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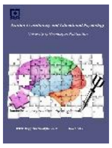

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The Model of E-learning Education Development in Iranian Higher Education System

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Abstract: In the present era, considering the power of digital technology and the expansion of information, higher education is on the verge of a revolution. Therefore, this research aims to present a model for developing electronic education in the Iranian higher education system. Educational systems at various levels around the world are striving to provide equal and effective educational opportunities for all using information and communication technology. In today's world, electronic education and learning stand out as crucial applications of information and communication technology, and are rapidly gaining prominence as a dominant technology in the field of education. Therefore, this research utilizes structural equation modeling and data collected from a researcher-designed questionnaire to examine the essential infrastructure required for the development of electronic education. The results demonstrated that the indicators of the development model in higher education are a multidimensional concept that includes organizational, technological, support, educational content, and participant characteristics. The findings indicate that support and technological variables play the most significant role in the model of electronic education development. The results provide practical implications for designing electronic education development programs in universities and higher education institutions.

Keywords: Quality of educational services, E-learning, Learning management system, Higher education

Introduction

The integration of e-learning in universities has a significant impact on the quality of education and learning. Modern information technologies enable universities to promote active, collaborative, flexible, and learner-centered teaching and learning approaches, resulting in enhanced student learning (Kovacova & Vackova, 2015; Mirzamohammadi, 2017). E-learning is not limited to participation in remote and distance learning, but is a conscious choice for promoting effective learning (Ayu, 2020; Guri-Rosenblit, 2005; Ruhe & Zumbo, 2008).

Many organizations fail to create a successful e-learning system due to their lack of evaluation on their capacity for e-learning (Ssekakubo et al., 2011). To reduce the risk of failure, organizations should assess their readiness for e-learning and improve their weaknesses through various actions and activities (Garavan et al., 2010; Giannakos et al., 2022; Kasemsap, 2016; Welle-Strand & Thune, 2003). Assessment activities should be conducted at the beginning of the project to avoid potential risks in the final stages (Al-Fraihat et al., 2020; Al Mulhem, 2020; Veeramanickam & Ramesh, 2022).

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Therefore, it is necessary to analyze an organization's readiness for project evaluation, as inadequate readiness may result in significant challenges. Higher education institutions often face issues related to a lack of investment in this area, leading to user dissatisfaction and inefficiency of e-learning.

The undeniable significance of e-learning in education has led to the widespread growth of e-learning courses and systems that offer various services (Al-Fraihat et al., 2017; Priatna et al., 2020). Evaluating e-learning systems is crucial to ensure successful delivery, effective use, and positive effects on learners. A substantial amount of research related to e-learning has enhanced our understanding of the fundamental factors that contribute to e-learning success, including system quality, information quality, service quality, satisfaction, and usefulness. In recent years, e-learning quality has received significant attention, and researchers have attempted to identify the factors that maximize its efficiency (Al-Fraihat et al., 2020; Cheng, 2022).

The emergence of a virtual world due to the internet has encouraged organizations to invest in electronic learning. The effort to achieve success in using e-learning systems and measuring their success has highlighted the importance of this issue (Alizadeh Jamal, 2022; Olyaei et al., 2015). As a result, education has rapidly expanded, and e-learning has become a powerful medium for learning, widely used in higher education (Al-Fraihat et al., 2017).

Learners play a crucial role in e-learning, and courses must be designed to align with their needs, beliefs, thoughts, and cultural values to attract their interest and motivation to continue and complete the course. Course continuity should also be based on learners' abilities since they often learn alone, and their willpower and determination to complete the course are essential. Identifying their needs is a critical aspect of designing a course (Saçak et al., 2022). The information obtained from learners' needs and beliefs should be balanced with educational and learning theories to provide better quality education.

Designing an e-learning course requires the use of electronic learning media, with subject matter experts involved in developing all courses and lessons. The difference between the skills learners have and the skills they need should be identified, and course lesson plans should be published to learners through the internet, multimedia, and other means.

Providing feedback and evaluating the results of e-learning is crucial to ensure learners' level of learning and to correct any issues in the learning process. Tests can be used to determine learners' knowledge gain, or by observing them in different situations and during work, it can be determined whether they use the added knowledge to change their behavior. Managing the implementation of e-learning courses is also essential, with accurate collection and analysis of test results. Successful completion of the course results in a certificate indicating the acquisition of new knowledge and skills. An educational

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management system allows for a suitable course to be planned according to the needs of each learner, and managers should encourage their employees to use this educational tool.

The integration of e-learning in Iranian higher education has been deliberate and has not been adequately developed, resulting in limited access to quality educational resources and opportunities for students. The lack of a comprehensive model for e-learning education development in Iranian higher education has hindered the effective implementation of e-learning, resulting in challenges such as low student engagement, limited student motivation, and inadequate teacher training. The absence of a clear plan for e-learning education development in Iran's higher education system has resulted in a fragmented approach with little coordination between universities, leading to inefficient use of resources and limited scalability. Therefore, there is a need for a comprehensive model for e-learning education development in Iranian higher education that considers the unique cultural, social, and economic contexts of the country and addresses the challenges facing the effective implementation of e-learning. Such a model would enable Iranian higher education institutions to promote active, collaborative, flexible, and learner-centered teaching and learning approaches, resulting in enhanced student learning and improved access to quality education.

Material and Methods

Using the correlation method, the current study examined the model of e-learning education development in Iranian higher education. The study population comprised undergraduate, graduate, and PhD students who utilized virtual e-learning systems in Hormozgan province, including students from Islamic Azad University, Payame Noor University, Applied Sciences, Technical and Vocational, non-profit, and state universities. As modeling required factor analysis, a large sample size was necessary for valid results. Thus, cluster sampling was employed, and 381 students were selected using Cochran's formula from an approximate population of 50,000 students. The instrument used was a researcher-made questionnaire, which was administered to the participants. The questionnaire's response scale was a five-point Likert scale ranging from "strongly disagree" to "strongly agree." The questionnaire's validity and reliability were evaluated in the study. The Kolmogorov-Smirnov test was used to assess the normality of the variables. To analyze the research model, the Partial Least Squares Structural Equation Modeling (PLS-SEM) method was applied in Smart PLS software, which is less sensitive to the normal distribution of data. PLS-SEM modeling was performed in two stages. In the first stage, measurement models (outer models) were examined through confirmatory factor analysis and validity and reliability analysis. In the second stage, the structural model (inner model) was evaluated by estimating the path between variables. The research model was analyzed in three stages: the outer model, inner model, and overall model.

Evaluation of the measurement model (outer model)

In the examination of the outer model, the factor loadings of the questions (or indicators) under investigation were calculated. Then, the reliability and subsequently the validity of the inner model were assessed.

Factor loadings of the questionnaire items: Factor loadings were calculated by determining the correlation coefficient between the indicators related to a structure and the structure. If this value is equal to or greater than 0.4, it indicates that the variance between the structure and its indicators is greater than the measurement error variance of that structure, and the reliability of that measurement model is acceptable.

Reliability of the outer model: In order to assess the reliability of the outer model, two measures were utilized: Cronbach's alpha coefficient and Composite Reliability (CR). Cronbach's alpha coefficient is a measure that ranges from 0 to 1, where a coefficient greater than 0.7 indicates acceptable reliability according to Cronbach (1951). However, Moss et al. (1998) suggested a lower threshold of 0.6 for variables with few questions. On the other hand, Composite Reliability was introduced by Werts et al. (1974) and is considered a superior measure to Cronbach's alpha coefficient. This is because the reliability of structures is calculated based on the correlation between their structures, rather than being calculated absolutely. A Composite Reliability value above 0.7 indicates acceptable internal reliability for measurement models, while a value below 0.6 indicates a lack of reliability. It is worth noting that Composite Reliability is a better measure in structural modeling compared to Cronbach's alpha coefficient because the factor loadings of indicators are taken into account. Indicators with greater factor loadings are given more importance in calculating Composite Reliability values, resulting in a more accurate and realistic measure than Cronbach's alpha coefficient.

Evaluation of the measurement model (outer model)

Convergent validity was used to examine the fit of the measurement models, which involves assessing the correlation between each structure and the questions (indicators) associated with that structure. The higher the correlation, the better the fit. For convergent validity, Fornell and Larcker (1981) introduced the Average Variance Extracted (AVE) measure and stated that the critical value is 0.5. If the AVE measure for a variable is less than 0.5, the question with the lowest factor loading should be removed.

Evaluation of the structural model fit

Coefficient of Determination (R^2): The R^2 measure determines the influence of an exogenous variable on an endogenous variable. It is important to note that the R^2 value is only calculated for endogenous

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structures, and for exogenous structures, the value of this measure is zero. The higher the R^2 value for the endogenous structures of a model, the better the fit of the model. Chin (1998) considers 0.19, 0.33, and 0.67 as the critical values for weak, moderate, and strong fit of the structural part of the model measured by the R^2 criterion.

Predictive Quality (Q^2): This measure indicates the predictive power of the model. Models with an acceptable structural fit should be able to predict the indicators associated with the endogenous structures of the model. Henseler et al. (2009) defined 0.02, 0.15, and 0.35 as the values for weak, moderate, and strong predictive power of the exogenous or endogenous structures related to them. It is worth noting that this measure is only calculated for the endogenous structures of the model that indicators are reflective.

Global Goodness-of-Fit (GOF): The GOF measure is related to the entire structural equation models, and with this measure, the researcher can control the global fit of the research model after assessing the fit of the measurement and structural parts of the model. Only one measure, called GOF, is used to evaluate the fit of the overall model. Values of 0.10, 0.25, and 0.36 are introduced as weak, moderate, and strong values for GOF (Wetzels et al., 2009).

Results

The data were checked for the presence of outliers caused by entering incorrect data into the software and necessary actions were taken to address them. Then, the questionnaires were examined for missing data, and questionnaires that had not answered more than 10% of the questions were excluded from the analysis (no such non-response was observed). Missing data in questionnaires with less than this amount was replaced by the mean of each variable. Descriptive statistics, including mean and standard deviation, and Kolmogorov-Smirnov test statistics are presented in Table 1. Since the significance level for all variables is less than 0.05, the distribution of all variables is non-normal. After calculating the factor loadings between the structure and its indicators, in the face of values less than 0.4, the indicators were corrected or removed from the research model. The factor loadings along with the t-statistics for the questionnaire components are presented in Table 2.

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Table 1. Descriptive statistics of research variables

Components	Min.	Max.	Mean	SD	K-S	p	Result
Determining goals and policies	3	15	7.06	2.49	.22	.001	Not normal
Financial Support	4	18	10.95	2.84	.14	.001	Not normal
Hardware	3	15	8.90	2.48	.13	.001	Not normal
Electronic education management system	5	25	17.57	2.90	.14	.001	Not normal
Infrastructure	3	15	10.44	2.93	.16	.001	Not normal
Training participants	4	20	13.85	3.78	.15	.001	Not normal
System support	4	20	11.40	2.95	.12	.001	Not normal
Content quality	3	15	12.16	1.98	.22	.001	Not normal
Learning evaluation	2	10	6.95	1.39	.14	.001	Not normal
Quality control of education	4	10	8	1.24	.33	.001	Not normal
Characteristics of professors	3	15	11.90	2.21	.27	.001	Not normal
Characteristics of students	3	15	11.48	1.93	.19	.001	Not normal

Table 2. Factor Loadings and t-statistics of the indicators in the proposed model

Components	Factor loading	T value	Result
Determining goals and policies	.83	29.75	Approved
Financial Support	.82	26.02	Approved
Hardware	.75	23.15	Approved
Electronic education management system	.76	33.94	Approved
Infrastructure	.77	29.41	Approved
Training participants	.87	76.74	Approved
System support	.84	44.46	Approved
Content quality	.75	37.56	Approved
Learning evaluation	.74	24.27	Approved
Quality control of education	.79	30.06	Approved
Characteristics of professors	.87	60.72	Approved
Characteristics of students	.88	80.21	Approved

Table 2 indicates that all indicators in the model have factor loadings above 0.4 and t-statistic values exceeding 1.96, indicating favorable validity. Moreover, standardized coefficients reveal significant and positive relationships between the components and the general factor of electronic education development in higher education. The Cronbach's alpha coefficients for all components, reported in Table 3, are over 0.7, denoting satisfactory model reliability. Table 4 presents the composite reliability coefficients and Average Variance Extracted (AVE) values for all variables. The proposed model fits the measurement models acceptably well, with composite reliability coefficients of the components exceeding 0.70. Additionally, the AVE values for all variables surpass 0.5, affirming the acceptable convergent validity of the structures.

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Table 3. values of the Cronbach's alpha coefficients and values of the composite reliability of the components

Components	Cronbach's alpha coefficients
Determining goals and policies	.86
Financial Support	.75
Hardware	.82
Electronic education management system	.86
Infrastructure	.82
Training participants	.81
System support	.78
Content quality	.74
Learning evaluation	.75
Quality control of education	.74
Characteristics of professors	.81
Characteristics of students	.81
Entire of model	.87

Table 4. Composite reliability coefficients and Average Variance Extracted (AVE) values

Factors	AVE	CR
organizational	.68	.81
technologically	.58	.80
Support	.74	.85
Educational content	.59	.81
Characteristics of participants	.77	.87
The whole model	.58	.90

In the proposed model, the fit of the structural part of the model was evaluated using the R^2 criterion. In this model, strong values were obtained, indicating a very acceptable level of fit. Additionally, the power (quality) of the model's prediction is also shown through the estimation of Q^2. These values are presented in Table 7. Since the R^2 coefficients of the model are at a high level and the Q^2 estimates are also strong, the overall model fit (GOF) value is 0.69, indicating a strong model fit.

Discussion

The model for developing electronic education in higher education comprises various components, such as goal-setting and policy formulation, financial support, hardware, electronic education management system, infrastructure, learner engagement, system support, content quality, learning assessment, training quality control, and characteristics of instructors and students. This section aligns the research outcomes with the research questions and objectives, as well as the theories and literature referred to.

Goal-setting and policy determination: To launch electronic courses, the university should first determine its policies for attracting students in an electronic format and set educational goals. It should also establish the necessary standards for conducting these courses. Additionally, these policies and goals should be monitored regularly and revised as necessary. Consistent with the present study, Cheawjindakarn et al. (2013) emphasize the role of organizational management in electronic education.

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Financial support: Due to the technology-centered nature of electronic education, financial support is crucial for organizing and implementing electronic courses. In traditional classroom teaching methods, the existence of a building to conduct classes is usually sufficient. However, for electronic courses, in addition to the cost of purchasing initial equipment, there are also maintenance and update costs for the equipment, and software procurement costs, which may be expensive. Additionally, the support and content production team also have its own unique costs. No research was found that directly refers to the financial support component.

Hardware: The most significant challenge that electronic education users face is the distribution and support of hardware and the effectiveness of these types of education. Amouzad et al. (2014) acknowledge access to the system and the internet as a fundamental requirement for virtual education, which is consistent with the current research. Chen and Yao (2016) also recognize the role of technology in electronic education, and Ozkan and Koseler (2009) identify technology as an inseparable part of electronic education.

Electronic education management system: The electronic education management system is a powerful resource management system that focuses on education and professional development, such as personnel groups, schools, and companies. Online education management combines database management with a digital framework for managing curricula, learning tools, and assessment. Although the technology of educational management systems has slowly made its way into traditional educational systems, the impact of the electronic education management system is more noticeable than traditional educational institutions. Today, traditional methods of knowledge production and distribution based on face-to-face communication are gradually losing their efficiency, and the use of innovative tools is necessary. Time constraints, high travel costs, and security issues have led researchers to think of ways to eliminate physical distances. Regarding education, they are also considering ways to engage teachers in qualitative interactions and minimize physical travel. In this regard, audio or video conferences provide the opportunity for interactive face-to-face interactions. Garrison (2016) has stated that the interaction of teachers with teachers is the main social basis in which teachers engage in activities. Constructivists believe that such a social presence is essential to provide the necessary multiple perspectives for the development of education in complex and especially multicultural areas, which is a unique aspect of electronic learning. Additionally, this method, which is very suitable and inexpensive, can provide a platform for speakers and experts to communicate and exchange views on the presented content.

Furthermore, virtual education has removed the spatial distance barrier, enabling better interaction between teachers and between teachers and students. In this regard, upgrading technical infrastructure, interactive two-way communication between teachers and students, and increasing the efforts of students and teachers to adapt to this type of education have been presented as final solutions to increase the quality of utilizing the conditions created. It can also be noted that virtual education has provided the opportunity for teachers from educational groups of one university or even other universities to participate. This finding is consistent with researchers such as Seok et al. (2006), Mehregan et al. (2011), and Cheawjindakarn et al. (2013).

Infrastructure: Virtual education is available in all universities and higher education institutions as long as the necessary infrastructure is provided based on the presented content and the necessary cultural groundwork is laid. Slow internet speeds or outdated systems can make accessing educational courses difficult and may lead to learner frustration and dropout. In this regard, this study is in line with researchers such as Mishra et al. (2020), Gandolfi (2021), and (Zhang et al., 2020), emphasizing the need to create a suitable platform for virtual education.

Training for Contributors: The topic of electronic content production is a specialized discussion that definitely requires training. In addition, the use of electronic education management systems and other related systems also requires separate training. The culture and acceptance of these courses should also be a consideration for policymakers. Additionally, a new topic that we encounter with the entry into virtual education is the culture of using virtual space. Direct research was not found on the topic of the contributor education component and was mainly categorized under the supporting research.

System Support: Aligned with this study, Akaslan and Law (2010) consider support systems as one of the components of the electronic education system. Blinco et al. (2004) have stated that the technology infrastructure should have the necessary capacity to support users and network load and should also be flexible enough to expand. This infrastructure should be stable to assure users that it is readily available at a high level and create a playground environment to support exchange between departments and provide the necessary security to maintain distributed content. Adequate bandwidth and continuous internet services are among these infrastructures. It should be noted that if the required bandwidth is inadequate and continuous internet services are not established, electronic education will not be able to achieve its goals.

Content Quality: In this regard, it can be stated that the use of virtual education can provide facilities for students, professors, and researchers to save time in collecting materials. They can study their favorite topics repeatedly and search for their specific materials from previous publications in a shorter time. In virtual education, professors and students can communicate live, audio and video, from different

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parts of the world without any geographical, political, and social constraints, making distance learning possible.

In this context, one of the advantages of virtual education is the possibility of making rapid changes to meet future needs without incurring additional costs. The virtual space has various facilities that if properly understood and adapted can facilitate learning. Therefore, the introduction of technology in education will not only be limiting, but it can also create diverse learning opportunities. This finding is consistent with researchers such as Cheawjindakarn et al. (2013) and Ozkan and Koseler (2009).

Learning Assessment: To deal with cheating in virtual learning environments, which has become a serious challenge for instructors today, various approaches are used, including cultural development and the creation of a platform, and in some cases, preventive and punitive measures are taken. In fact, in virtual education, we should seek to create diverse learning opportunities that enable learners to fulfill various roles in the learning process. Through these roles, we can not only manage learners' learning but also collect the necessary data for assessment and evaluation.

Quality control of education: In this field, the present research is in line with researchers such as Saxena et al. (2021) who consider defining and implementing e-learning standards at various levels and taking into account user conditions such as age, educational level, native and geographical features, and specific conditions of instructors and learners as the most important solution for ensuring the quality and efficiency of education. Additionally, the use of feedback from the audience for the development of e-learning is of great importance. Standardization of products in every industry will lead to optimal and widespread use of these products by users. Therefore, for such a situation to be created in the field of education, the existence and definition of comprehensive standards for the structure and educational tools is essential. Fortunately, extensive research has been conducted in recent years to define and develop acceptable standards in e-learning. Regarding the content and structure of e-learning, standards should also be created, similar to the above-mentioned toys, which make it possible to reuse content, collect or categorize content from various sources, at different times. The importance and necessity of developing and presenting valid standards in the field of educational technology become more apparent with the introduction of online education. The existence of valid standards has led to confidence in investing in human resources and time. These standards also enable the transfer from one system to another and, in other words, full and proper use of purchased educational materials. In addition, the creation of a library of course content using valid standard-based learning management systems reduces the risk of damage to various investments in educational technology.

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Characteristics of instructors: Instructors and coaches are among the main pillars of the teaching-learning process and play an undeniable role in quality assurance or quality improvement of the educational system. In this regard, Vahabi (2014) states that the behavior and performance of instructors in educational environments are judged by various groups. Among them, students have a closer relationship with the educational situation due to their direct presence, and their attitude towards the characteristics of a good instructor can have a significant impact on the learning process. It seems that a competent instructor in e-learning should not only have the characteristics that an instructor should have in face-to-face courses, but also be proficient in other specialized skills and competencies. This finding is consistent with researchers such Chen and Yao (2016) and Mehregan et al. (2011).

Characteristics of students: Given the differences between e-learning and traditional face-to-face education, participation in virtual classes requires a set of minimum skills that are lacking in traditional classroom settings. These skills include students' familiarity with information technology, their ability to actively participate in virtual spaces, internal motivation, and a positive attitude towards e-learning that should be present in these courses.

Limitations

1. The findings of the research may have limited applicability to other educational systems, as the study solely focuses on the Iranian higher education system.

2. The validity and reliability of the data collected may be limited by the use of a questionnaire designed by the researcher.

3. The study only investigates the fundamental infrastructure necessary for the development of electronic education, and does not explore the impact or effectiveness of electronic education on learning outcomes.

Suggestions

1. To broaden the understanding of electronic education development, future research could include various countries and educational systems in the study.

2. To enhance the accuracy and dependability of the data collected, future research could employ standardized questionnaires or multiple data collection methods.

3. Future research could assess the influence and efficacy of electronic education on learning outcomes, such as student engagement, satisfaction, and academic performance.

4. To contribute to the success of electronic education, future research could examine other factors, such as pedagogy and instructional design.

Conflict of interest: There is no conflict of interest associated with this research.

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