

1- Statement of the Problem

The use of Information and Communication Technology (ICT) in teaching and learning is of significant importance to a country's development and the social growth of individuals. As a result, ICT usage is gaining momentum in higher education (HE), particularly, e-learning as a modern form of education is increasingly adopted in HE settings and has been one of the main research lines of educational technology in the last decades. In Morocco, the education system has known many reforms after independence and particularly in the field of education. Thus, Moroccan higher education institutes (HEIs) have started to submit to this new shift by progressively integrating ICTs into their agendas.

Despite the call for ICT adoption and particularly e-learning in the Moroccan education setting, its implementation appears to be gradually progressing, and even in its initial stages due to various factors that prevent its effective integration. Although some HEIs have the will and desire to develop successful ICT programs, they are encountered with the serious challenges of appropriate implementation. In this sense, this thesis aims at exploring the use of e-learning as an alternative strategy to attain high standards in teaching engineering education within Moroccan HEIs, seeing that the 21st century is characterized as being the age of modern information technology (IT) in which learning has formerly begun relying on the employment of digital tools. The study also attempts to scrutinize the extent to which e-learning could be used as a tool to improve students' learning outcomes.

The study needs diverse elements to be taken into consideration, involving those linked to technology, institution and culture. Thus, students at higher educational institutes are assumed to be armed with the basic digital skills to comfortably use e-learning in learning engineering. This dissertation aims at offering a comprehensive portrayal of the issue of e-learning adoption and application among the departments of engineering within Moroccan

higher educational institutions. Moreover, it tries to identify the potential benefits of employing e-learning technology for the students and the educators so as to ensure high quality education, which prepares students well for success in the future.

2- Objectives of the Study

Due to the continuous growth of ICTs, this dissertation aims at examining the current state of e-learning technology in Moroccan tertiary education. More than that, it aims at shedding light of the latter's effects on scientific education, particularly the fields of engineering. Today's world is regarded as a small entity due to technology revolution. Now, we can see great transformation in various aspects of life including economy, finance, industry, health, etc... .

In Morocco, both the public and private sectors of higher education are striving hard to cope with globalization. Fortunately, the Moroccan government started to feel the need for new reforms to meet the future requirements. Yet, some educational technology researchers view e-learning as a menace to the conventional ways of learning; students thus are seen as being imprudent, inconsiderate, and inactive in front of technology. Nevertheless, studies in many developed countries have demonstrated the opposite; e-learning presents an effective tool that paves the way for new prospects for learning and teaching engineering.

This dissertation attempts to evaluate the impact of implementing e-learning in higher education, it highlights the significance of e-learning by following the previous efforts of some prominent countries in the educational arena so as to enhance its quality. In addition to that, it presents a guideline to integrating e-learning in Moroccan higher engineering education. Also, it puts emphasis on the aspects that require development and advancement within HE, with more emphasis on the students and instructors' awareness towards e-learning technology. On the other hand, the research focuses on the learners' new demands and how e-learning can meet

their requirements. Actually, the research findings may provide relevant groundwork for better application of e-learning which results in high quality of the Moroccan higher education system.

The study aims to investigate the integration of e-learning in Moroccan higher education institutions as a mechanism that enhances the quality of engineering education. Notably, the present study attempts to identify the barriers that impede the use and adoption of e-learning technology by the lecturers and learners, and thus, to determine the major impediments that hinder its effective implementation.

The general purpose and motive for this study stem from the fact that investigation in the field of e-learning in higher education is quite restricted in Morocco. Therefore, the present study seeks to develop a comprehensive framework that will eventually lead to effective implementation of e-learning in HE settings. Moreover, the study also focuses on the benefits and drawbacks of adopting e-learning for teaching and learning engineering. The principal objectives of the present research are:

- To identify the usefulness of implementing e-learning technology in the departments of engineering in Moroccan HEIs.
- To assess lecturers and learners' levels of employing technology for learning objectives.
- To investigate the current state of ICT and e-learning in some Moroccan higher engineering institutes.
- To determine the factors influencing the successful implementation of e-learning.
- To detect the linkage between sets of variables (gender, age, institution...etc.) and the adoption of e-learning in Moroccan tertiary education.

Based on the stated objectives, the following questions are formulated to guide the research.

RQ 1: What type of information and communication technologies do engineering students and instructors possess and benefit from?

RQ 2: How do students and instructors use ICT for learning and teaching engineering education?

RQ 3: How competent are the learners and the teachers in employing e-learning technology?

RQ 4: How do students and teachers' variables (sex, age, area of study, type of school) pertain to e-learning use and competencies?

RQ 5: How do college teachers and students perceive e-learning technology in learning and teaching higher engineering education?

RQ 6: What are the perceived educational benefits and opportunities of implementing e-learning technology in teaching and learning higher engineering education?

RQ 7: What are the perceived disadvantages of integrating e-learning in higher engineering education?

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

RQ 9: Is there any difference regarding e-learning readiness between public and private Moroccan HEIs?

RQ 10: What are the factors affecting the adoption of e-learning technology in learning engineering higher education?

Furthermore, the research paper was designed to test a set of hypotheses in order to determine the different factors that may influence e-learning implementation in HE settings. The research hypotheses emanating from the above research questions are set up as follows:

H1: Several factors influence the adoption of e-learning in the Moroccan education system.

H2: Moroccan university teachers and students have poor ICT skills to embrace e-learning technology.

H3: The adoption of e-learning technology enhances the quality of engineering education.

3- Research Methodology

A key part of any dissertation or thesis is a research methodology. The research paper can have fruitful findings if it relies on an appropriate theoretical paradigm. This study makes use of a mixed method research as it focuses on collecting, analyzing, and mixing both quantitative and qualitative data. The combination of these methods provides a better understanding of the topic under investigation.

Both quantitative and qualitative methods have been adopted in this study to complement each other. The qualitative method, though it helps in collecting very detailed and in depth data, its sample remains small in comparison to quantitative method; it only answers research questions that are not answered in the questionnaire. Moreover, the use of a quantitative method can lead to generalization as the sample is larger and it also answers specific research questions addressed in the study.

The research method that is employed in this paper has been selected based on the mixed method approach so as to collect information, and to gather knowledge concerning the usage of e-learning in Moroccan higher engineering education. The primary aim of the research paper is

to smooth the path towards an effective e-learning implementation in Moroccan higher HEIs and to depict the substantial role of e-learning in teaching higher engineering education. Thus, it was obligatory to examine the Moroccan engineering instructors and learners' digital literacy in the learning milieu and to identify the major factors influencing e-learning implementation. Accordingly, the research paper attempts to put to work the contributing determinants of e-learning implementation, and to examine the various restrictive elements that hinder the integration and utilization of the e-learning technology.

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). A printed questionnaire was directly distributed to students from the chosen educational institutes. Moreover, a web-based survey questionnaire was sent by email to faculty members, in addition to a semi-structured interview conducted with university teachers.

The paper-based questionnaire was randomly administered to college students and precisely targeted undergraduate students who have successfully completed at least one semester. The Sample population was randomly chosen without any kind of discrimination, and it incorporated students involved in the departments of engineering with the two Moroccan HEIs as representative research sites. The questionnaire is made up of seven sections including perceptions, knowledge, competences, and consciousness. The survey is split into several thematic sections:

The first section is dedicated to academic and social background information comprising age, gender, educational level and school name. The next section attempts to examine students' prior knowledge of information technologies (IT) including the Internet access, use and ownership of different technology devices, use of digital tools, etc. Besides, the section also

examines students' familiarity with e-learning tools used for learning engineering education. The third section deals with students' digital skill levels and attitudes towards educational technology.

Section four involves a Likert scale ranging from (1= Excellent) to (5=Very low) in which learners were asked to evaluate different educational e-resources and facilities in their institution. Section five attempts to examine the learners' perceptions and expectations of the effectiveness of e-learning in learning engineering; the utilization of a five-point Likert scale instrument was of considerable significance to evaluate students' perceptions and expectations, the students were expected to rate a set of statements related to e-learning use in learning engineering.

The sixth section includes a Likert-type scale in which participants were required to rate their satisfaction level with the traditional teaching paradigm in their departments ranging from (1= Highly satisfied) to (5= Highly dissatisfied). Finally, the seventh section provides a list of key drivers for an effective implementation of e-learning technology in education. The students were presented with a rating scale and asked to rate the importance of 6 different factors leading to successful e-learning adoption ranging from (1= Absolutely essential) to (5= Slightly important).

The technique of the web-based questionnaire was adopted to gather the data from professors from the engineering departments (Appendix 2). It attempts to collect certain principle information about university teachers and the research topic under investigation. In this research study, the online questionnaire was written in French and then translated into English since not all of the respondents can speak, write and understand the English language. It consists of three main sections:

The first section contains questions linked to personal background information comprising age, gender, workplace, years of the teaching experience. The second section deals with the teachers' technology usage (use and ownership of computers, access to the Internet, comfort level with digital tools, use of diverse ICT tools in their classes etc.). The third section examines the lecturers' familiarity and attitudes towards educational technology in engineering education, their prior knowledge of e-learning systems, their digital skill level and the kind of training programs they received to improve their ICT competencies. Besides, the section aims to explore the teachers' perceptions towards e-learning through citing some of its benefits and drawbacks when adopted for teaching engineering. The section also investigates the different factors that influence the integration of e-learning in Moroccan higher education settings.

4- Research Structure

This study is divided into an introduction, five major chapters and a conclusion. The general introduction reflects the background of the research. It lays the ground for understanding the context of the study and offers a general framework for e-learning integration in higher education. This chapter introduces the problem statement and the background related to the research study, as it covers the objectives of the study, research questions and hypotheses, research assumptions, theoretical framework, research methodology, and outlines the organization of the research paper. Moreover, it includes definitions of the most important key terms related to the research study.

Chapter two examines the literature from various perspectives; it is organized into four major sections. The first one introduces a comprehensive depiction of Information and Communication Technologies; it discusses e-learning evolution, definition, features, strengths and weaknesses. The second section sheds light on the students and instructors' characteristics and new responsibilities in the digital age. The third section discusses the teaching methods

used for teaching engineering education and offers a clear understanding of the role of assessment and e-assessment practices in the e-learning environment. The last section is devoted to the theoretical framework that underpins the research study. It sheds light on the different learning theories and highlights the preceding experiences of implementing e-learning in Moroccan education and in different nations as well.

Chapter three provides insight into the data collection tools and methods; it grants a thorough description of the techniques and procedures employed in the study. Moreover, it examines the effectiveness and steadiness of the instruments to obtain accurate results. Chapter four presents the results of the paper-based survey. Chapter five offers the findings of the web-based survey and the semi-structured interview. Chapter six discusses and interprets the main research findings. Lastly comes the conclusion of the research study which epitomizes the main findings, implications, limitations, and suggestions for future research, as it leaves the door open for further investigations that address the issue from another angle, since the progress of education requires additional academic research to achieve quality in teaching and learning.

5- Research Findings

This dissertation explores the implementation of e-learning in Moroccan higher education institutions (HEIs), engineering departments in particular; it also examines the factors that influence its successful adoption and application. The available literature indicated that empirical research on the integration of e-learning in higher engineering education is very rare. Nonetheless, a lot has been said about the potential benefits of integrating this modern approach in HEIs. Thus, the purpose of this research was, first, to explore the extent to which ICT and particularly e-learning is adopted in Moroccan higher engineering education. A survey was adopted to assess college students and teachers' perceptions and attitudes towards e-learning, in addition to a semi-structured interview conducted with lecturers to talk about their

experiences with technology usage in teaching engineering. The issue is authentic, new and problematic.

Overall, the research study is well organized, including the different chapters such as research methodology, findings, discussion and bibliography.

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 piece of work seeks to highlight the teachers and students' attitudes and perceptions as main predictors of the adoption of such new approach in educational contexts.

Both the quantitative and qualitative data address a number of issues relevant to e-learning in Morocco. The study attempts to offer a thorough understanding of the adoption of e-learning from institution, faculty, and learners variables. Besides, it is an examination of both the teachers and students' perceptions of electronic learning, its practice and challenges, the extent to which they believe e-learning is promoted as a component of the education system, their experiences with teaching and learning using e-learning tools, and eventually the degree of involvement in the development of a successful e-learning environment.

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. Besides, they revealed a strong sense of consciousness about the factors that impede the integration of e-learning in education.

As far as the online questionnaire is concerned, the findings demonstrated that the majority of the university teachers tended to employ a range of ICT resources in their classes to support students' learning and move them toward fulfillment of their individual potential. Actually, the results showed that the level of e-learning technology acceptance among faculty members in terms of awareness and motivation was generally high, except for a minority that is still reluctant to engage in educational technology. Teachers are aware of the fact that learners of the third Millennium need a variety of teaching methods and strategies to enhance the quality of education.

Moreover, like their students, most of the teachers showed a high degree of using computers and the Internet in their daily lives, which is a factor that influences their initial acceptance of technology-enhanced instruction. On the other hand, college professors expressed their frustrations in terms of some barriers that prevent them from embedding e-learning in their teaching practices; for them, e-learning is not yet at the level it should be due to the lack of technology-related training that promotes their digital skills and competencies. Therefore, if not equipped with the necessary skills, teachers are likely to continue employing traditional teaching methods.

For the semi-structured interview, the teachers were required to talk about their experience of using ICT in teaching and learning; the challenges they encounter when

embedding these tools and the factors that prevent them from fully integrate it in their pedagogical activities. The findings supported the results of the online questionnaire; most of the teachers showed high level of awareness of the increasing importance of technology in enhancing the teaching and learning processes; they tended to have positive attitudes towards technology and if they use it will help them create more active-learning environments and make a positive difference in education. Nevertheless, they revealed that successful implementation of ICT is primarily influenced by their digital skill level and training. The teachers highlighted the importance of ongoing intensive training programs that develop their digital literacy and technology skills in order to keep abreast of technology trends and thus be able to teach the Net-generation of learners. In addition to the lack of effective training and inadequate digital literacy, the teachers also identified other critical barriers to e-learning integration including lack of access to ICT resources, lack of technical support, and inadequate ICT equipment.

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.

6- Limitations of the Study

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. In fact, generalization should not be the primary objective in a research, rather, utilization of the results is of considerable significance, and it is up to the reader to determine how relevant the results are in their own context.

Although the research sample is small and the selected educational institutions are from the same city, the purpose of this study is not to generalize, but to offer a thoroughly contextualized understanding of the attitudes and challenges surrounding the use of e-learning in the Moroccan context. Finally, a major limitation of this dissertation 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.

7- Suggestions for Future Research

This research paper was carried out for the sake of tracking the continuous influx of technology with the intention of enhancing the teaching and the learning practices of Moroccan higher engineering education. Indeed, digital learning can improve the learners’ critical thinking as it can foster autonomous learning. The study has primarily examined the various attributes of participants (faculty & students), their prior knowledge and consciousness, their digital competencies, their readiness, their attitudes towards engineering education and ICT use, and their new responsibilities in the learning journey. Further research of scientific education may find the results pertinent and deserve further consideration and scrutiny through future research.

Likewise, future investigators might require students to provide their private access codes to gain access to the e-learning material in order to reach more information about technical, organizational, instructional and pedagogical practices in the e-learning environment, and to pursue the assessment process. In addition to that, the research questions were reconsidered in further discussion of the final findings, allowing for a more complete understanding of the main aspects of teaching and learning in e-learning settings. Consequently, various research areas have come into view in the phase of data examination, which can offer a favorable condition for further research in the field of e-learning within the Moroccan higher education institutions not only for engineering education, but also for other fields of education. Moroccan colleges need to modify, adjust, adapt, and orient their teaching programs to meet new educational demands, and thus provide high quality instruction.

Electronic learning, social networks, digital college campuses, digital platforms, Web conferencing incorporate new directions in the pedagogical side of many institutions within higher education; therefore, research is a continuous practice that can meet new modes of consideration and inquiry; by introducing conceptual foundations which could give rise to practical frameworks. Obviously, this will shape the scopes of higher education for the generations to come. Certain areas for further research might examine the academic institutions, which have begun adopting e-learning in their teaching programs through years of practice, and by producing long-term implications of the implementation on learners' performances.