

Review of Information Quality of E-learning Systems in Saudi Arabia

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Abstract: In the education field, quality is a significant matter, especially in e-learning systems. The e-learning systems have many quality dimensions, such as information and system performance. This paper defines the concept of e-learning and its framework and standards. Then, it discusses the information quality in e-learning systems because the content of teaching materials is a critical element that affects it. Furthermore, this paper presents the information framework, which has 14 attributes used to measure the quality of teaching materials in e-learning systems. Moreover, this paper evaluates the information quality in the current state of the e-learning systems in Saudi Arabia.

Keywords: E-learning, Information quality, E-learning framework, E-learning quality.

I. INTRODUCTION

Information Technology (IT) development has emerged rapidly in various aspects of modern life. Therefore, the integration of information systems and technologies in the organizations and Institutes lead to enhance the services quality and fulfill high levels of performance [1]. The burst of various technologies has led to the enhancement of different areas, such as communication, education, and transportation. Within education, there are enormous institutions and universities that use IT as fundamental requirements in the development of the education process, implementing and supporting e-transformation. They use innovativemethods of learning and teach their students by using virtual classes (e-learning) instead of traditional classes (face-to-face). E-learning'spurpose was to solve limitation problems experienced by traditional classes such as time, distance, and place by expanding educational areas and achieving freedom from these restrictions[2][3].

However, offeringinformation and communication technology (ICT) equipment to learners and teachers does not guarantee that the learning process is more successful. Thus, many organizations within higher education became more concerned about enhancing and improving their total quality management (TQM), especially in virtual classes (e-learning). In higher education, some universities and institutes seek to attract students from around the world as one of its essential goals.For that reason, e-learning is one of the best solutions [4].

The term 'e-learning' is used to define many areas such as virtual teaching, online teaching, web-based training, distance teaching, and distributed learning. In general, e-learning is defined as the utilization of technology to deliver learning materials usingan electronic layout via the internet.European learning communities define e-learning as "the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration[5]." In terms ofknowledge acquisition, e-learning can be defined as "the acquisition and use of knowledge distributed and facilitated by electronic means[6]." Also, from a pedagogical perspective (content and access) e-learning is defined as"an innovative approach for delivering well-designed, learner-centered, interactive, and facilitated learning environment to anyone, anyplace, anytime by utilizing the attributes and resources of various digital technologies along with other forms of learning materials suited for open, flexible, and distributed learning environments[7]." From previous definitions, three fundamental dimensions of e-learning have been recognized, which are technology, access, and quality [8]. Quality is a challenge,because e-learning has presented itself as an alternative to traditional education. As an information system, the e-learning system has two forms of quality: information quality (the quality of the learning material) and system quality (the performance of the system)[9]. In general, the quality of information provided by the information systems via the internet has multidimensional possibilities for measurement. So, the major problem in evaluating the quality of e-learning systems is how to identify the criteria by whichthe information quality is determined [10].

This paper will focus on the information quality of e-learning systems because the learning materials content is a critical component affecting the overall quality of e-learning process. This paper also provides an overview of frameworks used to measure information quality in e-learning systems, which affects the overall level of learning. The rest of this paper is divided into six sections organized as follows: The second section will present an overview of the e-learning standards and their types, the system architecture of an adaptive e-learning framework, and the relationship between information systems success models and the e-learning success model. The third section will give an overview of the quality of information provided by e-learning, while the fourth section will focus on the information quality measurement frameworks in e-learning systems. The fifth section will present the current state and effects of applying information quality measurement frameworks on the overall learning process. Finally, the conclusion and future work will be described in the sixth section.

II. E-LEARNING

A. Standards in E-learning

It is important to know the standards that should be reached in e-learning, using the instructional management system (IMS), to provide standardized communications protocols of e-learning, data-structures, and workflows of e-learning systems. Moreover, when standards are formalized and included in sold products, users of e-learning can buy the system components from different sellers based on the quality of the e-learning standards that have been organized and measured based on these standards [11].

Therefore, these standards are divided into the following:

1- Metadata:

This is related to the records and content that should be identified formally for supporting the saving, searching (discovery), indexing, and retrieval of the objects of learning, using various tools through different depositories. It uses data for referring to as learning objective metadata (LOM), which represents as its core elements, so the metadata standards include Dublin-Core Metadata and LOM Standard of IEEE Learning Technology.

2- Content Packaging:

The ability of the standards specifications and the content packaging allow the programs and courses to transfer from one education system to another. This content includes the IMS of the Content-Packaging Specification (CPS), the IMS Simple specification of sequencing, and the advanced distributed- Learning (ADL) as a Shareable-Content Object Reference Model (SCORM).

3. Learner Profile:

The learner profile holds information about personal data, specific plans for learning, history of learning, requirements of accessibility, certifications and degrees, knowledge evaluations, and participation. In the specifications of the IMS, it is important to unify the information from learner profiles.

4- Learner Registration:

This refers to the information that relates to the learner's registration. When the learner registers in the system, the system allows the delivery of learning and manages the components by providing the information about learner participation and learning materials. It also ensures that the material is available to the learner. There are two required initiatives required in e-learning: the enterprise and the school (educational environment) specifications.

5- Content Communication:

When the content is released, the system users need to connect with student data and the information related activity within the content. The ADL's SCORM project, established on the CMI specification [12] [13].

B. Type of E-learning Standards

There are three main types of e-learning standards, which propose the main function of e-learning standardization.

1. Implementation Standards:

The purpose of these standards is to support the functionality of interoperability within different e-learning domains, such as metadata, architectures, IT infrastructures, and interface standards.

2. Conceptual Standards:

These standards focus on quality development through providing reference models also based on the functionality of interoperability.

3. Level Standards:

Level standards are more important than previous standards because they support the identification of and address the quality level of e-learning systems. Thus, they are usually used for certification purposes. Fig. 1 presents the relationship between purposes of e-learning standards and its types[14].

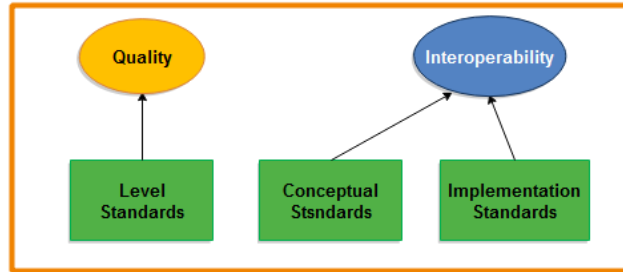


Fig. 1 Types of e-learning standards

C. E-learning Architecture and Framework

The proposed architecture of the framework presents the three main components as shown in Fig.2.

The learning domain services at the core of this framework, are composed of four components. The first component is Course Creation, which includes the curriculum, course management, and the course catalog). The second, is Course Delivery, which includes content sequence and learning flow. The third category is Assessment Regulation, which includes grading regulations. The fourth is Recording Regulation for monitoring and measuring the system, including reporting and quality assurance.

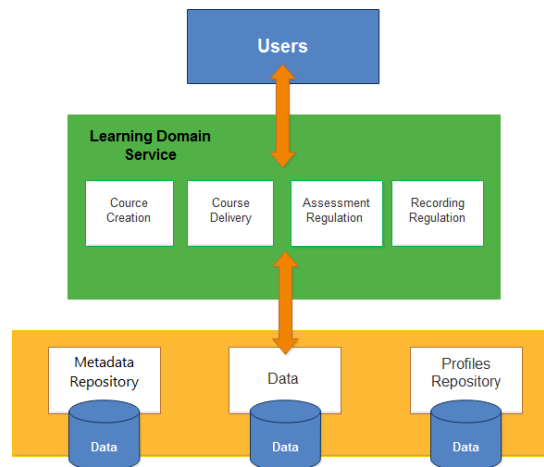


Fig. 2. System architecture for adaptive e-learning frameworks

Users are the people who use the e-learning system (learners [students], lecturers, and administrators). The system allows learners (students) and lecturers to manage various learning materials such as books, articles, presentations, e-spread sheets, videos, and pictures and both students and lecturers can access and manage their own personal information files, which can be shared with others, or not. Data contains metadata and profile depositories to store or retrieve personal information about each user [15].

D. Information systems and e-learning success model

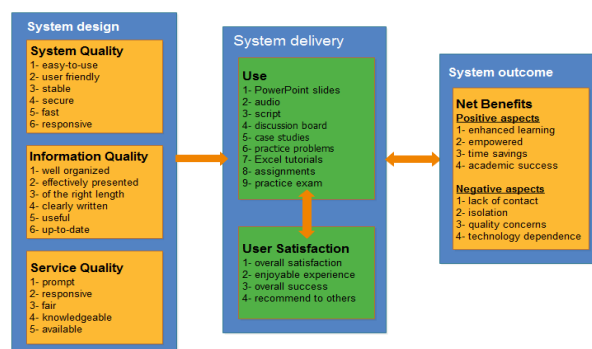


Fig. 3. The e-learning success model and sample metrics.

The e-learning success model, adapted from DeLone and McLean's information system success model, was used as a measurement tool. Information system success models are composed of systems design, systems delivery, and systems outcome. [16] Based on these components, an e-learning success model was implemented, as seen in Fig. 3.

In system design, components of e-learning success models are evaluated from three dimensions. The first dimension is system quality, which measures the suitability of the 'blackboard environment' such as ease of use, stability, security, speed, and ease of response. The second dimension relates to information quality and focuses on evaluating the course content (organization, presentation, length, usefulness, and prevalence). The third and last dimension relates to the quality of the e-learning service, and measures the interactions between students and their instructors, using terms such as promote, fair, responsive, and knowledgeable.

The system delivery is evaluated based on two success dimensions. The first is use, which evaluates the tools that are used, such as audio clips, PowerPoint presentations, lecture scripts, discussion boards, assignments, and practice examinations. The second is satisfaction of the user, which represents the enjoyment, success, and ability to recommend. The final component of the e-learning success model is based on the net benefits, and it is evaluated using positive and negative aspects. The positive aspects include enhancing learning and time saving, while the negative aspects include concerns regarding quality and a lack of content. All components of the success assessment are linked and the success of any of these components can influence another component. Therefore, it is very important to pay attention to each element [17].

III. INFORMATION QUALITY IN E-LEARNING

This section focuses on the quality information in e-learning systems. As previously mentioned, quality is one of e-learning's dimensions. In a general context, quality is an absolute concept [8]. So, it is difficult to find a standard definition of quality because it can be viewed from many different perspectives. However, quality can be defined as "the ability of a set of inherent characteristics of a system, product, or process to achieve the customers' demands" [18].

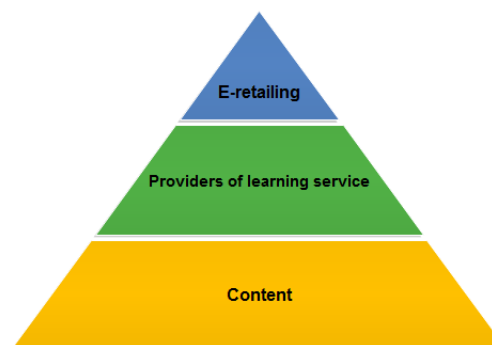


Fig. 4. The e-learning value chain pyramid

In an e-learning context, quality relates to every education and training service provided via the Internet. In addition, when defining the quality of e-learning systems, the viewpoint of users must be considered [8].

It is also important to determine the criteria for quality measurement [19]. There are various aspects of e-learning quality. At this point, the quality of e-learning can be viewed using the e-learning value chain pyramid, exhibited in Fig. 4.

The hierarchy has been sorted from top to bottom; the base of the pyramid is considered as the most critical element represented by the content of educational materials provided by e-learning systems. So, the quality of the learning content must support the improvement of the online teaching process and increase the attention of users for their learning. The electronic channels that provide online teaching services are positioned in the middle of the pyramid. These channels must always offer up-to-date content to the learners to maintain the quality of the online learning process. At the top of the e-learning pyramid, are the organizations and companies that are interested in educational online-retailing [20]. From the pyramid of e-learning, the content of online teaching materials has been considered as the essence of online teaching systems. As a result, this paper aims to provide an overview of the information quality (content) of e-learning systems and present frameworks that can be used to measure this quality. The information quality in the e-learning systems relies on the area of education, learning objectives, and standards that are used to measure it. Furthermore, it is difficult to determine the criteria that can be used to evaluate information quality because there is no standard definition, especially in information systems. As a result, this paper aims to provide an overview of the frameworks that can be used to measure the quality of information in e-learning systems.

IV. FRAMEWORK OF INFORMATION QUALITY IN E-LEARNING SYSTEMS

To measure the quality of information in e-learning systems, a framework has been developed based on Wang and Strong’s framework of data quality and has been designed with consideration of the importance of the quality dimensions of e-learning from a user’s perspective [21]. The framework has 14 attributes for information quality, grouped into three factors as shown in Fig. 5.

The first factor is to assess **the contextual representation of information quality**, which considers the user’s perspective when estimating the quality of online teaching materials, considering the user’s preferences as dimensions of its quality. It also focuses on the quality dimensions of teaching materials representation on e-learning systems. The set of information quality attributes in this factor are:

1. Conciseness: explaining the content of the teaching materials as briefly as possible.
2. Verifiability: checking the correctness of the provided teaching materials’ content.
3. Representational consistency: representing the content of teaching materials in a consistent manner.
4. Understandability: providing understandable teaching material content.
5. Amount of information: fitting the volume of content provided by the e-learning system with tasks.

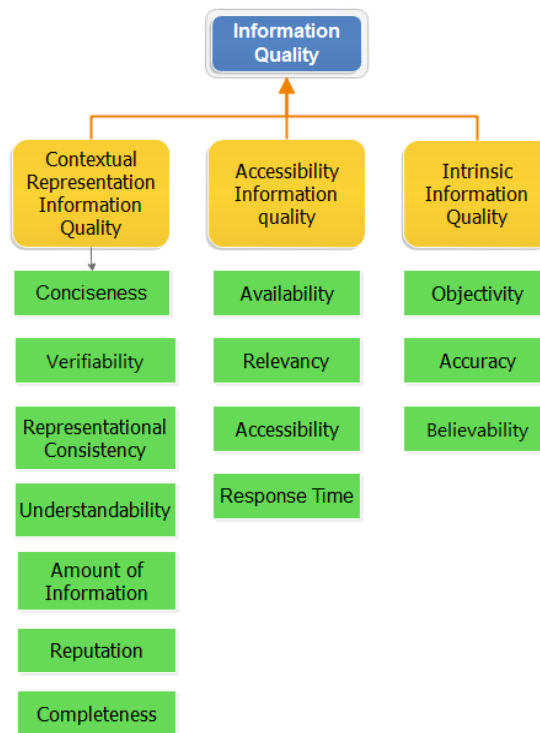


Fig. 5. The information quality framework for e-learning system [21]

6. Reputation: the degree of confidence in e-learning systems as a source of information.
7. Completeness: the teaching materials provided by the e-learning system must cover all the learners' needs.

The second factor in the information quality framework is **the accessibility of information quality**, which reflects the quality attributes of accessing the teaching materials quickly. The attributes used to measure e-learning information quality is as follows:

1. Availability: providing the students with the teaching materials and resources needed at any time.
2. Relevancy: providing teaching materials relevant to the learners' requirements and their educational background.
3. Accessibility: providing easy access of teaching materials for all learners.
4. Response time: the time that the e-learning system takes to respond to a certain task.

Finally, regardless of the users' viewpoint and the e-learning context, **the intrinsic information quality factor** focuses on measuring the quality dimensions that are initiated from the teaching content itself via the following attributes:

1. Objectivity: ensuring teaching materials provided by the e-learning system are not biased or prejudiced.
2. Accuracy: providing accurate content in the teaching materials in e-learning systems (the content must be consistent and correct).
3. Believability: presenting acceptable content in the e-learning teaching materials.

Designing the information quality framework based on the users' perspective of the quality importance will ensure that this framework can estimate the content of online teaching materials in any e-learning system regardless of the environment, objectives, or standards of that system.

V. INFORMATION QUALITY IN THE E-LEARNING SYSTEMS OF SAUDI ARABIA

In 2003, the planning of Saudi Arabian National information and instructional technology ICT began the implementation of e-learning and virtual learning and all related potential applications within higher education. Moreover, KSA established a National Center of e-learning and Distance Learning (NCeDL) in Riyadh to provide technical support and the tools necessary for e-learning content development. The center was built to interconnect all the universities, their efforts, and experiences in the development of e-learning. The project became the leader in the research, development, and implementation of the e-learning architecture within the higher education of Saudi Arabia. The center had many goals to achieve its future vision and one of these goals is developing quality standards for e-learning [22].

One of the studies illustrates the measurement tools of quality, based on four impacts. The first impact was information quality that provided. The second, was the system quality as a technical perspective. The third was individual users' impact and the last impact was organizational. In this study, the researchers focused on comprehensiveness, customizability, content accuracy, understandability, style and presentation, currency, and cultural sensitivity in the impact of the quality of information. The study measured the effect of the quality dimensions of the system, based on access, reliability, user-friendliness, ease of use, support service, learning support, and class interactions. The individual impact measured convenience, pace of customization, interest, depth of learning, student satisfaction, student performance, and future learning. The impact of Academic Institutions is evaluated based on costs, enrolment, quality, HRM, and strategic competitiveness [9].

In 2010, previous research was continued by the same authors to implement theories for measuring impact. They used quantitative methods due to enhancing the quality of the e-learning system at the Qassim University and King Abdul-Aziz University. The research found that organizational impact specific to faculty members (teachers) was greatly influenced by using e-learning. Another study explained the same idea; learners and instructors turned toward teaching and learning online at King Fahd University of Petroleum and Minerals in Saudi Arabia because they were more influential [23]. After focusing on encouraging faculty members to use e-learning, the investment return was increased in the educational organization after using the e-learning system. Moreover, system quality (ease of use and maintenance) also had a greater impact [24]. In fact, the universities in Saudi Arabia have their department of quality and development to monitor and enhance the quality of their education process. However, the King Abdulaziz University was one of the first universities that develop a program to apply the quality standards in all sectors [25].

The empirical research carried out at King Abdul Aziz University in Saudi Arabia [26], focused on studying the awareness of students and implementing e-learning in all colleges within the university. The survey's response was that most educated people agree that e-learning significantly benefits Saudi society, especially in females and people who live a distance from the universities. Although the government strongly supports e-learning, it needs to offer e-learning systems in different areas. The developers of e-learning in Saudi Arabia are working to enhance the higher education quality [27].

Another study that used quantitative study determined the main factors affecting the acceptance of students' use of e-learning at Saudi University and King Abdulaziz University. Furthermore, the usefulness of e-learning and its ease of use had a significant impact on learning. Also, the flexibility, accessibility, interactivity of e-learning had an important influence on the e-learning process. [28].

Overall, studies show that the system's ease of use has the same significant impact as accessibility and quality of information. The awareness of the students and their acceptability in using the e-learning system has more influence than other impacts. Teachers encourage their students to use this technology in higher education at King of Saudi Arabia (KSA). From the government's perspective, there were some issues regarding the Ministry of Higher Education (MOHE) regulations, which do not approve graduation degrees of students, although they accept students that have studied full-time. Therefore, the government does not view e-learning students as having graduated with acceptable quality of information (**Certified Certificates Issue**).

In addition, Saudi embassies do not give online certifications or distance education degrees that have been completed in foreign countries. The quality standards of e-learning in KSA are an obstacle in technical, telecommunication, and infrastructure being 83.10%, the highest impact. However, around 33% in materials and finance were the next highest obstacle. The issue was related insufficient e-learning resources to satisfy the different needs of students. Also, the accessibility of the materials was not efficient. The materials lacked equivalence between the quantity and quality of distance learning resources distributed to electronic learners in all regions [29].

In last year, the Ministry of Higher Education issued a Royal decree ordering the suspension of all distance education programs and enrollment. Based on this royal issued decree, King Abdul-Aziz University and the Jazan University stopped any e-learning program for the bachelor degree. The reason behind of that, as the Minister of Education Dr. Ahmed Al-Issa, said about the distance education and affiliation in universities, "the aim is to promote and achieve quality in universities." [30] [31].

VI. CONCLUSION

The effectiveness of using e-learning systems in the field of higher education in Saudi Arabia has been proven. First, this paper discussed the e-learning concept and its framework in general. It also focused on the quality of e-learning information and presented a framework that can be used to measure the quality of information for e-learning systems through 14 dimensions classified into three factors which are the contextual representation, accessibility, and intrinsic information quality. It has been determined in this paper that some issues related to the e-learning outputs in Saudi Arabia. The most critical issue is the quality of teaching materials provided by e-learning and the lack of the reliability of diplomas granted e-learning system, which reflects the system's quality of information.

Therefore, the researchers suggest that the applying of unified standards and measurements for the teaching materials provided by the e-learning system to overcome these issues and to raise the reliability of the quality of e-learning diplomas in Saudi Arabia. Furthermore, the researchers recommend doing more specific research in the field of measuring and improving the information quality of e-learning system in Saudi Arabia.

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