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# *Psychometric Evaluation of the E-Learning Acceptance Scale among Virtual Education Students of the Universities of Medical Sciences in Tehran Province, Iran*

Maryam Seyedian Ekhtesar [1], Lili Salehi [2, 3*]

[1] Northwest Health Center of Tehran, Iran University of Medical Sciences, Tehran, Iran.
[2] Research Center for Health, Safety and Environment, Alborz University of Medical Sciences, Karaj, Iran
[3] Department of Health Education & Promotion, Alborz University of Medical Sciences, Karaj, Iran.

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**Abstract**

***Background and Objective:*** E-learning has become an increasingly popular learning approach in higher educational institutions due to the rapid growth of technologies. We need valid and reliable tools to assess the acceptance of this type of training. This study aimed to validate the e-learning acceptance scale.

***Materials and Methods:*** This psychometric study was conducted on 223 samples of virtual education students from the Medical Universities in Tehran. Initial instrument was 49 questions from previous studies that were translated into Persian after obtaining permission from the original author. Instrument validation procedures included impact item method, content validity index (CVI) and content validity ratio (CVR) of the judgment of 10 experts and exploratory factor analysis and internal reliability of the scale was determined by Cronbach's alpha and with the test-retest method the external consistency of a test was assessed.

***Results****:* Of the original 49 items, all of them based on the impact item index, CVR, and CVI were considered as valid; based on exploratory factors analysis, 41 items were retained. And considering a minimum Eigen value of 1 for each factor, the five factors were extracted. This instrument was able to predict 52% of the properties as an acceptance e-learning variance.

***Conclusion****:* The results of this study indicated the strength of the factor structure and reliability of an instrument for measuring student acceptance e-learning scale.

[*] ***Corresponding Author:*** Salehi Lili, ***Email:***leilisalehi83@yahoo.com

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**Introduction**

Rapid growth of internet technology has turned electronic learning (E-learning) into a common educational approach in the related institutes. This system is known as an alternative or traditional educational supplement (1). Average global growth of E-learning has been estimated at 23% during 2012-2017 (2). E-learning includes a wide variety of software applications and educational methods based on information technology, such as personal computers, compact discs, network and internet, which facilitate training and learning in all individuals at any given time or place (3). Previous studies are indicative of increased access and use of information technology among students (4). Despite the global growth of this learning method, E-learning system are in their infancy in the Middle East (5) since many teachers still believe in the efficacy of traditional learning approaches (6).

There is a notion that E-learning emphasizes on presenting the educational contents in addition to considering the needs of learners (7) and is more effective than face-to-face learning. Furthermore, students receiving E-learning have been shown to obtain better grades compared to those receiving traditional educational (8). In a study, Sabah mentioned the advantages of E-learning and cooperative learning in motivating learners, stating that employed students are more interested in E-learning (9).

In another study by Selim *et al*., which evaluated the acceptance behaviors of E-learning, realizing the benefits and easy application positively influence the attitude of participants and their willingness to use the internet in their learning process (10). Positive attitude toward the efficacy of E-learning is considered essential to the acceptance and proper implementation of this method, along with the necessary knowledge and skills in this regard (11, 12).

According to a research conducted on 255 virtual learners in Ethiopia, perceived benefits and perceived easy application were determined as the influential factors in the intention to use the virtual education system (13). Moreover, Miladi (2011) suggested four main influential factors in the acceptance of E-learning, including the organization of educational contents, selecting the proper educational media, effective educational content, and easy access to the contents (14). In the study by Karimzadehgan (2011), flexibility, quality of the training courses, quality of the technology and evaluation were determined as the influential factors in this

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regard (15). E-learning creates an efficient, flexible educational environment, which promotes the cognitive abilities of the learners and helps educators to provide interactive learning environments in order to improve creativity and learning (4).

Despite the growing rate of E-learning, studies have shown that many learners who start E-learning do not succeed in completing the courses (16). In the age when E-learning is considered as one of the most prominent educational environments (17), further studies are required in relation to assess the knowledge, attitudes and acceptance of these methods, especially due to the remarkable dominance of computer-based education in the world and rising use of these methods in the Iranian universities and the key role of students in educational systems.

Although the benefits of E-learning techniques are well-known, successful implementation of these methods is affected by numerous factors, including the acceptance of students. The present study aimed to validate the E-learning acceptance scale among the virtual students of medical universities in Tehran, Iran in 2015.

## Materials and Methods

This psychometric study was conducted on 223 virtual students at the medical universities of Tehran, Iran in 2015, with the aim of validating the E-learning acceptance scale. For the psychometric evaluation of the scale, we used the 49-item questionnaire proposed by Lim, Hong and Tan (2008) (18). This instrument is scored based on a five-point Likert scale (Strongly Disagree: 1, Strongly Agree: 5). Psychometric stages were: 1. translation and localization of the scale, and 2. psychometric analysis of the model.

**Translation and Localization of the Model:**

In this stage, after obtaining the required permit from the author of the original version, the scale was translated by two proficient Persian language speakers, back-translated by two proficient English speakers and compared with the original scale to eliminate the gap between the two versions.

The E-learning acceptance model consists of 49 items, which have been classified into five main categories by the original author based on the analysis of its main components, including the attitude and behavior of learners (7 items), system technology (10 items), interactive applications (12 items), institutional factors (11 items), and characteristics of educators (11 items). Cronbach's alpha confirmed the total and

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subcategory consistency of the model in, so that the value was 0.782, 0.812, 0.816, 0.638 and 0.851 for the first, second, third, fourth and fifth category, respectively. In addition, reliability of the scale had been determined at 0.7 in the posttest.

**Psychometrics of the Model:**

In this stage, face validity, content validity and construct validity were determined. To do so, participants were selected from among a population of virtual students in the medical universities of Tehran via convenience sampling, who were mostly engaged in their second and third academic semester.

Content validity of the questionnaire was evaluated and corrected based on the comments of 10 experts in the field of education. In addition, face validity was measured based on the opinions of 20 virtual education students. To confirm the reliability, the questionnaire was randomly distributed among 15 students, reliability was assessed and the problems were corrected. Afterwards, the questionnaire was distributed in the study population, and its construct validity and internal consistency reliability were examined. It is notable that the audience in the implementation of the test project were excluded from the final evaluation. To determine the qualitative face validity, the items of the questionnaire were modified qualitatively. To determine the quantitative validity with the aim of calculating the determinant of the item impactsore, a complete list of the questionnaire items was prepared separately and handed to 10 subjects in the target group. Scores of effect were calculated, and item impact sores above 1.5 were considered acceptable for the next stage of the study and maintained. Furthermore, two items (number 9 and 43) were eliminated due to the item impact sore of less than 1.5.

In the qualitative evaluation of content validity, some of the main considerations were adherence to the grammatical rules of the Persian language, using proper words, appropriate position of the items in the questionnaire, accurate scoring, and allocating sufficient time for completing the model, and proportionality of the selected domain, so that all the items in the model would be modified consecutively. Reliability of the data collection tool was measured using content validity (quantitative), content validity ratio (CVR) and content validity index (CVI). As for the construct validity in the present study, exploratory factor analysis was used, along with the Kaiser-Meyer-Olkin test, Kervit-Bartlett test, scree plot chart, eigen value, and varimax rotation. To simplify the extracted

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factor structure, the varimax method was used, which classified the highly correlated items in one factor. In line with assessing the reliability of the data collection tool, the modified questionnaire was distributed among the community members. After collecting and extracting the data, total and factor Cronbach's alpha were calculated.

This study was approved by ethics committee (ethical code: Abzums.Rec.1396.65).

## Results

Mean age of the students participating in this study was 36.37±7.64 years, 80% of whom were female. Other demographic characteristics of the participants are presented in Table 1.

***Results of Face Validity:*** Eight items needed qualitative modification, and the comments of the professors in this regard were applied to the questionnaire. With the calculation of the item impact sore quantitatively, two items (number 9 and 43) were eliminated.

***Results of Content Validity:*** In terms of calculating the CVR and based on the evaluation by 10 experts with the criterion, the obtained results were compared in Lawshe's table. In this table, considering the number of participants (n=10) and the minimum value of its CVR (0.62), items more than 0.62 were maintained (Table 2). With regard to measuring the content validity index, items above 0.79 were maintained, and items between 0.7 and 0.79 were modified in the present study. Moreover, items 1, 3, 6, 13 and 30 were eliminated due to lack of appropriate scores, and the remaining questions were maintained (Table 2).

In evaluating the construct validity, sampling adequacy was initially tested to perform factor analysis, and considering the obtained results, the Kiaser-Meyer-Olkin value was estimated at 0.851. Additionally, the Bartlett's test of 5389/516 wassignificantat $P<0.001$; therefore, the minimum circumstances for performing the exploratory factor analysis was provided.

To extract the factors in the present study, we analyzedthemaincomponents,andto determine the number offactors,we used thespecial value method. Considering the special valuesof 1for the factors (sum of factor square coefficients of the loadings in each factor), five factors with 52% of the variance of the total scores were above the Eigen value to explain the variance for the acceptance of E-learning.

In the present study, varimax and oblimin rotations were applied to simplify the data, and the varimax rotation was compatible with the original scale; accordingly, five domains were extracted. Basedon the rotated correlation

matrix between the items regarding the acceptance of E-learning and identified factors, the items relating to each factor were identified and named. To reduce the number of factors and their alignment based on the rotated matrix, names of the components were determined considering the items of each factor and the associated factor loading by a panel of experts (Table 3). In this stage, variable with significant correlations to each other were placed inside one factor (Table 4).

In the current research, in order to verify the reliability of the index of E-learning acceptance, we used the reliability stability by determining the Spearman's correlation-coefficient ($P$=0.9) and measured the internal consistency reliability based on the Cronbach's alpha (α=0.935).

***Table 1: Socio Demographic Characteristics of Samples***

| variables | N (%) | Total |
|---|---|---|
| **Age(year)** | | |
| 20-29 | 34 (15.2) | 223(100) |
| 30-39 | 124 (55.6) | |
| 40-49 | 54 (24.2) | |
| 50-59 | 9( 4) | |
| >60 | 2 (0.9) | |
| **Sex** | | 223(100) |
| Male | 44 (19.7) | |
| Female | 179 (80.3) | |
| **Marital Status** | | 223(100) |
| Single | 30 (13.5) | |
| Married | 193 (8.5) | |
| **Academic Semester** | | 223(100) |
| 1 | 12(5.4) | |
| 2 | 164(73.5) | |
| >3 | 47(21.1) | |
| **Family Dimension** | | 223(100) |
| 2-3 | 85(3.81) | |
| 4 | 96(43) | |
| 5 | 29(13) | |
| 6 | 13(58) | |
| **Father Education** | | 223(100) |
| Illiterate | 13(58) | |
| Elementary | 42(18.8) | |
| High School | 37(16.6) | |
| Diploma | 66(29.6) | |
| Higher Education | 65(29.1) | |
| **Mother Education** | | 223(100) |
| Illiterate | 18(8.1) | |
| Elementary | 63(28.3) | |
| High School | 34(15.2) | |
| Diploma | 68(30.5) | |
| Higher Education | 40(17.9) | |
| **Internet Availability** | | 223(100) |
| Yes | 223(100) | |
| No | 0 | |
| **Internet Usage Duration(Hour)** | | 223(100) |
| 1-19 | 107(48) | |
| 20-39 | 78(35) | |
| 40-59 | 24(10.8) | |
| 60-79 | 12(5.4) | |
| >80 | 2(0.9) | |


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**Table 2: Item Impact Score, CVR and CVI**

| | | Impact Item Score | CVR | | CVI | |
|---|---|---|---|---|---|---|
| 1 | I am anxious in completing my degree. | 1.9 | 0.6 | 0.6 | 0.8 | 0.6 |
| 2 | I belief in my capability to interact with technology. | 2 | 1 | 0.9 | 1 | 0.7 |
| 3 | I am cognitively engages in doing the e-learning activities. | 1.7 | 0 | 0.9 | 0.5 | 0.2 |
| 4 | I am willing to participate in e-learning activities. | 1.95 | 0.8 | 0.9 | 0.9 | 0.8 |
| 5 | I have the initiative and motivation to learn and use the system. | 2 | 0.8 | 0.8 | 0.9 | 0.9 |
| 6 | I have high level of self confidence in using the system. | 2 | 0 | 0.8 | 0.6 | 0.6 |
| 7 | I am satisfactory with time and place flexibility of system. | 2.04 | 0.8 | 0.8 | 0.9 | 0.9 |
| 8 | The system allows easy access to information. | 1.95 | 0.8 | 0.9 | 1 | 0.9 |
| 9 | The configuration colour and background are clear and harmonious for the system. | 1.17 | 0 | 0.5 | 0.4 | 0.4 |
| 10 | There is information credibility in the system | 1.86 | 0.8 | 1 | 0.9 | 0.7 |
| 11 | The guidance screen is clear and easy to use. | 1.62 | 1 | 1 | 0.8 | 0.9 |
| 12 | The IT infrastructure is reliable and secure. | 1.95 | 0.8 | 0.8 | 0.9 | 0.9 |
| 13 | There is adequate investment in infrastructure to support electronic performance. | 1.62 | 0 | 0.9 | 0.4 | 0.6 |
| 14 | The Screen layout and design are appropriate. | 2.04 | 0.8 | 0.9 | 0.9 | 0.9 |
| 15 | I am rarely disconnected during online tutorial. | 1.91 | 0.8 | 0.8 | 0.9 | 0.9 |
| 16 | I am satisfied with the browsing speed. | 2.08 | 1 | 0.9 | 0.9 | 0.9 |
| 17 | I do not experience problems while navigating. | 2.22 | 1 | 0.9 | 0.8 | 0.9 |
| 18 | I think sharing knowledge through online/discussion is a good idea. | 2.32 | 1 | 0.9 | 0.8 | 0.7 |
| 19 | Online discussion enables students to exchange ideas and comments. | 2.14 | 0.8 | 0.8 | 0.8 | 1 |
| 20 | I benefits from using interactive applications. | 2.75 | 0.8 | 0.9 | 0.9 | 0.8 |
| 21 | I am able to ask questions and receive answers. | 2.12 | 0.8 | 0.9 | 0.9 | 1 |
| 22 | Browsing classmate’s works helps reflect own shortcoming. | 2.09 | 0.8 | 0.9 | 0.9 | 0.9 |
| 23 | I think sharing knowledge through online discussion is time consuming. | 2 | 0.8 | 0.9 | 0.9 | 1 |
| 24 | I am able to concentrate on the quality of learning. | 2.19 | 1 | 0.9 | 0.9 | 0.9 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 25 | I have discussion with course mates via e-learning system. | 1.5 | 0.8 | 1 | 1 | 1 |
| 26 | Uploading coursework is easy. | 1.81 | 0.8 | 1 | 0.9 | 1 |
| 27 | Browsing classmate's works helps improve the quality of own work. | 2.09 | 1 | 1 | 1 | 1 |
| 28 | Uploading coursework is an appropriate method. | 2.04 | 0.8 | 0.9 | 0.9 | 0.9 |
| 29 | I browse peer's feedbacks of most of classmates. | 1.62 | 0 | 0.7 | 0.8 | 0.8 |
| 30 | Accreditation is important in choosing an e-learning course. | 2.04 | 0.8 | 0.8 | 0.4 | 0.4 |
| 31 | Availability of virtual library is an important factor. | 1.95 | 0.8 | 0.9 | 0.8 | 0.9 |
| 32 | The course content method of delivery is important. | 2 | 1 | 1 | 1 | 1 |
| 33 | It is important that an institution has the copyrights of the online learning programme. | 2 | 1 | 1 | 0.9 | 0.9 |
| 34 | Electronic resources are easily accessible by clicking on the related links in the internet. | 1.95 | 0.8 | 0.9 | 0.8 | 0.9 |
| 35 | Materials in virtual library are relevant to the course. | 1.95 | 0.8 | 0.8 | 0.9 | 0.9 |
| 36 | Face to face delivery is complementary to e-learning. | 1.7 | 0.8 | 0.9 | 1 | 1 |
| 37 | It is equally effective to learn in online environment or classroom mode. | 1.95 | 1 | 1 | 0.8 | 0.9 |
| 38 | I perform better in the classroom mode of learning. | 1.81 | 1 | 1 | 1 | 1 |
| 39 | Instructors' knowledge on using the internet technology affects efficiency of online learning. | 2.12 | 1 | 1 | 0.8 | 0.9 |
| 40 | Instructors are friendly and approachable. | 1.95 | 0.8 | 0.8 | 0.9 | 0.9 |
| 41 | Instructors are easily contacted. | 2.12 | 0.8 | 0.9 | 1 | 1 |
| 42 | Instructors explain how to use the website at the beginning of the semester. | 2 | 1 | 0.9 | 0.9 | 1 |
| 43 | Instructors encourage student interactions. | 1.46 | 0 | 0.9 | 0.8 | 0.8 |
| 44 | Instructors provide sufficient learning resource online. | 2.12 | 0.8 | 1 | 1 | 1 |
| 45 | Instructors solve emerging problems efficiently. | 1.95 | 1 | 1 | 0.8 | 0.9 |
| 46 | Instructors provide fast feedbacks to queries in the discussion forum. | 2.12 | 0.8 | 0.9 | 0.9 | 0.9 |
| 47 | Instructors are enthusiastic in teaching and explain via the web. | 2.04 | 0.8 | 0.9 | 0.8 | 0.9 |
| 48 | Instructors reply e-mail queries rapidly. | 2.17 | 0.8 | 1 | 0.9 | 1 |
| 49 | Instructors do not intervene unless students asked for the course answers. | 2 | 0.8 | 0.9 | 1 | 0.9 |


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***Table 3: Eginvalue and Total Variance Explained***

| Component | Initial Eginvalue | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % |
| 1 | 13.408 | 32.703 | 32.703 | 13.408 | 32.703 | 32.703 | 5.457 | 13.310 | 13.310 |
| 2 | 2.510 | 6.122 | 38.825 | 2.510 | 6.122 | 38.825 | 5.390 | 13.145 | 26.455 |
| 3 | 2.043 | 4.982 | 43087 | 2.043 | 4.982 | 43.87 | 4.502 | 10.981 | 37.436 |
| 4 | 1.775 | 4.330 | 48.37 | 1.775 | 4.330 | 48.137 | 3.056 | 7.454 | 44.891 |
| 5 | 1.574 | 3.849 | 51.986 | 1.574 | 3.849 | 51.986 | 2.909 | 7.095 | 51.986 |
| 6 | 1.381 | 3.368 | 55.354 | | | | | | |
| 7 | 1.384 | 3.288 | 58.642 | | | | | | |
| 8 | 1.217 | 2.969 | 61.611 | | | | | | |
| 9 | 1.148 | 2.800 | 64.411 | | | | | | |
| 10 | 1.090 | 2.658 | 67.069 | | | | | | |
| 11 | 0.966 | 2.356 | 69.424 | | | | | | |
| 12 | 0.908 | 2.216 | 71.640 | | | | | | |
| 13 | 0.488 | 2.060 | 70.700 | | | | | | |
| 14 | 0.828 | 2.020 | 75.720 | | | | | | |
| 15 | 0.790 | 1.926 | 77.645 | | | | | | |
| 16 | 0.727 | 1.733 | 79.418 | | | | | | |
| 17 | 0.676 | 1.649 | 81.068 | | | | | | |
| 18 | 0.659 | 1.607 | 82.674 | | | | | | |
| 19 | 0.633 | 1.54 | 84.219 | | | | | | |
| 20 | 0.576 | 1.404 | 85.622 | | | | | | |
| 21 | 0.530 | 1.294 | 86.916 | | | | | | |
| 22 | 0.522 | 1.273 | 88.189 | | | | | | |
| 23 | 0.472 | 1.151 | 89.340 | | | | | | |
| 24 | 0.421 | 1.026 | 90.366 | | | | | | |
| 25 | 0.410 | 1.001 | 91.367 | | | | | | |
| 26 | 0.366 | 0.894 | 92.261 | | | | | | |



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| | | | |
|---|---|---|---|
| 27 | 0.359 | 0.876 | 93.138 |
| 28 | 0.350 | 0.854 | 93.991 |
| 29 | 0.297 | 0.723 | 94.715 |
| 30 | 0.271 | 0.661 | 95.367 |
| 31 | 0.249 | 0.608 | 95.984 |
| 32 | 0.242 | 0.589 | 96.573 |
| 33 | 0.221 | 0.538 | 97.112 |
| 34 | 0.211 | 0.515 | 97.627 |
| 35 | 0.198 | 0.483 | 98.109 |
| 36 | 0.177 | 0.431 | 98.540 |
| 37 | 0.171 | 0.416 | 98.956 |
| 38 | 0.132 | 0.322 | 99.278 |
| 39 | 0.126 | 0.306 | 99.585 |
| 40 | 0.087 | 0.213 | 99.798 |
| 41 | 0.083 | 0.202 | 100 |

***Table4: Labeling the Extracted Factors in This Study***

| **Factors** | Factors loading in Varimax Rotation |
|---|---|
| **Factor 1:** | 16,18, 27, 30, 33, 34, 35, 36, 39,40,41 |
| **Factor2:** | 2, 3, 11, 12, 19, 20, 23, 25, 26, 28, 29, 32 |
| **Factor3:** | 1, 5, 6, 7, 13, 14 , 21, 22 |
| **Factor4:** | 8 , 9, 10, 15,24 |
| **Factor5:** | 4,17,31,37, 38 |

## Discussion

The present study was conducted to compensate for the lack of reliable and valid tool regarding the acceptance of E-learning in the country and psychometric analysis of E-learning acceptance. To measure the construct validity at the beginning of factor analysis, Kiaser-Meyer-Olkin index test was performed, which determine the adequacy of the sample size. This value varies between zero and one, and higher values enhance factor analysis; the minimum acceptable value in this regard is more than 0.6 (19). In the current research, the value was calculated to be 0.851.

In a study performed by Khoshrang,




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Dadgaran and Shayegan (2014) for designing a questionnaire to measure threats and opportunities of e-learning , the researchers eliminated seven phrases out of 54 primary items with scores less than 1.5, four items in the qualitative content assessment, and nine items with scores less than 0.62 from the Lawshe's table. As such, the number of the items reduced to 41. In the mentioned study, the mean content validity index (CVI) of the questionnaire was 0.9, while in the present study, CVR and CVI were determined to be 0.79 and 0.99, respectively. Moreover, the Kervit-Bartlett test for the evaluation of item combination adequacy in our research was 5389.516 and significant at P<0.001, which is acceptable (20).

Similar to the questionnaire of Lim, Hong and Tan (2008) (18), the instrument used in the present study consisted of five factors, which indicates a significant overlap between the factors in these studies (first factor: 63% component overlap in line with the named factor, second factor: 67% overlap in line with the named factor, third factor: 75% overlap in line with the named factor, fourth factor: 100% overlap in line with the named factor, fifth factor: 40% overlap in line with the named factor). It seems that the observed difference in the factors between these two studies is caused by the conditions of the current research, so that the researchers in the present study were obliged to distribute the questionnaire after the exam session of the students of virtual education. Since the students were engaged in virtual studies, we had limited access to them in the other situations. Clearly, under such circumstances, the fatigue and physiological states of the students at the exam session impacts on their response rate, thereby leading to different results.

It seems that the second cause of difference between the current research and the original study might be associated with the variations in the infrastructure of the E-learning system in Iran and Malaysia (e.g., access of learners to high-speed internet, presenting complete learning packages proportionate to the bandwidth and speed of the internet).

According to the results of the present study, the important determinant of E-learning acceptance was the characteristics of the educators. In this regard, Lee *et al*. (2009) also suggested this parameter to be a significant influential factor in the intention to accept E-learning.

With respect to the use of the internet by the users in the current research, our findings indicated that 35% of the users used the

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internet more than 20 hours per week. In another study in this regard, which was conducted on the students of various fields, average length of using the internet was estimated at 14.56 hours per week (22). Furthermore, in another research, approximately 40.5% of the students used the internet more than 10 hours per week (23), which is consistent with the results of the present study. Also, Karim *et al*. (2010) stated that learners are only interested in using the internet to search for educational contents and materials (24).

Many of the virtual students participating in the present research were married; evidently, their plenty of troubles does not allow their presence in the actual academic classes, which has been confirmed by the previous studies in this regard (25). The majority of our participants were aged 30-39 years and married, which reveals that in Iran, virtual education is mostly an alternative for the individuals who have delayed their academic studies.

## Conclusion

The instrument that has been psychometrically analyzed in the present study can be used as a valid tool for the acceptance of E-learning. This scale, which has been psychometrically studied for the first time in Iran, could be applied by all individuals in governmental and non-governmental universities and educational institutions in Iran. The slight difference in the number of the factors with the original version of the model in our research could be attributed to the cultural diversities in the cognitive patterns, dominating learning culture in the universities across the country and differences in the infrastructures.

One of the limitations of the study was the poor cooperation of the students in completing the questionnaires, which was managed by justifying the participants and elaborating on the research objectives. In the viewpoint of the researcher, considering that this model has been psychometrically analyzed for the first time in Iran, it could lay the groundwork for further investigations in this regard in Iran in order to keep up with the developed countries in the world.

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