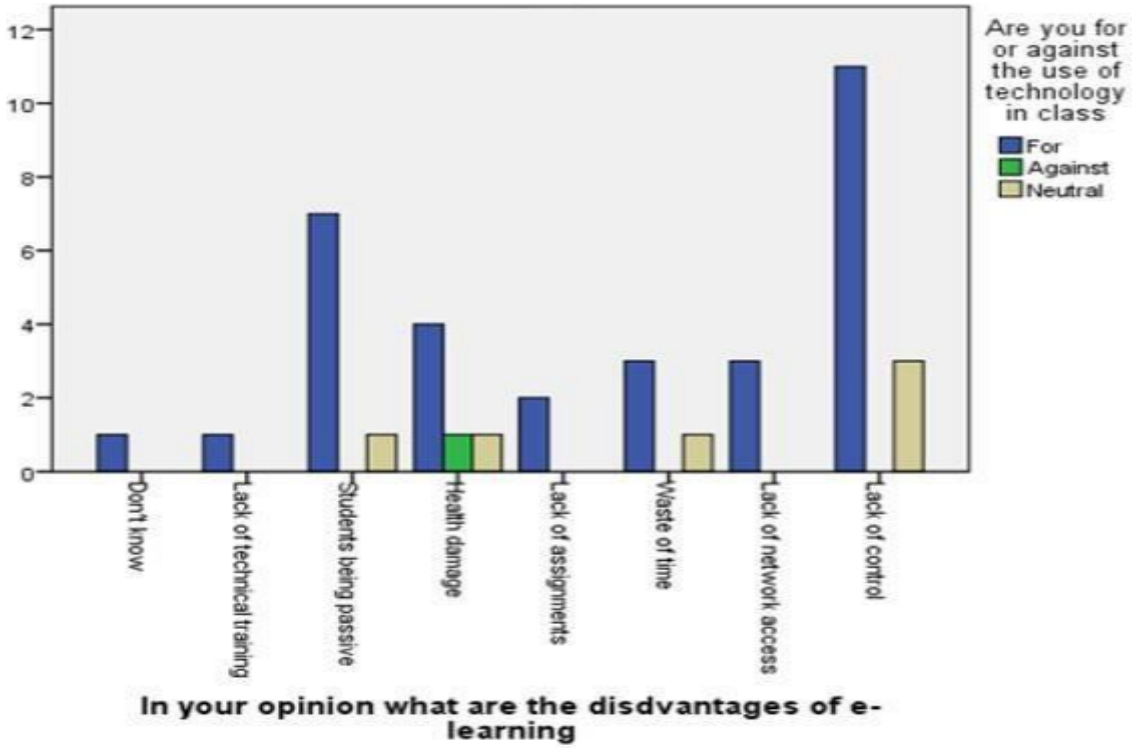
Following the same steps of the previous RQ, the researcher was able to extract the main disadvantages perceived by students thanks to the exploration phase, considering that the number of people who provided an answer to this question does not exceed 39 participants; they constitute 17.1% of the sample. The main perceived disadvantages are lack of technical training, students being passive, health damage, lack of assignments, waste of time, lack of network access, and lack of control. According to the findings, the main disadvantage of e-learning perceived by students is related to the professors' lack of control over their students, as shown in table 7 and bar chart 6 below:

Table N°7: Correlation between Students' Attitudes towards the Use of Technology in Class and Disadvantages of E-learning?

Are you for or against the Use of Technology in Class * in your Opinion what are the Disadvantages of E-learning Cross-tabulation

		Are you for or against the use of technology in class?			Total
		For	Against	Neutral	
In your opinion what are the disadvantages of e-learning?	Don't know	1	0	0	1
	Lack of technical training	1	0	0	1
	Students being passive	7	0	1	8
	Health damage	4	1	1	6
	Lack of assignments	2	0	0	2
	Waste of time	3	0	1	4
	Lack of network access	3	0	0	3
	Lack of control	11	0	3	14
Total		32	1	6	39

Figure N° 6: Students' Perceived Disadvantages of E-learning



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

The Integration of e-learning in Higher Education (HE) is becoming a very common trend in the world's largest universities. However, since engineering education is based on science and mathematics, makes it considerably different from other disciplines. In fact, although the adoption of e-learning has reached advanced stages in many countries all over the world, it is still in its infancy in Morocco (Ajhoun & Daoudi, 2018). In this regard, the eighth research question attempts to identify the extent to which e-learning is manifested in higher engineering institutions in order to support students' learning.

♣ RQ 8: To what extent e-learning is manifested in Moroccan higher engineering education?

In order to answer this question, the respondents were first asked whether the institution to which they belong offers online courses or not.

Table N°8: Frequency and Percentage for the Institution Inclusion of Online Courses

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	20	8,8	8,8	8,8
	No	208	91,2	91,2	100
Total		228	100	100	

Based on table 8, 20 out of the 228 respondents confirmed that the academic program includes online courses; they represent 8.8% of the sample. On the other hand, the vast majority of the surveyed respondents (91.2%, N=208) claimed the opposite.

Moreover, the respondents were required to evaluate different elements in their institutions, including the university infrastructure and e-resources and the teaching methods. In this sense, a five-point Likert scale ranging from very dissatisfied (1) to very satisfied (5) was used to determine the participants' evaluation of various components in their departments. The evaluation is made at the level of the degree of students' involvement in classroom discussions, the quality of the teaching methods, the content and pedagogical objectives of the courses, the degree of difficulty of the courses, the variety of pedagogical and assessment activities as well as the level of lectures and presentations. The following table 9 represents the answers collected from the students regarding their degree of satisfaction with different items in the engineering departments:

Table N°9. Frequency of Students' Satisfaction with their Departments

Satisfaction Frequencies

		Reponses		Percentage of observations
		N	Percent	
Satisfaction with the departments[a]	Very satisfied	120	6,0%	52,6%
	Satisfied	491	24,7%	215,4%
	Neutral	725	36,5%	318,0%
	Dissatisfied	432	21,8%	189,5%
	Very dissatisfied	216	10,9%	94,7%
Total		1984	100,0%	870,2%

In addition to asking participants to evaluate the different components in their departments, the questionnaire also included a five-point Likert type-rating scale ranging from poor (1) to high (5) on which the respondents were asked to evaluate the university infrastructure conditions and e-resources. The evaluation is made at the level of library resources, laboratories, multimedia room, classroom equipment (computers/data show), website of the university, e-learning platforms, interactive whiteboard, and the Internet connection. The following table represents the answers collected from the students regarding their evaluation of the resources:

Table N°10: Students' Evaluation of the University Resources

Educational _E-Resources_and_Facilities _Evaluation Frequencies

		Reponses		Percentage of
		N	Percentage	Observations
Resources & facilities	Poor	901	46,6%	419,1%
Evaluation[a]	Low	390	20,2%	181,4%
	Neutral	345	17,8%	160,5%
	Good	268	13,9%	124,7%
	High	31	1,6%	14,4%
Total		1935	100,0%	900,0%

In general, students' evaluation of these items are mainly negative as depicted in table 10. Almost 67% of the students gave a rating of "poor" (46.6%) or "low" (20.2%) to the e-resources and facilities provided by their institutions, while 17, 8% are neutral, however, only 15.5% consider the efforts made as "good" (13.9%) or "high" (1.6%).

In short, from the obtained results we can say that students' attitudes towards the current facilities and institutional infrastructure are negative, especially their evaluation of the current digital educational resources that play a significant role in promoting and supporting the implementation of e-learning in higher education.

4. Discussion Of Findings

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

At the current juncture, e-learning is not yet integrated in the Moroccan curriculum. Nevertheless, as discussed earlier, the Ministry of Higher Education has planned to develop new strategies and many initiatives to promote its use in education. Thus, this research study seeks to highlight students' attitudes and perceptions as main predictors of the adoption of such new approach in educational contexts. In this regard, Banathy (1991) claims that the

measurement of any innovation, especially pedagogical plans, should first take into account the level of knowledge and preparedness of its potential users.

The findings of the paper-based questionnaire showed that there are many factors that push learners to use e-learning such as its perceived ease of use, usefulness, flexibility of the learning process, and the design of the learning resources. Accordingly, using e-learning does not necessitate high skills from learners to possess; they are only required to have an experience interacting with computers and therefore use the e-learning systems easily. Likewise, today's tech-savvy learners have a tendency to use technology in almost every aspect of their lives including education, which implies that they are formerly prepared to employ e-learning tools for educational purposes. In fact, the findings revealed that college students use technology devices and the Internet very frequently, which is a factor that provides them opportunities to engage in technology-enhanced instruction in order to improve their learning outcomes and performances. Nonetheless, learners are not entirely satisfied with the conventional instructional methods; they are passionate about using technology and highly value its role in enhancing learning.

In general, engineering students are equipped with several technological devices including personal laptops, desktop computers, smart phones, tablets, and other technological tools. Today's learners are considered digital natives and are immersed in the world of interactive technology such as mobile phones, iPods, and other limitless digital resources. Based on the findings, almost all of the students have access to the Internet at home and use it on a daily basis to access educational resources to keep abreast of information that might not be included in textbooks and therefore take charge of their own education.

The findings disclosed that technology touches every part of the students 'lives; technology does not only provide students with access to countless resources, but it also helps them in the learning process. In fact, students use various online tools for education purposes including virtual worlds, synchronous and asynchronous chat tools to get more useful information and to connect with different learning groups. Moreover, some of them are even enrolled in some online courses.

College students in engineering departments of the two higher education institutions are likely to have adequate ICT skills to be employed in e-learning activities. The findings revealed that they were more confident in their digital skills. On the one hand, they use computers and other technology devices almost in every aspect of their life including education. On the other hand, as members of the "Net-Generation", learners are accustomed to high-tech gadgets, use the

Internet on a daily basis, and are always up-to-date with new technology innovations, which help them develop appropriate digital skills. These skills would subsequently ensure effective and productive use of ICT resources.

Finally, the 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

4.2. Discussion of Findings From Literature Review

The purpose of this research project is to examine engineering students' perception of e-learning, which is an alternative to traditional classroom teaching and learning. The findings of the students survey showed that e-learning is perceived as having some pedagogical benefits over conventional face-to-face learning, which if adopted can promote teaching and learning in a better way. The majority of students perceived e-learning as a learning experience that provides them with some degree of convenience that is not necessarily the case if they were studying in the physical classroom setting alone. Student respondents have considerably agreed of the conveniences e-learning offers as revealed by experts in the e-learning arena. To start with, (79.82%) of the respondents believe that e-learning is beneficial and useful. Among the arguments why e-learning is considered to be beneficial is that it allows learners fulfill their assignments more quickly as well as it enhances learning productiveness. This is since learners can have access to instructional resources, which are offered in the sort of electronic books and web links, which in turn enables them to concentrate on their studies without the need of going to the physical library to search for relevant course materials. This is consistent with a study carried out at the university of Cape Coast in Ghana, whereby the students had positive attitudes towards the usefulness and effectiveness of hybrid learning they took part in at this HE institution (Essel, Owusu-Boateng, & Saah, n.d.). Aside from being considered as beneficial and useful, e-learning was perceived as having other benefits and flexibilities for studying engineering education. Among the advantages e-learning provides to the learners is that it offers students the flexibility to complete their studies at their own pace, dependent on their personal situation. Such flexibility enables students to pursue education whenever and wherever they want and in their own special ways. The study findings revealed that majority of the engineering

students are aware and agree to these conveniences e-learning offers over face-to-face learning. Nonetheless, it must be noted that the benefits e-learning offers over traditional face-to-face learning can at times be a challenge; for instance, as students work at their own pace, they may feel a sense of isolation and remoteness due to lack of interaction with their peers and their teachers (Graham & Hewett, 2009). In this regard, the problem of not being able to communicate with their colleagues and instructors may engender disappointment, demotivation, and frustration due to such isolation. To address this problem, the students necessitate a higher motivation level to be effective at e-learning environments (Hever, Groot, & Hoppe, 2009). In this study, however, (87.8 %) of the student respondents showed high level of awareness towards the nature of e-learning and stressed its importance at the university. Besides, (91.7%) of the surveyed students believed that e-learning allows learning and communication to be practiced in real time, the same as it is in the conventional face-to-face setting. In other words, e-learning according to them, will encourage the students to communicate and exchange ideas with their fellows and teachers, which gives them a sense of belongingness as done in the physical classroom setting.

Moreover, the findings showed that (78%) of the respondents consider themselves capable of using an e-learning platform in which the majority (75%) do not think they need a specific training that helps them explore how it functions. Nonetheless, it should be mentioned that students' positive attitudes towards the ease of use of e-leaning platforms is insufficient to allow them to be effective at using them, considering that learners also need a certain degree of comfort and experience with computers and related technology to appropriately employ the e-learning platform. That is, without such digital skills and knowledge it becomes a barrier for the students to be successfully engaged in e-learning systems (Donnelly & Mc Sweeney, 2008). In this study, the findings revealed that student respondents possess the basic ICT skills they need to easily take part in e-learning activities without any difficulties. This guarantees that the learners will not encounter any hindrances due to lack of technical knowledge, which generally generates frustration to users and becomes a hindering obstacle to e-learning integration. This is because, majority of the surveyed respondents (97%) have expressed their high level of comfort with technology as (76.7%) consider themselves technology experts which promotes and enhances their e-learning experience. This is in line with a study done at the University of Ghana, which aimed to determine learners' perception of integrating e-learning in the teaching-learning process; the study concluded that learners entered the university with relatively good ICT knowledge, can take part in e-learning courses(Essel, et al, n.d.). These findings

demonstrate that learners with good ICT skills are able to participate in e-learning systems easily and will not be impeded because of lack of digital knowledge. This research project aims to advocate the fact that the rate of accepting electronic learning is growing dramatically around the world, and Morocco is not excluded from this e-learning acceptance. Yet, although all the student respondents surveyed in this research are learning through the old traditional methods, majority of them are eager to use e-learning in the future be it hybrid or fully online. Wang (2014) reported similar findings, based on the interviews with students, the researcher established that e-learning was considered as convenient and effective. The participants liked the fact that e-learning can be used anytime and anywhere. This is also consistent with a study conducted at the University of Cape Coast in Ghana, which concludes that among the options of pedagogical methods, learners favor e-learning modes of instruction.

The study findings demonstrate that in the coming future a lot of learners will opt for more e-learning programs than traditional face-to-face classes. It appears thus, that learners are intending to try at least one mode of e-learning sooner or later. The researcher believes that since the study findings are having the same conclusions (learners' interest in e-learning both online education and blended learning), which functions as an open invitation to Moroccan higher education institutes and other academic establishments to reinforce their traditional pedagogical methods with e-learning including blended, web enhanced or completely online.

Conclusions and Implications

Considering the paper-based questionnaire conducted for this research, the findings demonstrated that e-learning is an effective alternative medium of education for engineering students. First, today's students are tech-savvy learners who use technology in almost every aspect of their lives including education, which implies that they are formerly prepared to employ e-learning tools for educational purposes. In fact, students use various online tools for learning objectives including virtual worlds, synchronous and asynchronous chat tools to get more useful information and to connect with different learning groups. Moreover, some of them are even enrolled in some online courses. The questionnaire statistical analysis found that engineering students are no longer satisfied with the conventional teaching methods and are eager to use technology in their classes. They showed high willingness and motivation to use e-learning in learning engineering and reported high expectations concerning the effectiveness of this new teaching approach. Besides, as members of the "Net-Generation", learners are accustomed to high-tech gadgets, use the Internet on a daily basis, and are always up-to-date

with new technology innovations, which help them develop appropriate digital skills. These skills would subsequently ensure effective and productive use of e-learning.

This study addressed the instructional methods of teaching engineering education, as it offered suggestions and recommendations to overcome the limitations of traditional education by implementing e-learning as an alternative or complementary to the classical teaching methods. Consequently, one can assume that in contrast to the conventional education method, the adoption of e-learning technology can grant significant benefits due to its accessibility, quick delivery, and facilitated sessions or lectures. This research project presents an overall demonstration of the extent to which e-learning can facilitate the transformation of Higher Education Institutions (HEIs) in order to achieve high quality education. Actually, majority of the Moroccan universities seem to be lacking the adequate ICT facilities, professional training and technical support, which are considered key factors for successful e-learning implementation.

Like all research projects, this doctoral dissertation has its own limitations. In fact, certain limitations were realized concerning the methodology of this study. One limitation with respect to the context of this research is that it was carried out only in one city in Morocco; therefore, this may affect the generalization of the results of the study to other cities. In other words, the findings may not be generalized to other cities or cultures.

Finally, a major limitation of this study is the fact that it focused only on one field of education "engineering education" but not on other disciplines. In this regard, more studies need to be conducted on other fields and why not drawing comparisons between the different processes and results. The obtained results are exclusively valid in the departments of engineering in the city of Marrakech. Yet, this research project still offers a notable contribution in the education sector with the aim of reaching high quality teaching and learning in Moroccan higher education institutions.

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