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An empirical study of critical success factors of mobile learning platform from the perspective of instructors

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Abstract

Mobile learning is newest learning platform and based on the rapid rate of proliferation of mobile technology throughout the world is expected to grow at a rapid rate. However, the adoption of m-Learning is proceeding at a cautious rate. This mismatch in the rate of growth of the technology itself and the use of the technology in learning is a subject of extensive interest to researchers. However, research in the area has been mostly focused on understanding the success factors of the platform from learners' perspective. In this research, we have conducted an extensive analysis of the extent to which various factors are considered to impact the success of mobile learning from the perspective of instructors. This is because instructors not only are one of the core users of the platform they also hold a great deal of influence in promoting the platform usage among learners. The results of the research were not found to be statistically significant showing that greater population size is required to assess various hypotheses.

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Keywords: m-Learning, mobile learning, higher education, critical success factors, empirical studies.

1. Introduction

Mobile phone is easily the most profligate technology the world has ever seen, in terms growth, reach and technical advancements. While its prominence can be traced to the 1980s, in less than three decades the mobile technology has revolutionized the way people communicate and access information (Alrasheedi & Capretz, 2013a).

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This has result in rapid spread of mobile phones among the global population. For instance, while the reach of mobile phone was limited to about one-third of global population in 2004 (Paul & Seth, 2012), according to the recent estimates by World Bank, over 90% of the world population live within the range of a cell phone tower in 2010. This means that the number of people using mobile phones increased from less than 700 million in early 2000s to over 5 billion or 70% of the world population in 2010 (The World Bank Institute, 2012). Mobile phone technology has also grown leaps and bounds in terms of its versatility, which almost continual addition and extension of features and capabilities. This has made them devices of choice by an increasing number of people us to stay in touch with the rest of the world. Even though, educational systems have been shaped by the emerging technologies practices (Capuruço and Capretz 2009).

With this background, one would expect that the concept of mobile learning would be adopted at a similar rate, especially in higher-learning institutions in the technical sector where both learners and educators are more tech savvy. While much of the research suggests that the interest in exploring mobile learning has remained high (Rockley & Cooper, 2012) the adoption in the educational sector has been slow (Peters, 2009). This is especially true for higher educational sector, where the adoption of mobile learning has been especially slow. Interestingly students in higher education are receptive towards the idea of usage of mobile learning as they are comfortable with the technology. However, researchers speculate the issue lies with instructors many of whom do not understand how to use these devices in learning, while others are uncomfortable with the technology. The lack of an adoption framework combined with rapidly changing technology and concerns about security and privacy have only slowed down the actual adoption rate (Wilen-Daugenti, 2009). It can be seen that attitude of instructors is one of the major bottlenecks to the success of mobile learning. The detailed analysis of the opinions of instructors is the subject of the present study.

The structure of the paper is as follows. Section 2 presents the literature review where several relevant aspects related to mobile learning and perception have been discussed. Section 3 presents the research model and the hypotheses that would be tested. Section 4 presents the research methodology. Section 5 presents the analysis of data comprising of demographic analysis, correlation analysis and determination of regression equation. Section 6 presents a discussion of the results and the limitations of the present study. Section 7 presents the conclusion.

2. Literature review

Mobile learning offers users several unique features that were not possible in traditional learning platforms and even in e-learning to so extent. The first among these features is mobility that refers to the prospect of having flexibility in terms of time, place, pace and space that is not achievable when using non-mobile versions of devices (Andrews, et al., 2010). Another unique feature of mobile learning is collaborative learning. While collaboration is a part of education in traditional learning scenarios as well, the use of mobile devices means that learners can now interact with fellow students and educators from different locations even when they are not in a formal classroom. Mobility combined with collaborative learning makes the m-Learning platform different from any other existing learning platform, whether it is traditional face-to-face learning or other technology-based platforms like e-Learning (Kukulska-Hulme & Taxler, 2007).

Because of the ubuiquitousness of mobile technology, it difficult to escape the immense ramifications offered by the mobile learning platform. Ironically, every single feature that makes mobile learning possible has a downside to it, including the technology. First, the wireless communication technologies might offer anytime, anywhere learning possibilities, but the actual feasibility depends on the interest and diligence of learners (Kukulska-Hulme, Introduction, 2005). The education sector spends a lot to time and effort into making sure that students actually learn something and hence the focus on face-to-face interactions during learning and examination sessions. Wireless technology adds an additional burden because universities would be expected to impart successful degrees to the same caliber of students, if mobile learning is to be included as a mainstream education platform (Ally, 2009). Second, the security issues related to internet technologies are too pertinent to be ignored. This means that the university has to spend a significant amount to ensure that their systems are secure (Alrasheedi & Capretz, 2013b). This, in turn means, rising cost of education. As one of the objectives of distance education has always been reducing cost of learning, this aspect may nullify any cost savings. The hand-held device technology also acts as barrier in several ways. First the rapidly changing features, means that the development and modification of the

learning platform has to keep up its pace with changes in technology. As new models of all brands of phones turn up every few months, this is not a very easy thing to do. Also unlike standard computers, the user interfaces of mobile devices are too varied and hence designing a common user interface itself is a challenge. Finally, as multiple technologies exist in terms of the types of handsets, the operating systems, and device capabilities, the implementation of mobile learning platform to make it user friendly is extremely difficult (Melhuish & Falloon, 2010).

As can be seen from above, there are several legitimate barriers to the adoption of mobile learning by users. From a developer's perspective solutions are a cross between the requirements and budget. The requirements are decided by the users. Hence, the exact requirements of a successful mobile learning platform can be best decided by the users themselves. Researchers have conducted several studies to assess the factors that learners consider important. But as discussed at the start, learners are already receptive to the idea of mobile learning. It is the instructors who are skeptical of the idea and are slow to adopt the principles of m-Learning. As the success of any educational paradigm is dependent on the interest of the educators, it is important to understand the factors that educators consider important while adopting m-Learning. Furthermore, it's vital for instructors to improve the teaching strategies (Seddigi, Capretz, & House, 2009).

Ironically however, not many studies have been conducted in this regard. The few studies that have been conducted offer interesting background, though the studies are extremely limited in scope. MacCallum and Jeffrey (2009) conducted such a study in New Zealand on tertiary education. The researchers find that the educators have ambivalent feelings towards m-Learning in higher education sector. While all educators agree with the wide ranging benefits of the platform they are concerned about the integration of these technologies with the curriculum and the time taken for the implementation. While educators welcome low level integration of mobiles to support learning activities, the use of m-Learning as a separate platform is not one they are highly receptive to (MacCallum & Jeffrey, 2009). An extensive study conducted by Pollara (2011) in US found another reason why higher education faculty are not overtly receptive to the use of mobile technology in learning. The research found that faculty perceptions on the usefulness of mobile technology in education were affected because many believed that students used the devices actually for socializing purposes when they reported that they were doing study-related tasks. In their view, this affected the entire learning process by distracting students, to the extent that some instructors actively banned the use of mobile devices inside the classrooms. Interestingly students believed that they would perform better if the use of mobile phones were not restricted (Pollara, 2011). This background only serves to highlight how important is it to conduct a detailed study into understanding the perspective of instructors towards m-Learning in the higher education sector.

3. Research model & hypothesis

The purpose of the research is to present a research model for assessing how and to what extent different factors affect educators' perspectives on the use of m-Learning, in the higher education sector. Figure 1 below shows the research model diagram.

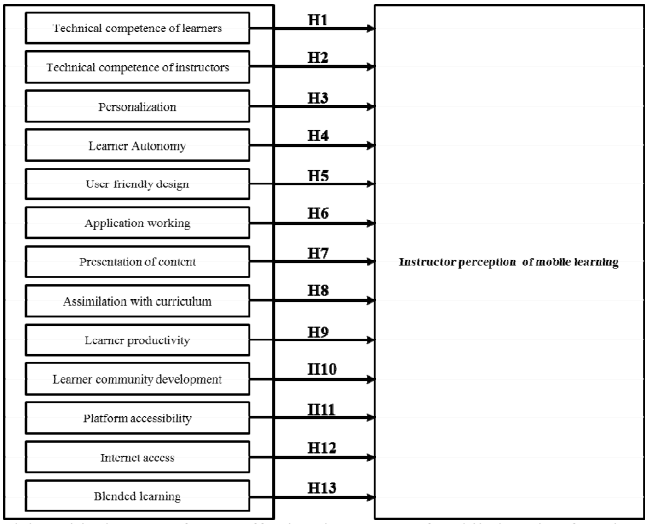

Fig. 1. Research model – critical success factors affecting the success of mobile learning from instructors' perspective

Educators are the backbone of learning and hence their attitude towards a new platform is extremely important to understand. Our previous research found 13 factors that affect the overall attitude towards the m-Learning platform (Alrasheedi & Capretz, 2013c). To determine the user satisfaction levels we have conducted a detailed survey targeting the educators using the m-Learning platform. (In this paper the words instructors and educators have been used interchangeably).

Overall the objective of the research is to determine the answer to the following question:

"To what extent do various critical success factors impact instructors' perception of a mobile learning platform?"

The multiple linear regression equation of the model is as follows:

Instructor perception = $c_0 + c_1f_1 + c_2f_2 + c_3f_3 + c_4f_4 + c_5f_5 + c_6f_6 + c_7f_7 + c_8f_8 + c_9f_9 + c_{10}f_{10} + c_{11}f_{11} + c_{12}f_{12} + c_{13}f_{13}$.

In the equation c_0, c_1, c_2, c_3, c_4, c_5, c_6, c_7, c_{08}, c_9, c_{10}, c_{11}, c_{12}, and c_{13} are coefficients and f_1, f_2, f_3, f_4, f_5, f_6, f_7, f_8, f_9, f_{10}, f_{11}, f_{12}, and f_{13} are the 13 independent variables. To empirically investigate the research question, the 13 hypothesis are derived as presented below:

Hypothesis 1. Technical competence of students positively affect the overall instructor perception

Hypothesis 2. Technical competence of instructors (from their own perspective) will positively affect the overall instructor perception

Hypothesis 3. Extent of personalization will positively affect the overall instructor perception

Hypothesis 4. Extent of learner autonomy will positively affect the overall instructor perception

Hypothesis 5. User friendly design of m-learning platform will positively affect the overall instructor perception

Hypothesis 6. Better application working (ease of platform usage) will positively affect the overall instructor perception

Hypothesis 7. Possibility of interesting ways of presenting the course matter will positively affect the overall instructor perception

Hypothesis 8. Assimilation with curriculum, from learners' perspective, will positively affect the overall instructor perception

Hypothesis 9. Perception of increased learner productivity will positively affect the overall instructor perception

Hypothesis 10. Perception of increased opportunities for learner community development will positively affect the overall instructor perception

Hypothesis 11. Perception of improved platform accessibility will positively affect the overall instructor perception

Hypothesis 12. Perception of improved internet access will positively affect the overall instructor perception

Hypothesis 13. Blended learning possibility will positively affect the overall instructor perception

4. Research methodology

Instructors are not only one of the primary users of the mobile learning platform, they also act as mentors to the primary users – the learners. In addition, instructors are also responsible for course design and dissemination, which makes them the more important user in terms of the extent to which they use the m-Learning platform. The present study focuses on gathering the opinions of instructors and analyzing them in a systematic manner. To collect the data we gave the questionnaire to various undergraduate and post graduate instructors teaching different courses in five universities in Saudi Arabia. We assured the instructors that the survey was confidential: their identity would not be disclosed and their primary responses would be used for this study only. We received a total of 64 completed questionnaires.

4.1. Reliability and validity analysis of measuring instrument

The present survey of mobile learning comprised of a series of questions determining the attitude of educators towards m-Learning platform. Nine of these questions were straightforward involving single-item measurements. However, four of the questions involved multi-item rating scales: learner productivity, learner community development & platform access, which use four-item measurements; and internet access that uses three-item measurement. In addition, the overall learner perception is also measured using three-item measurement. In all these cases it is important to assess the reliability of the measurement scales. This is done to quantify the reproducibility of a measurement and is performed using an internal consistency analysis – calculating the Cronbach's alpha. The limits of the satisfactory levels for this reliability coefficient has been performed by various researches. Most of the studies cite the studies by van de Ven and Ferry, who consider that coefficient of 0.55 and higher is satisfactory (Van de Ven & Ferry, 2008). Recent studies by researchers like Osterhof, however have increased this the minimum satisfactory level of the reliability coefficient to be somewhat higher at 0.6 (Osterhof, 2001). In our case, the reliability coefficient is all cases is >0.8, which means that the measuring instruments used are reliable. The Table 1 below shows the values of Cronbach's alpha and PCA eigen values for the factors discussed.

Table 1. Cronbach's alpha for multi-measuring rating scales.

Success Factors	Item Numbers	Cronbach's alpha	PCA eigen
Learner Productivity	(ix to xii)	0.9360	1.7159
Learner Community Development	(xiii to xvi)	0.8415	1.6147
Platform Accessibility	(xvii to xx)	0.9462	1.7019
Internet Access	(xxi to xxiii)	0.8078	1.6440

4.2. Data analysis procedure

The data analysis procedure for the present study comprises of three steps. The first step is to check if there is a parametric correlation test between the dependent and independent variables to check if any of the critical success factors or hypothesis could be rejected. The second step involves conducting a non-parametric test is conducted between the the dependent and independent variables in order to reduce the external validity threat (Raza, Capretz, & Ahmed, 2012). The third step is the actual regression analysis to determine the regression equation i.e. the value and sign of the coefficients for each of the variables.

5. Hypothesis tests and results

5.1. Demographic distribution of the population

This section discusses the distribution of the population based on demographics. As mentioned, the total population comprised of 64 teachers. Of this, 47 (~73.44%) were male and 17 (~26.56%) were female. Further, as mentioned earlier, the population comprised of tutors from different universities. The distribution was reasonably uniform. Only one of the instructors was under 25 years of age. A majority i.e. 36 or >50% of the instructors were between 36-55 years of age. The next largest age group was 26-35 years, which involved about 21 of the instructors. Only 6 instructors were over 55 years of age. An overwhelming majority of the instructors i.e. 61 out of 64 were employed full-time, the remaining were employed part-time. In terms of the teaching levels, 48 instructors or 75% of the population taught Undergraduate classes, while the remaining 16 instructors or 25% of the population taught post graduate classes.

One of the important aspects of demographic analysis was to understand the extent of mobile phone proliferation among this group of users. The survey results were extremely interesting in this regard. All the instructors owned mobile phones. Further an overwhelming majority i.e. 59 out of 64 instructors or 92.2% of the instructors owned a smart-phone or a PDA. Additionally, 55 instructors or 85.94% also owned a desktop PC, while a significant majority i.e. 62 instructors owed a laptop/tablet PC/mini notebook. All the instructors had internet installed on at least on of these devices, and a significant majority i.e. 59 instructors or 92.2% of the instructors had internet installed on their mobile phones. This data shows that the mobile phone and internet penetration was extremely high among instructors and they were both aware of and were active users of the mobile phone as well as internet technologies in tandem.

5.2. Hypothesis testing using parametric and non-parametric tests

Before conducting the actually regression analysis, additional tests were conducted on the hypothesis to see if any of these could be rejected thus simplifying the analysis. To test the hypotheses H1-H13, parametric and non-parametric statistics were used to examine the Pearson and Spearman correlation coefficients between the individual independent variables i.e. the critical success factors and the instructor perception of the critical success factors.

Table 2. Hypothesis testing using parametric test.

Hypothesis	Critical Success Factor	Pearson Correlation Coefficient	Spearman Correlation Coefficient
H1	Technical competence of learners	0.476	0.433
H2	Technical competence of instructors	0.689	0.592
H3	Personalization	0.647	0.555
H4	Learner Autonomy	0.658	0.627
H5	User friendly design	0.610	0.582
H6	Application working	0.673	0.600
H7	Presentation of content	0.613	0.558
H8	Assimilation with curriculum	0.536	0.564
H9	Learner productivity	0.601	0.684
H10	Learner community development	0.716	0.552
H11	Platform accessibility	0.702	0.592
H12	Internet access	0.644	0.491
H13	Blended learning	0.701	0.650

The results of the statistical calculation for the Pearson correlation coefficient are shown in Table 2 below. It is commonly fact that the lower the p-value the better chance there is of rejecting the null hypothesis and hence the more significant is the result in terms of its statistical significance (Stigler, 2008). In the present case, all the p-values are 0.00. This means that the results are significant.

5.3. Testing of the Research Model

A multiple linear regression equation for our research model was presented earlier. Following is the linear regression equation:

$$\text{Instructor perception} = c_0 + c_1f_1 + c_2f_2 + c_3f_3 + c_4f_4 + c_5f_5 + c_6f_6 + c_7f_7 + c_8f_8 + c_9f_9 + c_{10}f_{10} + c_{11}f_{11} + c_{12}f_{12} + c_{13}f_{13}.$$

In order to determine the coefficients of the equation above we run a regression analysis. In addition to giving the model coefficient the regression also gives the direction of association. As can be seen from the model equation above, all the critical success factors are assumed to have positive association with the user perception. The regression analysis will inform whether this is true in all cases. Further, the analysis does not include any categorical predicators. The results are given in Table 3 below.

The result of the regression analysis offer interesting insights into the model. First, not all the coefficients are positive. This means that critical success factors – Technical Competence of Learners, User Friendly Design, Learner Community Development and Platform Accessibility – all have negative association with instructor perception. This deviates from the expected relationship.

The final regression equation is as follows:

$$\begin{aligned}\textit{Instructor perception} &= 0.339 - 0.072\,(\textit{Technical Competence of Learners}) + 0.104\,(\textit{Technical Competence of Instructors})\\ &+ 0.014\,(\textit{Personalization}) + 0.221\,(\textit{Learner Autonomy}) - 0.020\,(\textit{User Friendly Design})\\ &+ 0.036\,(\textit{Application Working}) + 0.036\,(\textit{Presentation}) + 0.043\,(\textit{Assimilation with Curriculum})\\ &+ 0.258\,(\textit{Learner Productivity}) - 0.250\,(\textit{Learner Community Development}) - 0.019\,(\textit{Platform Accessibility})\\ &+ 0.249\,(\textit{Internet access}) + 0.250\,(\textit{Blended learning})\end{aligned}$$

From the regression analysis, it is seen that the model accounts for 53.76% variability in the dependent variable i.e. instructor perception. However, the p-values in all cases is more than 0.05, which means that none of the relationships is significant. This means that the relationship coefficients cannot really be said to show the actual relationships between the dependent and independent variables.

Table 3. Multiple regression analysis of the research model.

Critical Success Factor	Coefficient term	Coefficient value	t-value	p-value
Technical competence of learners	f_1	-0.072	-0.50	0.621
Technical competence of instructors	f_2	0.104	0.57	0.575
Personalization	f_3	0.014	0.08	0.937
Learner Autonomy	f_4	0.221	1.24	0.222
User friendly design	f_5	-0.020	-0.11	0.915
Application working	f_6	0.036	0.16	0.873
Presentation of content	f_7	0.036	0.23	0.818
Assimilation with curriculum	f_8	-0.043	0.25	0.801
Learner productivity	f_9	0.258	0.87	0.391
Learner community development	f_{10}	-0.250	-1.09	0.279
Platform accessibility	f_{11}	-0.019	-0.08	0.933
Internet access	f_{12}	0.249	1.49	0.144
Blended learning	f_{13}	0.250	1.64	0.108

6. Discussion of the results

The results of data analysis presented in this paper is only a snapshot of the detailed analysis. Further exploration of several of the interrelationships can be conducted using the data. These have not been covered here because of the results of the regression analysis.

The demographic analysis of the results shows a highly skewed distribution towards the male population. However, the presence of female instructions was not insignificant either as they comprised of one-fourth of the entire population. As expected most of the instructors are between 26 and 55 years of age, with a few instructors

over 55 age limits. Also, there is a minuscule representation of instructors less than the age of 25, as is expected in general from the faculty of tertiary technical institutions. Interestingly most of the instructor population was found to be technically savvy and very comfortable with owing and using advanced mobile phone devices. The use of internet was also universal and a majority of the population accessed internet from their mobile devices. The instructors were also found to be technically savvy an owned other devices likes desktop PC, laptops and tablet PCs. This clearly shows that lack of technical awareness is not an issue to the adoption of mobile learning platform within five Saudi Arabia universities.

The effect of four of the critical success factors - learner productivity, learner community development, platform accessibility, and internet access, as well as the dependent variable 'instructor perception' was determined using responses from multiple-items in the survey. As such, it was important to first assess the reliability of the instrument. This was done by conducting an internal analysis, by conducting an internal analysis by determining the Cronbach's alpha for these multiple-items. It was found that the Cronbach's alpha in all the cases was >0.8. This is clearly much higher than even the recently determined higher threshold of 0.6. Hence, the averages of the response could be used for determining the individual variable coefficients in the research mode.

The next step involved determining whether there was a correlation between the different independent variables and the dependent variables. In the present study both parametric and non-parametric studies were carried out. This was to remove the threats to external validity. In all the cases, the Spearman's Rho was found to be somewhat lower than Pearson's coefficient though the correlations were always >0.4. More importantly, all the hypothesis were found to be statistically significant as the p-values in each cases for both parametric and non-parametric correlation analysis was found to be 0.00. This meant that in all cases there was a reasonable correlation between the various critical success factors and the instructor perception based on the current data.

Once, it was made sure that the critical success factors had statistically significant relationships with instructor perception, the next step was to determine the regression model. It is at this point that the present study reaches a hitch. First, in case of the variables the expected direction is negative - Technical Competence of Learners, User Friendly Design, Learner Community Development and Platform Accessibility. This means that in all these cases, the instructors believe that the critical success factor is inversely related to the success of mobile learning. Interestingly, all the four factors are related to learners. It is very easy to believe that instructors consider that these factors are not of much important when deciding the success of mobile learning. One of the research studies in the literature review section points towards the attitude that instructors believe that mobile phones are disruptive to m-Learning, which might explain this attitude. Another interesting aspect is that none of the coefficients are >0.3, which shows that instructors are divided into what they believe are the critical factors for the success of mobile learning. Among the factors, the most influence was attributed to Learner Autonomy, Learner Productivity and Internet Access.

Additionally, and more crucially, in none of the cases the p-value was <0.05. In fact, in all the cases, the p-value was higher than 0.1 and in some cases it was even greater than 0.9. This shows that based on the current data, none of the relationships was found to be statistically significant. This might be because the population size was small and comprised of only 64 instructors which was used to analyze 13 hypotheses. Another reason might be because most of the success factors were considered from the learner perspective.

6.1. Limitations of the study

As mentioned earlier, this research did not explore all the interrelationships between the demographic factors and the instructor perception. Some factors such as gender are believed to have an effect on the user perception on mobile phones. The regression equation included only continuous parametric data and so the demographic categorical variables were not considered. The idea was to first explore the relationships without assessing the internal factors responsible for the individual responses. As none of the relationships were found to be statistically significant, the internal analysis using demographic variables was not conducted. The analysis can be a part of future analysis, once more data is collected to see whether increasing the survey population. As all the critical success factors showed significant correlation with the dependent variable i.e. instructor perception, this is a reasonable assumption to make.

7. Conclusion

In this paper, we have presented the results of a detailed and systematic investigation into the critical success factors affecting user perception of m-Learning from the perspective of instructors. As instructors are one of the crucial user groups, it is important to understand the factors they consider crucial for the success of mobile learning. The results of our study showed that none of the factors analyzed were statistically significant. The reason for this can be attributed to the large number of hypothesis tested and the small size of population. Future studies would involve whittling down the number of hypotheses and increasing the size of population.

The study result also showed that according to instructors, the following factors – Technical Competence of Learners, User Friendly Design, Learner Community Development and Platform Accessibility – had negative association with the success of mobile learning. Again this result cannot be said to be conclusive because the results were statistically not significant. Finally, the research was limited because the impact of demographic factors on survey responses was not assessed. Future work would endeavor to sort all these aspect of the research.

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