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A Systematic Review of the Critical Factors for Success of Mobile Learning in Higher Education (University Students' Perspective)

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Article

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Abstract

The phenomenon of the use of a mobile learning (m-Learning) platform in educational institutions is slowly gaining momentum. However, the enthusiasm with which mobile phones have been welcomed into every aspect of our lives is not yet apparent in the educational sector. To understand the reason, it is important to understand user expectations of the system. This article documents a systematic review of existing studies to find the success factors for effective m-Learning. Our systematic review collates results from 30 studies conducted in 17 countries, where 13 critical success factors were found to strongly impact m-Learning implementation. Using these results within the framework of the diffusion of innovation model for innovation adoption and the critical success factors together help us see what aspects of the innovation decision process are the likely causes of the reduced take-up of m-Learning by university students.

Keywords

mobile learning, CSFs, systematic review

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Introduction

The idea of m-Learning, a relatively new concept, is made interesting by the way it blends the notion of mobility into the already popular electronic learning context. The concept of mobility actually makes the concept of m-Leaning even more revolutionary than electronic learning (Ally, 2009). In other words, a learner can control what they want to learn, when they want to learn, and where they want to learn. They are not restricted to prescribed materials, a physical classroom, or even a particular time around which they have to schedule other activities (Kukulska-Hulme, 2005).

Research into m-Learning has always been scattered and noncohesive. One of the reasons is the inherent disagreement as to what constitutes m-Learning in the first place. As the specific definition used by a particular researcher automatically decides the scope of the research, the ensuing studies have been equally diversified in contexts and methodologies. M-Learning was originally defined from a device-centric perspective. The most refined definition from this point of view was given by Traxler (2009a), who described the technology of m-Learning to include both software and hardware that enabled the learning devices to be portable. Device-based definitions, however, limit the scope of m-Learning, as m-Learning is not merely a conjugation of the words *mobile* and *learning*. Similarly, m-Learning is distinctly different from e-Learning and cannot be defined in the words of Traxler as "eLearning made mobile" (Traxler, 2009b). The rapid changes in technology have also proved to be a hindrance to researchers attempting to define m-Learning in terms of devices.

One of the popular definitions encompasses the mobility and technological aspects, where m-Learning is characterized by its anytime anywhere learning capacity and use of multiple media functions like pictures, videos, text, and voice (Shih & Mills, 2007). In addition to the unfettered nature of learning in terms of space and time, m-Learning additionally includes ideas like spontaneity, interactivity, informality, and ownership of learning (Traxler, 2008).

Basically, mobile technology has seen high penetration in all aspects of people's lives; however, its usage as an educational platform has been very slow. There are definite barriers to adoption of an m-Learning platform, especially by institutions of higher learning. Multiple studies have been conducted in various countries across the world to evaluate the success factors of m-Learning in higher education. The studies are fragmented and meta-analyses of the studies have focused on the geographical clusters, learner profiles, and types of mobile devices. There is a need for research that collates the studies in the area of m-Learning in terms of factors that users perceive to be important for success. This aspect is needed to understand the best methodology for adopting m-Learning in a situation in a way that maximizes take-up. In any attempt to use an m-Learning platform, being able to get early take-up from students is vital to its long-term success, and from this perspective, a better understanding

of the aspects that will increase this during early adoption will be beneficial for other studies and program launches moving forward.

A significant body of work has been created with reference to factors involved in the success of m-Learning, and it is prudent to look at this work and ascertain what this study will contribute to research in this field. Some research focuses on the age and gender take-up of m-Learning to understand the effect of demographics on the success of projects. The work of Wang, Wu, and Wang (2009), in particular, has focused on both age and gender with respect to the unified theory of acceptance and use of technology. Other work, such as that by Liu, Li, and Carlsson (2010), looks closely at the long-term usefulness of m-Learning as the driving factor for adoption, while the work of Cochrane (2010), among others, examines the interaction between the technology and the course itself as a contributor to the success of a given m-Learning project. While these works all focus on a specific aspect of an m-Learning program, in this study we are looking at a more holistic view of the subject to better understand the whole situation in relation to students themselves.

First, this study is a systematic review of existing studies to determine the critical success factors (CSFs) for m-Learning in higher education. Secondly, an evaluation of studies was conducted in 17 countries, offering a broad case selection on which to base findings. Third, a mathematical evaluation of factors was also carried out using a common method and scale (Likert 5-point).

Finally, this study gives a comprehensive understanding of factors that learners (worldwide) expect in a good m-Learning system, as an evaluation of factors that users consider important would make it easier to design systems that could be adopted faster in a higher education setting.

Theoretical Framework

Although m-Learning itself is a relatively new concept, the adoption of new technologies and innovation within education is not, and with decades of study into this process the theoretical framework required is well researched. Perhaps, the most widely adopted framework is that of diffusion of innovation (Rogers, 2003) that has been suggested by many as the best framework for studies conducted in higher education (Li & Sui, 2011; Sherry & Gibson, 2002).

The theory postulates that there are five characteristics of innovation: complexity, trialability, observability, compatibility, and relative advantage. The final one, relative advantage, refers to the perceived improvement of an idea over that which it is intending to replace. Rogers (2003) suggests that this can be measured in terms of satisfaction, convenience, social prestige, and economics. Compatibility, when discussed with regard to this framework, is the degree to which the new process aligns with the needs and expectations of users. Observability refers to the benefits of the new innovation that can be observed by adopters, while trialability represents the "degree to which an innovation may

be experimented with on a limited basis" (Rogers, 2003). Finally, complexity is a measure of the ease of use of the innovation and the adopters' ability to understand it.

Along with these five attributes, Rogers (2003) also describes three types of decisions in the process: the decisions made by the individual themselves, known as optional; those made through the influence of others, that is collective decisions; and those made under the influence of authority, referred to as authority decisions. In the case of the optional decisions made by the individual, the choice is made independently of the social system. Collective decisions are made within the social system, and the choice is made by a consensus of members of the group. For authority-based choices, on the other hand, the decision is made by a group that possesses power, influence, or technical expertise. The framework builds a picture of adoption of innovation and choice that we can bring into our results.

According to the theory itself, the process of take-up of innovation contains five stages: knowledge, persuasion, decision, implementation, and confirmation. This describes the process of an individual adopter finding details of the innovation (knowledge), developing views regarding the innovation (persuasion), deciding whether to use the innovation or not (decision), using the innovation (implementation), and then finally the successful application (confirmation). With m-Learning, by utilizing mobile technology that is already widely considered as a positive and useful innovation in its own right, the theory works well for this subject.

Research Methodology

Research Objectives

This study attempts to answer the following main research question: What factors are critical to the success of m-Learning in the perspective of university students? The purpose of the study is to understand the factors leading to effective m-Learning in higher education (university-level students). The answer to the research question was gained by conducting a systematic review of the available quantitative studies in the area.

Research Design

The search process for this study started with a comprehensive search to find suitable studies from across the world to provide the holistic view of the medium; we were looking for CSFs mobile learning.

Research expressions that have used for this research purpose are "critical success factors mobile learning," "student perspective on m-Learning," "m-Learning students," "higher education," and "Likert scale."

Inclusion and Exclusion Criteria

As m-Learning is an extremely recent concept, there was no need to exclude data that were out of date. Indeed, few older works were discovered. Hence, the all-important, date-based exclusion criterion was not employed; on the contrary, there was a need to capture as much primary data as possible to give a more detailed and true picture of the status of m-Learning. Our inclusion criteria were related to the type of data included in the research papers:

- Research papers that used the Likert scale for assessing participant responses (regardless of the scale length).
- The complete details of the Likert scale data for the responses used in the study for each variable under assessment.

Following are the exclusion criteria:

- Research papers that did not use the Likert scale for assessing participant responses (i.e., included only percentage agreement/disagreement).
- Research papers that did not present the actual Likert scale data (for instance, in several studies only the correlation/regression statistics that had been derived from the Likert scale data were given, but original data were not given).
- No research papers were included that had only qualitative data.
- Duplicate reports of the same study (at least five studies were rejected on this basis). In such cases, the reports selected were those that had more primary data information and not only publication prestige
- Research studies that had only procedural information (at least two research studies belonged to this category, where the assessment procedure was cited and used in other studies but the original paper had no primary data, only the methodology).

Quality Assessment

The quality of each study was examined in the same way as Kitchenham's study, by employing a modified version of Database of Abstracts for Reviews and Dissemination (DARE) criteria developed by the Centre for Reviews and Dissemination (Kitchenham et al., 2009). The original DARE criteria were used for conducting the quality assessment of systematic literature reviews, as employed here.

Q1. Does the research study use the 5-point Likert scale study?
Q2. Does the research study mention the percentage of the population actually owing a mobile device and already using it for m-Learning purposes?

Q3. Does the research study divide the population based on gender?
Q4. Does the research study include responses from both students and educators?

The four questions were scored as follows:

Q1. Y (yes), there is no need for conversion; N (no), a different scale was used for assessing the responses and a conversion of the scale into the 5-point scale is required. A simple formula has been used here:

$$Convertd\,score = \frac{Orginal\,Score}{Original\,Scale} \times 5$$

Q2. Y (yes), complete details of participant mobile phone usage are available for this research study; N (no), absolutely no details of participant mobile phone usage are available for this research study; and P (partly), only partial details of participant mobile phone usage are available for this research study.
Q3. Y (yes), the research study divides the population specifically into male and female participants; N (no), the research study does not divide the population into male and female participants.
Q4. Y (yes), the research study contains responses from both students and educators; N (no), the research study does not contain responses from both students and educators.

The scoring procedure was also similar to Kitchenham: $Y = 1$; $P = 0.5$, $N = 0$. As the evaluation is based on the presence or absence of information and is not qualitative in nature, the value assignment is not subject to any individual researcher's opinion. This gives additional objectivity to the systematic nature of the study result represented in Table 1.

Data Collection and Analysis

The data extracted from each study were divided into two segments—the collection of responses of participants and the availability of the platform to participants. The first segment was used for the derivation of the success factors and their importance to successful m-Learning implementation. The second segment can be used to assess the actual penetration of general mobile usage and the awareness of m-Learning among the users.

Accordingly, for the first segment, CSF data, the following data were extracted:

- The source of the research study and full reference.

Table 1. Quality Evaluation of Individual Studies.

ID	Author names	Q1	Q2	Q3	Q4	Total
S1	(Liaw, Hatala, & Huang, 2010)	N	N	Y	N	1
S2	(Motiwalla, 2007)	Y	P	N	N	0.5
S2A	(Motiwalla, 2007)	Y	P	N	N	1.5
S3	(Mac Callum, 2009)	Y	P	Y	N	2.5
S4	(Conradie, Lombard, & Moller, 2013)	Y	P	Y	N	2.5
S5	(Alzaza & Yaakub, 2011)	Y	P	Y	N	2.5
S6	(Ismail, Bokhare, Azizan, & Azman, 2013)	Y	P	Y	Y	3.5
S7	(Maniar, Bennett, & Gal, 2007)	Y	N	N	N	1
S8	(Zengning, 2011)	Y	N	Y	N	2
S9	(Shih, Chuang, & Hwang 2010)	N	N	N	N	0
S10	(Imran, 2007)	Y	N	N	N	1
S11	(Alzaza, 2013)	Y	Y	Y	N	3
S12	(Huang, Yang, Huang, & Hsiao, 2010)	N	N	Y	Y	2
S13	(Jamaldeen, Hewagamage, & Ekanayake, 2012)	Y	Y	N	N	2
S14	(Suresh & Al-Khafaji, 2009)	Y	N	N	N	1
S15	(Adedoja, Adelore, Egbokhare, & Oluleye, 2013)	N	N	N	N	0
S16	(Corlett, Sharples, Bull, & Chan, 2005)	Y	N	N	N	1
S17	(Chang, Yan, & Tseng, 2012)	N	N	Y	N	1
S18	(Uzunboylu, Cavus, & Ercag, 2009)	Y	N	Y	N	2
S19	(Donaldson, 2012)	N	Y	Y	N	2
S20	(Moura & Carvalho, 2009)	N	Y	Y	N	2
S21	(Khwaileh & AlJarrah, 2010)	Y	Y	Y	N	3
S22	(Al-Fahad, 2009)	Y	P	Y	N	2.5
S23	(Thornton & Houser, 2005)	N	Y	Y	N	2
S24	(Knezek & Khaddage, 2012)	Y	Y	N	N	2
S25	(Cheong, Lee, Crooks, & Song, 2012)	N	N	Y	N	1
S26	(Özdoğan, Bas¸oğlu, & Erçetin, 2012)	Y	P	Y	N	3
S27	(Liu, Li, & Carlsson, 2010)	N	P	Y	N	2
S28	(Scornavacca, Huff, & Marshall, 2009)	Y	Y	Y	N	3
S29	(Liaw & Hwang, 2011)	N	N	Y	N	1
S30	(Motiwalla, 2008)	Y	P	N	N	2

- Author information and country where the research was actually conducted.
- Population and gender distribution and user classification (students or educators or both).
- Likert scale and actual score on the Likert scale (converted into score on a 5-point scale):
  - The individual scores for 20 individual CSFs were derived;
  - Factors—discussion with students, discussion with teachers, discussion tool quality, and accessing discussion—were grouped into the CSF: learner community development;
  - Factors—hardware know-how, software know-how, browser know-how, and overall know-how—were grouped into the CSF: technical competence of students;
  - After grouping, there were a total of 13 CSFs. In the absence of individual CSFs, the average of existing CSFs was taken as the scores for learner community development and technical competence of students.

For the second segment, platform availability, the following data were extracted:

- The source of the research study and full reference;
- Author information and country where the research was actually conducted;
- Population and how the data were presented (e.g., in percentage form or absolute numbers);
- The percentage (available or converted from absolute numbers) of users with:
  - Wireless device availability
  - Internet access
  - Access to data services, like short message service services
  - Present use of their mobile phones to access any m-Learning platform
  - Interest in using their mobile phones to access m-Learning.

Using the initial raw data collected from individual studies, data were tabulated systematically into multiple tables for analysis as follows:

- A table measuring the quality evaluation of individual studies
- A table measuring the Likert scale scores for the 13 CSFs with author name, country of study, year of study, and population and gender distribution, if any
- A table measuring the m-Learning availability, know-how, and interest among users with the number of studies and population.

From the information available, average scores were taken for the percentages for platform availability and Likert scores (converted into a 5-point scale,

where required). This, combined with the total number of studies that had the information (CSF weight), gives the relative importance of the CSF.

Results

The results from the systematic review are summarized and presented in this section. A total of 30 studies were eventually used in the present analysis.

Quality Evaluation of Individual Studies

The quality of each individual study was based on a score on the modified DARE criteria. The results of the quality assurance scores based on answers to the four quality assurance questions are shown in Table 1. None of the studies score a 4 on the quality assurance scale. This clearly demonstrates the diversity in the m-Learning assessment studies and shows that there has been no standardized assessment scheme for the studies. This lack indicates a dire need for a standardized assessment framework in the area.

Information on Platform Availability

From Tables 2 and 3, it can be seen that out of the total of 30 studies, 12 do not have any information about platform availability. This means that we do not have any information about the mobile platform availability or interest in m-Learning usage for about 34.2% of the population. Researchers have inquired about the availability of mobile phones in 17 cases (3,202 population sample). It was found that an overwhelming majority, 91.63%, of the sample population in the study owned a mobile phone, which corroborates the immense penetration of mobile technology in recent times. It can be reasonably concluded that access to a mobile phone would not pose a barrier to the success of m-Learning. In 11 cases, the researchers made an inquiry into access to the Internet and access to data services like short message service. This is important information because either of these are the primary ways in which students would have access to the m-Learning content, whenever they want and wherever they are.

Of the 1,565 sample population, about 61.35% had access to the Internet, clearly showing the lack of Internet access of a significant sample population; the cause of this could be due either to prohibitive cost or coverage issues. Similarly, of the 1,831 sample population, about 77.19% had access to data services. The reason behind this lack could be prohibitive costs or lack of reasonable usage plans on the part of the local mobile phone operators. This, too, could be a hindrance to the success of m-Learning. In 13 studies, researchers inquired whether students had experience in or were currently using mobile phones to access m-Learning. The results were encouraging, because of the 1,855 population about 63.97% reported having already used or currently using their mobile

Table 2. Platform Availability Information for the Study Population.

ID	Country	Population	Availability of mobile phone	Internet access	Access to data services	Already using mobile phone for m-Learning	Interested in using mobile phone for m-Learning
S1	China	152	NA	NA	NA	NA	NA
S2	United States	19	84.21	43.75	NA	NA	57.89
S2A	United States	44	86.36	NA	63.64	79.55	64.63
S3	New Zealand	30	89	NA	NA	NA	NA
S4	South Africa	54	100	NA	100	100	NA
S5	Malaysia	261	95.1	NA	81.3	80.1	NA
S6	Malaysia	38	NA	NA	NA	71.05	89.47
S7	United Kingdom	45	NA	NA	NA	NA	NA
S8	China	24	NA	NA	NA	NA	NA
S9	Taiwan	32	NA	NA	NA	NA	NA
S10	Pakistan	438	NA	NA	NA	NA	NA
S11	Palestine	378	97.4	69.8	60.3	79.1	85.2
S12	Taiwan	147	NA	NA	NA	NA	NA
S13	Sri Lanka	154	99	63	64	85	95
S14	United Kingdom	26	NA	NA	NA	NA	NA
S15	Nigeria	201	NA	NA	NA	NA	NA
S16	United Kingdom	17	NA	NA	NA	NA	NA
S17	Taiwan	158	NA	NA	NA	NA	NA
S18	North Cyprus	41	NA	NA	NA	NA	NA
S19	United States	330	95.15	79.1	84.24	87.27	86.7
S20	Portugal	15	100	87	73	80	93
S21	Jordan	314	86	NA	NA	80.32	80.73
S22	Saudi Arabia	186	47	43	45	25.3	74.4
S23	Japan	333	100	83	100	61	100
S24	United States	81	NA	NA	NA	NA	NA
S25	United States	177	86	NA	NA	NA	87.2
S26	Turkey	81	84	30	NA	NA	80
S27	China	209	93.3	64.59	NA	56	100
S28	New Zealand	569	96.8	64.9	82.8	30	90
S29	Taiwan	168	NA	NA	NA	NA	NA
S30	United States	33	91	45.45	93.9	NA	75.76

Note. NA: not applicable.

phones for accessing m-Learning. This number might be higher than either access to the Internet or data services as more users were polled in this study. This shows that there is a high level of awareness and experience regarding m-Learning. Finally, in 14 studies, researchers inquired about the interest in using

Table 3. Summary Statistics of the Platform Availability Primary Data.

Mobile platform availability	No. of studies out of 30	Population	Percentage of total population (%)
No information	12	1,626 out of total of 4,755	34.2
Availability of mobile phone	17	2,934 out of total of 3,202	91.63
Internet access	11	1,565 out of total of 2,551	61.35
Access to data services	11	1,831 out of total of 2,372	77.19
Already using a mobile phone for m-Learning	13	1,855 out of total of 2,900	63.97
Interested in using mobile phone for m-Learning	14	2,565 out of total of 2,915	88

m-Learning; majority, 88%, of the participants were interested in using m-Learning, indicating the popularity of the platform among potential users.

CSFs From a Systematic Review of the Studies

As there are a total of 14 CSFs, they have been divided into two tables—Tables 4 and 5—each containing scores on the Likert scale for the individual studies for seven CSFs. NA indicates that a score for that CSF is not available. In Table 4, learner perceptions have been highlighted separately. This factor is essentially what users think of m-Learning and is the actual factor that determines whether users are interested in using the platform in the future. Care has been taken to clearly show the studies that have user responses on a scale different from the standard and original 1 to 5 Likert scale. We have assessed 30 studies in our research from 17 countries—China (3), United States (6), New Zealand (2), South Africa (1), Malaysia (2), United Kingdom (3), Taiwan (3), Pakistan (1), Palestine (1), Sri Lanka (1), Nigeria (1), North Cyprus (1), Portugal (1), Jordan (1), Saudi Arabia (1), Japan (1), and Turkey (1). The values collected in Tables 4 and 5 were averaged for all 30 studies. The results are summarized in Table 6. All the factors are assessed on a Likert scale of 1 to 5 (*Strongly Disagree* to *Strongly Agree*). A score higher than the average 2.5 shows that users are satisfied with the particular feature of the m-Learning that they are currently using. The most interesting aspect of this study is that all of the 14 factors mentioned are considered to be important by the users, and they are satisfied with the particular feature as all the CSFs show a Likert-scale response much higher than the average value of 2.5.

The first factor of interest is user perception (shown in bold). This shows that users are, in general, happy with the existing m-Learning they are using and would like to continue to use the platform in the future. They perceive that the

Table 4. Likert Scale Responses for CSFs–Part A.

ID	Technical competence students	Technical competence educators	Personalization	Learner autonomy	User perception	User friendly design	Application working
S1	1.9[a]	NA	NA	2.87[a]	**3.14**[a]	3.94[a]	3.42[a]
S2	NA	NA	NA	NA	**3.71**	2.68	3
S2A	NA	NA	3.7	NA	**3.33**	NA	NA
S3	3.81	NA	NA	NA	**3.22**	NA	NA
S4	4.3	4.16	4.18	NA	**3.72**	3.83	3.28
S5	NA	NA	NA	NA	**3.87**	NA	NA
S6	NA	3.96	NA	NA	**4.21**	NA	NA
S7	NA	NA	3.66	NA	**3.54**	3.44	3.42
S8	4.74	NA	NA	4	**4.43**	NA	3.78
S9	NA	NA	NA	2.9[b]	**2.9**[b]	3.12[b]	3.14[b]
S10	NA	NA	NA	NA	**3.6**	NA	NA
S11	3.5	NA	NA	NA	**4.09**	NA	NA
S12	NA	NA	NA	NA	**3.56**[a]	3.64[a]	3.58[a]
S13	NA	NA	NA	NA	**3.84**	4.33	4.03
S14	NA	NA	NA	NA	**3.16**	3.11	3.08
S15	4.91[a]	NA	NA	2.59[a]	**3.97**[a]	4.36[a]	4.51[a]
S16	2.81	NA	NA	2.69	**3.19**	2	3.56
S17	3.78[a]	NA	3.77[a]	3.86[a]	**3.64**[a]	3.81[a]	3.99[a]
S18	NA	NA	3.8	NA	**3.87**	3.75	3.9
S19	NA	NA	NA	4.01[a]	**3.54**[a]	3.94[a]	3.74[a]
S20	NA	NA	NA	3.12[c]	**4.35**[c]	4.45[c]	4.27[c]
S21	4.1	NA	3.99	3.89	**4.46**	4.07	4.04
S22	NA	NA	NA	NA	**3.68**	NA	NA
S23	3.96[b]	NA	3.83[b]	NA	**4.44**[b]	3.39[b]	3.94[b]
S24	NA	NA	NA	NA	**4.33**	4.17	4.23
S25	3.44[a]	3.21[a]	3.71[a]	3.86[a]	**3.57**[a]	3.79[a]	3.69[a]
S26	NA	NA	4.05	3.63	**3.95**	4.27	3.74
S27	4.1[a]	NA	NA	3.31[a]	**3.43**[a]	NA	NA
S28	NA	NA	NA	NA	**3.67**	NA	3.67
S29	2.93[a]	NA	NA	3.11[a]	**2.86**[a]	4.09[a]	3.53[a]
S30	NA	NA	NA	NA	**3.58**	3.59	3.06

Note. CSF: critical success factor; NA: not applicable.
[a]Converted value from (1–7) scale.
[b]Converted value from (1–9) scale.
[c]Converted value from (1–3) scale.

Table 5. Likert Scale Responses for CSFs–Part B.

ID	Learning made interesting	Assimilation with curriculum	Increased productivity	Learner community development	Platform accessibility	Internet access	Blended learning
S1	3.08[a]	NA	NA	NA	NA	NA	NA
S2	NA	3.79	NA	3.52	NA	NA	NA
S2A	NA	3.64	3.89	4.05	4.27	3.8	375
S3	NA	NA	NA	NA	NA	NA	NA
S4	3.8	2.82	3.94	NA	NA	NA	NA
S5	NA	NA	3.91	3.91	4.05	4.05	NA
S6	4.39	4.17	4.08	3.27	4.8	NA	2.16
S7	3.66	NA	3.28	NA	3.89	NA	NA
S8	NA	NA	4.48	NA	4.65	NA	4.48
S9	3.06[b]	3.09[b]	3.28[b]	NA	NA	NA	3.09[b]
S10	NA	4.2	3.9	3.8	4.1	NA	3.9
S11	NA	3.8	4	3.96	4.03	3.8	NA
S12	NA	3.55[a]	NA	3.96[a]	NA	NA	NA
S13	4.18	3.25	3.89	2.03	3.6	3.1	NA
S14	NA	NA	NA	NA	NA	NA	NA
S15	3.78[a]	NA	2.46[a]	NA	NA	NA	NA
S16	3.18	NA	3.37	NA	NA	NA	NA
S17	3.64[a]	3.9[a]	3.65[a]	NA	3.95[a]	NA	NA
S18	4.12	3.87	4.04	3.87	3.85	3.8	4.02
S19	3.11[a]	NA	3.44[a]	3.21[a]	3.81[a]	NA	NA
S20	4.22[c]	4.67[c]	4.1[c]	4.32[c]	4.55[c]	4.55[c]	4.67[c]
S21	4.08	4.08	4.28	NA	4.12	NA	3.89
S22	NA	NA	2.44	2.47	2.55	1.96	NA
S23	4.22[b]	4.62[b]	4.06[b]	NA	NA	NA	4.61[b]
S24	3.98	4.09	4.26	NA	NA	NA	3.95
S25	3.42[a]	3.62[a]	3.51[a]	4.06[a]	4[a]	4.34[a]	3.66[a]
S26	3.65	NA	3.85	3.39	3.92	4.41	NA
S27	NA	NA	3.31[a]	NA	NA	NA	3.34[a]
S28	4.04	2.95	3.76	4.05	3.83	NA	3.58
S29	NA	2.94[a]	2.95[a]	3.89[a]	3.89[a]	4.17[a]	2.86[a]
S30	NA	NA	NA	3.67	3.36	NA	3.9

Note. CSF: critical success factor; NA: not applicable.
[a]Converted value from (1–7) scale.
[b]Converted value from (1–9) scale.
[c]Converted value from (1–3) scale.

Table 6. Summary Statistics of the Likert Scale Responses for the CSFs.

CSF	Average value	Number of studies out of 30	Population out of 4,755	Percentage population (%)
Technical competence students	3.69	13	2,215	46.58
Technical competence educators	3.37	3	579	12.18
Personalization	3.86	9	1,247	26.22
Learner autonomy	3.47	13	1,878	39.5
User perception	**3.68**	**30**	**4,755**	**100**
User-friendly application design	3.69	21	2,426	51.02
Application working	3.74	23	3,171	66.69
Learning made interesting	3.76	18	2,792	58.72
Assimilation with curriculum	3.73	17	3,006	63.22
Increased productivity	3.52	25	4,348	91.44
Learner community development	3.60	16	2,893	60.84
Platform accessibility	4.01	19	3,454	72.64
Internet access	3.96	10	1,505	31.65
Blended learning	3.8	15	2,516	52.91

Note. CSF: critical success factor.

platform offers them sufficient benefits to warrant continuing usage. As this is the core assessment response, the fact that it is present in all the studies does not mean anything special. The presence of other factors and their effect on user perception is actually of more interest, after a cursory look at whether users found the overall system useful.

From the point of view of the research, an understanding of whether users thought the m-Learning system increased their productivity was considered to be of the utmost significance. This explains the presence of the factor in more than 90% of the studies. Users, on average, considered that using m-Learning led to an increase in their efficiency and productivity. However, this does not mean that a lower percentage means that the factor is of less importance, merely that researchers did not include the factor as part of their research study. For instance, technical competence was assessed in only three studies, and logic states that educators need to be well trained in the platform to give the maximum benefit to the students. Similarly, access to the Internet, which students consider extremely important, was evaluated in merely 31% of the studies. The results from the analysis can be used by prospective researchers to enhance their research studies and gain pertinent information regarding the performance and perception of m-Learning within an institution.

Discussion

Summary of Results

Overall, our study identified 30 studies that contained primary data comprising the actual responses of the m-Learning users on how they evaluated the various aspects of the m-Learning process that was tested in their institution. The study contains research conducted in 17 countries worldwide with a combined sample population of 4,755 (the majority being students using m-Learning in various courses). Overall, the research showed that the users were seen to be fairly satisfied with the usage of m-Learning within their particular courses and were interested in using the system more in the future. On a 1 to 5 Likert scale, the satisfaction ratio was a respectable 3.68, which clearly shows a positive response.

While universal response about the availability of mobile phones and related services was not available, the studies that included this information found that more than 90% of the sample population claimed to own mobile phones. Similarly, although information regarding access to the Internet and data services was not universally available, more than 61% and 77% of the population, respectively, had access to these services. Interestingly, about 66% of the population (for the studies where information was available) had already used m-Learning platforms, and an overwhelming 88% of the population was interested in using mobile phones for m-Learning purposes. It is important that future studies conducted in this area have information on these aspects, as this would give a clear picture of the actual status of m-Learning in a particular institution and of possible technological barriers that need to be overcome in individual cases.

Discussion on CSFs

The information available about the CSFs is highly subjective to the individual researchers. Interestingly, all 13 factors were found to be necessary to the success of m-Learning. Even without considering the number of studies that assessed the success factors, the results of the present research can be used for indications of the relative importance of critical factors from the point of view of the users.

Platform accessibility was considered to be the most important factor, followed by Internet access, personalization of the platform, the possibility of blended learning, and the prospect of learning made interesting. This showed that the factor judged to be the most important was the involvement of the university administration in providing clear access, goals, and guides to using the platform. The second most important factor was access to the Internet, and the third most important factor was personalization of the platform. This is interesting because this shows that while students may or may not be interested in learner autonomy, they are extremely interested in the possibility of tailored

learning that would satisfy individual learning goals and objectives. The next most important factor was blended learning. Users also rated the prospect of mobile phones offering an interesting way to learn to be a key success factor. This factor becomes even more important in light of the fact that m-Learning is mostly controlled at the learners' pace and time, and it would not work efficiently if users are not interested in the learning itself. These top five CSFs need to be kept in mind if m-Learning is to find sustainable long-term success.

The other eight success factors, in decreasing order of importance, are application working, assimilation with curriculum, technical competence of students, user friendly application design, learner community development, increased productivity, learner autonomy, and technical competence of educators. A remarkable aspect of the results is that, while the factors are rated in decreasing order of importance, the least important factor has a Likert score of 3.37, which is significantly higher than average. Also, all the factors are close to each other with less than the maximum distance between adjoining factors of ≤ 1. When this information is combined with the fact that not all of the factors have been evaluated as part of all studies and that some CSFs have been evaluated as less, as 3 to 10 studies out of 30 show, the factors are fairly close to each other in importance and cannot be ignored in favor of others.

A total of 13 CSFs were evaluated as part of the study along with a measurement of user perceptions of m-Learning. All 13 factors were found to have a significant impact on the success of m-Learning from the user perspective. It was also found that users were satisfied with m-Learning and were interested in using it in the future. M-Learning was also considered to improve efficiency and productivity among the users. If we look back to the theoretical framework, we can see that our 13 CSFs can be assigned to the attributes of innovation as described.

- Relative Advantage—Learning made interesting, increased productivity
- Compatibility—Assimilation with curriculum, blended learning
- Complexity—User friendly design, Internet access, application working
- Trialability—Platform accessibility, learner autonomy, personalization
- Observability—Technically competent students, technically competent educators, learner community development.

Moving on, we can also see that these CSFs can also be attributed to the types of decisions being made as well, as shown here:

- Personal decision—Platform accessibility, learner autonomy, personalization, learning made interesting, increased productivity
- Collective decision—Learner community development, Internet access
- Authority decision—Assimilation with curriculum, blended learning, technically competent students, technically competent educators.

Using the framework and our CSF together helps us see what aspects of the innovation decision process are the likely causes of the reduced take-up of m-Learning in comparison to the popularity of the adoption of mobile options in other aspects of life.

Conclusion

There are a number of aspects of the research that must be borne in mind when assessing the resulting data, because different research assessed different demographics and numbers make absolute comparison seemingly impractical. However, by utilizing these results together, a broader view of the reaction to m-Learning throughout a wide range of students across the world can be gained. The opportunity for further work in the field by more detailed research into specific demographics and regions should not be ignored, however, and this would be a place to build on these findings.

This research work presents an exhaustive systematic survey of the existing research studies evaluating m-Learning worldwide. The study in particular is based on the perspective of university students. The systematic review collated the responses from 4,755 respondents collected in 30 studies conducted in 17 countries worldwide. The results of the systematic review showed that the research conducted in the area of m-Learning was fragmented and idiosyncratic and based on the understanding of the individual researcher.

With all our confirmed key CSFs falling into the theoretical framework, the results of the work studied here show that although the aspects required for successful take-up are largely in place, they are heavily skewed toward the personal decision type of adoption. This may seem an obvious occurrence given the nature of m-Learning, but it is also perhaps an indication that the benefits for the other innovation decisions, particularly the authority-type choices, are not as well satisfied currently. This gives an indication as to where the resistance to take-up is actually occurring.

The future focus of research in this area could be to evaluate the impact of individual success factors on the overall perception of the platform. This would quantify the effect of each success factor in precise statistical terms, and it would be a relevant basis on which to design and implement future m-Learning. We intend to include factors related to operations, content management and presentation, and functionality in our future studies.

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