



Factors Associated with the Use of E-Learning among Medical University Students; An Application of Technology Acceptance Model



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ABSTRACT

Aims Determining the effective factors in the use of e-learning among students can be useful in providing appropriate and practical solutions to increase the use of e-learning. Therefore, this study aimed to determine the factors related to the behavior of using e-learning among medical university students using the technology acceptance model (TAM) as a conceptual framework.

Instrument & Methods This cross-sectional study was conducted among 425 students of Hamadan University of Medical Sciences who were selected by stratified random sampling. The data collection tools included a questionnaire, including demographic data and TAM constructs. The data were analyzed in SPSS 23 software using one-way analysis of variance, independent t-test, Pearson correlation coefficient, and linear regression analysis.

Findings The age range of participants was between 18 and 54 years with an average age of 24.2±3.96 years. The history of participating in e-learning classes was significantly related to all the constructs of the TAM ($p < 0.05$). Also, undergraduate and graduate students had a significantly more positive attitude, higher perceived usefulness, and more usage intention and behavior concerning e-learning than professional doctorate students ($p < 0.05$). Attitude ($\beta = 0.394$), perceived usefulness ($\beta = 0.313$), and external variables ($\beta = 0.196$) were respectively the strongest predictors of intention to use e-learning ($p < 0.05$). The intention of e-learning usage directly and significantly predicted the behavior of using it ($\beta = 0.483$, $p < 0.05$).

Conclusion The TAM constructs predict the behavior of using e-learning among students.

Keywords Education, Distance; Educational Technology; Education, Medical; Behavior

CITATION LINKS

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Introduction

In recent years, the use of modern technologies in medical education has expanded greatly [1]. Electronic learning (e-learning) includes using information, communication, and technology interventions in the education-learning process [2]. Learning, behavioral, and cognitive theories strongly support the adoption of e-learning in higher education as it transcends the boundaries of time and space while promoting the leading role of students in the learning process [3-5]. Some reviews suggest that e-learning compared to face-to-face education, allows students to review the content as often as necessary and at a suitable speed; thus, it has had a positive impact on their learning process [6,7]. Co *et al.* in a systematic review reported that e-learning pedagogical approaches would improve students' enthusiasm and performance in learning complex medical procedures, such as surgical skills [8]. E-learning also increases the efficiency of the education process by increasing the quality of learning, easy access to a large amount of information, reducing educational costs, and improving the accuracy of course contents [9].

However, individual, technological, cultural, environmental, and pedagogical barriers develop some challenges in the way of implementation and adoption of e-learning in an academy as the effectiveness of learning through e-learning depends on the characteristics of the student, design of the teaching method, success of the student in coping with technical problems, and the experience and skill of working with computers [10,11]. On the other hand, e-learning has its limitations as it may not be a suitable substitute for teachers, human relationships, and face-to-face communications [12]. Considering the low costs of e-learning, infrastructural capacity, cultural acceptance, and the start of the COVID-19 pandemic, establishing e-learning in medical universities in Iran seemed logical [13].

The technology acceptance model (TAM) presented by Davis *et al.* is used to explain a predictive model for the use of e-learning among students. The constructs of this model include perceived usefulness, perceived ease of use, external variables, attitude, and behavioral intention. In the TAM, external variables are suggested as the basis for tracking the effect of external factors, which affect two main internal beliefs, perceived usefulness and ease of use from the individual's point of view. At the same time, behavioral intention, the effect of perceived ease of use, and perceived usefulness on the dependent variable mediate the use of technology [14]. Several studies based on this theory have been conducted to predict e-learning utilizing behavior [15-17].

The present study was done to identify factors affecting the use of e-learning among students to provide a practical solution to promote e-learning

utilization and to improve the quality of education at medical universities.

Instrument and Methods

This cross-sectional study was conducted among 425 students of Hamedan University of Medical Sciences in 2022. Considering alpha of 5%, "d" equal to 0.05, test power of 80%, and 10% bias in questionnaires, the sample size was estimated to be 425 people using the following formula:

$$N = \frac{Z^2_{1-\frac{\alpha}{2}} P (1 - P)}{d^2}$$

The sampling method of our study was stratified random with proportional allocation. After coordinating with the faculty officials and receiving the number of students of each faculty, the quota of each faculty, (with taking into account the number of students of that faculty, to the total students of the university) was determined. Further, by extracting the list of students, the study participants were selected randomly and entered the study. The inclusion criteria were the age of at least 18 years old, studying at the Hamedan University of Medical Sciences, and willingness to participate in the study. The exclusion criteria were physical and mental illnesses that caused the inability to answer appropriately, questionnaires with incomplete and distorted data, and the unwillingness of students to continue participating in the study.

Data were collected using questionnaires made based on the researcher's previous study and by self-report method. The validity and reliability of these questionnaires were checked and confirmed. The content validity index was 0.79 and the content validity ratio was 0.62. Reliability using Cronbach's alpha coefficient showed the internal correlation of the questions of each construct as follows: attitude: 0.77, perceived usefulness: 0.72, perceived ease of use: 0.68, and external variables: 0.71.

This questionnaire included two sections, the first section was about demographic variables, including age, sex, school, marital status, field of study, degree, duration of study, and history of participation in e-learning-related classes or workshops, and the second section was related to the constructs of the TAM. Individual attitudes toward using e-learning included 11 specific questions with a rating scale of 1-5 options and the range of scores that can be obtained was between 11 and 55, and a higher score indicated a positive attitude toward the use of e-learning. The perceived usefulness of using e-learning had five specific questions with a rating scale of 1-5 options and the range of scores that can be obtained was between 5 and 25, and a higher score indicated a high understanding of the usefulness of using e-learning. The perceived ease of using the e-learning also included four specific questions with a scale of 1-5 options and the range of scores that can

be obtained was between 4 and 20, and obtaining a higher score indicated a high understanding of the ease of using e-learning. The external variables related to the use of e-learning included four specific questions with a rating scale of 1-5 options and the range of scores that can be obtained was between 4 and 20; obtaining a higher score indicated the presence of external variables that facilitate the use of e-learning. Behavioral intention to use e-learning had one specific question with a rating scale of 1-5 options that evaluated the intention of behavior in the future. Also, the behavior of using e-learning had three specific questions with answers yes/no.

Data were analyzed by SPSS 23 statistical software using one-way analysis of variance, independent t-test, Pearson's correlation coefficient, and linear regression analysis.

Findings

The age range of the participants was between 18 and 54 years with an average age of 24.2 ± 3.96 years. Sixty-six percent of them were in the age group of 21 to 25 years and 18.8% were in the age group of 26-30 years. Also, 56% of the participants were male. Other demographic information of the participants is presented in Table 1.

Table 1. Demographic data of participants

Variable	No. (%)
Gender	
Male	238 (56)
Female	187 (44)
Age (year)	
Under 20	42 (9.9)
21 to 25	281 (66.1)
26 to 30	80 (18.8)
Above 30	22 (5.2)
Education	
Undergraduate	192 (45.2)
Graduate	45 (10.6)
PhD	8 (1.9)
Professional doctorate	180 (42.4)
Marital status	
Single	318 (74.8)
Married	107 (25.2)
History of participation in e-learning workshops	
Yes	280 (65.9)
No	145 (34.1)
Familiarity with e-learning level	
Very low	22 (5.2)
Low	40 (9.4)
Some deal	196 (46.1)
High	156 (36.7)
Very high	11 (2.6)
Desire to participate in e-learning workshops	
Yes	330 (77.6)
No	95 (22.4)

Among the TAM constructs, external variables in e-learning had the highest frequency and favorable status with 82.1% of the average score of the maximum obtainable score. Also, the status of attitude, perceived usefulness, perceived ease of use, and behavioral intention constructs were evaluated in a relatively favorable state. In terms of behavior,

86.8% of students used software related to e-learning and social networks to prepare and present the content of courses. The relationship between the demographic variables of the participants and the TAM constructs is presented in Table 2.

There was a significant relationship between attitude and perceived usefulness and educational level, marital status, and experience of participating in e-learning workshops ($p < 0.05$). Married students with a history of participating in e-learning workshops had a more positive attitude and perceived the usefulness of using e-learning. Also, the results of Tukey's test showed that undergraduate and graduate students had a significantly more positive attitude and perceived usefulness compared to professional doctorate students. There was a significant difference in the mean score of perceived ease of use of e-learning among the participants regarding educational level and experience of participating in e-learning workshops ($p < 0.05$) so that students with experience of participating in e-learning workshops and Ph.D. students significantly reported greater perceived ease of use. Also, there was a significant difference in the average score of external variables effective in e-learning in relation to participation in the e-learning workshop ($p < 0.05$) so that the students who participated in the workshop had a better understanding of the external variables effective in e-learning. There was a significant difference in the average score of the intention to use e-learning of the participants in the study in relation to variables, such as educational level, marital status, and experience of participating in the educational workshop ($p < 0.05$). Married students with a history of participating in e-learning workshops significantly reported more intent to use. Also, the results of Tukey's test showed that undergraduate and graduate students had significantly more intention to use e-learning compared to professional doctorate students. There was a significant difference in the average score of the behavior of using e-learning of the participants in the study in relation to variables, such as educational level and experience of participating in e-learning workshops ($p < 0.05$) so that students with experience of participating in e-learning workshops reported significantly more usage behavior. Also, the results of Tukey's test showed that undergraduate and graduate students had significantly more behavior of using e-learning compared to professional doctoral students ($p < 0.05$). Attitude ($\beta = 0.394$), perceived usefulness ($\beta = 0.313$), and external variables affecting e-learning ($\beta = 0.196$) were respectively the best predictors of intention to use e-learning. Also, these constructs explained 53.8% of the variance of changes in behavioral intention ($R^2 = 0.538$). The construct of behavioral intention ($\beta = 0.483$) was also a predictor of the behavior of e-learning usage and justified 23.3 % of the variance of behavior changes ($R^2 = 0.233$).

Table 2. Mean scores of the TAM constructs toward e-learning based on demographic variables

	Attitude	Perceived usefulness	Ease of use	External variables	Intention to use	Behavior of use
Gender						
Male	38.01±7.9	19.09±3.7	15.17±2.5	17.03±1.71	11±2.1	2.54±0.8
Female	36.55±8.3	18.35±4.1	14.74±2.9	17.30±1.68	10.98±2.4	2.47±0.9
p-value	0.069	0.054	0.113	0.106	0.958	0.364
Education						
Undergraduate	38.77±7.7	19.48±3.6	15.23±2.5	17.20±1.29	11.42±1.8	2.64±0.7
Graduate	40.62±6.8	20.04±2.7	15.56±2.6	17.04±1.22	11.49±1.7	2.71±0.7
PhD	38.38±5.6	19.38±3.2	16.13±1.8	15.88±3.09	11.01±2.8	2.63±0.7
Professional doctorate	35.02±8.4	17.66±4.1	14.52±2.9	17.18±2.07	10.41±2.6	2.31±0.9
p-value	0.001*	0.001*	0.019*	0.185	0.001*	0.001*
Age (year)						
Under 20	35.69±6.4	18.88±3.5	14.74±3.1	17.21±1.58	11±1.9	2.48±0.8
21 to 25	37.48±8.2	18.69±4.1	14.81±2.8	17.17±1.79	10.99±2.3	2.54±0.8
26 to 30	38±8.6	18.73±3.4	15.48±2.2	17.06±1.39	10.80±2.3	2.49±0.8
Above 30	36.82±8.6	19.64±4.2	15.73±2.8	17.09±1.95	11.68±2.3	2.18±0.9
p-value	0.494	0.743	0.129	0.956	0.462	0.291
Marital status						
Married	39.46±7.9	19.61±3.5	15.11±2.8	17.22±1.35	11.50±2.1	2.54±0.8
Single	36.66±8.1	18.49±3.9	14.94±2.7	17.12±1.81	10.82±2.3	2.50±0.8
p-value	0.002*	0.007*	0.570	0.595	0.005*	0.468
History of participation in e-learning workshops						
Yes	39.18±7.8	19.31±3.5	15.47±2.2	17.01±1.57	11.27±2.2	2.64±0.7
No	33.86±7.5	17.71±4.2	14.03±3.3	17.43±1.91	10.45±2.3	2.25±0.9
p-value	0.001*	0.001*	0.001*	0.019*	0.001*	0.001*

*Significant at p<0.05.

Discussion

In the present study, it was found that married people and people with a history of participating in classes related to e-learning had a more positive attitude and a higher perceived usefulness score toward e-learning. One of the reasons can be the interference of married life with people's education so that e-learning provides the opportunity to study at home and improves their attitude toward e-learning. E-learning also provides the possibility of studying at the same time as employment for married people and makes the benefit of using e-learning more noticeable than face-to-face education. On the other hand, students who had a history of participating in e-learning classes or workshops also had a more positive attitude and a higher perceived usefulness score toward e-learning. It seems that participation in classes related to e-learning, in addition to training students in order to take advantage of the capacities of e-learning, changes their negative attitude by removing ambiguities and misconceptions regarding e-learning.

Xing *et al.* in 2020 assessed 534 nurses from eight hospitals and revealed that nurses who had no previous experience or background in e-learning had a more negative attitude toward starting e-learning and using educational platforms. Also, nurses who were married were more familiar with computers and worked in urban hospitals had more positive attitudes and perceived usefulness towards e-learning [18]. In the present study, undergraduate and graduate students had a more positive attitude and a higher perceived usefulness score toward e-learning than professional doctorate students. One of the reasons is that medical and dental students need to learn through attending clinical centers to recruit their knowledge more actively. Also, to learn how to

manage patients, medical students need to closely observe the course of illness, treatment, and recovery in patients and follow how doctors manage the disease daily. This is truer for dental students who rely on practical training in addition to theoretical courses.

In this regard, our study was in the same direction as Samra *et al.*'s study, which was conducted in 2021 in India on 2319 dental students to investigate their attitude toward e-learning during the COVID-19 pandemic. In this study, 69.6% of students preferred face-to-face education over e-learning education. The most important causes of students' reluctance and negative attitude and their lower perceived usefulness score toward e-learning were the difficulty in adapting to new educational methods and the less interaction with patients and professors in e-learning [19]. In our study, those who had a history of participating in classes or workshops related to e-learning had a higher perceived ease score than the rest of the students, which shows that teaching how to use prerequisite tools for e-learning plays an important role in understanding ease of use.

In a cross-sectional study conducted by Venkatesh *et al.* in 2000 entitled "Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model", it was found that the experience of using e-learning over time increases the perception of its ease of use and this can be achieved through participation in relevant classes and workshops [20]. Internet speed, the existence of infrastructure related to e-learning, and the user's familiarity with software related to e-learning are among the external variables that influence the behavior of using e-learning. In the present study, married people and people who had a history of participating in classes related to e-

learning mentioned the intention to use e-learning more significantly than other groups.

This finding is consistent with Thapa *et al.*'s study, which was conducted in 2021 entitled "Nursing students' attitude on the practice of e-learning: A cross-sectional survey amid COVID-19 in Nepal". In this study, 67.7% of students agreed with the use of e-learning for married students instead of attending classes [21]. It seems that students trained in the field of e-learning intend to use e-learning to apply their training more than people who have not received training in this field. On the other hand, our study showed that students trained in the field of e-learning obtained a higher score in the behavior of using e-learning than other groups. Also, undergraduate and master's degree students had higher usage behavior scores than professional doctoral degree students. One of the reasons can be the nature of undergraduate and master's courses so that a greater number of courses, unlike the professional doctorate level (especially the final years of study at this level), rely on theoretical sciences, and the teaching and learning of these courses are done more easily and effectively through electronic education.

In a multicenter cross-sectional study on 1328 students studying health sciences from 11 countries in 2020, 40% of students found e-learning useful for learning theory courses, while more than 64% of students found e-learning not useful for learning clinical and practical skills. It should be noted that 91% of the students participating in this study were professional doctorate students [22]. However, studies have also shown that medical students have welcomed the integration of traditional methods and patient-centered e-learning to learn skills and have evaluated it as a positive change in the direction of education [23, 24]. In this multicenter study, it was also determined that students who had a history of participating in more sessions of e-learning significantly expressed a better attitude and experience of using e-learning [22].

We found a positive correlation between attitude, perceived usefulness, and perceived ease of use. Also, there was a positive correlation between the three mentioned components and the intention to use e-learning. These findings are compatible with those Ajzen [25], Davis *et al.* [26], Dillon and Morris [27], Park [28], Selim [29], and Khorasani *et al.* [30] reporting that students' attitude toward e-learning depends on perceived ease of use and perceived usefulness. Attitude is directly associated with the intention to use e-learning in students.

We found that attitude, perceived usefulness, and external variables were respectively the most important predictors of students' intention to use e-learning, and the intention to use e-learning predicted the behavior of using it. In this respect, our result was consistent with that of Khorasani *et al.* who investigated the factors influencing the acceptance of e-learning among students of the

Tehran University of Medical Sciences based on the TAM. In this study, attitude and perceived usefulness were respectively the strongest predictors of the intention to use e-learning among those students, and intention to use of e-learning was the only variable that strongly predicted the behavior of using e-learning [30].

According to the TAM, behavioral intention is a function of attitude, perceived usefulness, and external variables. However, in this model, unlike our finding, perceived ease is also a predictor of behavioral intention [14]. A justifying reason is that the use of virtual education tools is easy for the students of Hamedan University of Medical Sciences due to the completion of courses related to e-learning in students' curricula. Our study was consistent with Hussein's study in terms of the correlation between the TAM constructs and behavioral intention and the predictive power of attitude for behavioral intention. In this study, which was conducted in Malaysia on 151 students using a standard questionnaire based on TAM, there is a positive correlation between attitude, perceived usefulness, and behavioral intention, and attitude was the strongest predictor of behavioral intention to use e-learning among students [31].

We also found that married students intended to use e-learning more than unmarried students, but the behavior of using e-learning was not much different between married and unmarried students. One interpretation can be that the external conditions for moving from the intention to use e-learning to the behavior of using e-learning for married people are not provided. The behavior and use of e-learning was significantly higher in undergraduate and graduate students. Due to the nature of their field of study, undergraduate and graduate students use e-learning more than professional doctoral students who are generally studying in clinical environments. In the present study, the history of participation in classes and workshops related to e-learning was significantly related to all the constructs of the TAM and the intention and behavior of using e-learning.

The results of the present study showed that providing e-learning classes and workshops could have a positive effect on the constructs of the TAM, especially the behavioral intention to use e-learning and usage behavior. Several studies have been conducted regarding training and its role in the development and adoption of technology in an organization, which all emphasize the necessity of training target groups before introducing and developing new technology in the organization [32-39].

Conclusion

The constructs of the TAM predict the behavior of using electronic education among students, which indicates planning to improve the constructs of this model ultimately leads to the improvement of

behavioral intention and the behavior of using electronic education in students.

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Ethical Considerations: The current study incorporated all ethical considerations, including adherence to the ethics code approved by the Ethics Committee of Hamadan University of Medical Sciences (IR.UMSHA.REC.1401.302). Participants provided informed consent, and the confidentiality of collected data was strictly maintained. Participants were assured that the information would be analyzed as a whole and would not be used partially in the study. Trustworthiness was prioritized when utilizing sources.

Conflicts of Interests: All authors declared that they have no conflicts of interests.

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References

- 1- Akbarilakeh M, Razzaghi A, Delavar Pour Moghaddam H. Attitudes of faculty members towards using e-learning. *Res Dev Med Educ.* 2019;8(1):12-9.
- 2- O'Doherty D, Dromey M, Loughheed J, Hannigan A, Last J, McGrath D. Barriers and solutions to online learning in medical education-an integrative review. *BMC Med Educ.* 2018;18(1):130.
- 3- Gachanja F, Mwangi N, Gicheru W. E-learning in medical education during COVID-19 pandemic: experiences of a research course at Kenya Medical Training College. *BMC Med Educ.* 2021;21(1):612.
- 4- Huynh R. The role of E-learning in medical education. *Acad Med.* 2017;92(4):430.
- 5- Evgeniou E, Loizou P. The theoretical base of e-learning and its role in surgical education. *J Surg Educ.* 2012;69(5):665-9.
- 6- Bernard R, Abrami P, Lou Y, Borokhovski E, Wade A, Wozney L, et al. How does distance education compare with classroom instruction? a meta-analysis of the empirical literature. *Rev Educ Res.* 2004;74:379-439.
- 7- Vallée A, Blacher J, Cariou A, Sorbets E. Blended learning compared to traditional learning in medical education: Systematic review and meta-analysis. *J Med Internet Res.* 2020;22(8):e16504.
- 8- Co M, Cheung KYC, Cheung WS, Fok HM, Fong KH, Kwok OY, et al. Distance education for anatomy and surgical training-A systematic review. *Surgeon.* 2022;20(5):e195-205.
- 9- Zolfaghari M, Negarandeh R, Eybpoosh S. Developing a blended learning program for nursing and midwifery students in Iran: Process and preliminary outcomes. *Iran J*

Nurs Midwifery Res. 2013;18(1):20-6.

10- Ali S, Uppal MA, Gulliver SR. A conceptual framework highlighting e-learning implementation barriers. *Inf Technol People.* 2018;31(1):156-80.

11- Almaiah MA, Al-Khasawneh A, Althunibat A. Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic. *Educ Inf Technol.* 2020;25(6):5261-80.

12- Song L, Singleton ES, Hill JR, Koh MH. Improving online learning: Student perceptions of useful and challenging characteristics. *Internet Higher Educ.* 2004;7(1):59-70.

13- Irvani M, Nasab MB, Bahmaei H, Ghanbari S, Siahkal SF. The level of satisfaction and quality of E-learning in medical universities of Iran during the epidemic of COVID-19. *J Educ Health Promot.* 2022;11:9.

14- Davis FD. A technology acceptance model for empirically testing new end-user information systems: Theory and results. Cambridge: Massachusetts Institute of Technology; 1985.

15- Al Kurdi B, Alshurideh M, Salloum SA. Investigating a theoretical framework for e-learning technology acceptance. *Int J Electrical Comput Eng.* 2020;10(6):6484-96.

16- McKinnon K, Igonor A, editors. Explaining eLearning perceptions using the technology acceptance model and the theory of planned behavior. San Diego: Association for the Advancement of Computing in Education (AACE); 2008.

17- Punnoose AC. Determinants of intention to use eLearning based on the technology acceptance model. *J Inf Technol Educ Res.* 2012;11(1):301-37.

18- Xing W, Ao L, Xiao H, Liang L. Chinese nurses' preferences for and attitudes about e-learning in continuing education: A correlational study. *J Contin Educ Nurs.* 2020;51(2):87-96.

19- Samra RK, Nirola A, Verma A, Nagpal A, Thakur M. Dental students' perception on the impact of E-learning in continuing dental education during the current pandemic scenario. *Indian J Dental Sci.* 2021;13(2):61.

20- Venkatesh V. Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Inf Syst Res.* 2000;11(4):342-65.

21- Thapa P, Bhandari SL, Pathak S. Nursing students' attitude on the practice of e-learning: A cross-sectional survey amid COVID-19 in Nepal. *PloS one.* 2021;16(6):e0253651.

22- Abbasi MS, Ahmed N, Sajjad B, Alshahrani A, Saeed S, Sarfaraz S, et al. E-Learning perception and satisfaction among health sciences students amid the COVID-19 pandemic. *Work.* 2020;67(3):549-56.

23- Ikram UZ, Essink-Bot ML, Suurmond J. How we developed an effective e-learning module for medical students on using professional interpreters. *Med Teach.* 2015;37(5):422-7.

24- Khasawneh R, Simonsen K, Snowden J, Higgins J, Beck G. The effectiveness of e-learning in pediatric medical student education. *Med Educ Online.* 2016;21:10.

25- Ajzen I. Understanding attitudes and predicting social behavior. London: Pearson; 1980.

26- Davis FD, Bagozzi RP, Warshaw PR. User acceptance of computer technology: A comparison of two theoretical models. *Manag Sci.* 1989;35(8):982-1003.

27- Dillon A, Morris MG. User acceptance of information technology theory and models. *LearnTech Lib.* 1996;31:3-32.

- 28- Park SY. An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. *J Educ Technol Soc.* 2009;12(3):150-62.
- 29- Selim HM. An empirical investigation of student acceptance of course websites. *Computers Educ.* 2003;40(4):343-60.
- 30- Khorasani A, Abdolmaleki J, Zahedi H. Factors affecting E-learning acceptance among students of Tehran University of Medical Sciences based on technology acceptance model (TAM). *Iran J Med Educ.* 2012;11(6):664-73. [Persian]
- 31- Hussein Z. Leading to intention: The role of attitude in relation to technology acceptance model in e-learning. *Procedia Comput Sci.* 2017;105:159-64.
- 32- Barzekar H, Safdari R, Eshraghiyan MR, Dargahi H. The study of organizational factors affecting the application of information technology by middle managers in TUMS hospitals. *Payavard Salamat.* 2013;7(2):123-32. [Persian]
- 33- dos Reis RA, Freitas MdCD. Critical factors on information technology acceptance and use: An analysis on small and medium Brazilian clothing industries. *Procedia Comput Sci.* 2014;31:105-14.
- 34- Horton W, editor. Designing courseware for mobile devices, *Mobile learning for expending educational opportunities*; 2005.
- 35- Khodadad Hoseiny SH, Noori A, Zabihi MR. E-learning acceptance in higher education: Application of flow theory, technology acceptance model & e-service quality. *Res Plan Higher Educ.* 2023;19(1):111-36. [Persian]
- 36- Kon CL. Mobile learning: Different technologies aspects. designing usable systems, computer and internet technologies university of Strathclyde [Internet]. Perth: Meta Press. 2009- [Cited 2009, April, 17]. Available from: <http://inderscience.metapress.com/content/?k=Kon%2c>.
- 37- Kumar S, Vigil K. The net generation as preservice teachers: Transferring familiarity with new technologies to educational environments. *J Digital Learn Teach Educ.* 2011;27(4):144-53.
- 38- Kunda D, Brooks L. Assessing important factors that support component-based development in developing countries. *Inf Technol Dev.* 2000;9(3-4):123-39.
- 39- Madadi Y, Irvani H, Mohammadi Y. Investigating the factors effective on the acquaintance with and use of Information and Communication Technology (ICT) in organizational responsibilities of the faculty members of the college of agriculture and natural resources, university of Tehran. *J Inf Technol Manag.* 2014;6(1):127-44. [Persian]