

# Structural equation modeling (SEM) in institutionalizing e-learning culture case study AJA command and staff university

Asghar Asgharzadeh<sup>a,\*</sup>, Majid Mohammadzadeh<sup>b</sup>, Ali Reza Mirjomehri<sup>b</sup>

<sup>a</sup>Faculty of Social Sciences, AJA University of Command and Staff, Tehran, Iran

<sup>b</sup>AJA University of Command and Staff, Tehran, Iran

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## Abstract

Education has become an integral part of human life, and new methods of providing education emerge every day owing to the advancement of new technology. The education process has also changed from traditional to virtual concurrent with the advancement of technology and entering the information technology era. The penetration of information technology into the educational system, educational institutions, higher education systems, and military educational organizations has created a new concept called *e-learning*. In addition to in-person education, there is a need for using virtual *e-learning* in various educational systems, but *e-learning* cannot be successful without taking into account individuals' views on it. In other words, this type of learning should be examined according to stakeholders' views to detect its blind spots. With the aim of institutionalizing *e-learning* at DAFOOS University, the present research used a mixed-method exploratory approach based on the theory of continuous adaptation and randomly selected and interviewed 8 experts in *e-learning* using the non-probability method. In the quantitative phase, 190 questionnaires were randomly given to the statistical sample and structural equation modeling (SEM) with Smart PLS software was used for inferential analysis. The research findings indicated that believing in *e-learning* with an impact factor of 0.741 and valuing *e-learning* with an impact factor of 0.699 were prerequisites for accepting *e-learning*.

Keywords: culture, *E-learning*, AJA university of command and staff (DAFOOS)  
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## 1 Introduction

In the new era, individuals' lives and relationships have fundamentally changed, and extensive changes and development have been made in information and communication technology (ICT) [14]. The expansion of educational opportunities has become an important concern of countries and governments in today's complex world due to the changing nature of knowledge, educational needs, the need to learn, the expansion of science and technology, and lifelong re-education owing to higher expectations, limited resources compared to the increasing population growth,

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\*Corresponding author

Email addresses: [a.asgharzadeh@casu.ac.ir](mailto:a.asgharzadeh@casu.ac.ir) (Asghar Asgharzadeh), [mm.mohammadzade@ut.ac.ir](mailto:mm.mohammadzade@ut.ac.ir) (Majid Mohammadzadeh), [alireza\\_mirjomehri@atu.ac.ir](mailto:alireza_mirjomehri@atu.ac.ir) (Ali Reza Mirjomehri)

and the increasing demand for flexible educational opportunities because of the impossibility of regular and continuous attendance in physical and in-person (traditional) classrooms [6]. Knowledge and technology have passed the same way and one of them cannot be easily obtained without the other. Virtual space provides its users with many capabilities in the field of education with vast resources and facilities in the field of science and knowledge acquisition, as well as features such as timelessness, locationlessness, and interactivity [3]. Most universities are increasing the effectiveness of emerging technologies in their educational activities and programs [16]. Installing and creating *e-learning* centers on university campuses, holding virtual courses in universities, and opening and creating new and completely-virtual universities are examples of these activities [5]. With these momentary changes, organizations have gained the insight that being a leader in organizational affairs requires specialized, creative, and highly-motivated human resources, leading to higher organizational empowerment and productivity. Meanwhile, *e-learning* has relied on information and communication technology (ICT) and considered humans the active learners and has thus developed education and learning in the 21st century and sought to meet the challenge of the growing social demand for education and the lack of sufficient educational resources [10]. The military forces of the Islamic Republic of Iran are among the most important and complex organizations in Iran. Human capital is considered the most important resource in military organizations so that their training and development are among the strategic programs of the armed forces. New technologies have developed all aspects of social life, including organizations, and affected the training and development of the human capital of the armed forces [8]. The army and military organizations, as the most vital organizations of the country, which educate and train human forces in various fields and have special training departments and systems, need to use new training methods every day and every moment and institutionalize this type of training in their organizations if necessary. In the COVID-19 crisis and similar situations, including air pollution in big cities, *e-learning* has been a way to prevent interruptions in education, but a case study on professors and the feedback from the results of *e-learning* studies and research indicated no acceptable results in this regard. According to researchers, the solution is not to institutionalize this procedure of education in educational centers and organizations. Over the past few years, especially during the COVID-19 crisis and epidemic, several studies have been conducted in various organizations and bodies on *e-learning* and its relevant issues. For example, Jason Keys [12] conducted a study titled "Comparing in-person and online professional military education for air force during the COVID-19 era and explained that the cross-sectional, semi-experimental 12-month study collected and analyzed data from three of the world's largest leadership schools. The instructors' salary and time were equal to or higher than in-person courses to complete the initial instructor qualification training courses. Hernandez et al. [7] presented the outcomes of two rapid course conversions to the online environment: A case study at the United States Air Force School of Aerospace Medicine. The attractive and flexible online environment helps reduce traditional challenges. The positive attributes obtained from online training, potential cost savings, and initial findings about student evaluations indicate that virtual courses are useful for training aeronauts. In another study, Javier [9] indicated that despite the desire and interest of educational institutions to use online education, the teachers' attitudes toward this method should be taken into consideration. In another research, Alhabeeb and Rowley [1] reported that *e-learning* and education are conducted in universities of different countries and even though many investments have been made in this field, the use of these systems by professors and students is mostly low in both developed and developing countries. Nazari Farrokhi et al. [15] concluded that among the variables, namely the value of information, system usage, software and infrastructure efficiency, student's capability, supporters, teacher's characteristics, and external factors, the software and infrastructure efficiency, student's capability, supporters, teacher's characteristics and internal factors, the value of information in the system, the system usage, and the efficiency of software were respectively more important than other components in the success and use of *e-learning* technology. Kiakojouri and Roudsari [11] reported that all components, namely institute, technology, resource support, management, interface design, ethics, evaluation, and education affected the development of *e-learning* respectively. Mirazeian [13] indicated that among the four components, namely improving the level of access to virtual space, promoting the culture of use, developing infrastructure, and teaching the use of virtual space content, and their effects on the growth of self-employment among the university students, promoting the culture of using virtual space was more important and effective than other components. Zarghani et al. [19] conducted a study titled "Virtual library: an essential element in the *e-learning* structure" and concluded that the virtual library is the outcome of modern information and communication technologies, and their correct use can meet many needs of online users and eliminate the need for users to visit the physical environment of the library. Therefore, managers of *e-learning* centers must gain greater knowledge about support and library services in *e-learning* centers and provide necessary services for users' needs. Izadi Tameh [8] came to the conclusion that the optimal use of new technologies in the training and development of the armed forces requires changes in beliefs, attitudes, views, and treatment of all commanders, especially educational and curriculum planners, educational principals, and finally, trainers towards these technologies.

According to the literature review and despite many studies on *e-learning*, effective factors in its promotion have

been pointed out, but the institutionalization of the *e-learning* culture by a codified model has not been investigated which necessitates the need to conduct such research.

Therefore, the main research question is as follows: What is the structural model for the institutionalization of *e-learning* culture in the educational environment? According to interviews with the experts, the institutionalization factors of the *e-learning* culture are then explained and the relationships are analyzed using structural equation modeling.

## 2 Research method

The present research was applied in terms of purpose and had a mixed-method exploratory approach (qualitative-quantitative). In the qualitative phase, the sampling method was purposive and information-based. In other words, we used samples, which could give us the richest information of documents and interviews in an improbable way. Therefore, a total of 8 experts in education were selected randomly (this population was chosen due to availability), and the researcher sought the desired word to be addressed directly based on the thematization of the codes.

Table 1: Interviewers' characteristics

Expert's code	Field of study	The Last educational degree	History of teaching
1	Education management	Ph.D.	8 years
2	Education management	Ph.D.	12 years
3	Information and Communication Technology (ICT)	Master	18 years
4	Education management	Ph.D.	12 years
5	Education management	Ph.D.	16 years
6	IT management	Ph.D.	16 years
7	ICT	Ph.D.	26 years
8	ICT	Ph.D.	26 years

The statistical sample of the quantitative phase included 375 professors and students of AJA University of Command and Staff in 2022. The sampling was performed using Cochran's formula and simple random method. Furthermore, a total of 190 questionnaires on a 5-point Likert scale were distributed and structural equation modeling (SEM) in Smart PLS software was also utilized for statistical data analysis.

## 3 Data collection method

A semi-structured interview was used to investigate *e-learning* institutionalization. The interviews included questions about the professors' biographical information in addition to three basic questions about the institutionalization of culture according to Edgar Schein's model: What factors affect the professor's and students' beliefs in the institutionalization of *e-learning* culture? What factors are considered as values for professors and students in institutionalizing the *e-learning* culture that must be created by the university? What factors affect the professor's and students' beliefs in the institutionalization of *e-learning* culture? The interviews lasted about 20 to 30 minutes. Conversations were recorded and transcribed after listening, and then carefully analyzed.

According to the research background and literature about *e-learning* and the interviews, the analysis unit included all terms and words referring to the factors of *e-learning* institutionalization. A code was assigned to each teacher. The interview text of each professor and unit was written based on its first mention in the list of factors. In other words, even though a professor repeated some factors, that factor was listed in the list only once. The text of the interviews along with the results of the preliminary analysis was also given to another researcher to examine the validity of the findings. The obtained list was approved and the main axes were finally recorded with consent. Furthermore, the interviews with professors and the detailed description of the interviewees, as well as the data collection and analysis methods indicate the validity of the findings.

## 4 Findings

Three main axes were obtained based on the study, review, and analysis of interviews with experts at AJA University of Command and Staff (DAFOOS), Iran, as well as the factors of *e-learning* institutionalization as follows: 1. Belief in *e-learning* 2. Valuing *e-learning*, 3. treatment to *e-learning* (admission)

Table 2: List of factors of e-learning institutionalization according to professors

Main axis		
Belief	Value	Treatment
Sub-axis		
COVID-19	Preparation of guidelines for holding virtual classes	Creating a context for the previous two dimensions
Air pollution	Creating a unique web-based education system for the university	Active presence in class
Unforeseen crises	Purchasing a free SIM card	Maximum attendance in class
Energy saving in emergency situations	Internet quality guarantee	Limited access to extracurricular educational content (in-person)
Management of social crises and accidents	Creating a rich digital library and linking it to the online education system	Belief in better learning by students
Waste of time in commuting	Not changing the status of classes from online to in-person, and vice versa	Getting better grades by learners
Tired of commuting	Trusting the professors in the educational content and time of classes	Reducing anxiety during the exam
Agreed teaching time	Enriching the digital library by linking to other universities	Having an electronic question key and easy and quick correction of exam papers
Convenient holding of extracurricular classes	Purchasing free tablets or laptops for students	
Facilitating coordination with the visiting professor	Providing high-speed and free internet	
The attractiveness of e-learning	Linking to educational content of other universities	
Searching in the digital library	Creating rules and regulations to prevent cheating	
Internet searches in online class	Linking to universities abroad	
Preparation of educational videos	Creating and using a system (like a webcam) to monitor and actively participate in the class	
Using less paper and preserving the environment	Archive of classes	
Easy access		
Reducing university costs in different sectors		

According to Edgar Schein’s model of culture institutionalization, the results of the interviews indicated that e-learning could be explained and categorized in three layers, first, belief in e-learning with 17 codes, second, valuing e-learning with 15 codes, and third, treatment towards e-learning (admission) with 8 codes. Based on codes in this classification, belief in e-learning was put in the first priority, valuing e-learning in the second priority, and treating e-learning (admission) was put on the third priority.

## 5 Evaluation of the measurement model (external model)

### Reliability of the measurement model

Cronbach’s alpha should be greater than 0.7 in reliability evaluation. The reliability of the measurement model was confirmed according to the results of the table below.

Table 3: Reliability values

Axial code	Cronbach’s alpha
Belief in e-learning	0.845
Valuing e-learning	0.814
Treating e-learning (admission)	0.880

### 5.1 Evaluation of the validity of the measurement model

There are two types of validity in this section: Convergent and divergent. Convergent validity means that the latent variable is adequately explained by the obvious variables. The Average Variance Extracted (AVE) is used to measure the convergent validity, its minimum acceptable value of which is 0.5. Divergent validity also means that the latent variable is better explained by its obvious variables than the variables of other factors. We use the Fornell-Larcker criterion to measure it in PLS path modeling. This criterion indicates that a variable should have higher dispersion among its indicators than the indicators of other latent variables, or in other words, the average variance extracted from each latent variable should be greater than the highest square correlation of that variable with other latent variables. According to the table below, AVE<sub>i</sub> > CR and it can be claimed that each variable has correlation and convergence with each other.

Table 4: The results of the Fornell-Larker test and AVE

	Belief	Value	Treatment	CR	AVE
Belief	0.806			0.789	0.854
Value	0.340	0.883		0.765	0.875
Treatment	0.462	0.703	0.842	0.740	0.891

### 5.2 Commonality index measurement

This index measures the model’s ability to predict observable variables through their corresponding latent variable values. Positive values of this index indicate the appropriate and acceptable quality of the measurement model. The following table presents the commonality index values for each variable. As shown, the values are positive and greater than zero.

Table 5: The results of the measurement model quality test

Variable	CV Com
Belief	0.423
Value	0.304
Treatment	0.444

### 5.3 Evaluation of the structural model (internal model)

After evaluating the measurement model and confirming the reliability and validity of the model, it is possible to evaluate the structural model using two criteria.

### 5.4 Coefficient of determination ( $R^2$ )

The coefficient of determination is the basic criterion for evaluating the degree of explanation of dependent variables. This coefficient indicates how many percent of changes in the dependent variable is explained by the independent variables. The value of this coefficient varies from 0 to 1. Chen [4] evaluates values close to 0.67 as desirable, values close to 0.33 as normal, and values close to 0.19 as weak (22). Based on the following model, the coefficient of determination of belief in *e*-learning was 0.741, and valuing *e*-learning was 0.699 for admitting *e*-learning and they were in the desired range.

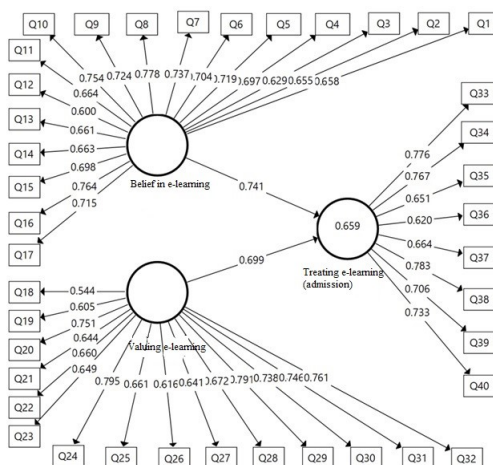


Figure 1: The model in the structural meaning coefficient mode

Path coefficients are evaluated among the latent variables in the model. The size of the path coefficient indicates the strength of the relationship between the two latent variables. Furthermore, the algebraic sign of the path coefficient should be taken into consideration. In this research, the bootstrap test with 190 replications (equal to the number of statistical samples) was used to obtain the statistical *t*-value.

According to Table 6, the results of the path test indicated that belief in *e*-learning with an impact factor of 0.741, and valuing *e*-learning with an impact factor of 0.699 were confirmed for *e*-learning admission.

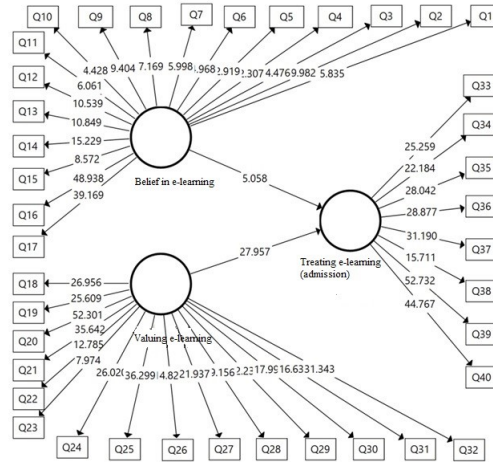


Figure 2: Model in the significant number mode

Table 6: Results of the path test

Path	Path coefficient ( $\beta$ )	Critical value ( $t$ )	Significance level ( $P$ )	Result at 5%
Belief in <i>e</i> -learning	0.741	5.058	0.000	Confirmed at a probability of 0.99
Valuing <i>e</i> -learning	0.699	27.957	0.000	Confirmed at a probability of 0.99

### Discussion and conclusion

The results of the present study indicated the necessity of paying attention to *e*-learning because the COVID-19 epidemic also proved this importance. The existence of unforeseeable crises in the future also increases the importance of this issue, just like when COVID-19 was unknown. In the current situation in Iran, national managers have embraced *e*-learning due to air pollution and fossil energy management, indicating the importance and continued planning to institutionalize this type of education in universities and educational centers. Therefore, the researchers examined the factors of *e*-learning institutionalization according to Edgar Schein’s view opinion in the institutionalization of *e*-learning culture in three dimensions (value, belief, and treatment). The findings of the present research reached 18 codes in the belief dimension. The easy access to this type of learning, and in fact with one click, was a point mentioned in the present research to make this type of education believable. The result was consistent with research by Alhabeeb and Rowley [1] who explained that *e*-learning and education were implemented and used in universities of different countries, and despite many investments in this field, these systems were almost less used by professors and students in both developed and developing countries. They also pointed out that the success factors of *e*-learning were different from the points of view of professors and students, and also the student’s characteristics, teacher’s characteristics, support and training, and ease of access affected the success of *e*-learning. The use of educational videos, the simultaneous use of the Internet and online information, digital library, and ease of access were among the issues mentioned by the professors, and they were consistent with a study by Benisi, Torfehnejad, and Tahaei [2]. In this research, the benefits of *e*-learning included the continuity of learning without the need for the student’s physical presence, the entry of new technologies into education, and inspiration from them to help improve the education of future generations, as well as giving teachers and professors the opportunity to rethink and update their knowledge. Furthermore, it develops educational tools and methods so that all people can learn at any place and time with their facilities in the time frame that they determine. This type of learning is a basis for the use of technology, communication, and professional and academic psychological concepts based on common criteria and standards that take special forms according to the existing goals, needs, and realities of societies. Other issues, which were mentioned by the professors, included the use of experienced visiting professors from other universities and depreciation and maintenance of educational and heating equipment costs at the university. These results were consistent with research by Farrokhi et al. [15] titled “Identifying and ranking the success factors of using *e*-learning technology: A case study of Imam Ali Army Officer University. In this study, among the variables, namely the value of information, the system usage, the efficiency of software and infrastructure, the student’s ability, the supporters, the professor’s characteristics,

and external factors, the software and infrastructure efficiency, student's ability, supporters, professor's characteristics, and external factors; the value of the information in the system, the system usage, and the efficiency of the software were respectively more important than other components in the success and use of electronic education technology. These factors were related to the performance of software analysts and experts and system designers to provide better and high-quality services, and increase the convenient use and application, and functional quality of the system so that the users would be more willing to use the system. The prioritization of the components indicated that the "value of information and content" component was out on the first priority compared to other components of the success of using e-learning. Furthermore, the attractiveness of e-learning, cost reduction, and fatigue in commuting are consistent with research by Hernandez et al. [7] titled "Examination of Military Student and Faculty Opinions and Outcomes of Two Rapid Course Conversions to the Online Environment: A Case Study at the United States Air Force School of Aerospace Medicine", indicating that attractive and compatible online space helps reduce traditional challenges. The positive attributes of online delivery, potential cost savings, and preliminary findings on student evaluations indicate that virtual courses are useful for training aeronauts.

The value layer as the main level in this study included 15 axes. The themes, namely laptops, free internet, and creating a unique education system were among the indices mentioned by the professors, and this result was consistent with research by Javier [9] who explained that despite the desire and interest of educational institutions to use online education, more attention should be paid to teachers' attitude towards this method which may be an obstacle to this issue. The existence of the necessary infrastructure for the use and implementation of electronic education and the possibility of its vast use are the conditions of research for the success of this method of education. Furthermore, other categories, including the creation of a web-based education system, purchasing SIM cards, and purchasing free tablets and laptops, and high-speed internet were consistent with a study by Kiakojour and Roudsari [11] titled "A study on student's attitude toward the effectiveness of factors affecting the development of e-learning" (Case study: Imam Khomeini Maritime University in Nowshahr". In this research, all components, namely the institute, technology, resource support, management, interface design, ethics, evaluation, and educational factors respectively affected the development of e-learning. Given the militarized environment of Imam Khomeini Maritime University in Nowshahr, the most important suggestions are as follows: The university officials and principals should ensure the timeliness of the services; the academic staff's skills (professors and employees) in the field of e-learning should be continuously evaluated, and a suitable leadership style should be adopted according to the military nature of the university with an emphasis on e-learning. Enriching the library is also consistent with research by Zarghani et al. titled "Virtual library: an essential element in the e-learning structure". They concluded that the virtual library is the result of modern information and communication technologies, and the correct use of these technologies could meet many needs of online users and eliminate the users' need for the in-person visit to the physical environment of the library. Therefore, principals of e-learning centers should also gain more knowledge about library and support services in e-learning centers and provide necessary services for users' needs. The virtual library is considered an essential part of the e-learning system; hence, the authorities should plan to run the library and recruit trained specialist librarians.

A total of 8 themes were obtained in the treatment layer. Obtaining high grades and academic progress were among the indices that were consistent with research by Jason Keys [12] titled "Comparing In-Person and Online Air Force Professional Military Education Instruction during the COVID-19 Pandemic", indicating that students generally scored higher in online classes than in-person.

#### • Practical suggestions

- It is suggested to hold courses and meetings in the university by inviting expert professors in this field to increase the capabilities and potential of e-learning.
- It is suggested to explain the limitations of in-person learning according to the conditions and advances in technology and globalization as well as capabilities and functions of e-learning.
- It is suggested to increase the lessons of virtual classes compared to in-person classes.
- It is suggested to develop a detailed statute for the use of e-learning in organizations and universities.
- It is suggested to imperceptibly remove professors, who are not interested in holding virtual classes, from the list of virtual classes by categorizing the professors.

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