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Erin Czerwinski, Carnegie Mellon University, USA

Jean-Pierre Toumazet, IUT - Université Clermont Auvergne, France

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Developing and Assessing a Holistic eLearning 4.0 Model for Higher Education in Saudi Arabia

Mohammad Alnassar¹, Tomayess Issa¹, S Zaung Nau¹, Bilal Abu Salih²
¹Curtin University, Perth, Australia, ²The University of Jordan, Amman, Jordan
e-mail: mohammad.alnassar@student.curtin.edu.au
e-mail: tomayess.issa@cbs.curtin.edu.au
e-mail: z.nau@curtin.edu.au
e-mail: b.abusalih@ju.edu.jo

Abstract— The rapid technological developments in various fields have changed the usual patterns of human life. Clearly, technology has contributed to the diversification of the teaching and learning methods used in the education sectors and has changed the way that information is delivered to students, particularly during the eLearning 1.0, 2.0 and 3.0 stages. The literature indicates that the Semantic Web (eLearning 3.0) has been researched extensively and few issues have yet to be investigated. However, since eLearning 4.0 is a new generation of eLearning, to the best of the researchers' knowledge, very few studies have examined the factors that facilitate its implementation. Given the recent emergence of eLearning 4.0, the aim of this research is to examine the implementation of this relatively new technology in the higher education sector, and a holistic eLearning 4.0 model for Saudi Arabia higher education will be proposed. This will contribute to the Saudi Arabian government's achievement of its goals for the education sector specified in its Vision 2030. In this research, nine factors that constitute the initial model will be thoroughly examined. These factors are: Pedagogical Quality, Academic Success, Environment, Financial Cost, User Support, Behavioural Intention, Collaboration, Satisfaction and "Smart Technology 4.0 Adoption and Design". The contribution of this research is that it examines the effectiveness of the nine factors with a focus on the new factor "Smart Technology 4.0 Adoption and Design", and then improves the initial holistic eLearning 4.0 model. A mixed-methods approach will be adopted. An explanatory sequential design will inform the data collection process. The target population for the online survey will be the academics and the students in public and private Saudi universities. For the collection of qualitative data, semi-structured interviews will be conducted with at least twenty-five e-learning experts. This paper is part of an ongoing research effort to develop and promote e-learning in Saudi Arabia.

Keywords—eLearning; HCI; Web4.0; Initial Model; Saudi Arabian Higher Education.

I. INTRODUCTION

In the introduction section, we defined eLearning, its generations, eLearning in Saudi higher education, and research questions.

A. eLearning:

eLearning is defined as the education that the student obtains electronically through a computer network [1]. The

delivery of education via information technology has several impacts on the way that teachers teach, and students learn. eLearning can be conducted through direct Internet connection at a specific time or at a time chosen by the students and via any device that suits them [2].

B. eLearning 1.0:

eLearning 1.0 was developed as a means of improving education by facilitating communication between teachers and learners using the technologies offered by Web 1.0. In the early transition of education to technology, several digital tools were available in the education system, but they were not connected simultaneously [3]. The use of the Internet was the first step in eLearning 1.0, making it easier for students to access educational material "anytime, anywhere, anyone" [4]. The technical capabilities of Web 1.0 allowed the learner to read only, not write. Instructions were received in the traditional way because the educational materials were unidirectional (i.e., from the teacher) without interaction with the learners [5].

C. eLearning 2.0:

eLearning 2.0, according to the description given by [6], is what Web 2.0 provides for educational use. Unlike Web 1.0, Web 2.0 enabled the user to write and save content [7]. It allowed people to discuss and express ideas among themselves, which helped build a social foundation that was missing in Web 1.0 [8]. More specifically, Web 2.0 comprised social networks and their technologies, such as Facebook, Twitter, blogs, podcasts, discussion board, and wikis. eLearning 2.0 enabled the building of social knowledge through multi-directional interactive communication [5]. Moreover, it allowed the teacher to communicate with the students directly and evaluate their learning process. It also gave students the opportunity to contribute their own material and share it with others [3].

D. eLearning 3.0:

eLearning 3.0 is based on the Semantic Web, known as Web 3.0. It provides education in a meaningful and content-related way [3]. Instead of documents, the Semantic Web is built on databases [9] that allow users to share data with

each other without being monopolized [10]. To build an eLearning 3.0 system in a way that facilitates the learning process for students, it is possible to rely on data mining and artificial intelligence to filter the huge and complex amount of data [8]. Modern technology, such as cloud computing, high resolution screens, and large data storage capacity, have contributed to the transition from previous eLearning to eLearning 3.0 [5]. One of the most prominent examples of a system implemented for eLearning 3.0 is the Adaptive Hypermedia Knowledge Management E-Learning Platform that complies with Web 3.0 educational requirements [11].

E. eLearning 4.0:

eLearning 4.0 is the latest technology in digital transformation and innovation in the education sector along with other fields [12], and despite all the advantages that were provided by eLearning 3.0, it has shortcomings because of the nature of Web 3.0 and its technical issues including interoperability, inability of the server to check, inadequate privacy safeguards, and the security risks [13]. The successful implementation of eLearning 4.0 depends on machines as well as people, so it is vital that the two be coordinated. This coordination will find innovative solutions to various problems, which may contribute to improving modern life [14]. For the successful implementation of eLearning 4.0, teachers must be competent users of the eLearning 4.0 technologies. This could be achieved through training courses and workshops designed to improve teachers’ skills and efficiency in using eLearning 4.0 in the classroom [15]. eLearning 4.0 can contribute to making learning and teaching dynamic and engaging. In particular, higher education institutions should seek innovative ways to develop educational processes that are in sync with the needs of the Industrial Revolution 4.0 [15]. The concept of Web 4.0 is connecting intelligence which has transferred to eLearning 4.0 [16].

F. eLearning in Saudi higher education

Education is the cornerstone of the Kingdom of Saudi Arabia’s Vision 2030 agenda for building a vibrant society. Saudi Arabia, which seeks to develop and modernize its entire education system, aims to keep pace with modern technologies that help students develop their scientific outputs and practical skills during their educational journey to achieve the goals of 2030 Vision. This vision aims, through the educational and academic system, to obtain qualified graduates who can contribute to and help develop a prosperous economy for the country [17]. The higher education sector in Saudi Arabia comprises thirty-nine universities, both public and private, and has one hundred and thirty-nine university campuses [18][19]. In this country, computers have been used in education since the 1990s. At that time, specifically in 1996, the Computer and Information Centre was established, and was responsible for providing technical services to universities [20]. Public universities in

Saudi Arabia, which constitute the majority of the higher education sector, have a policy for having a deanship for eLearning and distance education. These deanships build an infrastructure for the success of eLearning in universities by providing the technical means to convert traditional courses into those that can be offered through eLearning while providing support to users to ensure the quality of the education [21].

This paper aims to present the idea to develop a holistic eLearning 4.0 model for higher education in Saudi Arabia. Further research will be carried out in the future to examine the following research questions: 1-What are the essential factors that are required for developing a holistic eLearning 4.0 model for Saudi Arabia? 2-What are the perceptions and attitudes of stakeholders toward a holistic eLearning 4.0 model for Saudi Arabia higher education? 3-What is the Smart Technology 4.0 adoption and design factors required to develop a holistic eLearning 4.0 model for Saudi Arabia?

The rest of this paper is organized as follows. Section II summaries studies exploring eLearning factors. Section III explains the research gap. Section IV outlines the research significance. Section V explains the research methodology. Section VI about conclusion and future work.

II. LITERATURE REVIEW

Based on the studies listed in Table 1, the researchers proposed an initial holistic eLearning 4.0 model for Saudi Arabia (see Figure 1) as the first version of an eLearning 4.0 model for the Saudi Arabian higher education sector. There are nine factors in this initial model: Pedagogical Quality, Academic Success, Environment, Financial Cost, User Support, Smart Technology 4.0 Adoption and Design Factors, Behavioural Intention Factors, Collaboration Factors, and Satisfaction Factors.

TABLE 1. STUDIES EXPLORING ELEARNING FACTORS AND SUBFACTORS.

Factor Name	Definition/sub-factors	Reference
Pedagogical Quality	The pedagogical quality factor plays an important role in eLearning system, since it has seven different sub-factors related to quality: information, instructor, instructor competencies, technical support, course delivery, tutor competence and facilitating conditions.	[22]-[28]
Academic Success	Academic success has five factors: service quality, organizational factors, technology/systems factors, social factors, and instructors’ factors.	[29]-[32]
Environment	The environment factor has six sub-factors: e-content development, student awareness, facilitating conditions, social presence, cognitive presence, and teaching presence.	[33]-[37]

Financial Cost	Price value is the first sub-factor under financial cost. Bates [38] states that the use of technology in education helps to reduce the costs of education incurred by students. Financial support is the second component of financial cost. Every organization and its departments need ongoing financial support in order to survive.	[38]-[41]
User Support	User support has two sub-factors: resource support and training programs. Resource support enables students to communicate easily with both the technical support team and the teachers. The training programs play an influential role in the distance education process.	[42][43]
Behavioural Intention	Behavioural intention is a central factor in eLearning. In this research, behavioural intention consists of six sub-factors namely: social influence, trust, self-efficacy, performance expectancy, hedonic motivation and perceived enjoyment.	[34][39][54]-[60]
Collaboration	Collaboration in education involves the activities in which a group of students jointly engage in order to accomplish the academic tasks required of them [61].	[43][61]-[66]
Satisfaction	Student satisfaction can be determined by their continuous evaluation of the quality of teachers in teaching and the quality of the educational material provided to them [26].	[26][67]-[70]
Smart Technology 4.0 Adoption and Design	Smart technology 4.0 adoption and design factors are essential for eLearning 4.0, and to date have been under-researched. This factor has six sub-factors: flexibility, user acceptance, computer self-efficacy, design quality, infrastructure component, and accomplishment.	[33][44]-[53]

III. RESEARCH GAP

eLearning 4.0 is a new term associated with other terms like Education 4.0, Pedagogical 4.0, Web 4.0, and Industry 4.0. Numerous factors that facilitate eLearning implementation have been investigated by [39][71]-[75]. To the best of the researchers' knowledge, most aspects of eLearning 1.0, 2.0, 3.0 have been researched and reported in the literature [5][8][13]. Lately, researchers have been studying the concept of eLearning 4.0. Studies by [12][15][16] have explained eLearning 4.0, the new technologies involved, the value added to education, and how eLearning 4.0 will meet the needs of Industrial Revolution 4.0. eLearning 4.0 has been devolved to catch up with new technologies extending to the education environment. These technologies, such as 3D Printing, Augmented Reality, Virtual Reality, Cloud Computing, Hologram, Biometrics, Paper-thin Smartphone, Multi-touch LCD screen, Internet of Things, Artificial Intelligence, Big Data, and QR-code were studied by [12][15] who give details of each technology and its benefit to education. However, many aspects of eLearning 4.0 have yet to be covered as it is a relatively new technology, together with all the technologies related to it. To the best of the researchers' knowledge, no study has been conducted that focuses on the learner or that proposes a holistic eLearning 4.0 model for Saudi Arabia higher education. The available researches conducted on Saudi Arabia [20][76]-[81] have investigated various factors, either from the teachers' or students' perspectives, that influence the implementation of eLearning.

IV. RESEARCH SIGNIFICANCE

The overall goal of this research is to make a theoretical and practical contribution to eLearning 4.0, specifically in the higher education sector in Saudi Arabia.

A. Theoretical Significance

The significance of this research lies in the academic and theoretical contributions it will make to the existing literature pertaining to eLearning. Among other things, it offers a summary of the important factors required for the successful implementation of eLearning 4.0 in Saudi Arabia. Who benefits from this study? The major beneficiaries of this research are the stakeholders in the higher education sector in Saudi Arabia: Ministry of Education staff, university administrators and heads of departments, the IT departments of universities, researchers, and both undergraduate and postgraduate students. The benefit of the research will not be limited to Saudi Arabia, but could extend to neighboring Gulf countries, given the similar cultural, educational and administrative characteristics of the six countries. Overall, the study will make a theoretical contribution since there has been no investigation to date of new factors influencing the implementation of eLearning 4.0 in the higher education sector. The research limitations will open up avenues of future research for other students from Saudi Arabia who wish to pursue tertiary courses and conduct studies in this particular area.

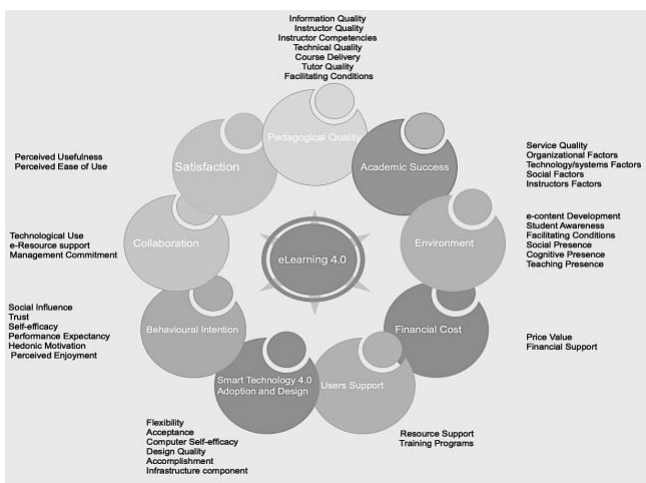


Figure 1. Initial eLearning 4.0 Model - Factors & Sub-factors for Saudi higher education.

B. Practical Significance

As mentioned previously, eLearning 4.0 is an emerging topic in academia. Given the novelty of the concept, there are several aspects of eLearning 4.0 that researchers around the world have not addressed. Specifically, Saudi Arabia, which has a large area and a diverse geography, needs to adopt eLearning more so than other countries. There is an urgent need for studies to be conducted on the important factors that constitute a successful eLearning 4.0 model for Saudi Arabia. It is anticipated that the results of this study will be of value to all stakeholders in the higher education sector in Saudi Arabia as they will inform the strategies for the practical application of eLearning 4.0. In addition, a model is needed that can avoid the shortcomings, problems, and defects that surfaced during the implementation of eLearning 3.0 in the education sector, which became more clearly evident during the Covid-19 pandemic. The Saudi Vision 2030 specifies that education is a priority and explicitly stipulates the adoption of eLearning throughout the country. This research is well-aligned with the Saudi Arabia 2030 Vision and its goal of improving education in the country. Applying eLearning 4.0 early and with quality, will be effective for Saudis in their journey to keep pace with the needs of the Fourth Industrial Revolution. Finally, the benefits derived this study can be applied to all Gulf countries that have similar systems of education and face the same challenges as Saudi Arabia in this regard.

V. RESEARCH METHODOLOGY

To examine the use of eLearning 4.0 in Saudi Arabia, and to develop an initial holistic model, the pragmatism philosophy will be adopted. Pragmatism is a method based on the abduction concept which oscillates between deduction and induction approaches [82]. For information systems researchers, pragmatism is considered as the ideal approach for their studies as it enables them to use more than one method to obtain a wide range of data, thereby facilitating the answering of research question [82]. The mixed-methods approach involves the collection and analysis of both quantitative and qualitative data [83]. In order to achieve the research objectives, a “sequential explanatory design” will be adopted for this study. The data collection process has two phases: the quantitative phase followed by the qualitative phase [83]. For this study, an online survey will be used for collecting quantitative data, and semi-structured interviews will be conducted to collect qualitative data. After these data have been collected and analysed separately, the results will be integrated so that conclusions can be drawn [84][85]. The significant benefit of adopting a sequential mixed-methods approach is that it provides a comprehensive picture of a phenomenon. Through this approach, statistical results can be obtained from the analysis of the quantitative data, and these can complement or be supported by the qualitative data obtained from, in this case, interviews [83]. The sequential explanatory design prioritises the collection of quantitative data which is considered the more significant of the two

[83]. To achieve this aim, the views of stakeholders in higher education in Saudi Arabia in regard to the new eLearning 4.0 model will be collected and analysed. Quantitative data will be collected via an online survey of stakeholders (staff and students). The data will be analysed to determine whether new factors emerge that will improve the initial eLearning 4.0 model. In the second phase, the qualitative data is collected by means of semi-structured interviews conducted with IT experts who specialise in education in the Saudi higher education sector, to gather their opinions about essential eLearning factors that may improve the implementation and ensure the success of Web 4.0 technology in the education sector. In order to obtain valid and accurate data, the sample for the qualitative phase will comprise at least twenty-five experts.

VI. CONCLUSION AND FUTURE WORK

In conclusion, the drive of this research is to develop a holistic eLearning 4.0 model for higher education in Saudi Arabia. What was presented in this paper from: e-learning generations, research questions, literature review on factors and the proposed model accordingly, research gap, research significances, and research methodology will be used as the starting point and basis for future research.

We expect that the model proposed in this paper will undergo development following the next two research phases (the quantitative and the qualitative), and the results and modifications will be published in future papers including answers to the research questions. In addition, the research will suggest new factors that relate particularly to eLearning 4.0 namely “smart technology 4.0 adoption”, which will be examined in more depth. It is anticipated that this work will encourage institutions to implement eLearning 4.0 successfully, thereby supporting the Saudi government’s Vision 2030 goal for higher education.

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