

Original Article

The Evaluation of e-Learning System based on the D&M Model

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Abstract - The research in this paper investigates the impact of e-learning systems based on the D&M model. The approach comprises six key dimensions: system quality, information quality, service quality, user satisfaction, and net benefits. The dimensions of quality factors play an important role in the effectiveness of e-learning systems. By analyzing each of these dimensions, organizations can gain valuable insights into the strengths and weaknesses of their e-learning platforms, enabling them to make informed decisions and enhance the user experience. The study yielded several key findings, including a statistically significant impact of e-learning systems based on the D&M model on user satisfaction in terms of system quality. Additionally, a statistically significant impact was found on user dissatisfaction regarding information quality and service quality. In light of these results, the study provided various recommendations, including encouraging educational institutions to focus on effective security measures for e-learning systems to protect users' security and privacy. Educational institutions were also advised to monitor and evaluate users' progress in learning, which may involve providing regular progress reports, individual assessments, and constructive feedback.

Keywords - e-learning, D&M model, Software model, Software quality, User satisfaction.

1. Introduction

The need to combine conventional learning with e-learning has arisen owing to the growth of learning methodologies and the appearance of various environmental elements. As a result, the phases of software development have accelerated due to the rising demand for it. Therefore, the quality of e-learning systems is an important factor affecting student use. These factors are among the main aspects considered when designing and developing e-learning systems so students can benefit from the system. Quality assurance is a set of processes that seek to verify the quality standards applied to the product and methods of verifying that the product is of high quality. The program's quality can be defined according to the ISO definition as a set of product characteristics and attributes that must be considered when describing and evaluating product quality. The IEEE standards also specify that the quality of the programs is the extent to which the system meets the requirements. An e-learning system is an Information System (IS) used for teaching and learning [1]. E-learning refers to using electronic educational content via the Internet to learn, and synonymous terms for E-learning are web-based learning or online learning [2]. Quality factors affect the system's quality, and the reason for student dissatisfaction with e-learning systems may be due to quality factors such as ease of use, efficiency, and safety.

The literature on software engineering contains numerous quality models, each with somewhat different quality variables. From these models, significant quality indicators associated with student satisfaction were taken out to assess e-learning systems from the user's perspective. As a result, the quality factors system quality, information quality, and service quality were separated into three primary areas by Delone and Mclean's (D&M) information system success model. The quality of any system is represented by the quality of its services, which has an important impact on the user experience. To improve the user experience, the system must provide useful content that is easy to navigate and use. The user of e-learning systems is interested in the security factors of any system, which increases his desire to use it [3]. The level of satisfaction of end users (students in this case) from the completion of a specific task in an e-learning platform can be useful, and nobody would be surprised if it is the main reason for the students' displeasure with some e-learning systems over the past decade, which is connected to the numerous mal-functionalities and issues. In this connection, the progress of every single system is evaluating its acceptability and how much the quality factors have been used. First, Let us outline this research's purposes and the specific issues it addresses. It should be noted that many factors may affect a user's dissatisfaction with the e-learning



systems, and these factors may not be applied to e-learning systems. Consequently, these causative factors have been aggravated, and there is a need to identify them to provide information that will help the developers of these systems. More importantly, the theory of user satisfaction is that the user gets satisfaction from their needs first, and every user has a need, which can be satisfied by having a desire. Sections 1.1 and 1.2 explain the two main factors for the e-learning system.

1.1. Characteristics of Success and Failure of Software Systems

The success of any e-learning system is linked to the extent to which students use this system easily and that the system meets their needs and desires. Therefore, this study can achieve specific quality factors in any e-learning system because any deficiency in one of these factors will make the experience and use of the system undesirable. It is important to consider the student and his interest because the e-learning system was founded to facilitate the education process for him, so this study must check some of the quality factors associated with the electronic educational systems. System quality is influenced by quality variables, and quality issues like safety, efficiency, and simplicity of use may be the cause of students' discontent with e-learning platforms. In addition, according to Delone and Mclean's (D&M) information system success model, the success factors of any system include three dimensions due to their importance to the user, such as the quality of the systems, which are represented in the services provided to the user, the usefulness of the content provided to him, the ease of navigation between the services provided by the system, and the simplicity of obtaining them. Students' satisfaction with e-learning systems does not depend only on the quality of services but also on the quality of information. If the information provided is incomprehensible, vague, and unhelpful, this will lead to students' unwillingness to use electronic educational systems and, thus, the failure of these systems. To keep these systems working for the longest possible period, specialists must consider the quality of the services provided by knowing the opinions and experiences of users after receiving the service to develop the system and improve the quality of its services [4].

1.2. Satisfaction and E-learning Systems

E-learning system provides high-quality services and meet students' expectations, then satisfaction and interest in the e-learning system increase during the next decision. The quality of services and service outputs will be taken into account during the development of an e-learning system, which will positively affect student satisfaction. Therefore, for the success of any e-learning system, some basic factors must be considered and present in the systems, such as ease of use and performance [5]. Suppose the e-learning system does not achieve student satisfaction. In that case, it will fail due to the student's unwillingness to use such systems, leading to problems with integrating traditional and electronic education [6].

2. Delone and Mclean Model

Delone and Mclean IS Success Model the Delone and Mclean Information Systems Success Model is a framework used to understand and measure the success and quality of information systems. This model emerged from multiple studies conducted by researchers Delone and Mclean in the eighties. Since then, it has been widely utilized across various fields to comprehend how to evaluate success in information systems.

The model relies on three main dimensions: the functional dimension, focusing on system efficiency and performance; the organizational dimension, addressing the system's impact on the entire organization; and the usage dimension, concentrating on the user experience and adoption of the system [7]. These interconnected dimensions are fundamental in comprehending the multifaceted success of information systems, offering a comprehensive view of how these systems impact work and overall performance. The model has undergone continuous developments and improvements to adapt to the successive challenges and advancements in information technology and communications. A profound understanding of this model and its applications contributes to making relevant business and information technology decisions. The following discusses the Delone and Mclean Model from different dimensions.

2.1. Dimensions of Success in the Model

The Delone and Mclean IS Success Model distinguishes itself by focusing on three primary dimensions that form the basis of success in information systems [8]: the Functional Dimension, the Organizational Dimension, and the Use Dimension.

- **Functional Dimension:** This dimension concentrates on system performance and efficiency in meeting user needs. Evaluation of the functional dimension involves several criteria, such as technical performance, quality, flexibility, security, and the system's effectiveness in meeting the enterprise's core tasks and operations.
- **Organizational Dimension:** This dimension focuses on how the system impacts the entire organization. Assessment of the organizational dimension encompasses factors like productivity enhancement, resource provision, and improvement of internal and external relationships within the organization. Evaluating this dimension contributes to understanding how the system influences the organizational structure and decision-making processes.
- **Used Dimension:** This dimension centers around the user experience and system adoption. Evaluation of the use dimension includes factors such as ease of use, overall user satisfaction, and adaptability to user requirements.

These three dimensions are interconnected and overlapping, where the impact of each dimension interacts with others to form a comprehensive picture of information system success. Understanding these dimensions helps identify aspects of the system that require improvement and development to ensure maximum success and benefit within the enterprise context. Factors of Success According to the Delone and Mclean IS Success Model, The Delone and Mclean IS Success Model relies on several key factors that directly impact the success of information systems [9]. These factors include:

- **System Quality:** System quality is a crucial factor influencing the success of information systems. According to researchers Delone and Mclean, if a system demonstrates effective performance and provides high quality, it will likely increase user acceptance and achieve desired objectives.
- **Service Quality:** Service quality is a significant factor in the system's ability to deliver high-quality services and meet users' needs exceptionally, contributing to satisfaction and increased system adoption.
- **Information Quality:** The user experience and decisions are affected by the information quality provided by the system. Based on Delone and Mclean, if accurate, reliable, and easily accessible information, it contributes to greater effectiveness of use and enhances trust in the system.

Application of the Model in Understanding Success in Modern Information Systems: Given the advancements in technology and complexities within the competitive environment, understanding the factors that determine the success of information systems has become an urgent necessity in the modern age. The D&M success model plays a prominent role in analyzing and comprehending these successes. It serves as a comprehensive framework for evaluating the performance of information systems. By identifying the three dimensions—functional, organizational, and usage—the model offers a holistic view of system performance and its impact on the organization and users.

The model enables an understanding of the interrelationships among different dimensions of success. This understanding enhances our comprehension of how system quality affects user satisfaction and how organizational factors can influence system performance. The model guides policies and strategic decision-making to improve information systems. Understanding success and failure factors can assist in directing investments and prioritizing performance enhancements. The model enhances the integration of research and practical applications. It is an analytical tool in academic research and practical applications within enterprises. As a flexible and comprehensive framework, the

Delone and Mclean IS Success Model plays a fundamental role in understanding and analyzing success in modern information systems, contributing to directing efforts toward improving their performance and effectiveness [10].

3. E-learning System

The tremendous technological development at the beginning of the twenty-first century led to the development of systems that make it easier for users to perform their work. Based on these developments, systems for the educational process called e-learning were developed, and one of the reasons that led to the acceleration of these systems was the COVID-19 pandemic. E-learning systems have become one of the most important things for every user due to the transition of e-learning from the traditional form to the modern form, which are electronic educational systems e-learning systems are defined as a set of modern communication tools used to complete the education process [11]. Therefore, some researchers in this field consider that providing high-quality and diverse services increases the interaction between the student and e-learning systems [12].

E-learning systems can be defined as a group of systems that provide different services that integrate to form a single system that provides services to users with high quality, and building this system contributes to increasing the number of learners by reducing the distance and reducing the effort expended to perform the tasks required of the student.

The rapid development of these systems due to their high demand led to the production of electronic educational systems that are not characterized by high quality. Therefore, the researchers studied the most important quality factors that would affect the user satisfaction of these systems. Educational institutions work on user satisfaction, and this is due to the type of users of these systems. The first is an employee of this institution, and the second is the student who is considered a consumer for them.

Consumer satisfaction contributes to using the system and staying in the educational institution. User satisfaction with e-learning systems is a priority based on the previous experiences of educational institutions, and user satisfaction contributes to increasing confidence in e-learning [13]. The user is sensitive to the quality of the services provided to him, so quality services must be provided consistent with his current expectations, and his future expectations must be monitored to ensure user satisfaction with e-learning systems and ensure his use of these systems [13].

To ensure user satisfaction, educational institutions must continuously develop e-learning systems by taking user reviews periodically and working to find out what makes them dissatisfied. This is done through a digital communication channel between the service provider (educational institutions) and the service recipient (user of both types) [14].

4. Related Works

The researchers conducted a literature review to collect quality factors related to e-learning systems that specialize DM information system success model, extracted the quality factors related to e-learning systems, and divided them based on the DM information system success model, quality through this model into the services quality provided to the user, the information quality that the user will obtain, and the quality of the systems from which the user receives services, in addition to some factors that, from our point of view, will affect the satisfaction of users. The researchers worked on developing a model that extends from the Delone and Mclean model to study the effects of quality factors and organizational factors on students' satisfaction with the quality of e-learning systems at King Faisal bin Abdulaziz University. Data was collected from 250 university students.

Analyzing data in different ways to obtain useful information. The data analysis results showed a strong relationship between organizational factors and the quality of the e-learning system and its factors; in addition, the results showed that the quality factors have a positive and significant impact on students' satisfaction [15]. The researchers reviewed the previous literature to study e-learning systems and the quality factors that affect them from the perspective of Malaysian users through a questionnaire derived from previous literature. Data was collected through a research sample of 1616 undergraduate and postgraduate students from public universities. In Malaysia, the questionnaire consists of three sections.

The first section is demographic information, and the second is information about the quality of information, services, and the system. The third section discusses measuring the user's intention to continue using these systems. The results showed that service quality influences user satisfaction the most [16]. In Maruf, Gbadebo Salimon [5] explored how system quality affects E-learning systems' acceptance among students and teachers. This study examines how perceived benefit and intention of use affect the use of E-learning systems.

Collecting data was collected from several universities, and structural equation modeling methods were used for 336 questionnaires. The results revealed that the system's quality affects the user's intention to use the electronic educational system and the perceived benefit. Moreover, the study also confirms that the system's quality does not directly affect the actual use of the E-learning system; it is affected through a series of variables: acceptance, perceived interest, and intention to use. The main objective of the results is to improve the understanding of students' acceptance and behavior towards the e-learning system universities and the impact of quality factors on this relationship. Puriwat [6] studied the impact of the Corona pandemic on e-learning systems and the extent to which quality factors relate to e-learning systems.

The researchers explained the importance of e-learning, and this was due to one of the reasons, the most important of which is the suspension of working hours, which has become the role of e-learning systems that are sensitive to the continuity of the education process. The researchers studied the quality factors affecting e-learning systems and the extent to which these factors relate to the impact on user satisfaction, and they studied the quality factors applied to e-learning systems in Thailand during the epidemic, based on experimental research of 185 higher education students. The results revealed that the quality of e-learning was a structure consisting of three elements. The first is the content of the course, its design, technical and administrative support, and the trainer's or teacher's characteristics. The content and design of the course were among the most important dimensions of the quality of e-learning, and the overall quality positively impacted student satisfaction and continued use intentions towards the platforms.

Purnomo Agung et al. [17] use the information needed to develop a conceptual model that would be used to evaluate how well E-learning is being applied in academic institutions. They also compare literature from books, scholarly articles, and expert opinions to strengthen research findings. Based on the study's findings, a theoretical model utilizes systems and user satisfaction as moderators in the relationship between the benefits of e-learning and the quality of the information, services, and systems. Based on a range of success variables [18], a comprehensive model has been developed that provides a complete image and differentiates between diverse success levels. An e-learning success model that considers the researched aspects was created due to the research. An empirical investigation was done to trial the model. The study offers both theoretical and practical aspects, contributing in a varied way.

5. Research Design

This research aims to assess the extent of the satisfaction of users in e-learning systems and to know the quality factors that affect their satisfaction of the user. After reviewing the literature, the quality factors that affect the satisfaction of users were summarized in thirteen factors, which were validated by implementing questionnaires for a sample of students and teachers. The study includes the following:

- **Quality Factors for Satisfaction:** A detailed satisfaction analysis was conducted to determine the relationship between satisfaction and quality factors. This was done to determine the quality factors that affect e-learning systems.
- **Most Effective Quality Factors in Satisfaction for e-learning:** Based on a review of previous literature related to quality factors and their impact on e-learning systems, these factors were extracted, and we suggested and added a set of other factors that suit the culture of the country in which the study takes place and that must be measured.

Table 1. E-learning and System quality factors

| Systems Quality Factors | Description |
|--------------------------------|---|
| Security | E-learning systems are equipped with a multitude of effective security protection features, including authentication procedures, the ability to log in to users who have an account, and the protection of personal data privacy. |
| Navigability | The user can navigate effectively and freely between pages with the ability to know the user's location in the e-learning system. |
| Ease of Use/Usability | E-learning systems must have a user-friendly interface that helps users use and operate easily. |
| Efficiency | Using e-learning systems results in significant time, money, and effort savings. |

Table 2. E-learning and Information quality factors

| Information Quality Factors | Description |
|------------------------------------|---|
| Currency | E-learning systems provide up-to-date information. |
| Accuracy | E-learning systems provide accurate and error-free information. |
| Relevance | Information on e-learning systems must be relevant and appropriate to user needs. |
| Completeness | E-learning systems must provide complete and comprehensive information to users. |

Table 3. E-learning and Service quality factors

| Service Quality Factors | Description |
|--------------------------------|--|
| Tangibles | Attractive and satisfying browsing experiences are a feature of e-learning systems. |
| Reliability | While e-learning platforms give users accurate services, their dependability is quite great. |
| Responsiveness | E-learning platforms offer responsive services that are quick and helpful in resolving my issues. |
| Empathy | I can personalize the services that e-learning systems offer by choosing the kinds of information and services that will be shown. |
| Assurance | The availability of e-learning platforms makes online education easier. |

These factors are measured through a set of questions corresponding to each quality factor, as shown in Tables 1, 2, and 3, which will be included in a questionnaire and disseminated by various means.

Thus, the study achieves the first research objective through a comprehensive literature review process and extracts the most important factors affecting e-learning systems from various scientific research. Important quality factors in satisfaction with e-learning are included in section 6.

- **Measurement of Satisfaction:** This stage measures the extent of user Satisfaction in E-learning using the influential quality factors for satisfaction.
- **Data Extraction:** This stage measures the extent of satisfaction in learning systems through effective quality factors for satisfaction. This study will use a questionnaire for a community research sample, and a quantitative approach will be used to obtain the results.
- **Data Analysis:** An analysis of the population structure of the research sample will be carried out to know some general details about the research sample and to show some information about them, and then analyze the data of the indicators to know the acceptance rate for the indicator and the average, to reach a decision that fits our research plan.

6. E-learning Systems Results and Discussion

This section proposes a complete analysis of the definition of satisfaction and its effect on using the systems. Then, explain the concept of every main quality section, discuss the procedure for collecting data, and discuss the development of research instruments and questionnaires. Finally, the results were detailed, and the research sample and other analyses were analysed to reach useful results.

6.1. Analyzing Satisfaction Definition

User satisfaction is a critical factor when assessing e-learning systems, and it plays a pivotal role in the success and adoption of these systems. The extent to which users are satisfied with these systems can significantly impact their willingness to use and continue using them [19]. User satisfaction is a multifaceted concept without a universally accepted and comprehensive definition encompassing all quality factors. Researchers have divided user satisfaction into different dimensions, each with unique characteristics and definitions. Understanding these dimensions is essential for evaluating the overall success and effectiveness of e-learning systems. User satisfaction can encompass various elements, including ease of use, system reliability, response time, content quality, and overall user experience. Satisfaction is often influenced by factors such as the system’s functionality, user interface design, and the quality of information and services. Researchers commonly rely on surveys,

questionnaires, and user feedback to assess user satisfaction and gain insights into the aspects contributing to a positive or negative user experience. User satisfaction is a critical aspect of e-learning systems, particularly in the context of e-learning. The degree to which users are satisfied with the functionality, usability, and quality of services offered by electronic systems can significantly affect their willingness to engage with and trust these systems. Consequently, researchers and policymakers need to consider user satisfaction as a key factor when evaluating the success of e-learning and striving to improve the user experience.

6.2. System Quality and User Satisfaction

According to the DM IS Success Model, the intrinsic quality of an information system is the basic determinant of success or the quality of information management and processing through the system. System quality spans a wide array of dimensions, from the relative ease of use and navigability and the general appeal of the presentation format to the perceived reliability and security of the platform. High quality means addressing the issues regarding speed, reliability, and accessibility of the system, which will encourage users to use the system; hence, it is one of the most important factors affecting the satisfaction and experience of users. The study by Ramayah et al. [20] depicted that users believe the system should be easy to use and useful and make them feel in control, which will help render satisfaction. As a result, the quality of systems can undoubtedly improve satisfaction levels with the services and e-learning platforms they provide.

- Information Quality and User Satisfaction: Information quality defines the truthfulness, relevance, and usefulness of the information obtained by the system. In e-learning, the relation is about quality to the information quality of learning activities. When information quality defines completeness, truthfulness, and effectiveness for the learning activity, it automatically enhances the users' satisfaction with the system.
- Quality of Service and User Satisfaction: This means that the quality of the service determines how well a system can execute its services for the end user. Users perceive the quality based on their subjective experiences after interaction with the system. When an e-learning system exhibits better service than expected, satisfaction increases. Accordingly, ongoing improvement in service quality and systems' performance is highly relevant in enhancing users' satisfaction with e-learning systems.

7. Procedure for Collecting Data

This research is quantitative and used to obtain meaningful samples. The target respondents in this study are ordinary users who receive services from E-learning systems. A two-part questionnaire was used in this paper. The first contains demographic questions for the survey participants,

occupation, and other information related to the user gathered, occupation, and other information related to the user collected. Before distributing the questionnaires to the research sample, a readability test was conducted on 7 participants from different backgrounds. It is important to do a readability test to assess the understanding of the questionnaires and achieve the research objectives. In other words, to check respondents' understanding of the questions, ambiguous questions, and typos, and look for any suggestions and modifications.

This test was done to reduce misunderstandings in the previously reviewed papers, so the comments of these 7 respondents will provide some hints as to whether our proposed questions are misleading. Then, a pilot study of 20 respondents was conducted to confirm the validity of each quality factor in the questionnaires. Through this pilot study, it was ascertained that the questionnaire had passed the readability and validity test.

It has been distributed using different online channels, including social media and email. Of these, a total of 450 were received, but after removing all the spam or invalid ones, 378 valid responses were retained. Responses from different educational backgrounds have been received, and information was collected for 9 continuous weeks from 23 August 2024 to 23 October 2024.

The study includes the following indicators: Developments of Research Instruments and Questionnaires: Indicators were identified based on a comprehensive literature review, and each indicator was adapted to the questionnaire items. Each item is evaluated using a 5-point Likert scale, where 5 indicates strong agreement, and 1 indicates strong disagreement.

This scale was used to give more clarity. In addition, mandatory questions were placed in the questionnaires asking about general information so the respondents could know the target audience. Then, to get more accurate and honest answers instead of inaccurate answers, ask the respondents to provide honest answers in the questionnaire instructions with the mention that their identity will be anonymous. We have guaranteed that their answers will only be used in this research.

In addition, to reduce sample bias (gender bias), ask the respondents to provide information about their gender in the first part (demographic questions) to ensure that both groups are fairly represented in the questionnaire. Finally, Tables 4, 5, and 6 indicate the total indicators and the corresponding questions translated from the original Arabic version of the final questionnaire. Analyzing Data of the Demographics of the Sample: The aim of analyzing the demographics is to show some information about the respondents, as shown in Figure 1, which presents the results of the frequency and relative frequency of the study sample.

Table 4. System quality indicators: Questionnaires

| Systems quality | Indicators: Questionnaires Statements |
|------------------------|--|
| Security | Does the e-learning platform use any safety protocol for authentication or secure methodologies for login? Regarding personal information, does it maintain my personal data confidently and safely? |
| Navigability | Page Navigation: Is it an easy system to navigate through, and can you move from one page to another within this e-learning platform? Where are clear guidelines enabling me to know my location in this system? |
| Ease of Use/Usability | Does it have an easy-to-use web-based interface that will make navigation and handling easy for its users? |
| Efficiency | Does this e-learning system help by saving me time, effort, and money? I gain higher efficiency because of using the same? |

Table 5. Information quality indicators: Questionnaires

| Information quality | Indicators: Questionnaires Statements |
|----------------------------|--|
| Currency | Is the system's technology up to date? |
| Accuracy | What measures do e-learning systems take to ensure that the information they provide is accurate and error-free? |
| Relevance | What strategies do e-learning systems use to ensure that the information provided is relevant and appropriate to the needs of their users? |
| Completeness | How do e-learning systems ensure that they provide complete and comprehensive information to meet the learning needs of users? |

Table 6. Service quality indicators: Questionnaires

| Service Quality | Indicators: Questionnaires Statements |
|------------------------|---|
| Tangibles | What is my attitude in relation to aesthetics in this e-learning platform? Are design elements appealing and satisfying to the degree that they create an overall good feeling in me due to learning? |
| Responsiveness | How timely is the e-learning platform when one encounters a problem, and is the solution being given effective and timely enough to see him get productive again? |
| Empathy | Will I be able to adapt what goes on within an e-learning environment to suit my needs? How well does it support me to choose what kinds of information and services I may want to see? |
| Assurance | How do I feel about comfort in using the e-learning platform for education? Is that feeling of confidence sufficient for making an acquaintance and, hence, successful at studies? |

The previous statistical test results indicate that the number of males in the study sample was 168, while the number of females was 210. Most participants were from the Zarqa Governorate, representing 66% of the sample. Regarding the institutions through which the participants engage with E-learning, it was found that most of the study sample interact with E-learning through government universities, accounting for 38.5%, and government schools, accounting for 31.5%. The table also reveals that most E-learning participants fall within the “from one to less than three years.” They are followed by those in the “more than three years” category, with the lowest proportion in the “less than one-year” category. The analysis results also show that most participants are aged 18 years or older, representing 93.5%. On the educational level, most of these participants are in the university stage, making up 80% of the sample, affirming their capability to respond to the study’s questions and measurements. Assessment of Indicator Data Given the nature of their answers, pointing to the relevance of the given criteria, it was attempted to evaluate the answers of the indicators in this study by using a descriptive methodology. This was aimed at increasing our knowledge about the causes

of the outcomes of user satisfaction. According to the following equation, the descriptive approach was developed: Relative importance - (maximum alternative - minimum alternative) / number of levels - (5 - 1) / 3 - 1.333, which is from (Less than 2.33) is a low score, (from 2.33 less than 3.67) is a medium score, and (from 3.67 - 5) is a high score. To uncover the sample individuals’ assessments of the relative importance of the system quality variable, the arithmetic means and standard deviations of their responses were computed. The results are as indicated in Figure 1. The results in Figure 1 indicate that the arithmetic means of sample individuals’ assessments for the items related to system quality ranged between (3.57-4.05). Item number (4), which states, “E-learning systems can save many resources when used, such as time, effort and cost”, ranked highest with an arithmetic mean of (4.05) and a high relative importance. Conversely, item number (3), which mentions, “E-learning systems have user-friendly interfaces that make the system easy to use and operate”, ranked lowest with an arithmetic mean of (3.57) and moderate relative importance. The overall arithmetic mean for system quality was (3.80), indicating high relative importance.

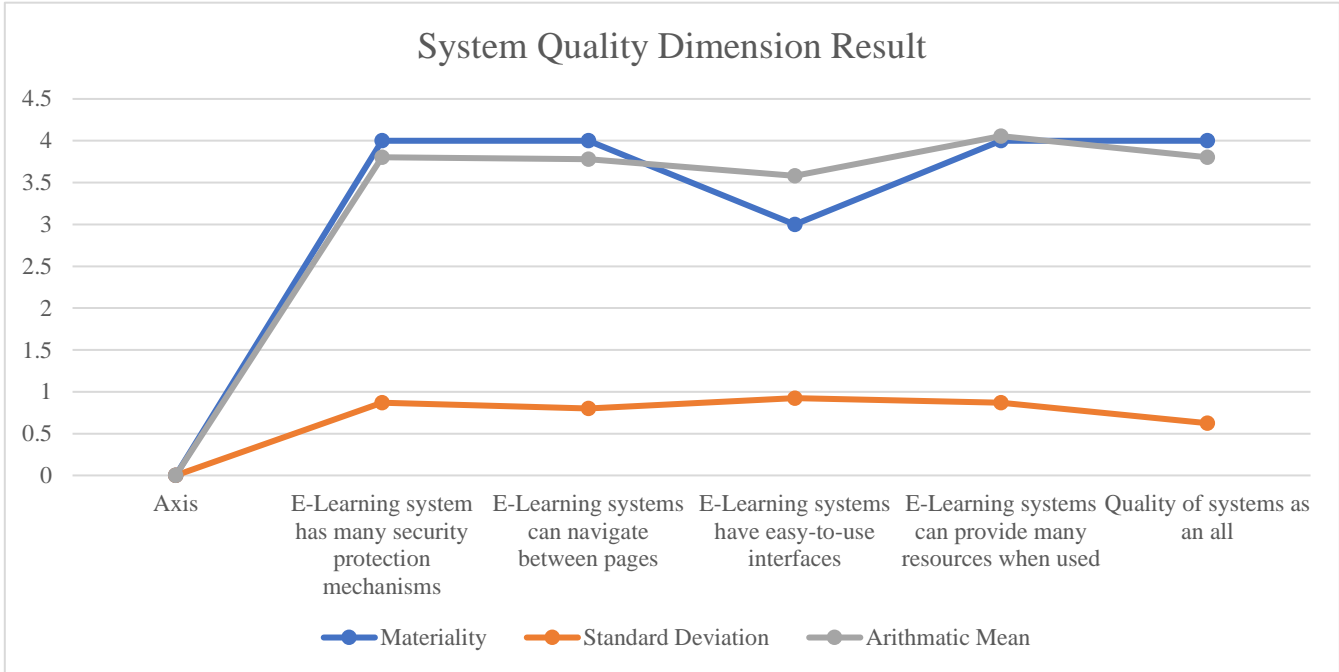


Fig. 1 System quality dimension result

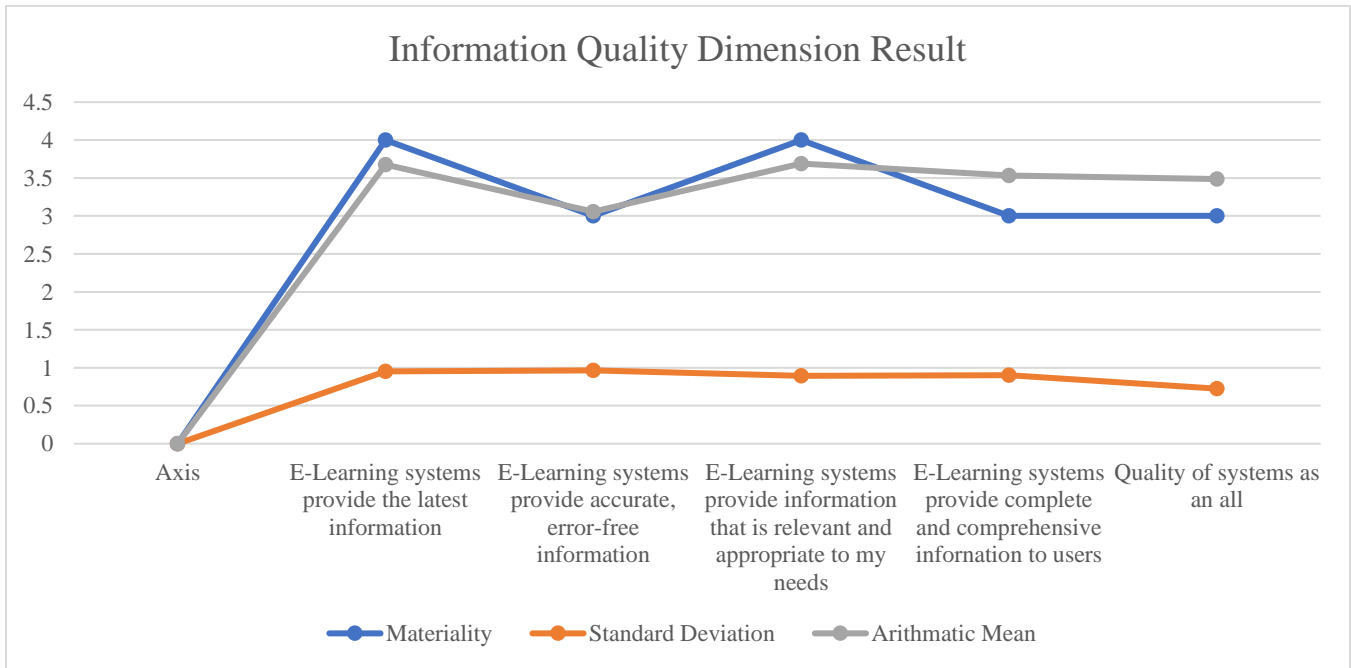


Fig. 2 Information quality dimension result

This suggests that e-learning systems offer various security measures, easy navigation, user-friendly interfaces, and the provision of numerous resources when utilized. Figure 2 Arithmetic means and standard deviations of the sample members' answers on the information quality dimension. To reveal the sample individuals' estimations of the relative importance of the information quality variable, the arithmetic means and standard deviations of their responses were

computed. The results are depicted in Figure 2. The results in Figure 2 indicate that the arithmetic means of sample individuals' assessments for the items related to information quality ranged between (3.05-3.69). Item number (3) states, "Get tailor-made materials via the e-learning platform about my needs." Ranked highest with an arithmetic mean of (3.69) and a high relative importance. In contrast, item number (2), which mentions, "E-learning systems provide accurate and

error-free information”, ranked lowest with an arithmetic mean of (3.05) and moderate relative importance. The overall arithmetic mean for information quality was (3.48), indicating moderate relative importance. This suggests that E-learning systems offer up-to-date and relevant information tailored to users’ needs and comprehensive and error-free information

Figure 3: The arithmetic means and standard deviations of the sample individuals’ responses regarding service quality. To reveal the sample individuals' assessments of the relative importance of the service quality variable, the arithmetic means and standard deviations of their responses were computed. The results are depicted in Figure 3. The results in Figure 3 indicate that the arithmetic means of sample individuals’ assessments for the items related to service

quality ranged between (3.38-4.10). Item number (5), which states, "The existence of e-learning systems facilitates the process of education via the Internet”, ranked highest with an arithmetic mean of (4.10) and a high relative importance. In contrast, item number (2), which mentions” e-learning systems provide highly reliable services.” ranked lowest with an arithmetic mean of (3.38) and moderate relative importance. The overall arithmetic mean for service quality was (3.62), indicating moderate relative importance. This suggests that the existence of E-learning systems eases the process of online education and that these systems provide customizable services to cater to learners’ needs. Additionally, e-learning systems offer enjoyable and satisfying page views as part of their services.

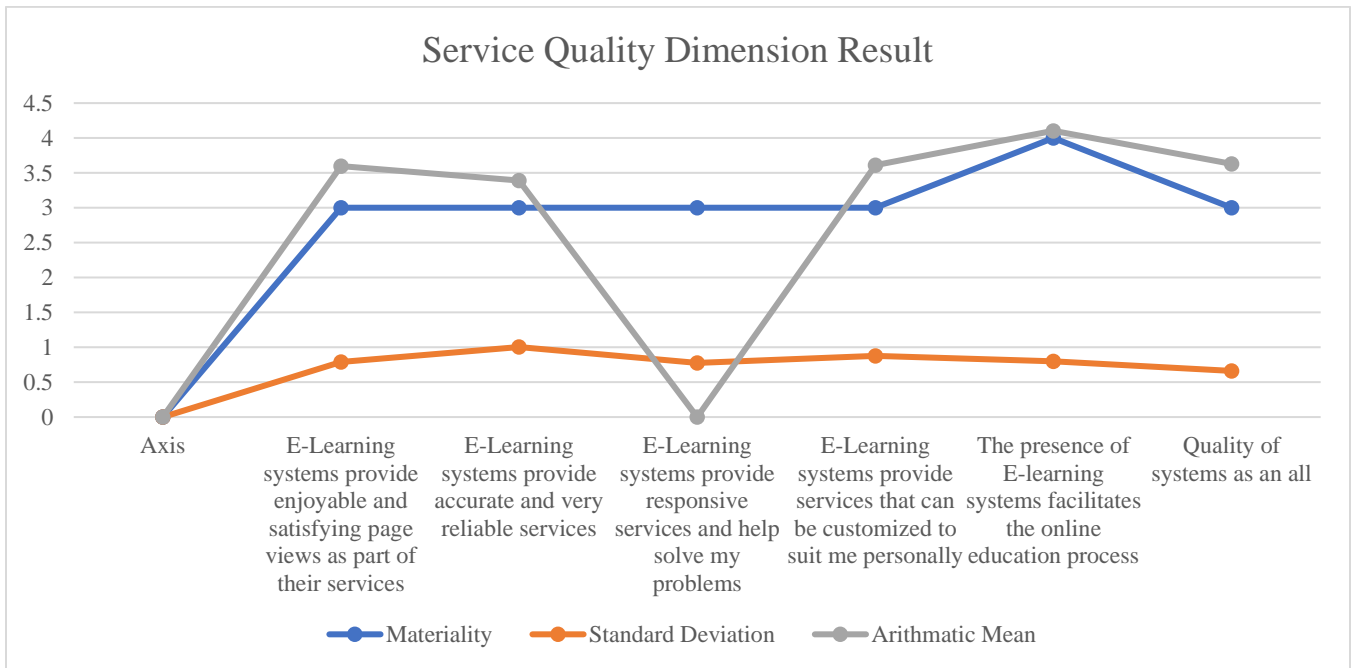


Fig. 3 Service quality dimension result

Table 7. Factors received medium or low rate

| Quality Factor | Description |
|-----------------------|---|
| Ease of Use/Usability | E-learning platforms are designed to be user-friendly and made for ease of navigation and use. |
| Accuracy | Whatever information is passed, these sites ensure it is correct and error-free. |
| Completeness | E-learning systems present complete information to the users. |
| Tangibles | The services of the e-learning platforms come in attractive and pleasing design. |
| Responsiveness | The e-learning systems are prompt to use and hence help solve the users' problems. |
| Empathy | Such online platforms enable the user to tailor-make their choice in which category of information and services they are interested in. |

The above tables show that some quality factors are of a high level in terms of the relative importance of impacts on the user's satisfaction. Most of them can be regarded as system quality. The average score of each indicator of these factors has shown that system quality is at the top regarding its critical role in determining the user's satisfaction with the e-learning system.

- System Quality and User Satisfaction Relationship: Our study results support that system quality dimensions significantly affect users' satisfaction levels in e-learning systems. In other words, from this, it can be elaborated that information quality and service quality are the two most imperative developers, and negligence should not occur while updating any e-learning environment for

better satisfaction. Thus, the system's quality, per se, does not appear to act as a determining factor in the dissatisfaction of users of the electronic learning environment. Further, improving the quality of the information and services constitutes a prior condition for user satisfaction in learning environments. Table 7 shows that the factors discussed here, although of primary importance for the development of e-learning systems, relate to average or lower levels of user satisfaction.

8. Conclusion

This research work aimed to find the main quality factors of e-learning systems and those critical factors that will guarantee users' dissatisfaction. To highlight the effect, the concepts of quality assurance, user satisfaction, and e-learning systems were first identified, and then a detailed comparison of several factors and criteria of the existing quality models was undertaken.

First, it is considered a set of key quality factors applying the D&M model, analyzing various previous studies that considered dimensions of user satisfaction in an e-learning environment. Second, they categorized them into three key groups based on their properties, thereby allowing finer granularity in testing which factors have the most critical effect on driving user satisfaction with an e-learning system. The Study prepared questionnaires that included questions about these quality factors; afterwards, the responses from the research sample of 126 users. Data analysis is done by different techniques such as:

- Analysis of demographic data.
- Data analysis of the pointers that determined the results.

The inspection also showed that user dissatisfaction is highly related to information quality and system service

quality; thus, much emphasis should be given to those areas to improve users' overall satisfaction with e-learning platforms.

Finally, comparing our study to the previous studies concluded that Al-Mulheim 9 shows that there are significant relationships between organizational factors with the quality of the e-learning system and its parameters; furthermore also, as regards students' satisfaction appearance, from a development point have positive significant on student's satisfaction. In addition, Ramayah's [16] results appear that service has a higher impact on user satisfaction. Salimon [5] explains and predicts students' acceptance and behavior regarding quality factors in an e-learning system in Jordanian public universities. The outcomes e-learning quality test had 3 item structures indicated by Puriwat [6], including the course content, delivery and structure, and technical support like ease of use for students/administrators, instructor or lecturer attributes.

The Purnomo [17] theoretical model would be the “results to system” benefits of e-learning systems and quality mediated by user satisfaction while moderated by use. Our study results indicated that information quality and service quality have a significant impact on the dissatisfaction of users with e-learning systems. The results were reached by analyzing the questionnaire data differently, which led to obtaining results that benefitted the researchers.

Future Work

In the future, we will apply the test steps to a different e-learning system and take different study cases and environments. Furthermore, prepare a different scenario for the user's behavior to fill in the gaps caused by this research and to obtain useful results that enhance our understanding of the user satisfaction process for e-learning systems.

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