Original Article

Current status of mobile learning indicators in Universities of Medical Sciences

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Abstract

Background: The speed of advance in medical education, creativity in technology, limit time for new work has created new vision in medical education. Considering the importance of developing Iran's global position in the scientific and technological in Southwest Asia and the importance of improving the quality of learning and education, the present study identifies and examines the current status of mobile learning indicators in medical sciences universities.

Methods: This study was applied in terms of purpose, descriptive-correlation in nature and survey method. The statistical population of the study consists of specialists from different medical groups. Based on Morgan's table, the sample size was estimated to be 200 people who were selected by simple random. Mobile learning components were extracted using text analysis and interviews with experts. In order to comply with the principle of validity in the questionnaire, in addition to the opinions of supervisors and advisors, the validity of factor analysis has been used. Cronbach's alpha coefficient was estimated above 0.7, so the reliability of the questionnaire was confirmed. For data analysis, exploratory factor analysis and univariate analysis were used in Spss23 software.

Results: Four factors (infrastructure, organizational planning, tools and equipment, human resources) and 16 indicators explain about 79.9% of mobile learning variance. Also, according to the obtained results, there were significant differences between the current and desired conditions based on the values (sig<0.05) in all components.

Conclusion: Designers of mobile learning tools should maximize the efficiency of this tool while paying attention to users' preferences.

Keywords: Cell Phone; Equipment and Supplies; Organizations; Organization and Administration; Workforce; Universities.

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Introduction

Defining mobile learning can emphasize those unique attributes that position it within informal learning, rather than formal. These attributes place much mobile learning at odds with formal learning (with its cohorts,

courses, semesters, assessments, and campuses) and with its monitoring and evaluation regimes.

Success in global competition is only possible through increasing the quality of various products or services. The 21st century is a change from an industrial society to an information society. In this regard, the basic concepts of life are changing from the concept of work to the concept of education (1). Quality improvement in universities and learning and education has always been among the crucial issues. Utilizing technology to support teaching and learning activities can be effective to achieve this goal. Students cannot be educated on a particular subject or get answers to their questions whenever they need (2). The diversity of some disciplines and the need for interaction with them in related studies to achieve the goals of scientific development and such capability to present the educational content in some of the disciplines in the form of a classroom provide the conditions to achieve this goal (3). Access to study resources is needed by students and study groups at a low level. The existing educational methods do not provide students with the information they need quickly. They are not flexible for the different conditions of the students and cannot motivate them sufficiently (4).

Recently, higher education has undergone extensive changes due to technological advances. Following the increased use of modern communication technologies, traditional teaching methods using these technologies have introduced the concept of e-Learning. Mobile learning uses modern methods such as texting and advanced messaging services (capable to send simple animation and sound) and gap. Limited studies have been conducted on the advantages of mobile learning in Iran. The results of the quasi-experimental study conducted to investigate the effect of the mobile phone learning method on the learning rate of agricultural students and comparing it with the lecture-based learning method in Kermanshah province showed that mobile phone learning has a greater effect on the learning rate than lecture-based learning method. Despite the many advantages of mobile learning, it is facing challenges in Iran, including the lack of sufficient experts in the field of designing educational programs, especially for mobile tools, the lack of awareness of the benefits of this type of learning, and the negative attitude of organizations towards this learning (5). All upstream documents, like the 20-year vision, the sixth five-year plan, and the comprehensive scientific map of the country emphasize the development of Iran's global position in the economic, scientific, and technological sectors and achieving the first economic, scientific, and technological position in the Southwest Asian region. Thus, given the significance of the subject, this article identifies and examines the current status of mobile learning indicators in universities of medical sciences.

Methods

Study design: This study was an applied descriptive-correlational. The statistical population of the study consists of faculty members and experts in medical sciences. The present research was a mixed type in in two qualitative and quantitative phases. The qualitative phase included a literature review and interviews with experts. In the quantitative phase, the current status was determined by analyzing the researcher-made questionnaire and factor analysis.

Sampling: Based on Morgan's table, the sample size was estimated at 200 professors of different fields of medical sciences at the Iran University of Medical Sciences. They were selected based on the random quota sampling method.

Data Extraction: In the literature review section, the dimensions and components related to mobile learning were extracted after determining related articles and reviewing them. First, a systematic review

was done by searching the ELSEVIER, EMERALD, SPRING, GOOGLE and SCHOLAR PUBMED, SCOPUS, SID, SCIENCE DIRECT databases, Iran Information Science and Technology Research Institute, Academic Jahad Scientific Information Database, Noor Specialized Journals Database, Publications Database of Iran to find related articles and studies from 2010 to 2020 (2010-2020).

The components of mobile learning were extracted from the analysis of the texts. In the second stage, with semi-structured interviews with professors and experts in medical education, the characteristics and components of mobile learning were explained. By combining text analysis with these components, a questionnaire containing the dimensions and components of mobile learning was developed. Its validity and reliability were also examined. To observe the principle of validity in the questionnaire, in addition to the opinions of supervisors and advisors, the validity of factor analysis was used. Cronbach's alpha test was used to examine the reliability of the research tool in the quantitative phase. In other words, it is first implemented on a small statistical sample and if it has appropriate reliability, it would be used on the target statistical sample of the study. Cronbach's alpha coefficient was estimated above 0.7.

Statistical methods: Exploratory factor analysis and univariate t-test were used in Spss-23 software to analyze the data.

Results

Based on the results, 57% of samples were female and 43% were male. 36.5% samples were in the age group of 35-40 years. 66% were assistant professors and only 6% were professors. Table 1.

Table 1. Demographic information of the participants

Variable		N.	%
Gender	Male	86	43%
	Female	114	57%
Job group	The coach	28	14%
	Assistant Professor	131	66%
	Associate Professor	28	14%
	Professor	31	6%
Type of employment	Official	115	57.5%
	Contractual	55	27.5%
	Tuition	30	15%
Age	35-40years	73	36.5%
	41-45years	44	22%
	46-50years	37	18.5%
	51-55years	33	16.5%
	>55yaears	13	6.5%
Education group	Medical	98	49%
	Paramedical	54	27%
	Humanities	48	24%

Table 2 shows these 4 factors explain about 79.898% of the total variance of the questions (items), indicating the appropriate structure for the total of the questions. Also, the conceptual model, the primary part of which was extracted by interviewing experts, has reached saturation and frequent factors were extracted as components. The scree plot in Figure 1 shows the number of extracted significant factors, which have an eigenvalue above one.

Table 2. Total explained variance

Components	eigenvalues			sum of squared loads before rotation			sum of squared loads after rotation		
	Total	Percentage of variance	Cumulative percentage	Total	Percentage of variance	Cumulative percentage	Total	Percentage of variance	Cumulative percentage
1	18.009	50.025	50.025	18.009	50.025	50.025	6.461	17.948	17.948
2	2.498	6.938	56.963	2.498	6.938	56.963	5.824	16.178	34.126
3	2.140	5.944	62.907	2.140	5.944	62.907	5.560	15.445	49.571
4	1.643	4.563	67.470	1.643	4.563	67.470	3.718	10.327	79.898

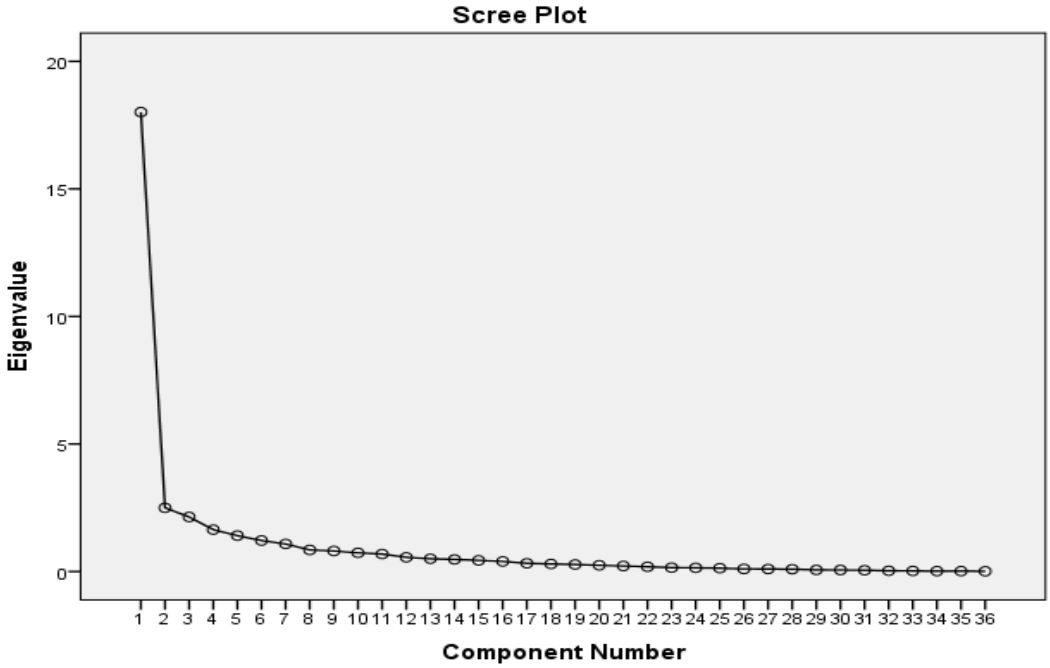

Figure 1: Scree plot

As seen, the first 4 factors have an eigenvalue above one, which is extracted as significant factors. In the continuation of the exploratory factor analysis, the results of the factor analysis for these components and the factor load coefficients of each of the components are given in Table 3. It shows the matrix of factor loads after rotating the factors using the Varimax method.

In Table 3, factor loads above 0.53 are considered strong. the first 16 indicators were placed together in one factor (the first 7 indicators on the first factor had a factor load above 0.53, and 9 indicators had a factor load less than 0.53) and they were removed. These indicators measure the infrastructure factor of mobile learning in medical sciences. Also, planning and organization indicators were listed in the second factor. Its nine factors were above 0.53, and the tools and equipment indicators were listed in the third factor. They had 4 indicators above 0.53. The indicators of human resource capability and motivation were listed in the fourth factor and 2 indicators were above 0.53.

According to the results of Table 4 and the sig>0.05, it can be concluded that all the variables are statistically normal.

Based on the results of Table 5, the existing and desired statuses are statistically significant according to the sig<0.05 in all components.

Discussion

Aim of this study was examines the current status of mobile learning indicators in medical sciences universities. The results showed that 4 factors explain about 79.9% of the variance of the total questions (items). It indicates the proper structure for all the items. Also, the conceptual model, the primary part of which was extracted by interviewing experts, reached saturation, and frequent factors were extracted as components. The first 4 factors had an eigenvalue above one and were extracted as significant factors and factor loads higher than 0.53 were considered strong. The first 16 indicators were placed together in one factor (the first 7 indicators on the first factor had a factor load above 0.53, and 9 indicators had a factor load less than 0.53) and they were removed.

Table 3. Matrix of components after varimax rotation

Components	Dimensions			
	Infrastructure 1	Organizational planning 2	Tools and equipment 3	Human resources 4
Internet network upgrading	0.827			
Software support	0.788			
Systematic coordination	0.785			
lunching Web site	0.720			
Providing bandwidth	0.601			0.552
Providing credits	0.600			
Training skills	0.555	0.450		
Preparation of all kinds of software	0.550		0.444	0.376
Empowerment	0.543			0.531
Provision of necessary facilities	0.540		0.373	0.429
Technology equipment	0.533		0.391	
Training courses	0.466		0.437	
financial facilities		0.888		
Response centers		0.751		
Technology Council		0.736		
Evaluation of students		0.667		0.382
Student services		0.606	0.510	
Notification		0.582	0.513	
Scientific rules		0.556	0.386	
Curriculum		0.551		
Scientific development	0.378	0.548	0.443	
Reducing educational costs			0.802	
Reducing educational challenges	0.383		0.768	
Educational opportunity			0.707	
Time flexibility			0.704	
Student oriented		0.366	0.522	
Extension of learning			0.518	
Providing electronic books				0.791
Learning to work with tools	0.515			0.622
Preparation of all kinds of software			0.521	0.555
Educational experience		0.500		0.532
Specialist supply				
Educational encouragement				
Incentive rules		0.467		
Internet card donation organizing a conference	0.425		0.528	

These indicators measure the infrastructure factor of mobile learning in medical sciences. Also, planning and organization indicators were listed in the second factor. Its nine factors were above 0.53, and the tools and equipment indicators were listed in the third factor. They had 4 indicators above 0.53. The indicators of human resource capability and motivation were listed in the fourth factor and 2 indicators were above 0.53. According to the above results and the sig>0.05, it can be concluded that all the variables are statistically normal.

Financial facilities, provision of e-books, educational opportunity and time flexibility were the main effective factors compared to others in learning indicators.

Table 4. Kolmogorov-Smirnov test of data normality

Row	Infrastructure	Human resources	Organizational planning	Equipment
Absolute	0.030	0.050	0.050	0.030
Positive	0.020	0.020	0.010	0.010
Negative	-0.030	-0.050	-0.050	-0.030
Kolmogorov-Simonov Z	0.212	0.354	0.354	0.212
Sig	1.000	1.000	1.000	1.000

Table 5. T-test comparing the mean current and desired statuses of mobile learning components in universities of medical sciences

Row	Leven's test		t	df	Sig	Mean difference	Standard error difference	95% Confidence factor Lower bound	Upper bound
	F	Sig							
Bandwidth provision	4.165	0.042	16.839	398	0.000	4.05500	0.24081	4.52843	3.58157
Launching the site	4.243	0.040	16.149	398	0.000	3.86000	0.23902	4.32990	3.39010
Systematic coordination	10.671	0.001	18.226	398	0.000	4.03500	0.22139	4.47023	3.59977
Internet network upgrade	0.716	0.398	19.860	398	0.000	4.45000	0.22407	4.89050	4.00950
Software support	0.178	0.673	22.414	393	0.000	4.52751	0.20199	4.92463	4.13039
Providing credits	4.382	0.037	20.522	398	0.000	4.25500	0.20734	4.66262	3.84738
Technology equipment	0.267	0.606	24.942	398	0.000	4.73000	0.18964	5.10282	4.35718
Learning to work with tools	17.512	0.000	21.112	398	0.000	4.30500	0.20391	4.70588	3.90412
Empowerment	19.694	0.000	21.757	394	0.000	4.34204	0.19957	4.73440	3.94968
Educational courses	12.297	0.001	25.232	398	0.000	4.93500	0.19558	5.31951	4.55049
organizing a conference	3.096	0.079	20.509	398	0.000	4.52000	0.22039	4.95328	4.08672
Training skills	1.718	0.191	23.507	398	0.000	4.70000	0.19994	5.09306	4.30694
Specialist supply	0.073	0.788	24.752	398	0.000	4.85000	0.19595	5.23522	4.46478
Internet card donation	13.369	0.000	28.323	398	0.000	5.47500	0.19331	5.85503	5.09497
Incentive rules	5.243	0.023	28.801	398	0.000	5.72000	0.19861	6.11045	5.32955
Educational encouragement	13.695	0.000	29.234	398	0.000	5.44500	0.18625	5.81116	5.07884
Student oriented	0.789	0.375	32.112	398	0.000	5.51500	0.17174	5.85264	5.17736
Extension of learning	0.875	0.350	29.619	398	0.000	5.57000	0.18805	5.93970	5.20030
Scientific rules	.000	0.983	27.228	398	0.000	5.37500	0.19741	5.76309	4.98691
Curriculum	17.208	0.000	28.280	398	0.000	5.41000	0.19130	5.78609	5.03391
Notification	7.975	0.005	25.651	398	0.000	4.79500	0.18693	5.16249	4.42751
Evaluation of students	2.270	0.133	27.423	398	0.000	5.33500	0.19455	5.71747	4.95253
financial facilities	1.045	0.307	32.398	398	0.000	6.28500	0.19399	6.66638	5.90362
Student services	0.617	0.433	34.970	394	0.000	5.68487	0.16257	6.00448	5.36527
Response centers	0.762	0.383	29.476	398	0.000	5.59500	0.18982	5.96817	5.22183
Technology Council	1.652	0.199	25.666	395	0.000	5.43226	0.21165	5.84836	5.01616
Scientific development	3.947	0.048	26.725	393	0.000	5.00854	0.18741	5.37699	4.64008
Educational experience	26.480	0.000	30.984	398	0.000	5.32000	0.17170	5.65755	4.98245
Educational opportunity	23.301	0.000	26.165	398	0.000	5.39000	0.20600	5.79498	4.98502
Reducing educational costs	6.917	0.009	22.330	398	0.000	4.58500	0.20533	4.98866	4.18134
Time flexibility	41.327	0.000	21.390	398	0.000	4.33500	0.20267	4.73343	3.93657
Reducing educational challenges	21.918	0.000	22.111	398	0.000	4.51000	0.20397	4.91100	4.10900
Provision of necessary facilities	13.283	0.000	33.520	398	0.000	5.79000	0.17273	6.12958	5.45042
Preparation of all kinds of software	13.605	0.000	29.976	398	0.000	5.23000	0.17447	5.57300	4.88700
Providing electronic books	0.513	0.474	30.634	398	0.000	5.67000	0.18509	6.03387	5.30613
Preparation of all kinds of software	1.039	0.309	28.585	398	0.000	5.18500	0.18139	5.54160	4.82840

The study conducted in The study by Mcconathaet al., at the American University reported that mobile learning is a complementary method for students and confirmed its effectiveness (7). According to Motiwalla, although studies confirmed the effectiveness of mobile learning, different educational institutions have organizational cultures (values, procedures, standards, and expectations), organizational resources (financial, human, physical, and specialized), and different social conditions. Each field in each educational institution has special conditions and special needs (8). A study examined the effect of the mobile self-regulated learning approach on the learning achievements and self-regulated learning skills of the students. The results indicated a significant effect of the mobile self-

regulated learning approach on the learning achievements and self-regulated learning skills of the students (9). The study by Naimi et al., regarding the use of internet learning showed that students have a positive attitude towards the use of internet learning, and the variables of personal computer knowledge and gender have an effect on students' attitudes. They also showed no significant difference between the variables of the field of study and the location of access to the Internet by students. They also found that the more the students use the Internet to do educational and research work or communicate the more favorable their attitude toward Internet learning will be. Also, the employees will have a positive attitude toward mobile learning. The variables of people's age, employment history, and organizational position significantly affect their attitude toward mobile learning. However, there was no significant relationship between people's attitudes toward mobile learning and income and literacy level. Therefore, by implementing the mobile learning method, many opportunities can be provided to expand agricultural education in villages and guide move rural communities toward mobile learning (10).

These results are consistent with the results of the present study. A study by Morshidi et al., examined the attitude of agricultural promotion and education students toward mobile learning. They concluded that their target population had the basic requirements for creating an educational system based on mobile learning. They found that the students who are familiar with the tools needed for mobile learning use these tools more. However, learners who are not familiar with the principles of mobile learning use these tools less for learning. Since the students have primary readiness for mobile learning, this method can be used (11). In a study by Khosravi et al., entitled "Investigating the Effective Factors on Mobile Learning in Medical Education Based on FRAME Model", the results showed that learners prefer their mobile phones to be of the flat touch screen type and have a memory of more than 3 GB with High processing speed and medium size. Based on the results, he concluded that designers of mobile learning tools should pay attention to the preferences of users in designing tools and produce tools that maximize the efficiency of these tools (12).

Mobile learning focuses on the mobility of the learner and the learner can participate in educational activities anytime and anywhere. The results of our study showed that the possibility of creating mobile educational methods can play a role in increasing interest and focus on learning more than other factors.Thus, this type of learning takes place in any situation using the training opportunities that can be provided by mobile technologies such as personal digital power, mobile phones, laptops, and multi-purpose devices (13). The results of a study by Ahmadi et al., showed that the farmers' attitude towards the mobile learning system is positive and this positive attitude is a necessary and initial step for the implementation of any new project. There was a positive and significant relationship between the variables of literacy, farmers' income, the number of mobile tools used by farmers, understanding of the limitations and benefits of mobile learning, and farmers' technical knowledge about mobile learning. Also, the lowest level of knowledge was related to illiterate farmers and the highest level of knowledge was related to farmers with a bachelor's degree or higher. It was also found that participating in training courses had made farmers interested in mobile learning and completed their technical knowledge about using mobile tools, services provided through the educational system, and mobile learning (14).

The results of a study by Manian & Sohrabi, showed that the effect of the three main variables of the theory of planned behavior on behavioral intention is confirmed, and

the effect of perceived ease of use and perceived usefulness on attitude was rejected. Also, the effect of learning autonomy on perceived behavioral control was not confirmed. Additionally, it was found that the preparation of professors and students positively and significantly affects their mental norms. It suggests that students are more affected by their peers in using mobile learning. Also, students believe that professors are less prepared than students to use mobile learning. Finally, the results showed that the effect of the perceived self-efficacy variable on the perceived behavioral control variable was positive and significant (15). Shobeiri & Shamsi Papkiade, conducted a study entitled "Evaluation of factors affecting the implementation of mobile learning in environmental education programs using the theory of planned behavior model". Path analysis of eleven research variables revealed a significant relationship between all the variables except for the relationship between the perceived ease and attitude and learning autonomy and the control of perceived behaviors (16). Baghrianfar & Javadipour, also showed that the rate of application of mobile learning and its components in the learning of physical education students of Yasouj University was almost unfavorable and students used mobile learning less due to reasons such as the type of field, lack of necessary infrastructure, and high costs. Moreover, students' familiarity with the mobile learning programs was at an unfavorable level. However, the students who used this type of learning found it useful (17). In an exploratory case study conducted to examine the current status of the students at the Dublin Institute of Technology, their results showed that the use of the virtual environment on mobile phones improved the students' work (18).

Recommendations

According to the present study, it is recommended:

Internet bandwidth should be provided at an appropriate speed to facilitate the use of mobile learning in medical sciences; Setting up educational sites in the field of mobile learning; Systematic internal and external coordination of mobile learning should be done; Providing and implementing Internet and telecommunications network should be considered by educational authorities; Software support, and preparation of all kinds of educational, and up-to-date software from other scientific centers of the world; Investing and providing the necessary credits for the introduction of mobile learning in medical sciences.

Conclusion

Based on the present study, it can be stated that mobile learning seeks to provide opportunities through mobile technologies to transfer information, strengthen, and improve the learning of learners. Thus, it is a solution to issues such as accessibility, cost and expectation, flexibility in terms of time and place, and the speed of access to teaching and learning resources, which remove the challenges of traditional methods and can increase the growth of information, and enhance human knowledge to meet the needs of the information society by using the latest information.

Author's contribution

Leila Ahangarzadeh and Hamideh Reshadatjo developed the study concept and design. Kamran Mohammadkhani and Nadergholi Ghourchian acquired the data. Akhtar Jamali and Leila Ahangarzadeh analyzed and interpreted the data, and wrote the first draft of the manuscript. All authors contributed to the intellectual content, manuscript editing and read and approved the final manuscript.

Informed consent

Questionnaires were filled with the participants' satisfaction and written

consent was obtained from the participants in this study.

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Conflict of interest

The authors declare that they have no conflict of interests.

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