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Review Article

A Meta-Synthesis Approach to Designing a Conceptual Framework for Mobile Learning in Higher Education

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ABSTRACT

Background: Higher education is considered as a source of inspiration and a major factor in the development and advancement of every society. The realization of an effective education in any educational institution requires the formation of an efficient teaching-learning process. The purpose of this study was to design a framework for mobile learning in higher education.

Methods: It is an analytical-oriented qualitative study in designing a framework-based meta-synthesis. Data were collected through documentary method using search engines as well as valid websites presenting national and international articles. In the search for mobile learning keywords in higher education, 418 Persian and English papers were found and after examining their titles, it appeared that the majority of them covered topics relevant to mobile learning, such as e-learning. Hence, a total of 119 articles were selected to consider their abstracts. Upon studying the abstracts and contents of the above-mentioned articles, 71 papers were chosen. Due to the principles of conducting meta-synthesis research and omitting incomplete papers, 52 articles were selected for content analysis.

Results: According to the results, five main dimensions including: strategy, data, process, infrastructure and human forces are recognized for adopting mobile learning in higher education. Infrastructures develop the highest frequency in the considered studies and out of 52 papers only 42 of them have mentioned codes and factors relevant to the infrastructure.

Conclusion: Experts in this study provided their assessments and opinions about research findings in order to score, acknowledge and finalize the dimensions of m-learning in higher education.

Keywords: Designing, Mobile learning, Mata-synthesis approach, Higher education

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Background

The new millennium was named the Information Age, the era in which we notice the emergence of modern information and communication technologies (1). Higher education is considered an inspiration source and a factor for the development and advancement of every society. The realization of effective education in any educational institution requires the formation of an efficient teaching-learning process. Teaching-learning in higher education consists of various components that can be comprehensively assessed in a framework of an effective behavioral system. Dramatic transformations have occurred as a result of advances in modern technologies, especially mobile technologies, with the subsequent emergence of new teaching and learning methods and technologies.

E-learning has gained much focus from educators and researchers, with many extolling e-learning over traditional learning (2). At present mobile learning (m-learning) has become a quite significant factor in higher education. The increasing growth of mobile technology in our society has become a reality (3-7).

As a new stage in the development of a distant-learning system and one of the e-learning methods, mobile-learning can create extensive communications in spite of the physical distance. Mobile learning is a kind of learning in which the learner is not in a fixed or predetermined location, or in which learner uses the opportunities provided by mobile phone technology (8). In other words, mobile learning as a stimulus can generate feedback in educational activities. Mobile learning enables learning the topics of interest and freely sharing them with friends at any time and place.

There is an increasing interest in the learning processes that are accompanied by new technological tools, such as those found in mobile learning (onwards, m-learning). Nowadays, for every one person who accesses the internet from a computer, two do so from a mobile device (9). In conjunction with the development of mobile learning in universities and higher education institutions, it is important to account for the requirements and standards of design, development, and implementation of mobile learning in higher education (10).

The increasing usage of smartphones, the increasing acceptance of electronic learning (e-learning), the improvement in the status of mobile networks and the global internet as well as the need for flexibility in the learning process have led to the emergence of a phenomenon called m-learning. M-learning is not limited to time and place and it will make the desire of "equal education for all people around the world" comes true (11-13).

M-learning is a modern strategy in formal and informal education. The use of mobile phone technology in education has a growing effect on individuals' motivation, self-esteem, cooperation and information sharing It helps reduce individuals' isolation, and improves self-regulation, metacognitive skills, information sharing and learner interactions. It can even influence lifelong education consistent with the leaners' needs, and provides opportunities for the learner, teacher, and the university.

The recognition of an effective education in any educational institution requires the formation of an efficient teaching-learning process. Teaching-learning in higher education consists of various components that can be comprehensively assessed in the framework of an effective behavioral system. Mobile learning applies information and communication technology to break down temporal and spatial boundaries. It offers new learning tools and intends to provide an appropriate context for learning and exploring. Being the focal point of scientific and research developments in any country, higher education is no exception to this rule. It intends to step into the world of mobile learning in accordance with its objectives, which include systemization of education, increasing knowledge generation, achieving global standards of literacy and education, enhancing educational quality and

development of entrepreneurship. Given its novelty, adaptation of this technology is one of the major current issues in research. Even in most developed countries, various dimensions of this phenomenon are yet to be researched by experts. Studies conducted on mobile learning have investigated its different aspects; some have addressed its effects and outcomes, others have investigated the perspectives of society and statistical samples about the place of mobile phone in education, still others have assessed the effects of mobile learning on variables such as academic learning and achievement. Only a few can be found to have considered a meta-synthesis approach to the design of a mobile learning framework in higher education. Given the conflicting results in the conducted studies, there is still a need for further research into this field, particularly since facilities and means are being constantly transformed. In designing an appropriate model and framework of mobile teaching-learning in higher education, it is very important to consider availability of its tools at any time and place, as well as being inexpensive, lighter, smaller, and portable, and most importantly, its benefit of reducing the distance between professors and students, and providing students with the opportunity to have access to their professors not just during lectures but at all times.

The most important challenge of designing and launching mobile learning in higher education is to disregard all the important aspects that constitute a learning environment, which can take into account the complexities of the clinical and educational environment in design (3). In designing an appropriate model and framework for mobile learning in higher education one should contemplate all aspects of the higher education environment. In accordance with the increasing importance of mobile learning in universities, researchers decided to conduct a research to design a conceptual framework for mobile learning in higher education.

Materials and Methods

The study is an exploratory-applied and qualitative study using the meta-synthesis. Meta-synthesis is an in-depth analysis of research conducted in a particular field. It can be considered as a qualitative analysis of the past research findings, which were used in the study to identify, evaluate and combine the studies related to the application of mobile learning in higher education. To achieve the study objectives, Sandelowski & Barroso's (2007) seven-stage method was used as follows (Figure 1).

The study population consisted of all studies related to the design of mobile learning in higher education, which have been published in books and journals in English and Persian between 2000 and 2018. Given the methodology of the study, first the main question of the study is addressed and the main objective is determined. Then systematic studies on mobile learning are reviewed. Using relevant keywords, a search is conducted in the references provided by foreign databases such as: Science direct, Google scholar, Scopus, as well as the references provided by domestic databases, including SID, Virascience, and Ensani. A certain number of domestic and foreign articles related to the subject of the research are reviewed.

The data were analyzed qualitatively. First a certain number of relevant Persian and English articles were reviewed, of which, articles that seemed to contain topics and

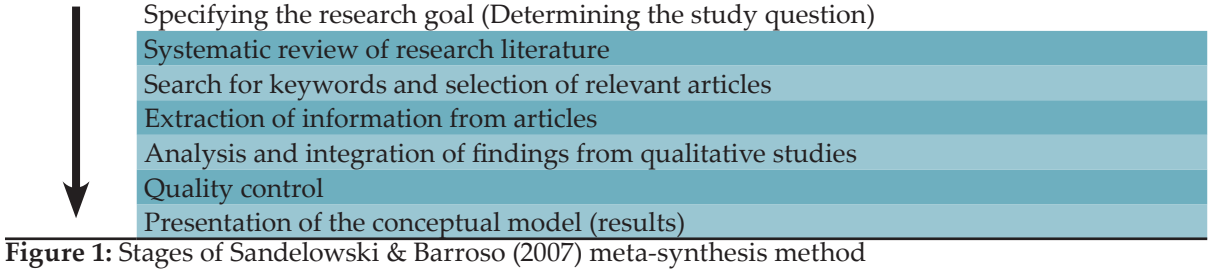

Figure 1: Stages of Sandelowski & Barroso (2007) meta-synthesis method

theories on the subject of mobile learning in higher education were explored and encoded. The filtered codes in articles were assessed.

Ethical Considerations

Due to frequent references made to other domestic and foreign articles, attempt has been made in the present study to observe the utmost confidentiality in providing references and quoting topics from other research materials, and to directly state any topics from the reference stated.

Results

The present study findings are based on the seven stages of Sandelowski & Barroso (2007), as follows:

Stage one: The Study Question

The first step in posing the study question is to focus on what the study is. The study objective is to provide a conceptual framework for mobile learning in higher education, which is set by responding to the following questions:

1. Who: it specifies the study population. In this study, databases, journals and search engines were investigated.

2. When: it states the time framework. The references in this study included all studies associated with the design of mobile learning in higher education conducted between 2000 and 2018.

3. How: In the meta-citation analysis study, data analysis is cited in secondary form. Taking into account certain criteria, researcher identifies suitable articles for inclusion in and exclusion from meta-synthesis process (Table 1).

Hence, the main study question is: what are the distinctive features of a conceptual framework for mobile learning in higher education?

Stage Two: Systematic Review of Literature

References were searched for in the following websites: "Science direct", "Google scholar", "Scopus", as well as the sources provided by domestic databases including "SID", "virascience", and "ensani", using keywords: Mobile, smart phone, learning or teaching, university or higher education, and framework or model or pattern.

Stage Three: Search and Selection of Suitable Articles

The researcher used the algorithm presented in Figure 1 to evaluate and select the right references. The references were reviewed according to four parameters (Title, abstract, content, and methodology). To obtain the ultimate resources through the methodology parameter, the Gilian tool (with four main criteria: statistical population, data collection, study design, and results) was used. After an extensive search, a total of 497 Persian and English articles were found for smart phone, 540 for e-learning, 900 for learning and higher education, and finally, 418 for "Mobile learning" and "Mobile learning in higher education". Reviewing their titles revealed that most of them were relevant to mobile learning fields such as e-learning and therefore, 119 were selected

Table 1: Inclusion and exclusion criteria for meta-synthesis of articles

Index	Acceptance criteria	Rejection criteria
Article language	Persian and English	
Article presentation date	From 2000 to 2018	
Article topic	Designing mobile learning in higher education	Mobile learning in school or hospital
Article type	Articles published in credible journals and conferences	Unpublished articles, personal views, Non-research articles
Information status	Full information about author, journal, method of study and resources	Articles with incomplete information

for review of abstracts. Overall a total of 71 articles were selected after review of abstracts and contents. Based on the principles of meta-synthesis studies and elimination of incomplete articles (which will be cited later), 52 articles were chosen for full assessment and content analysis. Finally, all articles with the aim to design a mobile learning model or framework published between 2001 and 2018 in domestic Persian and non-Persian databases were selected. Figure 2 shows methods of acceptance and rejection of articles separately (Figure 2).

Stage Four: Extraction of Results of Resources

In preparation for analysis, data from selected references are categorized, summarized and encoded according to the author's name and surname, publication year, study objectives, method, and Results. Table 2 presents frequency distribution of the studies collected according to publication year, and Tables 3, 4 show frequency distribution of collected studies based on methodology and language.

According to the above tables, the majority of studies conducted on mobile learning have been of causal-comparative type, and only

Total number of references and articles found (N=418)	Total number of references and articles rejected in terms of title (N=299)
Total number of screened abstracts (N=119)	Total number of references and articles rejected in terms of abstract (N=48)
Total contents of articles assessed (N=71)	
Total number of initially accepted articles (N=52)	Total number of references and articles rejected in terms of content (N=19)
Total number of final articles (N=52)	Total number of references and articles rejected for lack of information (N=0)

Figure 2: Systematic search process and selection of articles on mobile learning in higher education

Table 2: Frequency distribution of collected studies by publication year

Publication year	Frequency	Frequency percentage
2000-2006	15	28.8
2007-2010	18	34.6
2011-2018	19	36.6
Total	52	100

Table 3: Frequency distribution of studies by methodology

Method	Frequency	Frequency percentage
Quasi-experimental	6	11.5
Causal-comparative	26	50
Descriptive-survey	16	30.8
Meta-analysis and meta-synthesis	4	7.7
Total	52	100

Table 4: Studies conducted based on language used

Type	Language	Frequency	Frequency percentage
Thesis	Persian	7	13.5
	English	0	0
Article	Persian	28	53.8
	English	17	32.7
Total	Persian	35	67.3
	English	17	32.7

Table 5: Themes and codes extracted from resources

Item	Code	References
Strategy	Inclusiveness	Mosadeq (2009); Karimi et al. (2014); Hwang & Fang Chang (2011); Karami (2016); Sarani et al. (2014); Briz-Ponce et al. 2017); Jacob & Isaac (2007); Power & Chris (2010); Rao et al. (2008); Mc Conatha et al. (2008) Al-Emran et al. (2016); Briz-Ponce et al. (2016); Hamidi & Chavoshi (2018) Dashtestani (2016) Sahin & Basak (2017)
	Cost-saving	Yazdanpanah&Bayat (2013); Karami (2016); Sarani et al. (2014); Zargham et al. (2014); Hwang Fang Chang (2011); Vriz-Ponce et al. (2017); Lu et al. (2008); Jacob & Isaac (2007) Toktarova, et al. (2015);
	Flexible spatial teaching-learning	Abdolvahabi et al. (2011); Karami (2016); Sarani et al. (2014); Zargham et al. (2014); Hwang Fang Chang (2011); Briz-Ponce et al. (2017); Lu et al. (2008); Jacob Isaac (2007); Power & Chris (2010); Rao et al. (2008) Ferreira, et al. (2013); Hamidi & Chavoshi (2018) Dashtestani (2016) Sahin & Basak (2017)
	Flexible temporal teaching-learning	Karimi et al. (2014); Briz-Ponce et al. (2017); Sarani et al. (2014); Karami (2016); Zargham et al. (2014)); Hwang Fang Chang (2011); Lu et al. (2008); Jacob Isaac (2007); Power & Chris (2010); Rao et al. (2008) Ferreira, et al. (2013); Hamidi & Chavoshi (2018) Dashtestani (2016) Sahin & Basak (2017)
	Appropriate educational structure	Abdolvahabi et al. (2011); Karami (2016); Zargham et al. (2014); Hwang Fang Chang (2011); Lu et al. (2008); Jacob Isaac (2007); Power & Chris (2010); Rao et al. (2008) Al-Emran et al. (2016); Briz-Ponce et al. (2016); Toktarova, et al. (2015);
	Design and creation of appropriate methods	Georgallkellos et al. (2009); Rodrigues et al. (2018); Karami (2016); Power & Chris (2010); Rao et al. (2008) Toktarova, et al. (2015); Patil et al. (2016);
	Strengths and weaknesses	Georgallkellos et al. (2009); Power & Chris (2010); Mc Conatha et al. (2008) Briz-Ponce et al. (2016); Toktarova, et al. (2015);
	Rational and subjective feasibility study	El-Gazzar et al. (2010); Karami (2016); Sarani et al. (2014); Hwang Fang Chang (2011)); Mc Conatha et al. (2008) Toktarova, et al. (2015); Patil et al. (2016);
	Change in physical infrastructures	Abdolvahabi et al. (2011) Toktarova, et al. (2015); Ferreira, et al. (2013);
	Higher education experts and planners	K-Uszpa (2005); Karami (2016); Sarani et al. (2014); Mc Conatha et al. (2008)
Data or resources	Portable electronic tools	Salehi (2015); Briz-Ponce et al. (2017); Karami (2016); Sarani et al. (2014); Jacob & Isaac (2007) Dashtestani (2016)
	E-lectures	Morshedi et al. (2012); Sarani et al (2014); Karami (2016) Patil et al. (2016);
	Electronic content (multi-media …)	Fathivajargahetval. (2005); Karami (2016); Sarani et al. (2014); Jacob & Isaac (2007) Dashtestani (2016) Patil et al. (2016);
Process	Mobile learning-based teaching process	Afzalkhani et al. (2010), Karami (2016) Toktarova, et al. (2015);
	Student-teacher communication	Hassanzadeh (2003); Karami (2016); Sarani et al. (2014); Jacob & Isaac (2007); Rao et al. (2008); Mc Conatha et al. (2008) Ferreira, et al. (2013); Sahin & Basak (2017) Patil et al. (2016);
	Student-student communication	Hassanzadeh (2003); Karami (2016) Sahin & Basak (2017)
	Student-teacher educations	Rahimidost&Razavi (2010); Sarani et al. (2014) Sahin & Basak (2017) Patil et al. (2016);
	Design of mobile learning tools	Morshedi et al. (2012) Toktarova, et al. (2015);

Infra-structure	Mobile internet network	Afzakhani et al. (2010) Hamidi & Chavoshi (2018)
	Flexible and accessible tools	Karimi et al. (2014); Zargham et al. (2014); Briz-Ponce et al. (2017); Jacob & Isaac (2007) Ferreira, et al. (2013); Hamidi & Chavoshi (2018) Dashtestani (2016) Sahin & Basak (2017)
	Feasibility of security software in virtual education	Karami (2016); Jacob & Isaac (2007) Ferreira, et al. (2013);
	Feasibility of mobile education system software	Afzakhani et al. (2010); Karami (2016); Zargham et al. (2014) Toktarova, et al. (2015); Sahin & Basak (2017)
	Possibility of credit for payment of technical support personnel	Jacob & Isaac (2007)
	Possibility of credit for purchase of mobile education equipment	Briz-Ponce et al. (2017)
	Students and professors	Rahimi dost & Razavi (2010); Karami (2016); Rao et al. (2008); Mc Conatha et al. (2008) Al-Emran et al. (2016); Ferreira, et al. (2013);
	Acceptance by professors	Rahimidost & Razavi (2010); Karami (2016); Sarani et al. (2014); Zargham et al. (2014); Jacob & Isaac (2007); Rao et al. (2008) ; Al-Emran et al. (2016)

References (3,8, 13-20)

7.7% of the selected articles have used meta-analytical and metal-synthesis methods.

Analysis and Integration of Qualitative Results

In this stage, researcher seeks to find codes emerged from the meta-synthesis process. First, based on various dimensions cited in the study text, codes (semantic units) are extracted, and concepts (subthemes) are obtained by combining these semantic units. In order to achieve the first study objective, namely determining dimensions of mobile learning in higher education with meta-synthesis approach, all dimensions of mobile learning in higher education are initially extracted and represented by codes (Table 5).

Based on the findings in the above table, five main dimensions were identified for mobile learning in higher education, including strategy, data, process, infrastructure, and human resources.

Stage Six: Quality Control and Assessment

Validation and finalization of dimensions of m-learning in higher education were carried out using experts' views expressed in confirmation and accreditation of the study achievements. The study subjects included six experts and university professors in disciplines related to the subject such as: educational technology, e-learning, educational and curriculum management. They had been purposively selected, and exchanged their views and finalized the framework of mobile learning in higher education in planned and focused meetings. The study inclusion criteria were: up-to-date knowledge of educational technology and experience of virtual teaching, and exclusion criteria were: unwillingness to collaborate with the study.

Lawshe model (1975) was used to determine the credibility of mobile learning in higher education, and a researcher-made questionnaire was developed based on mobile learning dimensions with three options including "necessary", "useful but not necessary", and "unnecessary" with corresponding numbers 0, 1, and 2. Since codes had been extracted from various credible research sources, there were no disagreements among the experts about their confirmation and no views on them being "unnecessary". The disagreements were about whether they were "necessary" or "useful but unnecessary" (Table 6).

Table 6: Content validity ratio, numerical mean, and content validity index by codes and dimensions

Item	Item CVI	Code	Numerical mean of conceptual code	CVR of conceptual code
Strategy	92.8	Inclusiveness	2	1
		Cost-saving	2	1
		Flexible spatial teaching-learning	2	1
		Flexible temporal teaching-learning	1.8	1
		Appropriate educational structure	2	1
		Design and implementation of appropriate methods	2.2	1
		Strengths and weaknesses	1.8	1
		Rational and subjective feasibility	2	0.5
		Change in physical infrastructures	1.75	0.75
		Change in behavioral patterns	2	0.75
Data	82.8	Potable electronic tools	1.8	0.5
		Electronic lectures	2.2	1
		Electronic contents (multi-media …..)	1.87	1
Process	72.6	Mobile learning achievement process	2	0.5
		Student-teacher communication	1.8	0.75
		Student-student communication	2.2	1
		Student and professors educations	2	0.5
		Design of mobile learning tools	2	0.5
Infrastruc-ture	86.5	Wireless internet network	1.8	0.75
		Flexible and available wireless tools	1.88	0.75
		Feasibility of security software in virtual education	2.2	1
		Feasibility of mobile education system software	2	1
		Credit for payment of technical support personnel	2	1
		Credit for purchase of mobile education system equipment	2	0.5
Human resources	79.2	Students and professors	1.8	1
		Acceptance by professors	2	1
		Higher education experts and planners	1.8	0.5

In relation to each of the dimensions of mobile learning, content validity ratio (CVR), numerical mean values for codes, and content validity index (CVI) were determined. Based on Lawshe equation, CVR and CVI are found as follows:

$$CVR = \frac{\left(ne - \frac{N}{2}\right)}{\frac{N}{2}}$$

$$CVI = \sum \frac{CVR}{\text{Retained numbers}}$$

In the above equation, ne=number of experts who opted for the "necessary" option, N=total number of experts, and Retained numbers=number of confirmed items

Lawshe theory defines a specific number for minimum CVR based on number of experts, which in this case is 0.99 for six experts, and the following criteria are used in accepting various items:

- Unconditional acceptance of items with CVR>0.99
- Acceptance of items with 0<CVR<1 and numerical mean votes≥1.5. This shows that more than half of experts agreed with the necessity of an item.

The results presented in the above table are clearly indicative of mean and validity of each of the dimensions and items related to mobile learning in higher education.

Question Three: How the final framework of mobile learning in higher education should be?

Stage Seven: Presentation of Results

The final framework is presented in the last of the seven stages of meta-synthesis. (Figure 3)

The proposed framework of mobile learning in higher education with five main dimensions (strategy, data, process, infrastructure, and human resources) and 27 subthemes is described below:

Strategy: After feasibility assessments, attention should be drawn to ubiquitousness and temporal and spatial flexibility of teaching-learning environment, creating an adequate educational structure, designing appropriate educational methods, identifying threats and opportunities and weaknesses and strengths, and reducing costs.

Data: Portable electronic tools, subjects, courses, and mobile e-contents should be provided.

Process: Mobile learning-based teaching process, student-professor communication, student-student communication, strengthening driving factors, designing mobile learning tools

Infrastructures: Wireless internet network, flexible and accessible wireless tools, setting up security software in virtual education, mobile teaching software, allocating payroll for technical and support staff, and allocating credit for purchase of mobile education equipment.

Human resources: Professors, students, experts, and planners (programmers).

The important point about this model is its reversibility. Each item has a dynamic and organic relationship with the item before and after it. This implies fluidity and non-linearity

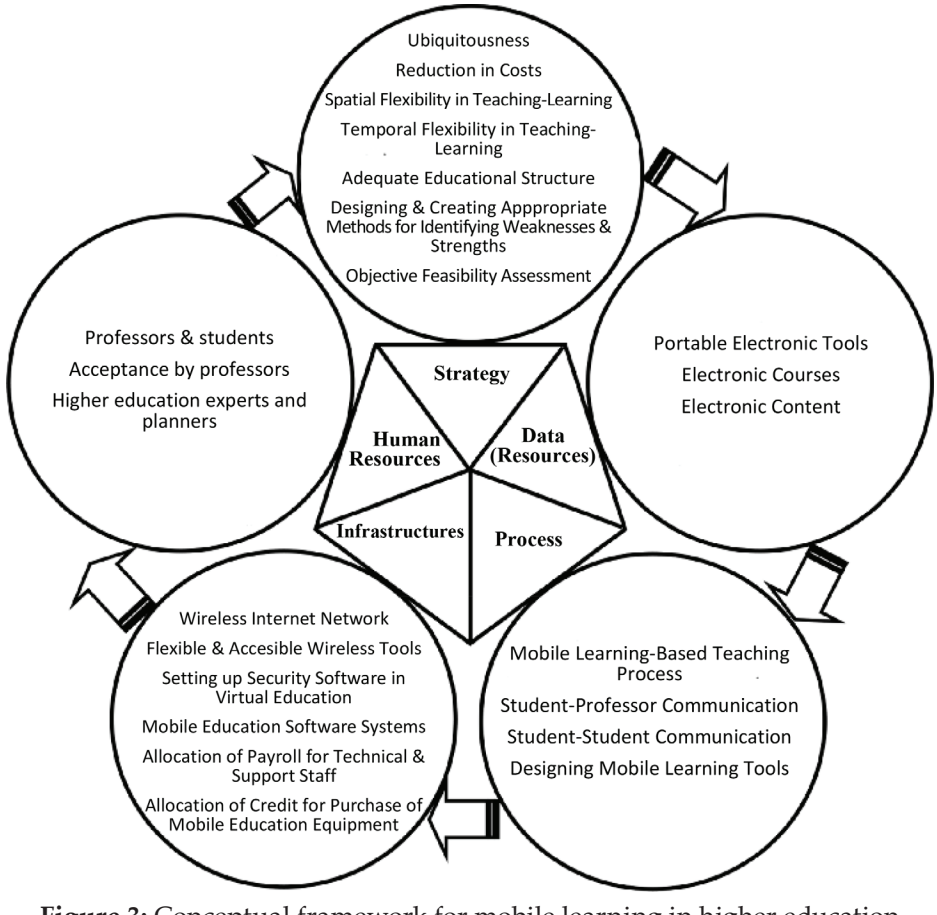

Figure 3: Conceptual framework for mobile learning in higher education

of this framework. According to Dewey (1938), every ending is a new beginning, and every beginning comes from a previous ending. Returning to previous stages enables the model to improve its capabilities.

Discussion

The present study aimed to design and validate a framework for m-learning in higher education. The findings showed five interrelated main dimensions for the proposed framework of mobile learning in higher education that move from the dimension of strategy, data, process, infrastructure, human resources toward mobile learning in higher education. In the dimension of strategy, while assessing feasibility, it is essential that appropriate teaching-learning strategies are designed. This dimension focuses on the learner and responds to his needs, it places the learner in the center of the learning environment and it can provide a solution for those in search of flexible education. In this regard, in a study entitled "agent-based mobile event notification system" El Gazzar et al. (2001) concluded that given their small size, lightness, and portability, m-learning and education tools including mobile phones provide flexibility and compatibility in learning and can affect the quality of learning and academic motivation of students. Moreover, they allow higher education organizations better notification access to their students.

Another component of this framework was the dimensions of data. In this dimension, the focus of design is on mobile-compatible tools for providing lectures, courses, and electronic contents, and learning activities. In this respect, Chen & Hsu (2008) used a successful information system model to investigate factors affecting the use of mobile learning. The study observed that different educational environments require different tools and standards, and that an environmental process that makes use of traditional data is not efficient in directly forming newer environments. These results are consistent with the results of the present study. As a communication bridge between human and technology, tools should enjoy the necessary physical and psychological ease and convenience. For example, in mobile tools, such features as weight, size, and structure should be compatible with the learners' conditions, so that they can easily focus on the cognitive topics and place learning in the context of his routine life and real environment.

Teaching-learning processes are among highly important dimensions of the proposed conceptual model. Teaching-learning processes and activities in this model include active, interactive, and flexible learning. Learning does not happen in absence of students' efforts. Therefore, active teaching-learning strategies are used individually or in groups. In an active process, learners are required to be active rather than to just read. They need to write, debate, solve problems, and be engaged in high level activities such as: analysis, integration, and evaluation of thoughts. The longer the learners spend on active learning, the better learning will be. At this level, the learner is aware of the learning process and understands educational goals, and can identify his capabilities and weaknesses in achieving the learning goals. In an active learning environment, strategies are used to increase opportunities for interactions between teacher and learner, learners with each other, and with educational materials, and academic discipline or educational topics, which have been accounted for in this model. In this regard, Koole designed a rational analytical learning framework, in which learning is considered the outcome of fine mobile technologies, and human learning and social interaction. This model attributes all educational problems caused by information overload, knowledge conduction, collaboration and participation to learning. In the above model, learners create and use information individually and collectively, and interaction with information happens through technology. Complexity of such an interaction makes information useful and meaningful. Mobile learning strategies are

focused on technology. These technologies affect teachers and students. Revolutionary educational technologies are created in the classroom and provide new means of education. However, technology per se is not the only goal (21). Mobile learning technologies provide non-linear learning strategies, so that a student can move between topics according to his plan and schedule, which is accounted for in this model. Hence the need for infrastructures. The importance of the dimension of infrastructure in this framework is that, without it, continuing kind of learning activity will be impossible, and it is among the primary requirements for mobile learning to progress.

Learning is the student's main responsibility, and this requires motivation, planning and the ability to utilize and analyze the information learnt. This is a highly complex process in m-learning. To succeed in mobile learning, students need to be adequately supported, and this has been accounted for in the human resources dimension of this model. Students who do not attend the university or are not physically in that environment need to access supportive resources and services such as: library, consultation with professors, and technological support. Mobile learning technologies and infrastructures facilitate the flow of information and communication, and thus a learner-based, flexible, and interactive learning environment is properly designed. Success of mobile learning courses is hugely dependent on the subject's teacher (22). The transition from traditional courses to mobile-based courses is not easy. Leaving aside obvious changes, of which technology is one, education will have new dimensions, and they should identify the students' needs and prepare contents for them without actually meeting them. Development of a distant mobile course is very complicated. Distant mobile education represents major changes in educational resources and development of a faculty. Hence, preparing teachers is particularly important, which is also considered in the design of this model.

Generally, given the place of different dimensions of mobile learning in higher education, it is recommended that each of the mobile learning dimensions such as strategy, process and data should be considered and emphasized by planners in the field of higher education, and each of the related concepts should be attended to. Moreover, given that infrastructures are among the most important issues and considered among the dimensions associated with mobile learning, it is recommended that the required infrastructures should be particularly taken into account before implementation of a mobile learning project in higher education. By assessing structural prerequisites, an attempt should be made to pave the way for excellence in higher education through mobile learning. Other recommended measures include explaining the place of technology in higher education systems, facilitating synergy between higher education systems, up-to-date technologies and learners' needs (which is among the measures related to production of appropriate educational contents), and preparing teachers, students, and even students' families and society. In conclusion, meticulous attention should be paid to all aspects and components of an m-learning design before establishing it.

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Ethical Considerations

This study was approved by the Ethics Committee of the Islamic Azad University, Shiraz Branch. In this study, the following ethical issues were considered: This study was based solely on the data provided by specific websites, and the research literature and patients were not involved.

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Authors' Contributions

All authors have contributed substantially

to the conception and design of the manuscript. HD, and NZ drafted the manuscript, reviewed and developed the manuscript for submission. All authors read and approved the final manuscript

Conflict of Interests

The authors declare that they have no conflict of interests.

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