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# Analysis of E-Learning System Use Using Combined TAM and ECT Factors

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**Abstract:** The use of e-learning systems has become widespread in higher education institutions in Oman. However, understanding of factors that influence student acceptance and usage of these systems is lacking. This study combined the factors of the Technology Acceptance Model (TAM) and Expectation–Confirmation Theory (ECT) to examine the acceptance and use of e-learning systems by students in Omani HEIs. A survey was conducted with 220 students from Al-Buraimi University College in Oman to collect data on perceived usefulness, perceived ease of use, behavioral intention, and e-learning system use. A model was created by merging eight interactions between TAM, ECT, and seven variables. The results showed that perceived usefulness and ease of use were significant predictors of students' intention to use e-learning systems, and behavioral intention had a direct effect on the actual use of e-learning systems. These findings provide valuable insights for e-learning system designers, developers, and educators in Oman and similar contexts to design and implement e-learning systems that meet student needs and expectations.

**Keywords:** acceptance model; TAM; educational sector; ECT



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## 1. Introduction

E-learning systems use electronic technology to facilitate and promote learning [1,2]. The exponential increase in students using advanced communication technologies and tools has allowed adjustments to e-learning systems. The expansion of e-learning platforms has placed focus on variables that support e-learning. Previous studies have conducted assessments using the active acceptance model rather than using combined models to validate the results [3].

Theories aim to understand the relationships between the components employed in models. Several studies have discussed the connection between adoption and technological acceptability that result in the use of e-learning [4]. The Expectation–Confirmation theory (ECT) is consistently utilized to operate systems. Moreover, the Technology Acceptance Model (TAM) is used to ensure system utilization [5].

Previous studies have identified contributing components in higher education institutions (HEIs) using established models [6]. However, studies on adoption that consider continuity issues are limited. This is related to reasons for ongoing use of e-learning and pronounced lack of students in HEIs [7,8].

E-learning provides colleges the opportunity to improve their teaching strategies and boost student learning outcomes [9]. Students in HEIs who have experience and are comfortable utilizing technology are good candidates for e-learning [3]. The overall goal of e-learning is to help students feel satisfied by providing them with a variety of platforms that encourage teamwork, communication, and creativity. HEIs expanded in response to the advancement of teaching and learning [9,10]. E-learning is a useful approach in HEIs, despite the poorly designed models that are employed, which impact how students use online learning. This study examined the effectiveness of the learning mechanisms and electronic technology that is currently available. In addition, it analyzed the assessment support components and outcomes that validate student satisfaction and other learning outcomes. This study aimed to identify the relevant elements that influence how e-learning systems are used.

E-learning, the use of electronic technologies to deliver educational content, has gained significant importance in Oman. The country has recognized the potential of e-learning to enhance the quality of education, increase accessibility, and prepare its citizens for the demands of a knowledge-based economy. This description delves into the importance of e-learning in Oman, the conditions for adopting e-learning, government programs promoting e-learning, and an analysis of e-learning system use using the combined Technology Acceptance Model (TAM) and Extended Unified Theory of Acceptance and Use of Technology (ECT) factors [1,5,11,12].

The increasing adoption of e-learning systems in HEIs in Oman presents a need to understand the factors that influence student acceptance and usage of these systems. This study used the TAM and ECT to examine the acceptance and use of e-learning systems by students in Omani HEIs. This study sought to determine the extent to which perceived usefulness (PU), perceived ease of use (PEOU), and behavioral intention (BI) affect the students' intention to use e-learning systems and the actual use of these systems in Omani HEIs.

Importance of E-Learning in Oman, Accessibility: E-learning allows students in remote areas or with physical disabilities to access education without the constraints of geographical boundaries. It provides equal opportunities for education to individuals who may otherwise face challenges attending traditional classrooms [13]. Flexibility: E-learning offers flexibility in terms of time and location, enabling learners to access educational materials at their own pace and convenience. This is particularly beneficial for working professionals, adult learners, and those with family commitments [12,14,15]. Quality Enhancement: E-learning platforms in Oman focus on delivering high-quality educational content, leveraging multimedia elements such as videos, interactive simulations, and online assessments. This interactive approach enhances the learning experience and promotes better knowledge retention [12,13,15,16]. Lifelong Learning: E-learning encourages lifelong learning by providing opportunities for individuals to acquire new skills and knowledge at any stage of their lives. This aligns with Oman's vision of promoting a culture of continuous learning and skill development [1,5].

E-learning in Oman needs infrastructure to facilitate widespread e-learning adoption, Oman has made significant investments in improving digital infrastructure, including internet connectivity, access to computers, and mobile devices. Oman's government has taken measures to expand and improve internet connectivity across the country, ensuring reliable and high-speed internet access in both urban and rural areas. This is crucial for enabling seamless e-learning experiences. Moreover, Oman has recognized the importance of digital literacy and is actively promoting digital skills among its population. By equipping learners and educators with the necessary digital competencies, the country is ensuring effective utilization of e-learning platforms [12,17].

By applying this combined model, researchers and policymakers can assess the factors influencing the acceptance and usage of e-learning systems in Oman. They can identify barriers, understand user behavior, and develop strategies to enhance adoption and engagement. This analysis can help in designing more effective e-learning systems and improving the overall educational experience for learners in Oman.

The TAM and Unified Theory of Acceptance and Use of Technology (UTAUT) are widely used to understand and predict technology adoption and use behavior. While UTAUT is more recent, it is not always superior to the TAM.

The TAM is a simple and straightforward model that focuses on two key factors: PU and PEOU. In contrast, the UTAUT includes multiple constructs, such as performance expectancy, effort expectancy, social influence, and facilitating conditions, which can make it more complex and difficult to apply in some contexts [10,18]. Moreover, the TAM has been widely used and tested in various settings and across different technologies, such as mobile apps, e-learning systems, and social media platforms. This demonstrates the model's broad applicability and generalizability, making it a reliable choice for research and practical purposes [19,20]. Furthermore, depending on the specific research questions and objectives, the TAM may be more suitable than the UTAUT. For instance, if the focus is on understanding the factors that influence users' decisions to adopt or reject a new technology, the TAM's emphasis on PU and PEOU may be more relevant than the UTAUT's broader range of constructs [1]. In addition, if data on PU and PEOU are available, it may be more practical to use the TAM rather than collecting additional data on the UTAUT's constructs [10,21].

The choice between the TAM and UTAUT ultimately depends on the specific research questions, the available data, and the context of the study. Researchers should carefully consider the strengths and limitations of each model and choose the one that best fits their needs.

The novelty of this study includes Enhanced Understanding of User Behavior: The study may provide deeper insights into the factors influencing user acceptance and adoption of e-learning systems by combining the TAM and ECT frameworks. It can shed light on the complex interplay between perceived usefulness, ease of use, social influence, facilitating conditions, and individual characteristics in the context of e-learning. Identification of Critical Factors: The research may identify specific factors that play a crucial role in the successful utilization of e-learning systems. It can highlight which variables have the most significant impact on user acceptance and engagement, thereby informing the development of targeted interventions and strategies to enhance e-learning effectiveness. Validation of Combined Model: The study may validate the effectiveness and relevance of integrating the TAM and ECT frameworks for analyzing e-learning system use. By demonstrating the compatibility and explanatory power of these models, it can contribute to the methodological advancements in the field of technology acceptance and usage. Contextual Application to E-Learning: The research may focus on applying the combined TAM and ECT factors specifically to the domain of e-learning. By tailoring the model to the unique characteristics and requirements of e-learning systems, it can provide insights and recommendations that are directly applicable to e-learning contexts, supporting the further development and improvement of e-learning platforms and practices.

This study is divided into several sections: The first section is the explanation of e-learning acceptance models with the main common models TAM and ECT. The second section is the factors used in the study and its rational casual. In the third section, the data is analyzed in the study and the collected data from the distributed survey. Finally, the conclusion, implications, limitations, and future work for the next research paper are discussed.

## 2. E-Learning Acceptance Models

The standard e-learning assessment determines if the HEI has acquired the necessary degree of acceptance in the framework of the universities.

E-learning acceptance models are theoretical frameworks that attempt to explain and predict user adoption and usage of technology-enhanced learning [7]. These models identify the factors that influence an individual's decision to use technology for learning and factors that drive continued use. Some common e-learning acceptance models include the TAM, the UTAUT, and Diffusion of Innovations theory [5]. These models help educators,

instructional designers, and e-learning technology developers understand how to design, implement, and evaluate e-learning systems that meet learner needs and expectations [11].

Several studies have examined the main factors that influence people's decision to adopt and accept technology, as well as their intention to use online systems. The combination of in-person and online classes, ranging from 15% to 100% in-person and 20% to 99% online, can be transformed into a complete online learning experience. However, earlier research indicated uncertainty about whether the benefits of online learning outweighed those of traditional learning in terms of enhancing students' motivation to use e-learning systems [1,6,18,19]. Various criteria are used to evaluate acceptance of e-learning systems [5,7], such as course content, which is based on the knowledge, training, and experience of teachers [3,9,10]. Moreover, the use of e-learning systems helps teachers provide content that is simple for students to access and follow. E-learning acceptance variables presented in Figure 1 were used to develop system utilization.

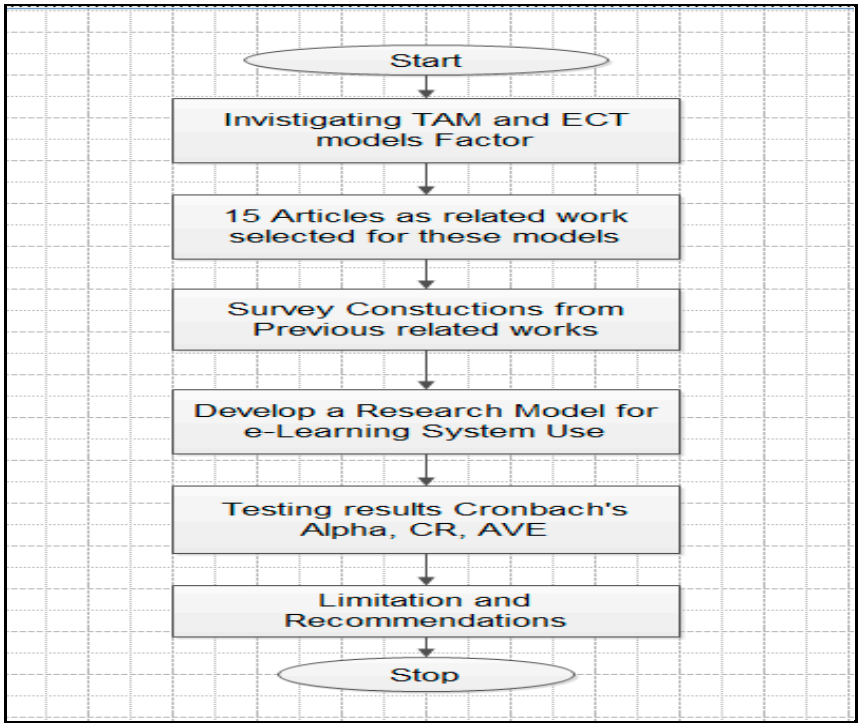


**Figure 1.** Research flowchart.

To improve learning outcomes, instructors should have specialized knowledge. Teachers require the aid of teaching technologies [7], and students should practice using technology tools and online resources to resolve issues individually or in groups [1,6,7,11].

Acquiring and effectively using knowledge requires abilities, including creativity, invention, decision-making, problem-solving, and critical thinking. In addition, students require teamwork and communication skills, which may affect how well pupils write, design, and engage with technology in a professional setting [10]. The studies examined are shown in Table 1.

The lack of a comprehensive model for e-learning acceptance poses a challenge for e-learning system designers, developers, and educators, as it limits their ability to design and implement effective e-learning systems that meet the needs and expectations of students. The study aimed to fill this gap by synthesizing existing theories and models of e-learning acceptance and integrating new insights to develop a comprehensive model that captures the complex interplay of factors influencing e-learning acceptance. The proposed model can provide a basis for future research and practical applications in the field of e-learning and

contribute to a better understanding of how to design and implement effective e-learning systems that enhance student learning outcomes.

Furthermore, the integration of technology into education has the potential to greatly enhance student learning outcomes; however, the adoption of these technologies by educators is not always straightforward. The resistance to change and lack of technical knowledge and skills among educators can be major barriers to the successful adoption of teaching technologies [19,22]. This study is aimed to identify the key individual and organizational factors that influence the adoption of teaching technologies by educators and role of external stakeholders, such as policymakers and funding agencies. The results can inform the development of strategies and programs to encourage and support the successful adoption of teaching technologies by educators, with the ultimate goal of enhancing student learning outcomes.

According to [23], despite the widespread use of e-learning systems, factors that drive student acceptance, which is crucial for effective and efficient learning, remain unknown. This presents a challenge for e-learning system designers, developers, and educators. They aimed to fill this gap by exploring the major factors that contribute to e-learning acceptance and providing a comprehensive understanding of the underlying mechanisms and processes that influence student acceptance of e-learning systems. The results can inform the design and implementation of effective e-learning systems and contribute to a better understanding of how to enhance student learning outcomes through e-learning.

**Table 1.** A comprehensive review of key research findings.

| Ref | Problem | Aim | Method of Work | Results and Outcomes | Sample Size | Country |
|---|---|---|---|---|---|---|
| [1] | The lack of a comprehensive model for e-learning acceptance poses a challenge for e-learning system designers, developers, and educators | Develop a combined model for e-learning acceptance | The new model provides a basis for future research and practical applications in the field of e-learning | Proposed model provides a basis for future research and practical applications in the field of e-learning | 295 | Oman |
| [19] | Integration of technology into educational sector | Fill this gap by exploring the major factors that contribute to e-learning acceptance | Determine the role of external stakeholders such as policymakers and funding agencies | It's necessary to adopt teaching technologies | 487 | --- |
| [6] | Despite the widespread use of e-learning systems to learn mathematics | Aims to address is identifying the major factors that contribute to the acceptance of e-learning systems by students | A qualitative survey distributed to all participant teachers | The results of this research informs the design and implementation of effective e-learning systems | 161 | Indonesia Oman |
| [11] | Slowness and weakness of student understanding to learn mathematics and graphics courses | Understanding the continuous intention to use systems needs | Adapting model with advanced model | High acceptance of model factors | 15 | Oman |
| [24] | Describe the factors for student satisfaction upgrading e-learning system needs | The major factor for satisfied learners | Reducing time consuming through the system use and validation | Significant use of model factors | 153 | Tanzania |
| [8] | Finding the factors affecting mobile learning for learning sustainability | Find a global model for e-learning acceptance | Improve outcomes by expert e-learning platform | Redesign a balance state among all functions | 200 | Malaysia |

**Table 1.** *Cont.*

| Ref | Problem | Aim | Method of Work | Results and Outcomes | Sample Size | Country |
|---|---|---|---|---|---|---|
| [25] | Estimate the measurements efforts between individual's and the processes need using social media | Test 3 goal mediation for core factors of e-learning systems | Survey distribution for undergraduates | Students improved capabilities and performance | 430 | Malaysia |
| [4] | Improving e-learning by finding the attitude role in TAM | Find a significant model for e-learning | Open ended survey and interviews | High acceptance of model factors | 151 | Malaysia |
| [26] | Finding the pre-service teachers' acceptance for e-learning factors | Reducing the factors used for acceptance model | Survey distribution with an adopted model | Students' acceptance and satisfaction | 120 | United Arab Emirates |
| [14] | Determine the factors for student perception toward using e-learning model | Innovating a contributing factor for easy learning | Survey distribution with an adopted model | Students' acceptance and satisfaction | 95 | Oman |
| [27] | Determine what factors influenced the acceptance of blended learning | Understanding the continuous intention to use systems needs | Open ended survey and interviews | These models help educators, instructional designers, and e-Learning technology developers understand how to design, implement, and evaluate e-Learning systems that meet the needs and expectations of learners | 347 | Malaysia |
| [18] | How to modify TAM to improve the e-health system | Design a modified (TAM) model on the sustainable for improving e-learning health system | Open ended survey and interviews | Students' acceptance and satisfaction | 384 | Ethiopia |
| [28] | Find out the student perception using mobile learning within COVID-19 | Enhance and improve students' perceptions using m-learning of TAM during COVID-19. | Open ended survey and interviews | Students' acceptance and satisfaction | ----- | Jordan |
| [12] | How to find the contributing factors using e-learning | Developing a model within minimum factors and highest performance | Survey distribution with an adopted model | Students' acceptance and satisfaction | ------ | Oman |
| [29] | Building a combined model for e-learning enhancement using influence of YouTube videos on the learning experience | Helping disable students to use you tube videos to improve their learning | Survey distribution with an adopted model | Students' acceptance and satisfaction | 60 | Jordan |

Several strategies can be used to assist learning outcomes in an e-learning setting: (1) using multimedia, such as videos, animations, and simulations to make the content more engaging and interactive for the learner; (2) offering personalized learning paths, such as adaptive learning, that cater to the individual learning styles and needs of each learner [10]; (3) providing regular and timely feedback on the learner's progress and opportunities for self-assessment and reflection; (4) encouraging collaboration and peer-to-peer interaction through discussion forums, group projects, and other social learning activities; (5) incorporating elements of game design, such as rewards, challenges, and competition, to motivate learners and enhance their engagement; (6) and connecting the learning material to real-world situations and contexts to increase the relevance and motivation of the learners [19]. These strategies can create an e-learning environment that is effective, engaging, and aligned with learner needs and expectations [23].

### *2.1. Technology Acceptance Model*

The TAM is a theoretical framework that explains and predicts user acceptance and adoption of information technology (IT) systems. Developed by Davis in 1989, the TAM posits that PU and PEOU influence an individual's decision to adopt and use a technology [1]. PU refers to the degree to which a user believes that using a technology will enhance their job performance or lead to better outcomes. PEOU refers to the degree to which a user finds the technology to be easy to use and accessible. The TAM suggests that these two factors determine the user's attitude towards using the technology, which in turn influences their intention to use it. The actual use of the technology is then influenced by the intention to use, as well as other factors, such as social influence and facilitating conditions [11,30,31].

The TAM has been widely used and tested in various IT adoption and usage contexts and has been found to be a reliable and valid model for understanding user acceptance and adoption of technology. It provides a practical framework for technology developers and designers to understand the factors that influence user adoption and design technology systems that meet user needs and expectations [9,15,19].

The TAM model is built from the theories of reasoned action (TRA) [1]. This model has four constructions and influencing factors on behavior. The TAM is also applicable to behavioral intention. The model presented in a previous study [32] was used as an initial system to test and validate the acceptance models with e-learning.

Figure 2 demonstrates the original TAM's four standout factors, which indicate system use [32]. These elements are widely acknowledged to support its use [9].

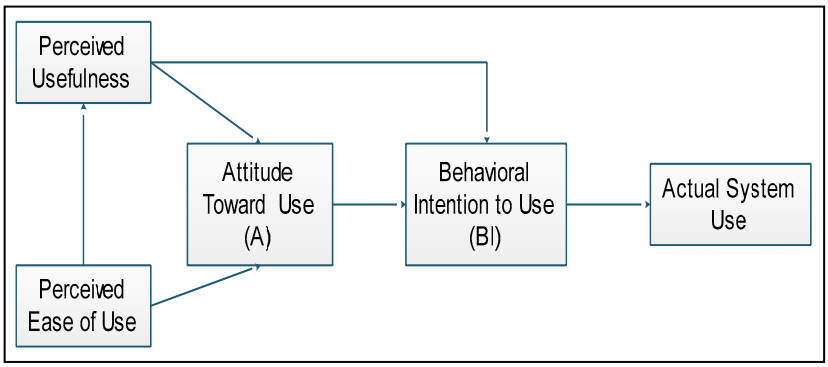


**Figure 2.** The (TAM) model.

This study used the original TAM and its key components to shed light on system services that directly affect e-learning use.

### *2.2. Expectation–Confirmation Theory*

The ECT, which was introduced for the marketing field in 1980 [33], is utilized to support market satisfaction and repurchase intention values. The earliest iteration of this theory is shown in Figure 3. The five constructs that make up the ECT are PU, expectation, confirmation, satisfaction, and repurchase intention.

The ECT explains how a person's expectations and subsequent experiences with a product or service influence their overall satisfaction and loyalty. The theory proposes that a person's expectations of a product or service are formed based on various sources of information, including prior experiences, marketing communications, and social influence [3,28]. The ECT posits that a person's expectations are then confirmed or disconfirmed by their actual experiences with the product or service. If the actual experience confirms the person's expectations, then the person feels satisfied and is more likely to continue using the product or service in the future. If the actual experience does not match the expectations, then the person feels dissatisfied and may be less likely to continue using the product or service.

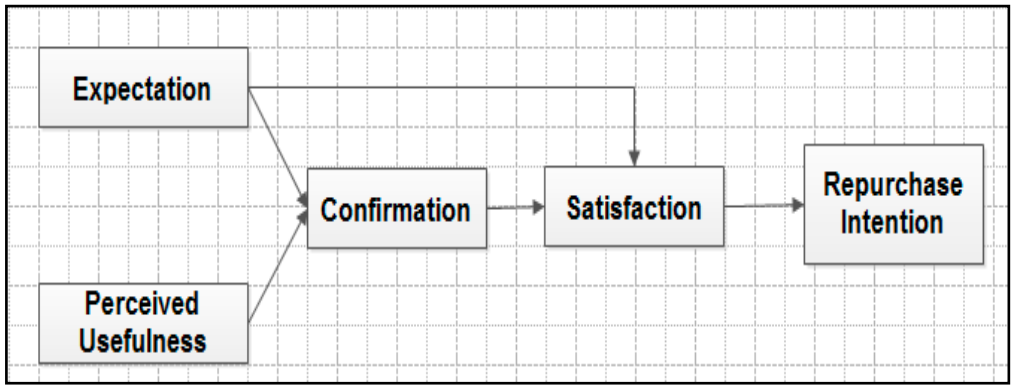


**Figure 3.** Expectation–Confirmation Theory (ECT).

The ECT has been widely applied in various domains, including customer satisfaction and loyalty, health services, and technology acceptance. The theory provides a useful framework for understanding how expectations and experiences interact to influence satisfaction and behavior. It can be useful for organizations to understand how to manage customer expectations and design products and services that meet or exceed those expectations to improve customer satisfaction and loyalty [4].

The ECT has been utilized to support students' desires and satisfaction in using technology information and e-learning systems [1,7,9]. Perceived utility and satisfaction, which influence the adoption of e-learning and how these components may alter one's propensity to utilize e-learning systems, should be investigated [3]. To assess how satisfaction influences the model used to improve the e-learning system, these components are necessary. In the field of education, student acceptance and usage were associated with satisfaction [23]. The ECT recently gained popularity in validating e-learning platforms [6,34]. It has been utilized to support student satisfaction with each stage of model testing and maintenance [4,11]. The PU was used to examine the adoption of technology in relation to system utilization.

## 3. Factors Analyzed

Table 2 shows the factors frequently analyzed in 15 previous studies. Table 3 shows the impact of relationships. Many studies used the TAM to test the validity of teaching and learning enhancement and enhance intention to use e-learning systems [26]. Further research on student perceptions, behavioral intention, and acceptance is required to improve HEIs [19,35].

**Table 2.** Summary of factors.

| Ref. | Perceived Usefulness | Perceived Ease of Use | Course Content | Behavioral Intention | Support Assessment | Student Satisfaction | System Use |
|---|---|---|---|---|---|---|---|
| [1] | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| [19] | Yes | Yes | | Yes | | | Yes |
| [29] | Yes | | | Yes | | Yes | Yes |
| [11] | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| [6] | Yes | Yes | Yes | Yes | | | Yes |
| [28] | Yes | Yes | | Yes | | | Yes |
| [24] | | | | | Yes | Yes | Yes |
| [18] | Yes | Yes | | Yes | | | Yes |

**Table 2.** *Cont.*

| Ref. | Perceived Usefulness | Perceived Ease of Use | Course Content | Behavioral Intention | Support Assessment | Student Satisfaction | System Use |
|---|---|---|---|---|---|---|---|
| [8] | Yes | Yes | | Yes | Yes | | Yes |
| [25] | Yes | Yes | | Yes | | Yes | Yes |
| [12] | Yes | Yes | | Yes | | | Yes |
| [4] | Yes | Yes | | Yes | | | Yes |
| [26] | Yes | Yes | Yes | Yes | | | Yes |
| [14] | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| [27] | Yes | Yes | | Yes | | | Yes |

**Table 3.** Causal relationships from literature.

| Causal Link | Model | References |
|---|---|---|
| PU → BI | Technology Acceptance Model | [1,19,25,27] |
| PEOU → PU | Technology Acceptance Model | [1,6,11,14,25] |
| PEOU → BI | Technology Acceptance Model | [1,8,12,24,26] |
| PEOU → SS | Expectation Confirmation-Theory | [18,24,25] |
| CC → SA | E-Learning Model | [1,4,8,27] |
| BI → AP | Online-Learning Model | [6,8,12,26,29] |
| SA → SU | General Model | [8,14,24,26] |
| SS → SU | Expectation Confirmation-Theory | [4,8,12,24,29] |

## 4. Conceptual Model Development

The model was constructed from three separate models and based on the existing general model [36] based on 16 possibilities.

Intention to use the e-learning system is the degree to which a student intends to use the e-learning system in the future [16,37]. Actual use of the e-learning system is the extent to which a student actually uses the e-learning system.

The model proposed that PU and PEOU determine a student's intention to use the e-learning system, and behavioral intention affects the actual use of the e-learning system; however, the latter was not included because it is not one of ECT model factors [38]. The actual use of the e-learning system influences satisfaction and confirms or disconfirms expectations. The model suggests that the combined effect of PU, PEOU, and behavioral intention on the acceptance and use of e-learning systems can provide valuable insights for e-learning system designers, developers, and educators in Oman and other similar contexts [17,39].

Based on the constant selection of the system of use, as depicted in Figure 4, new complimentary elements were included to boost student performance.

The factors found in previous acceptance models were used to generate the hypotheses following the TAM and ECT [17,25,40]. Three criteria, PU, PEOU, and course content, were considered to evaluate e-learning. Additional elements from other technological models to identify benefits for the advancement of continuous intention were not considered.

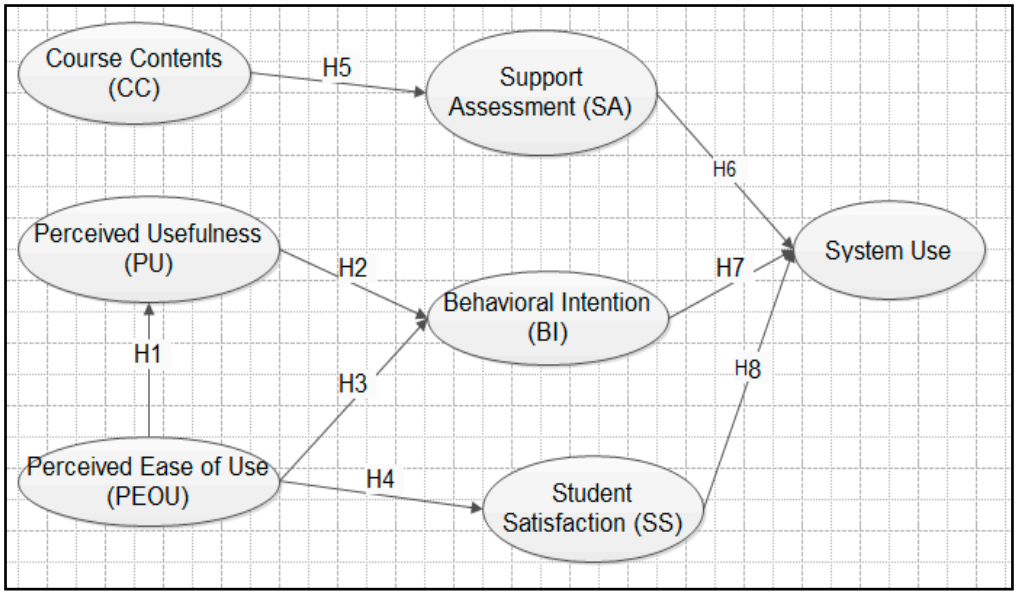


**Figure 4.** Research model.

The TAM posits that PEOU and PU influence individuals' adoption and use of new technologies. Several studies have investigated the relationship between PEOU and PU and their impact on technology adoption and use. Davis [30] found that PEOU has a significant positive effect on PU, indicating that individuals are more likely to perceive a technology as useful if they believe it is easy to use. This finding has been replicated in several studies across various technologies, such as mobile apps [39] and e-learning systems [12,30,41]. These studies suggest that improving the ease of use of a technology can positively impact its PU, which can increase its adoption and use. Therefore, the following hypothesis was proposed:

**H1.** PEOU positively influences PU.

Individuals' propensity to employ a technology in the future is referred to as behavioral intention (BI). According to the TAM, PU is an important predictor of BI, as people are more inclined to utilize a technology if they think it will be valuable to them. The interaction between PU and BI and their effects on the uptake and use of technology have been the subject of numerous studies. PU has been found to significantly improve BI [22,25]. People are more likely to intend to use a technology if they think it will be helpful. Several studies using a variety of technologies, including social media platforms [40,42,43] and healthcare technology, have confirmed this finding. Therefore, enhancing the PU of a technology can positively impact individuals' intention to use it, which can increase its adoption and use. Therefore, the following hypothesis was proposed:

**H2.** PU positively influences BI.

According to the TAM, PEOU is a significant predictor of BI. If people think technology is simple to use, they are more likely to want to utilize it. The connection between PEOU and BI and their effects on the uptake and use of technology have been the subject of numerous studies. PEOU has been shown to significantly improve BI [2]. People are more likely to intend to use a technology if they think it will be simple to use. This result has been confirmed in numerous studies using a variety of technologies, including mobile apps and e-commerce websites [19,28]. These studies suggest that improving the ease of use of a technology can positively impact individuals' intention to use it, which can increase its adoption and use. Therefore, the following hypothesis was proposed:

**H3.** PEOU positively influences BI.

Student satisfaction is an important factor in the adoption and use of educational technologies. The TAM proposes that PEOU is a significant predictor of satisfaction, as individuals are more likely to be satisfied with a technology if they perceive it as easy to use. Several studies have investigated the relationship between PEOU and satisfaction in the context of educational technologies. PEOU has been shown to have a significant positive effect on satisfaction with e-learning systems [36,42]. Students were more satisfied with the system if they perceived it as easy to use. This finding has been replicated in several studies across various educational technologies. Therefore, the following hypothesis was proposed:

**H4.** PEOU positively influences student satisfaction.

The quality of course content is crucial in ensuring that students can understand and apply the knowledge they gain from a course. Alignment between course content and assessment is equally important in ensuring that students are able to demonstrate their understanding of the material. Several studies have investigated the relationship between course content and assessment in the context of educational technologies. Course content has been found to have a significant positive influence on the alignment between course content and assessment [28,40]. Students were more likely to perform well in assessments if they perceived the content to be well-designed and relevant to the assessment. This finding has been replicated in several studies across various educational technologies, such as online learning platforms [5,12,36,38] and intelligent tutoring systems. These studies suggest that improving the quality of course content can positively impact the alignment between course content and assessment, which can improve students' performance. Therefore, the following hypothesis was proposed:

**H5.** Course content positively influences the alignment between course content and assessment.

BI refers to individuals' willingness to use a technology in the future. The TAM proposes that BI is a significant predictor of system use, as individuals are more likely to use a technology if they have the intention to do so. Several studies have investigated the relationship between BI and system use and their impact on technology adoption. BI has been found to have a significant positive effect on system use [35,44]. This finding has been replicated in several studies across various technologies, such as social media platforms [45,46] and e-commerce websites. These studies suggest that improving individuals' BI toward a technology can positively impact its adoption and use. Therefore, the following hypothesis was proposed:

**H6.** BI positively influences system use.

The support and feedback students receive during the assessment process can have a significant impact on their performance and engagement. Several studies have investigated the relationship between support during assessment and system use in the context of educational technologies [29,47]. Support during assessment has been found to have a significant positive influence on system use in an online learning environment [9]. Students were more likely to engage with the system if they received timely and relevant feedback on their assessments. This finding has been replicated in several studies across various educational technologies, such as intelligent tutoring systems [23,42] and e-learning platforms [46,48]. These studies suggest that providing effective support and feedback during the assessment process can positively impact students' engagement and use of educational technologies. Therefore, the following hypothesis was proposed:

**H7.** Support and feedback during assessment positively influence system use.

Student satisfaction is a crucial factor in ensuring the adoption and use of educational technologies. Students are more likely to engage with a system if they are satisfied with its usability and performance. Several studies have investigated the relationship between student satisfaction and system use in the context of educational technologies. Student satisfaction has been found to have a significant positive influence on the use of e-learning

systems [2,20]. Students were more likely to use the system if they were satisfied with its usability, content, and features. This finding has been replicated in several studies across various educational technologies, such as mobile learning platforms [12,20] and intelligent tutoring systems [18,24]. These studies suggest that improving student satisfaction with the usability and features of educational technologies can positively impact their adoption and use. Therefore, the following hypothesis was proposed:

**H8.** Student satisfaction positively influences system use.

## 5. Methodology

This study provides a comprehensive explanation of the methodology, instrument, data collection, data analysis, procedure, and consent of participants. The study was conducted at Al-Buraimi University College during the first semester of the 2019–20 academic year, involving a sample of 276 students in the IT field. Out of the distributed questionnaires, 220 completed responses were collected for analysis.

To determine the expected sample size, the researchers employed G-power, a statistical software commonly used for power analysis. Based on the analysis, it was determined that a minimum of 85 responses was needed to achieve statistical significance [44,49,50].

After the data collection phase, the collected data underwent a cleaning and preparation process to ensure its accuracy and reliability. The author employed descriptive statistics to summarize the data, utilizing the SEM-PLS program for the analysis. Structural Equation Modeling-Partial Least Squares (SEM-PLS) is a statistical technique commonly used for analyzing complex relationships between variables.

Furthermore, factor analysis was employed to identify the factors that influence e-learning acceptance and use. This technique allows researchers to uncover underlying dimensions or latent constructs that contribute to the observed data patterns. Regression analysis was then utilized to examine the relationships between the identified factors and e-learning acceptance and use. Regression analysis enables researchers to assess the extent to which one variable predicts or explains the variance in another variable.

## 6. Data Analysis

To analyze the data collected in this study, the author employed a combined approach that integrates the Technology Acceptance Model (TAM) and the Extended Unified Theory of Acceptance and Use of Technology (ECT). The TAM framework explores how users perceive and adopt technology, while the ECT framework considers various factors that influence user acceptance and usage of technology.

Using this combined approach, the author conducted a thorough analysis of the collected data. The specific details of the data analysis techniques, such as the statistical methods or software used, are SEM-PLS program. However, it is crucial for the author to employ appropriate statistical analyses, such as regression analysis or structural equation modeling, to examine the relationships between the identified TAM and ECT factors and e-learning system use. These analyses help to determine the significance and strength of the relationships between the variables.

The collected data were cleaned and prepared for analysis. Descriptive statistics were used to summarize the data. Factor analysis was used to identify the factors that influence e-learning acceptance and use. Regression analysis was used to test the relationships between the identified factors and e-learning acceptance and use.

The procedure followed in this study involved several stages. Firstly, the research objectives were defined and research questions related to e-learning system use were formulated. The study involved a literature review to identify the relevant TAM and ECT factors that influence technology acceptance and usage. Next, a survey or questionnaire based on the identified TAM and ECT factors was designed. The participants, 220, were individuals who have experience or exposure to e-learning systems. The researchers then obtained the necessary ethical approvals, if applicable, to ensure that the study adheres to ethical guidelines. After obtaining the required permissions and approvals, the author

distributed the survey or questionnaire to the participants. It is essential provide clear instructions and guidelines to ensure consistency and accuracy in data collection.

Cronbach's alpha results are shown in Table 4. Seventeen survey items were divided into seven factors. This study was used to clarify the measures content and its effect on each factor of the model. These findings demonstrated that all proposed constructs had good consistency ($\alpha = 0.7$) and composite reliability. All factors had average variance extracted values greater than 0.5. Table 3 lists the survey items. Each item measures its mean (M) and standard deviation (SD). According to use of the five points scale in the survey, the accepted mean value should be greater than 3, and for SD it should be above 0.6 to be accepted results for all items.

**Table 4.** Factors measures.

| Factors | Cronbach's Alpha | CR | AVE | Code | Mean | SD | Items |
|---|---|---|---|---|---|---|---|
| Perceived Usefulness (PU) | 0.911 | 0.952 | 0.659 | PU1 | 4.038 | 0.854 | E-learning makes students more valuable. |
| | | | | PU2 | 3.985 | 0.738 | Student performance is supported by e-learning. |
| | | | | PU3 | 3.918 | 0.781 | E-learning makes it simple to convert content to student understanding. |
| Perceived Ease of Use (PEOU) | 0.931 | 0.931 | 0.676 | PEOU1 | 4.028 | 0.823 | E-learning is simple to utilize. |
| | | | | PEOU2 | 4.037 | 0.791 | E-learning makes it easier for students to submit projects. |
| Course Content (CC) | 0.864 | 0.781 | 0.704 | CC1 | 3.847 | 0.762 | Through e-learning, students learn to think. |
| | | | | CC2 | 3.979 | 0.849 | Assignments for classes are understandable. |
| | | | | CC3 | 4.170 | 0.851 | Courses are updated with new information. |
| Support Assessment (SA) | 0.820 | 0.801 | 0.810 | SA1 | 3.972 | 0.739 | E-learning followed in time and quality. |
| | | | | SA2 | 3.895 | 0.788 | Evaluation of assessment is clearly explained. |
| Behavioral Intention (BI) | 0.894 | 0.814 | 0.813 | BI1 | 4.026 | 0.828 | I persevered using e-learning software. |
| | | | | BI2 | 4.051 | 0.849 | I advised other students to use the e-learning. |
| | | | | BI3 | 3.950 | 0.796 | I recommended to use e-learning in the future. |
| System use (SU) | 0.916 | 0.924 | 0.861 | SU1 | 3.978 | 0.843 | I prefer e-learning systems within current features. |
| | | | | SU2 | 4.069 | 0.857 | E-learning earn time in a good manner. |
| Student Satisfaction (SS) | 0.792 | 0.893 | 0.720 | SS1 | 4.105 | 0.796 | E-learning is a simple process. |
| | | | | SS2 | 3.897 | 0.738 | I enjoy using e-learning. |

The data were subjected to an exploratory factor analysis to confirm strong cross-loadings between the constructs. The diagonal values of the Fornell–Larcker Criterion must be greater than 0.5 for acceptable model results [43,51]. As shown in Table 4, the right diagonal values were above 0.5 for all constructs. The values of the lower triangle were less than 0.5, as shown in Table 5.

**Table 5.** Fornell–Larcker Criterion.

| Factor | BI | System Use | Course Content | PEOU | PU | SS | SA |
|---|---|---|---|---|---|---|---|
| Behavioral Intention (BI) | 0.80 | | | | | | |
| System Use (SU) | 0.36 | 0.83 | | | | | |
| Course Content (CC) | 0.28 | 0.34 | 0.95 | | | | |
| Perceived Ease of Use (PEOU) | 0.12 | 0.14 | 0.37 | 0.90 | | | |
| Perceived Usefulness (PU) | 0.44 | 0.47 | 0.34 | 0.32 | 0.78 | | |
| Student Satisfaction (SS) | 0.35 | 0.43 | 0.23 | 0.16 | 0.48 | 0.84 | |
| Support Assessment (SA) | 0.28 | 0.39 | 0.30 | 0.34 | 0.38 | 0.26 | 0.80 |

Table 6 presents the outcomes. The results of the *p*-value test were considered acceptable if B $\geq$ 0.1 and $p = 0.01$ or $p = 0.001$.

**Table 6.** Path coefficient and β results.

| | Relationship | β | *p*-Value | Remarks |
|---|---|---|---|---|
| H1 | Perceived Ease of Use → Perceived Usefulness | 0.097 | 0.000 | Successful |
| H2 | Perceived Usefulness → Behavioral Intention | 0.123 | 0.001 | Successful |
| H3 | Perceived Ease of Use → Behavioral Intention | 0.107 | 0.001 | Successful |
| H4 | Perceived Ease of Use → Student Satisfaction | 0.125 | 0.001 | Successful |
| H5 | Course Content → Support Assessment | 0.107 | 0.000 | Successful |
| H6 | Support Assessment → System Use | 0.128 | 0.001 | Successful |
| H7 | Behavior Intention → System Use | 0.027 | 0.001 | Successful |
| H8 | Student Satisfaction → System Use | 0.174 | 0.000 | Successful |

There was a positive correlation between PEOU and PU (B = 0.097), PU and BI (B = 0.123), PEOU and BI (B = 0.107), PEOU and student satisfaction (B = 0.125), course content and alignment between course content and assessment (B = 0.107), support and feedback during assessment and system use (B = 0.128), BI and system use (B = 0.027), and student satisfaction and system use (B = 0.174), supporting H1, H2, H3, H4, H5, H6, H7, and H8, respectively. *p* values were between 0.01 and 0.001 for all hypotheses.

$R^2$ values derived from the proposed model are shown in Table 7.

**Table 7.** $R^2$ Values.

| Factor | $R^2$ |
|---|---|
| Behaviour Intention (BI) | 0.521 |
| Perceived Usefulness (PU) | 0.464 |
| Student Support (SA) | 0.602 |
| Student Satisfaction (SS) | 0.427 |
| System Use (SU) | 0.738 |

$R^2$ values are used in regression analyses to indicate the proportion of variation in the dependent variable that is explained by the independent variables. In simple terms, $R^2$ values measure the goodness of fit of a regression model. The $R^2$ value is a number between 0 and 1, and the closer it is to 1, the better the model fits the data.

## 7. Discussion

This study discussed the importance of e-learning acceptance and explored the factors that influence the adoption and usage of e-learning systems [29]. Various e-learning acceptance models, such as TAM, ECT, and Diffusion of Innovations theory, have been developed to explain and predict user behavior in technology-enhanced learning [12,29].

The paragraphs mention that several studies have investigated the factors influencing people's decision to adopt and accept technology for learning [1,8,12,14,27]. Most of these studies pointed to the factors used in TAM and the additional factors of Satisfaction and Use form ECT and other models, included perceived usefulness, perceived ease of use, behavioral intention, and system use [1,12,14]. While the combination of in-person and online classes can provide a complete e-learning experience, earlier research raised uncertainty about the benefits of online learning compared with traditional methods. Evaluating acceptance criteria for e-learning systems involves considering course content, the expertise of teachers, and the simplicity of accessing and following the content [4,6,11].

To improve learning outcomes, instructors need specialized knowledge and the aid of teaching technologies [6,26]. Students also benefit from practicing technology skills and resolving issues individually or in groups. Acquiring knowledge requires abilities such as creativity, problem-solving, and critical thinking, as well as teamwork and communication skills. These factors can influence how well students engage with technology in a professional setting [8,19,25,28,29].

The lack of a comprehensive model for e-learning acceptance poses a challenge for designers, developers, and educators in designing effective e-learning systems. The studies mentioned aim to fill this gap by exploring the major factors contributing to e-learning acceptance and providing a comprehensive understanding of the underlying mechanisms and processes. The proposed models can inform the design and implementation of effective e-learning systems and enhance student learning outcomes [1,12,14].

Additionally, the integration of technology into education has the potential to enhance student learning outcomes. However, the adoption of teaching technologies by educators can face barriers such as resistance to change and lack of technical knowledge and skills. Understanding the key individual and organizational factors that influence the adoption of teaching technologies can inform the development of strategies and programs to support educators and improve student learning outcomes.

Overall, these findings emphasize the importance of understanding and addressing the factors that influence e-learning acceptance to design and implement effective e-learning systems that enhance student learning outcomes. Strategies such as using multimedia, offering personalized learning paths, providing timely feedback, encouraging collaboration, incorporating game elements, and connecting learning to real-world contexts can create an engaging and effective e-learning environment aligned with learner needs and expectations.

The model was constructed by integrating three separate models and building upon an existing general model. This indicates that the research findings have a broader applicability beyond the specific context in which the study was conducted.

The intention to use the e-learning system, which reflects the students' degree of intention to use the system in the future, is another important factor highlighted in the research. This aspect can be relevant across different educational levels, as students' intention to use technology for learning can have a significant impact on their engagement and outcomes.

Furthermore, the actual use of the e-learning system, measuring the extent to which students actually utilize the system, is a crucial factor to consider. This factor provides insights into the effectiveness of e-learning implementation and can guide future improvements in the design and implementation of e-learning systems at different educational levels.

While the specific research cited may focus on a particular educational context, the underlying concepts and factors explored can have broader implications. However, it is important to consider the unique characteristics and requirements of different educational levels when implementing and adapting the research findings. Customization and

adaptation may be necessary to account for variations in learners' needs, technological infrastructure, and pedagogical approaches across different educational contexts.

## 8. Implications

The combined use of the TAM and ECT factors in examining e-learning system use has important implications for improving the adoption and use of educational technologies. By considering PU, PEOU, and satisfaction with the technology, this approach can provide a more comprehensive understanding of the factors that impact students' intentions to use a system.

The integration of the TAM and ECT can help identify specific areas for improvement in the design and implementation of e-learning systems. For instance, the use of satisfaction factors can provide insights for improving students' experience with the technology, whereas the inclusion of PU and PEOU can help ensure that the system is designed to meet the needs and expectations of its users.

Overall, the use of a combined TAM and ECT approach can enhance the development and implementation of e-learning systems, resulting in increased student engagement, improved learning outcomes, and greater overall satisfaction with the technology.

Based on the research on the analysis of e-learning system use using combined TAM and ECT factors, several practical recommendations can be derived. These recommendations aim to improve the design, implementation, and utilization of e-learning systems. Here are some potential practical recommendations that can be drawn from the research:

Enhance user intention to use: Recognizing the importance of user intention to use e-learning systems, strategies should be implemented to increase students' motivation and willingness to engage with the technology. This can be achieved by highlighting the benefits of e-learning, creating a positive learning environment, and aligning the system with students' needs and expectations [1,14,19].

Promote actual usage of the e-learning system: Encouraging students to actively utilize the e-learning system is crucial for its effectiveness. Instructors and educational institutions should provide ongoing support and training to students to ensure they have the necessary skills and knowledge to navigate and use the system effectively. Additionally, incorporating interactive elements, collaborative activities, and real-world applications can enhance student engagement and promote the actual usage of the e-learning system [4,11,24].

Continuous evaluation and improvement: Regularly assessing the effectiveness of the e-learning system is essential. Collecting feedback from students, monitoring system usage data, and conducting evaluations can provide insights into areas that need improvement. Based on these findings, adjustments can be made to enhance the user experience, address any challenges or barriers, and optimize the overall effectiveness of the e-learning system [1,18].

Customization for different educational levels: While the combined TAM and ECT factors offer valuable insights, it is important to consider the unique characteristics of different educational levels. Recommendations should be customized and adapted to suit the specific needs, preferences, and developmental stages of learners at different educational levels. Flexibility and adaptability in the design and implementation of e-learning systems can maximize their impact across diverse educational contexts [28,29].

These practical recommendations can help guide educators, instructional designers, and e-learning system developers in creating and implementing effective e-learning systems that promote user acceptance and utilization, leading to improved learning outcomes for students.

## 9. Conclusions

E-learning system use has grown in importance in determining the investigative components of standard system utilization. The modifications resulting from this research require a response to the factors and combining of the generated theoretical models' key components. This study aimed to examine the components of e-learning systems.

## 10. Limitations and Future Work

This study had some limitations. First, the sample used in the study may not be representative of the population of students in Omani HEIs, leading to sampling bias. Second, this study relied on self-reported data, which may be subject to social desirability bias or other forms of measurement error. Third, this study used a cross-sectional design, which limits the ability to establish causality between the factors affecting e-learning system use. Fourth, this study focused on the Omani context, which may limit the generalizability of the results to other countries or regions with different cultural and educational norms. Fifth, this study only considered a limited number of predictors of e-learning system use and satisfaction and may not capture other important factors that influence these outcomes. Sixth, this study only captured a snapshot of the students' attitudes and behaviors towards e-learning systems and may not reflect changes over time. Moreover, this model was designed for the Gulf area, where most universities and colleges use the same platform and mostly the same portal system of educational requirements. These limitations should be taken into account when interpreting the results of the study and generalizing the findings to other contexts. Further research is needed to address these limitations and build upon the insights generated in this study.

Based on the present findings, several recommendations can be made for e-learning system designers, developers, and educators in Oman and other similar contexts in Gulf countries. Designers and developers of e-learning systems should focus on enhancing the PU of their systems by incorporating features that support students' learning outcomes and improve job performance. Efforts should be made to make the e-learning systems user-friendly and accessible by simplifying the user interface and reducing the associated with using the systems. Educators should aim to increase student engagement with e-learning systems by incorporating interactive and collaborative features that encourage student participation and motivation. Designers and developers of e-learning systems should provide adequate student support and help in using the systems to enhance PEOU. Educators should regularly monitor student feedback and satisfaction with e-learning systems to identify areas for improvement and to ensure that the systems are meeting the needs and expectations of students. Further research is needed to build upon the insights generated by this study and explore other factors that may influence student acceptance and use of e-learning systems in Oman and other similar contexts. By incorporating these recommendations, e-learning system designers, developers, and educators in Oman can design and implement e-learning systems that meet the needs and expectations of students and enhance their learning outcomes.

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