



## Mobile Learning Application Evaluation Scale Development Study

Elif Babacan<sup>1</sup> Emine Senyuva<sup>2</sup> Emre Dunder<sup>3</sup> Nagihan Sim Aygul<sup>4</sup>

<sup>1,4</sup>Istanbul University Cerrahpasa, Institute of Graduate Studies, <sup>2</sup>Istanbul University Cerrahpasa Florence Nightingale Faculty of Nursing, <sup>3</sup>Ondokuz Mayıs University, Faculty of Science University, Turkey

Email : esenyuva@iuc.edu.tr

**Published:** January 2025



### Abstract

**Aim:** The study aimed to develop a valid and reliable tool that can be used in the multidimensional evaluation of a mobile learning application.

**Method:** The research is a methodological research type; it was carried out with 251 people who met the inclusion criteria and were determined by random sampling method. Data was collected with Mobile Learning Application Evaluation Scale Form. All the empirical applications were performed in R-Project software using Lavaan, SemPlot and Psych packages.

**Results:** In the study, Bartlett's Sphericity test result was significant

( $p < 0.05$ ). The KMO value is quite high ( $KMO > 0.9$ ). Two factors explain 72.3% of the total variance. According to the EFA conducted on 18 items, all factor loads are greater than 0.40, there is no cross-loading problem. The sociability values of the items are quite high ( $> 0.30$ ). Scale factors: It is named Instructional Features and Technical Features. AVE and CR values of each factor are satisfactory ( $CR > 0.70$ ,  $AVE > 0.50$ ). The Cronbach Alpha coefficients of the factors were very high (0.967 and 0.899) and all corrected item-total correlations were positive. In CFA, all items were significantly included in two factors ( $p < 0.05$ ). The standardized load values of the items included in the factors are all positive and greater than  $> 0.30$ .

**Conclusion and Suggestions:** It was determined that the Mobile Learning Practice Evaluation Scale is a valid and reliable tool for determining individuals' evaluations of mobile learning practices and is a reliable tool that can be used in nursing research.

### Keywords

Mobile learning, Mobile learning applications, Assessment scale, Nursing

### To cite this article :

Elif Babacan, Emine Senyuva, Emre Dunder, N. S. A. (2025). Mobile Learning Application Evaluation Scale Development Study. *International Journal of Health, Education & Social (IJHES)*, 8(1), 65–82.



## Introduction

We are currently witnessing remarkable advances and transformations in technology. In this environment of technological progress, mobile technologies play an important role as carefully designed and systematically implemented educational tools. Their widespread use ranges from education to healthcare (Senyuva, 2021; Corpman, 2013; Sener, 2013).

According to We are Social's 2022 data, more than 60% of the world's population (five billion people (<https://wearesocial.com/uk/blog/2022/01/digital-2022-another-year-of-bumper-growth-2/>, 06.08.2023) use mobile technologies as online or offline communication tools used for both personal and professional communication that allow individuals to create content and share this content (emotions, thoughts, opinions, photos and videos) effectively and in real time in various fields (Kemp, 2022; Corpman, 2013; Sener, 2013). These tools are tablets, laptops, palmtops, and smartphones that provide instant access to content regardless of location, are personal, informal, contextual, portable, ubiquitous, enable communication with other learners, and offer the shortest way to access information (Martin et al., 2013).

*Mobile learning* is a distance health education model in which learning is realized through these mobile tools (Gokcearslan et al., 2017; Demir & Akpınar, 2016; Martin et al., 2013). With mobile learning, individuals can access information online or offline at their convenience, enabling self-paced learning and efficient use of resources. This technology facilitates the broad dissemination of information to large audiences, significantly contributing to lifelong health learning. It has emerged as a crucial tool not only within formal education but also for informal learning. (Aydın, 2021; Levene & Seabury, 2015).

As the features of mobile devices used for mobile learning are developing and changing daily, mobile learning applications are differentiated over time; not only is content distributed through devices, but learning takes place in different times and contexts, and learning efficiency is at different levels. This situation is critical in terms of determining the limitations in the technical and content of the application by evaluating mobile learning, improving and increasing its effectiveness, preventing disadvantages such as technological, cost, and usability, evaluating the



accuracy and management of the application, and developing applications faster or producing new mobile education applications with more effective versions (Ozcan and Gudek, 2023; Demir & Akpınar 2016). In a study on usability evaluation of mobile applications (Google Maps, Google Apps) using ISO 9241 and ISO 25062 standards, it is emphasized that the applications have content and technical problems (Moumane et al., 2016). A study pertaining to the quality assessment of three mobile learning applications designed for English language instruction underscores the significance of an evaluation approach encompassing technical, pedagogical, economic, and socio-cultural dimensions (Willians Soad et al., 2018). Many healthcare companies/hospitals are investing in apps that will serve as patient education tools, including videos and touch-based teaching methods. In addition, in a study revealing the use of mobile applications in the education of medical students using exams and virtual flashcards, it is stated that a certification program was created using a set of standards to evaluate the quality of mobile medical applications in terms of interoperability, privacy, security, and content. However, the certification program results are not very positive (Hanrahan et al., 2014). Another study stated that there is wide heterogeneity in the criteria for evaluating the quality of mobile health applications and that it would be useful to develop a more complete evaluation tool to help improve existing tools (Nouri et al., 2018).

When the literature is examined, it is frequently found that there are studies on different mobile learning applications, the effects of mobile learning, and perceptions/attitudes toward mobile learning (Zhang et al., 2021; Uysal & Ulusinan, 2020; Bingol, 2016; McMillan et al., 2016; Hanrahan et al., 2014), studies on the evaluation of different mobile learning applications (Ercil Cagiltay & İnal, 2019; Nouri et al., 2018; Anstey & Watson, 2018; Capras & Bolboaca, 2016; Soad et al., 2016; Stoyanov et al., 2015; Sama et al., 2014). A limited number of studies (Terhorst et al., 2020; Arrasyid et al., 2020; Lin et al., 2016; Celik, 2013) were found on measurement tools that can be used to evaluate mobile health learning applications. This situation reveals the lack of a measurement tool to be used to standardize mobile learning applications, their technical and design competence, and their evaluation of educational content. In this regard, the research in which a



measurement tool for evaluating mobile learning applications is developed is important in terms of contributing to literature.

Obviously, these studies emphasize the use of mobile learning in various fields. However, they also emphasize the need for quality assessment of mobile health learning applications using more objective measurement tools. A quality mobile health app is expected to contribute to nursing research and nursing innovations.

### **Aim**

The study aimed to develop a valid and reliable tool that can be used in the multidimensional evaluation of a mobile learning application.

### **Research Question**

Is the Mobile Learning Application Evaluation Scale a valid and reliable tool that can be used to evaluate mobile learning applications?

### **Research Type**

Methodological research type.

### **Research Population and Sample**

The study population consisted of all individuals with mobile application experience in Turkey.

In the literature, it is stated that in the evaluation of the validity and reliability of an assessment tool, the sample group should be determined concerning the number of items administered and that it is appropriate to take at least 5 participants per item, or 10 or 15 participants if appropriate (Sahin et al., 2018). Accordingly, the sample size was calculated by taking the number of items/participant ratio 1/10. For the 18 items in the draft scale, the study sample was determined as at least 180 participants. The study was conducted with 251 participants who met the inclusion criteria and were selected by random sampling method.



The inclusion criteria are as follows:

- ✓ Voluntary participation in research
- ✓ Being between the ages of 18 and 65
- ✓ Using any mobile application for at least one year
- ✓ Not having any disability that would prevent communication

### **Data Collection**

Information Form and Mobile Learning Application Evaluation Scale (MLAES) were used as data collection tools.

**Information Form:** It was developed by researchers in line with literature (Unal 2022; Oral 2020; Sahin 2018). The form included a total of five questions to determine the descriptive characteristics of the participants (age, gender, education level, occupation) (four questions) and the duration of mobile device use (one question).

**Mobile Learning Application Evaluation Scale (Draft Form):** The draft scale was developed in two stages.

#### **1. Phase 1 - Creation of the item pool and development of the draft scale:**

In line with the literature, a draft item pool consisting of 37 items, including statements about the evaluation of the mobile health learning application, was created by the researchers (Zhang et al., 2021; Arrasyid et al., 2020; Terhorst et al., 2020; Ercil Cagiltay, 2019; Watson, 2018; Nouri et al., 2018; Şahin, 2018; Gokcearslan, 2017; Hwang et al., 2017; Capras, 2016; Lin et al., 2016; McMillan et al., 2016; Soad et al., 2016; Stoyanov et al., 2015).

The Davis technique was used to prepare the content validity index to determine whether the items in the draft scale met the characteristics to be measured. Davis (1992) technique grades the expert opinions as (a) "Appropriate," (b) "The item should be slightly revised," (c) "The item should be seriously revised," and (d) "The item is not appropriate." In this technique, the number of experts



who marked (a) and (b) options is divided by the total number of experts to obtain the "content validity index" for the item (Yurdugul, 2012). The draft scale prepared in this context was reviewed by eight experts regarding scope and comprehensibility (four faculty members of the Faculty of Computer and Information Sciences and four faculty members of the Faculty of Nursing).

In line with the experts' feedback, a total of seven items, including four items that were not considered consistent with the purpose of the scale and three items with similar expressions, were removed from the draft scale. The number of items in the item pool decreased to 25. Exploratory factor analysis was conducted on 25 items, and seven items with cross-loadings and low factor loadings ( $0.40 <$ ) were excluded from the analysis (Howard, 2016). The number of items in the draft scale was reduced to 18.

In order to evaluate the items in the 18-item draft scale in terms of scope and comprehensibility, a pilot study was conducted with 30 participants who met the inclusion criteria. In the pilot study, the total item correlation was found to be 0.30 and above, and Cronbach's Alpha coefficient was 0.981. After the analysis, no item was removed from the draft scale. The 18-item draft scale was made ready for application.

**Phase 1 - Testing the validity and reliability of the scale:** The finalized draft scale was applied to 251 participants who met the inclusion criteria and were randomly selected, and its content validity and reliability were evaluated. The scale was graded on a 5-point Likert scale [(5) Strongly agree, (4) Agree, (3) Undecided, (2) Disagree, and (1) Strongly disagree. The higher the score obtained from the scale, the more likely the mobile learning application had the technical and educational features a mobile health learning tool should have.



---

### **Ethical Aspects**

Ethics Committee permission was obtained from the Social and Humanities Research Ethics Committee of Istanbul University-Cerrahpasa (Date: 07.11.2022 Number: 288). Written permission was also obtained from the participants who participated in the study.

### **Data Collection**

The study data were collected between September 27 and November 2, 2022, through Google Docs online data collection application. Participants were reached through social media networks (Twitter, Instagram, Facebook, LinkedIn, WhatsApp groups). No time limit was set during data collection, and it took approximately 5-7 minutes to fill out the forms.

### **Data Analysis**

All empirical data were analyzed in R-Project software using Vaan (Rosseel, 2012), semPlot (Epskamp, 2015), and psychic packages (Revelle, 2018). Descriptive statistical analyses (number, percentage, mean, standard deviation) were used to analyze the data on descriptive characteristics. Whether the data were normally distributed was checked with conformity normality tests and kurtosis-skewness values. In order to determine the content and construct validity of the scale, the very set sample was initially divided into two equal sample sets ( $n_1=125$ ,  $n_2=126$ ). Exploratory factor analysis (EFA) was applied to the first sample set and used to create the subscales of the scale. Horn's parallel methods (Warne & Larsen, 2014) were used to extract the optimal number of factors of the scale. In the EFA phase, varimax rotation and principal component estimation were used. Composite reliability (CR), average variance extracted (AVE), and Cronbach's Alpha scores were obtained for each factor. The second sample set was used to confirm the construct validity of the scale through confirmatory factor analysis (CFA). Since the scale contains ordinal data due to the Likert rating, the appropriate DWLS estimator was used in CFA.



## RESULTS

The findings are discussed under two headings: the descriptive characteristics of the participants and the analysis of the validity and reliability of the Mobile Learning Application Evaluation Scale (MLAES).

### Participants' Descriptive Characteristics

Among the participants, 35.9% were between 26-40 years of age, with a mean age of  $33.9 \pm 10.7$  years. 70.5% were female, 64.1% had undergraduate degrees, 31.5% had postgraduate degrees, and 34.6% were healthcare professionals. Forty-three percent had been using mobile devices for ten years or less, and 23.9% for 11-15 years (mean  $13.7 \pm 5.8$  years) (Table 1).

**Table 1.** Participants' descriptive characteristics (n: 251)

|                          |                          | n          | %           | Mean      |
|--------------------------|--------------------------|------------|-------------|-----------|
| Age                      | <26                      | 80         | 31.9        | 33,9±10,7 |
|                          | <b>26-40</b>             | <b>90</b>  | <b>35.9</b> |           |
|                          | 40>                      | 81         | 32.2        |           |
| Gender                   | <b>Female</b>            | <b>177</b> | <b>70.5</b> |           |
|                          | Male                     | 74         | 29.5        |           |
| Education status         | Primary education        | 1          | 0.4         |           |
|                          | High School              | 10         | 4.0         |           |
|                          | <b>BA</b>                | <b>161</b> | <b>64.1</b> |           |
|                          | MA                       | 52         | 20.7        |           |
|                          | PhD                      | 27         | 10.8        |           |
| Mobile device usage time | <b>&lt;10</b>            | <b>108</b> | <b>43.0</b> | 13,7±5,8  |
|                          | 11-15                    | 60         | 23.9        |           |
|                          | 15>                      | 83         | 33.1        |           |
| Occupation               | Academic                 | 29         | 11,5        |           |
|                          | <b>Health Care Staff</b> | <b>87</b>  | <b>34,6</b> |           |
|                          | Student                  | 65         | 26          |           |
|                          | Teacher                  | 19         | 7,6         |           |
|                          | Others                   | 51         | 20,3        |           |



### Validity and Reliability Analysis of MLAES

**Table 2.** Sampling adequacy and sphericity test results

|                            |                             |
|----------------------------|-----------------------------|
| Bartlett's Sphericity Test | CHISQ=2487.687, $p < 0.001$ |
| KMO Statistic              | 0.923                       |

CHISQ: Chi-squared test statistic

In the first stage of EFA, the sampling adequacy of the data and the existence of relationships between items were examined (Table 2). Bartlett's Sphericity test result is significant ( $p < 0.05$ ). The KMO value is quite high ( $KMO > 0.9$ ) (Table 2).

**Table 3.** Results of eigenvalues and percentage of variance explained

| Factors | Eigenvalues | AD-Eigenvalues | PEV (%) | Cumulative PEV (%) |
|---------|-------------|----------------|---------|--------------------|
| 1       | 10.351      | 11.228         | 45.100  | 45.100             |
| 2       | 1.124       | 1.801          | 27.285  | 72.384             |

AD: Adjusted values; PEV: Percentage of explained variance

Two factors explain 72.3% of the total variance (Table 3).

**Table 4:** Factor loadings and common features of items based on EFA results

| Item | Factors              |                    | Communalities |
|------|----------------------|--------------------|---------------|
|      | Educational Features | Technical Features |               |
| q10  | <b>0.902</b>         | 0.203              | 0.856         |
| q15  | <b>0.890</b>         | 0.216              | 0.838         |
| q9   | <b>0.882</b>         | 0.212              | 0.823         |
| q11  | <b>0.853</b>         | 0.261              | 0.795         |
| q8   | <b>0.788</b>         | 0.322              | 0.724         |
| q12  | <b>0.784</b>         | 0.364              | 0.747         |
| q2   | <b>0.769</b>         | 0.408              | 0.758         |
| q16  | <b>0.745</b>         | 0.366              | 0.690         |
| q4   | <b>0.727</b>         | 0.355              | 0.654         |
| q1   | <b>0.726</b>         | 0.447              | 0.727         |
| q3   | <b>0.713</b>         | 0.373              | 0.648         |
| q18  | <b>0.698</b>         | 0.476              | 0.714         |
| q21  | 0.204                | <b>0.791</b>       | 0.668         |



|     |       |              |       |
|-----|-------|--------------|-------|
| q20 | 0.346 | <b>0.780</b> | 0.728 |
| q22 | 0.276 | <b>0.776</b> | 0.678 |
| q19 | 0.318 | <b>0.772</b> | 0.698 |
| q24 | 0.185 | <b>0.753</b> | 0.601 |
| q23 | 0.448 | <b>0.695</b> | 0.684 |

According to the EFA conducted on 18 items, all factor loadings are greater than 0.40, and no cross-loading problem exists. The sociability values of the items are quite high ( $>0.30$ ) (Table 4).

Scale factors were named Educational Features and Technical Features (Table 4).

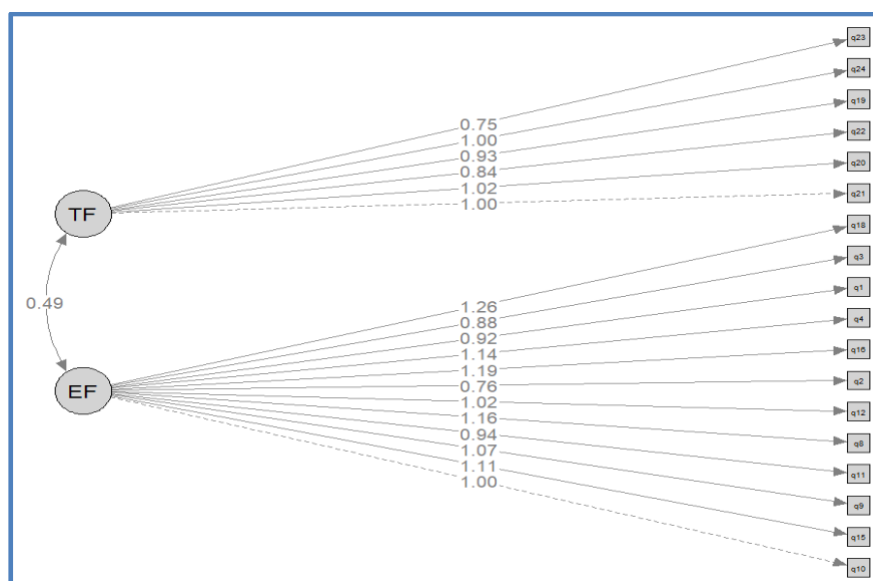
**Table 5:** Reliability and validity results of MLAES

| Factors              | Item | M     | SD    | Corrected correlation | Alpha if the item dropped | CR    | AVE   | Cronbach Alpha |
|----------------------|------|-------|-------|-----------------------|---------------------------|-------|-------|----------------|
| Educational Features | q10  | 4.232 | 0.853 | 0.900                 | 0.962                     | 0.943 | 0.632 | 0.967          |
|                      | q15  | 4.224 | 0.812 | 0.888                 | 0.962                     |       |       |                |
|                      | q9   | 4.256 | 0.860 | 0.883                 | 0.963                     |       |       |                |
|                      | q11  | 4.216 | 0.885 | 0.874                 | 0.963                     |       |       |                |
|                      | q8   | 4.064 | 0.998 | 0.827                 | 0.965                     |       |       |                |
|                      | q12  | 4.216 | 0.838 | 0.853                 | 0.963                     |       |       |                |
|                      | q2   | 4.176 | 0.741 | 0.876                 | 0.963                     |       |       |                |
|                      | q16  | 4.256 | 0.728 | 0.819                 | 0.964                     |       |       |                |
|                      | q4   | 4.080 | 0.819 | 0.796                 | 0.965                     |       |       |                |
|                      | q1   | 4.168 | 0.801 | 0.846                 | 0.964                     |       |       |                |
|                      | q3   | 4.224 | 0.717 | 0.800                 | 0.965                     |       |       |                |
|                      | q18  | 4.104 | 0.896 | 0.826                 | 0.964                     |       |       |                |
| Technical Features   | q21  | 3.456 | 1.335 | 0.749                 | 0.886                     | 0.891 | 0.596 | 0.899          |
|                      | q20  | 3.880 | 1.097 | 0.834                 | 0.874                     |       |       |                |
|                      | q22  | 3.864 | 0.962 | 0.794                 | 0.879                     |       |       |                |
|                      | q19  | 3.888 | 1.049 | 0.815                 | 0.878                     |       |       |                |
|                      | q24  | 3.736 | 1.165 | 0.718                 | 0.890                     |       |       |                |
|                      | q23  | 3.960 | 0.954 | 0.790                 | 0.880                     |       |       |                |

M: Mean, SD: Standard deviation, Alpha: Cronbach's Alpha, CR: Composite reliability, AVE: Average variance extracted

The AVE and CR values of each factor are satisfactory ( $CR > 0.70$ ,  $AVE > 0.50$ ) (Table 5).

The Cronbach's Alpha coefficients of the factors are very high (0.967 and 0.899), and the adjusted item-total correlations are all positive. There is a significant increase in Cronbach's Alpha coefficient if any item is excluded. Therefore, all items were included (Table 5).



**Figure1:** CFA graph

In CFA, all items were significantly included in two factors ( $p < 0.05$ ) (Figure 1).

**Table 6:** Standardized loadings of factors

| Factors              | Item | Standardized loading | p      |
|----------------------|------|----------------------|--------|
| Educational Features | q10  | 0.831                | <0.001 |
|                      | q15  | 0.833                | <0.001 |
|                      | q9   | 0.825                | <0.001 |
|                      | q11  | 0.778                | <0.001 |
|                      | q8   | 0.817                | <0.001 |
|                      | q12  | 0.750                | <0.001 |
|                      | q2   | 0.674                | <0.001 |
|                      | q16  | 0.880                | <0.001 |
|                      | q4   | 0.821                | <0.001 |
|                      | q1   | 0.755                | <0.001 |
|                      | q3   | 0.709                | <0.001 |
|                      | q18  | 0.793                | <0.001 |
| Technical Features   | q21  | 0.663                | <0.001 |
|                      | q20  | 0.878                | <0.001 |
|                      | q22  | 0.747                | <0.001 |
|                      | q19  | 0.849                | <0.001 |
|                      | q24  | 0.788                | <0.001 |



q23

0.759

&lt;0.001

All standardized loading values of the items in the factors are positive and >0.30 (Table 6).

**Table 7:** Goodness of fit indices

| CHISQ  | DF  | GFI   | CFI | AGFI  | TLI | NNFI | RMSEA | SRMR  |
|--------|-----|-------|-----|-------|-----|------|-------|-------|
| 62.523 | 134 | 0.983 | 1   | 0.979 | 1   | 1    | 0.000 | 0.082 |

CHISQ: Chi-squared test statistic

MLAES incremental fit indices are CFI=1, AGFI=0.979, TLI=1, NNFI=1, all greater than 0.9. Error indices RMSEA = 0.000, SRMR = 0.082, <0.10. The ratio CHISQ/df=0.466 is <2 (Table 7).

## DISCUSSION

The evaluation of mobile applications by users, which are increasing in number worldwide, is important for the faster development of applications or the production and updating of new mobile health learning applications with more effective versions. Therefore, this study aims to develop an MLAES that can be used to evaluate the suitability of a mobile learning application in terms of educational and technical features. The findings are discussed in line with the literature.

Bartlett's test results;  $\chi^2(153) = 2487.687$   $p < 0.001$  and the KMO value was found to be quite high (KMO>0.9) (Table 2). It is also stated in the literature that Bartlett's Sphericity test result is considered sufficient if it is between 0.8 and 1 (Shrestha, 2021). This result shows that the correlational structure of the MLAES is significant, and the sample size is sufficient.

The two factors explain 72.3% of the total variance (Table 3). This result shows that item loadings are appropriate for variance adequacy.

All MLAES factor loadings are greater than 0.40, and no cross-loading problem exists (Table 4). This result shows that the sociability values of the items are quite high (>0.30)

A Cronbach's alpha coefficient of 0.7 and above is acceptable, and the result indicates high reliability (Shrestha, 2021; Xie et al., 2022). Cronbach's alpha coefficients of the two factors of the MLAES are very high, and the adjusted item-total correlations are all positive. The AVE and CR values of each factor are satisfactory (CR>0.70, AVE>0.50). The Cronbach Alpha coefficient of the Educational Features factor is quite high (0.967), and all of the adjusted item-total correlations



are positive. The standardized loadings of the educational factor are  $>0.6$  and  $p<0.001$  (Table 5). As a result of the standardized factor loadings test for item discriminant validity, it was observed that the scale items provided discriminant validity ( $p<.001$ ). The Cronbach's Alpha coefficient (0.899) and the corrected item-total correlations of the second factor, the item subcategory where users evaluate Technical Features, are all positive. Its standardized loadings are  $>0.6$  and  $p<0.001$  (Table 5). This result shows that the scale has composite reliability and discriminant validity; in other words, the scale is highly reliable.

All standardized loadings of the items in the MLAES factors are positive and  $>0.30$ . In CFA, all items were significantly included in two factors ( $p<0.05$ ) (Figure 1) (Table 6).

MLAES incremental fit indices are greater than 0.9, and error indices are  $<0.10$ . The CHISQ/df ratio is  $<2$  (Table 7). This result shows that MLAES has a good fit.

### CONCLUSION and RECOMMENDATION

MLAES can be said to be distinctive in terms of evaluating the educational and technical features of a mobile learning application. Based on the analysis results, this scale, which proved to be valid and reliable, can be used in applications with educational content and in the evaluation of mobile applications prepared in the health field and nursing research.



## References

1. Anstey, L., and Watson G. (2018). *A Rubric for Evaluating e-Learning Tools in Higher Education*. Retrieved from <https://er.educause.edu/articles/2018/9/a-rubric-for-evaluating-e-learning-tools-in-higher-education> , on 07.02.2022.
2. Arrasyid, R., Ruhimat, M., Abdullah, C.U., Suwandi A., Darsiharjo, Raka, H. (2020). Design, Development, And Evaluation of a Mobile Learning Application for Tourism Education. *Journal of Engineering Science and Technology*. Vol. 15, No. 6 (2020) 3859 – 3875.
3. Aydin, D. (2021). The effectiveness of gamification components in mobile learning environments (Unpublished doctoral dissertation). Istanbul University, Institute of Science, Informatics Program.
4. Bingol, A. (2016). The state of mobile learning systems in universities offering distance education in Turkey. In *Proceedings of the 10th International Symposium on Computer and Instructional Technologies* (pp. 726–733).
5. Buyukozturk, S., Akgun, E.O., Karadeniz, S., Demirel, F., Kılıç Çakmak, K.C. (2023). Scientific research methods in education. Pegem Publishing. ISBN 978-9944-919-28-9, pp. 129–136.
6. Corpman, DW. (2013). Mobile health in China: a review of research and programs in medical care, health education, and public health. *J Health Commun*, 18(11):1345-67).
7. Capras R. D., Bolboaca S. D. (2016). An evaluation of free medical applications for android smartphones. *Applied Medical Informatics*. Vol. 38, No. 3-4, pp: 117-132.
8. Celik, A. (2013). M-learning attitude scale: Validity and reliability analysis. *Journal of Educational and Instructional Studies in the World*, 2(4), Article 20. ISSN: 2146-9199.
9. Demir, K., Akpınar, E. (2016). Development of the mobile learning attitude scale. *Education Technology Theory and Practice*, 6(1). Retrieved from <https://dergipark.org.tr/en/download/article-file/271655> on 02.09.2022.
10. Ercil Cagiltay, N., Inal, Y. (2019). User evaluation of the E-Nabiz mobile health application. *Hacettepe Journal of Health Administration*, 22(2), 375–388.
11. Gokcearslan, S., Solmaz, V., Kukul, V. (2017). Readiness for mobile learning scale: An adaptation study. *Education Technology Theory and Practice*, 7(1). Retrieved from <https://dergipark.org.tr/en/download/article-file/274811> on 02.09.2022.
12. Gokdemir, F., Yılmaz, T. (2023). The processes of using, modifying, adapting, and developing Likert-type scales. *Journal of Nursology*, 26(2), 148–160. <https://doi.org/10.5152/JANHS.2023.22260>



13. Hair, J., Hult G.T.M., Ringle, C., Sarstedt, M. (2014). A primer on partial least squares structural equation modeling (PLS-SEM), *Sage Publications*, Los Angeles.
14. Hanrahan, C., Aungst T., Cole S. (2014). Evaluating mobile medical application. *American Society of Health-System Pharmacists*. Inc. All rights reserved.
15. Howard, M. C. (2016). A review of exploratory factor analysis decisions and overview of current practices: What we are doing and how can we improve? *International Journal of Human-Computer Interaction*. 32(1), 51-62.
16. Hwang, H.L., Kuo, M. L., Tu, C. T. (2017). Health education and competency scale: development and testing. *Journal of Clinical Nursing*. 27(7), <https://doi.org/10.1111/jocn.14116>
17. Kemp S. (2022). Digital 2022: *Global Overview Report* <https://datareportal.com/reports/digital-2022-global-overview-report>
18. Levene J. and Seabury H. (2015). Evaluation of mobile learning: current research and implications for instructional designers. *TechTrends* V:59 N:6 P:46-52
19. Lin, H. H., Lin, S., Yeh, C. H., Wang S. Y. (2016). Measuring mobile learning readiness: scale development and validation. *Emerald internet research* Vol. 26 No. 1, 265-287.
20. Martin, C., Flood, D., Harrison R. (2013). *Oxford Brookes University, United Kingdom A Protocol for evaluating mobile applications*. Retrieved from <https://www.semanticscholar.org/paper/A-protocol-for-evaluating-mobile-applications-Martin-Flood/e678f754e62453ab6431adc01187f8b6de581b9d> on 10.02.2022
21. McKim C. (2022). Using the literature to create a scale: an innovative qualitative methodological piece. *Int J Soc Res Methodol*, P:348.
22. McMillan, B., Hickey, E., Patel, M.G. (2016). Quality assessment of a sample of mobile app-based health behavior change interventions using a tool based on the National Institute of Health and Care Excellence behavior change guidance. *Patient Education and Counseling*. 99 (3). pp. 429-435. ISSN 0738-3991
23. Moumane, K., Idri A., Abran A. (2016). Usability evaluation of mobile applications using ISO 9241 and ISO 25062 standards. *SpringerPlus* (2016) 5:548. <https://doi.org/10.1186/s40064-016-2171-z>
24. Nouri, R., Niakan Kalhori SR., N., Marjan Ghazisaeedi M., Marchand G., Mobin Yasini M. (2018). Criteria for assessing the quality of mHealth apps: a systematic review. *Journal of the American Medical Informatics Association*. 25(8), 1089–1098.
25. Oral, B., Coban, A. (2020). Scientific research methods in education: From theory to practice (1st ed.). Pegem Publishing. ISBN 978-625-7880-17-6. <https://doi.org/10.14527/9786257880176>. (Chapter 4, pp. 79–91)



26. Ozcan, S. M., Gudek, B. (2023). A study on mobile applications for voice education. *International Social Mentality and Researcher Thinkers Journal*, 9(68), 2887–2897. <https://doi.org/10.29228/smryj.67697>
27. Revelle, W. (2018). Procedures for Personality and Psychological Research, Northwestern University, Evanston, Illinois, USA, project.org/package=psych Version = 1.8.12.
28. Sama, P. R., Eapen, Z.J., Weinfurt, K. P., Shah B.R. (2014). An evaluation of mobile health application tools. *JMIR mhealth and uhealth* 2(2): e19 [doi:10.2196/mhealth.3088](https://doi.org/10.2196/mhealth.3088)
29. Shrestha N. (2021). Factor analysis as a tool for survey analysis. *American Journal of Applied Mathematics and Statistics*. 2021, 9(1), 4-11. DOI: 10.12691/ajams-9-1-2 Retrieved from <http://pubs.sciepub.com/ajams/9/1/2> on 01.08.2023
30. Soad, G. W., Duarte Filho, N. F., Barbosa, E. F. (2016). Quality evaluation of mobile learning applications. *Conference: 2016 IEEE Frontiers in Education Conference (FIE)*. DOI:[10.1109/FIE.2016.7757540](https://doi.org/10.1109/FIE.2016.7757540)
31. Stoyanov S. R., Hides, L., Kavanagh, D. J., Zelenko O., Tjondronegoro D., Mani M. (2015). Mobile app rating scale: a new tool for assessing the quality of health mobile apps. *JMIR mHealth uHealth*, 3(1): e27) DOI: [10.2196/mhealth.3422](https://doi.org/10.2196/mhealth.3422)
32. Sahin, M. G., Boztunc Ozturk, N. (2018). The process of scale development in education: A content analysis study. *Kastamonu University Journal of Education*, 26(1), January.
33. Sahin, S. Y., Dal, U., Vural, G. (2014). Expectations of burn patients from nurses. *TAF Preventive Medicine Bulletin*, 13(1).
34. Sener, E., Samur, M. (2013). Social media as a health-promoting factor: Health on Facebook. *Gumushane University Journal of Health Sciences*, 2(4), 508–523.
35. Senyuva, E. (2021). The use of information technologies in health education: Strengths and weaknesses. *Turkiye Klinikleri Journal of Nursing Sciences*, 13(4), 994–1004. DOI:[10.5336/nurses.2021-83083](https://doi.org/10.5336/nurses.2021-83083)
36. Terhorst Y, Philippi P, Sander LB, Schultchen D, Paganini S, Bardus M, et al. (2020). *Validation of the Mobile Application Rating Scale (MARS)*. PLoS ONE 15(11): e0241480. Retrieved from <https://doi.org/10.1371/journal.pone.0241480> on 02.10.2022
37. Uysal, B., Ulusinan, E. (2020). Examination of current digital health applications. *Selcuk Health Journal*, 1, 46–60.
38. Unal, N., Tosun, B. (2022). Examination of the relationship between nursing students' mobile learning readiness and individual innovativeness levels. *Journal of Health and Nursing Management*, 9(2), 250–260.



- 
39. Warne, R. T., and Larsen, R. (2014). Evaluating a proposed modification of the Guttman rule for determining the number of factors in an exploratory factor analysis. *Psychological Test and Assessment Modeling*, 56(1), 104.
40. We are Social (2022). Retrieved from <https://wearesocial.com/uk/blog/2022/01/digital-2022-another-year-of-bumper-growth-2/> on 06.08.2023.
41. Willians, Soad G., Duarte Filho N.F., Barbosa E. F. (2018). Quality Evaluation of Mobile Learning Applications. Retrieved from <https://www.researchgate.net/publication/311313572> on 06.08.2023
42. Zhang Q., Huang, W., Dai, W., Tian, H., Tang, O., Wang, S. (2021). Development and clinical uses of a mobile application for smart wound nursing management. *Adv Skin Wound Care* 2021; 34:1–6. DOI:[10.1097/01.ASW.0000749492.17742.4e](https://doi.org/10.1097/01.ASW.0000749492.17742.4e)



International Journal of Health, Education and Social (IJHES)



### MOBILE LEARNING APPLICATION EVALUATION SCALE

|                                                                                                                     | Strongly Agree | Agree | Undecided | Disagree | Strongly Disagree |
|---------------------------------------------------------------------------------------------------------------------|----------------|-------|-----------|----------|-------------------|
| <b>EDUCATIONAL CHARACTERISTICS</b>                                                                                  |                |       |           |          |                   |
| 1. Training objectives meet learning needs.                                                                         |                |       |           |          |                   |
| 2. Training content meets the learning needs.                                                                       |                |       |           |          |                   |
| 3. Training content is clear and understandable.                                                                    |                |       |           |          |                   |
| 4. Training content is scientifically adequate (comprehensive, up-to-date, provable)                                |                |       |           |          |                   |
| 5. Evaluation questions related to training content support learning                                                |                |       |           |          |                   |
| 6. Pictures facilitate learning of the training content.                                                            |                |       |           |          |                   |
| 7. Figures/graphics support the clarity of the training content.                                                    |                |       |           |          |                   |
| 8. Animations/videos facilitate learning of training content.                                                       |                |       |           |          |                   |
| 9. Pictures, shapes/graphics, animations/videos are interesting.                                                    |                |       |           |          |                   |
| 10. Colors used in fonts and background multimedia elements (images, graphics, shapes, animations) are appropriate. |                |       |           |          |                   |
| 11. Commands/direction signs are easy to use                                                                        |                |       |           |          |                   |
| 12. Reminders ensure continuity of learning.                                                                        |                |       |           |          |                   |
| <b>TECHNICAL CHARACTERISTICS</b>                                                                                    |                |       |           |          |                   |
| 13. There is communication and interaction between the user and the trainer.                                        |                |       |           |          |                   |
| 14. Feedback is given to the user (monitoring their progress, evaluating their knowledge, participation status)     |                |       |           |          |                   |
| 15. It can be used without being connected to the internet.                                                         |                |       |           |          |                   |



## The International Journal of Health, Education and Social (IJHES)

|                                                           |  |  |  |  |  |
|-----------------------------------------------------------|--|--|--|--|--|
| 16. Confidentiality of personal information is ensured.   |  |  |  |  |  |
| 17. Content and activity data are recorded.               |  |  |  |  |  |
| 18. Technical support is provided in case of any problem. |  |  |  |  |  |



International Journal of Health, Education and Social (IJHES)