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Mobile Applications of Learning Management Systems and Student Acceptance: An Empirical Study in Saudi Arabia*

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Abstract

Nowadays, learning management systems (LMS) are an effective and efficient tool for providing students with a high-quality education. The current study examines the effect of different factors on the use of the blackboard application on mobile phones. The study selects four important factors after factor analysis, such as facilitating factor, performance factor, satisfaction factor, and difficulties factor. The data was collected through a structured questionnaire from 45 students as a sample in the college of business administration at Prince Sattam Bin Abdulaziz University. The study uses a logistic regression model to examine the empirical relationship between LMS adoption and different factors associated with blackboard adoption. The results show that 71 percent of the respondents are between the age of 18–20 years, and 100 percent of students have experience in using blackboard. The empirical results show that the satisfaction factor is positive and significant at the 10 percent level of significance and the difficulties factor is also positive and significant at the 1 percent level of significance. The results conclude that the students are satisfied with using the blackboard on mobile, nevertheless, the difficulties factor which is positive and significant shows that students are facing some difficulties in using the blackboard on their mobile.

Keywords: Mobile Technology, Blackboard, LMS Adoption, E-learning, Saudi Arabia

JEL Classification Code: O31, O33, O43, O53, P46

1. Introduction

The existence of trade and competition among the businesses, and the firmness of purpose among the human beings are due to learning. There is a collection of information through the teaching and learning process in the current period of information. The appreciation goes to the information technology for making online learning grows. The rapid development in online learning is due to a number of concerns, such as traffic, population, work from home, time management, etc. These are the concerns that have smoothened the way for online learning. The recent growth in business, economic, social aspects of people, technology, etc. have paved the way for the introduction of electronic learning. Moreover, there is a constant change in the system of higher education, and the system demands growth in terms of shape, design, teaching vision, and relationships (Georgina & Olson, 2008; Alshalan, 2019). Further, the institutions of higher education have modified themselves from the physical pattern of offering education to an informative pattern through the use of technology.

The process of e-learning comprises providing educational content to the students by using technology. In other words, the provision of access to educational needs anywhere all the time is called e-learning (Holmes & Gardner, 2006; Yılmaz, 2012). Further, e-learning should not be confused with distance learning, where the latter is a type of e-learning. E-learning is carried out through the Internet, and the process is carried out through Learning Management Systems (LMS). A LMS is a soft application that delivers things online, such as training to students, distribution of study material, tracking students' progress, and generating student grades. Therefore, the study through LMS becomes an effective and efficient tool in delivering good quality

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education to the students. This application bridges the gap between students and mentors by associating them online.

Moreover, communication through mobile is embedded into the life of human beings, where they feel uneasy without holding it. The present developments in mobile technologies have made mobile phones perform in a smart manner through holding an ample number of applications, and enhanced Internet usage. Moreover, it was observed that the use of mobile devices by the students is more compared to the use of personal computers. In addition, mobile manufacturing companies provide many features in mobile devices that are useful to browse different applications. The benefits of using mobile technologies by students and faculties include an increase in active participation in academic activities, increase motivation for learning, enhanced student interaction, and organize classroom practices.

The use of smartphone devices in the Kingdom of Saudi Arabia is more among the young population, while its usage is limited in terms of academics. Even though ICT adoption by the Saudi Arabian higher educational institutions has increased (establishment of Saudi Electronic University), there exists a gap in how best these ICT practices are implemented. Therefore, the core objective of the current study is to examine the factors that affect the usage of LMS through mobile technology in the universities of Saudi Arabia.

2. Literature Review

Beatty and Ulasewicz (2006) examined the perceptions of faculty members on the LMS transition from blackboard to moodle. There were different perceptions of faculty members, such as moodle is an attractive instrument for the faculty and student when it is used for the first time, and difficult using it when considered online. On the other hand, a transition plan has to be prepared when moving from one LMS to other, if the new plan develops new features, and this should be done in the early stages. They concluded by saying that the most significant factor in an online system is to select the right tool for the learning system to make students successful. Larreamendy-Joerns and Leinhardt (2006) studied the advantages and limitations of the online education system. They focused on quality of education, liberty in education, and democratization. They found the quality of education and democratization as the main contributions toward the LMS education.

Appan (2008) examined the advantages and limitations of using LMS in the context of students, faculty, etc. She found advantages in using LMS, such as improved learning quality, the contribution of students to a knowledge-based society, opportunities for learning and earning profits, etc. Similarly, she found some disadvantages, such as funding, preparedness, readiness by the students and faculty, etc. Chang (2008) examined the perceptions of faculty members in using LMS in the higher education system. The study found a significant association between the usage of LMS and the perception of faculty members in using it. But the study found an insignificant association between the perceptions of faculty members and the design of blackboard features. Dykman and Davis (2008) studied online teaching and traditional teaching comparatively. They suggested that online teaching is easier than traditional teaching in a classroom. The process of online teaching shall be easier in the long term teaching online by the faculty, but there will be some difficulties initially. Al-Fahad (2009) examined the perceptions and attitudes of students towards the effectiveness of LMS at KSU. The study found the retention of some program students by introducing LMS. They also suggested that this LMS system can be used anytime and anywhere.

Thomson (2010) studied the perceptions of faculty and students on learning online. She found that learning online is gifted education. It opens opportunities to students, allows access to the courses in advanced levels, feels controlled in the learning system, individualized experience, etc. Dray et al. (2011) tried to develop an instrument for the readiness of students' online learning. The authors found an effective instrument through their rigorous work that is not only an instrument, but which defines the readiness in terms of ICT, division of digital, and learners' literature. Mathur (2011) studied the perceptions of students of LMS. The study found a positive relationship between the perceptions of students and the use of LMS by the students. The students are interested in using online LMS components, such as Grades, Information, Announcements, and Contacts. Renes and Strange (2011) studied the use of technology in developing higher education. They suggested that colleges support distance education with different aspects of technology. They also suggested helping students in distance education similar to the conventional methods.

Kearns (2012) examined the challenges and effective practices of student assessment in LMS learning. The study found some challenges faced by faculty, such as data collection, feedback provision, physical distance, and dependence on technological instruments. Eldridge (2014) investigated the LMS adoption by the faculty in a Kentucky community college by using the Rasch model. The result of the study has highlighted many variations in terms of users and non-users of LMS. The faculties adopting LMS for the first time, and least experience are among the non-users of the blackboard. The users of blackboard used it for syllabus, survey and test pool, grades and announcements, etc. Bousbahi and Alrazgan (2015) investigated the resistance of faculty to LMS adoption using the technology model. They found some important factors that play a significant role in the perception of LMS, such as organizational support, motivation, and load. Their findings suggest the technology

acceptance model. Venter et al. (2015) studied the use of blackboard through mobile application in higher educational institutions by the IT students at a Central University in South Africa. The results show that a large number of students are not using the LMS mobile application because of the huge cost, and unsupported devices. The students are using the desktop PCs to access the blackboard.

Ülker and Yilmaz (2016) studied the Learning Management System and compare OSLMS and PLMS. They found that open-source LMS is useful to those companies established in the technological field, while the proprietary LMS is useful to those companies that do not have technological software. Yu and Richardson (2016) studied the innovation of an instrument to measure student online readiness. The instrument was validated through Exploratory Factor Analysis. He found four factors that explain the student online readiness, such as social competencies with students, faculty, communication, and technical. Omolade and Opesade (2017) studied different factors that impact the adoption and use of LMS applications by students pursuing higher education using the UTAUT model. They found the factors, such as performance expectancy, social influence, effort and price to be significantly associated with the LMS adoption. They suggested the use of mobile applications for education to increase potential academic activities. Al Meajel and Sharadgah (2018) examined the difficulties in using the LMS system in learning and teaching in the context of teaching faculty. They found no significance in perceptions of faculty in use or non-use of the blackboard system. Further, the study highlighted two barriers that mostly hinder, such as technological and institutional.

Shemahonge and Mtebe (2018) examined mobile applications to help students pursuing distance education in Tanzania. They found that the mobile application facilitates faculty members in providing technical and academic services to students, and also in tracking the progress of students. Alkhaldi and Abualkishik (2019) observed different factors that influence the use of mobile blackboard systems. They found factors, such as performance, effort, self-management learning, previous experience, social aspect, etc. Even though factors such as performance are negative, they shall not affect the relation with LMS adoption. Alshalan (2019) investigated the LMS adoption by the faculty members at both the KSUs. The study found fear of technological variation among the faculty of Kansas University, but no fear of technological variation among the faculty of King Saud University. The study recommended training for the faculties of both universities. Lee (2020) examined the online and offline proctoring of exams on the performance of students and found no significant difference between the two. Further, Marlina et al. (2021) studied the influence of the e-learning process on the performance of students in Indonesia and reported that some factors, such as motivation, environment, organizational structure, etc. affect the students' performance. Moreover, Shameem and Sanjeetha (2021) examined the mobile learning system and found factors, such as social influence, effort, and facilitation significantly affect mobile learning.

The study formulates the following hypothesis to examine the effect of different factors of LMS on the adoption of the mobile blackboard.

H0: *The factors of the Learning Management System (LMS) do not affect the blackboard mobile adoption.*

3. Conceptual Framework

The current study examines the impact of different factors related to the usage of the mobile blackboard on LMS adoption (adopting mobile blackboard). The theoretical framework explaining this relationship is shown in Figure 1. The different factors affecting the blackboard usage are:

1. **Facilitating Factors:** This factor explains the facilities used in adopting the mobile blackboard, such as the different resources available on the blackboard to use, having sufficient knowledge in usage of blackboard, technical support in case of a problem, and suitable speed of internet required for using mobile blackboard.
2. **Performance Factor:** This factor explains the performance of mobile blackboard in terms of different benefits, such as easy to log in on mobile, using mobile blackboard is productive, time-saving, and tasks are completed on time through mobile blackboard usage.
3. **Satisfaction Factor:** This factor explains the satisfaction derived by the students by using mobile blackboard, such as study schedule and its follow-up, submission of assignments is easy, different exams can be taken easily through mobile blackboard, and easy to follow different announcements made.
4. **Difficulties Factor:** This factor explains the difficulties faced by the students by using mobile blackboard, such as mobile blackboard takes longer time to get accessed, mobile has a small screen that

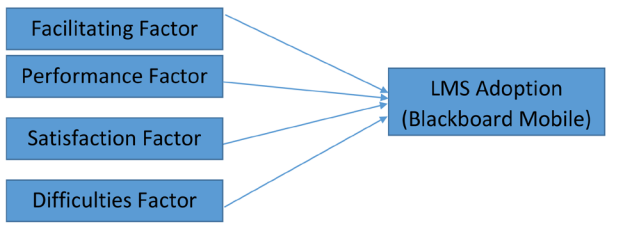

Figure 1: Theoretical Framework of LMS Adoption

is not clearly visible, usage of the mobile phone becomes weak, cost of internet provided by internet service provider might be high, and network signal is weak in the vicinity of the university.

4. Data and Methodology

The current study uses exploratory research to examine the impact of different factors on LMS adoption by the students of Prince Sattam Bin Abdulaziz University. The study uses primary data to estimate the results. The study collects the data through a structured questionnaire. The questionnaire was distributed electronically to the students in the college of business at Prince Sattam Bin Abdulaziz University. The study received responses from 55 students. Further, the data cleaning process was undertaken, and finally, the study considered 45 students as a final sample. Further, the factor analysis was also undertaken, and four factors were chosen to estimate the relationship empirically. The selected factors with their reliability values are given in Table 1.

The factors with their reliability values are given in Table 5. The Cronbach alpha results show that the facilitating component has a value of 0.79, the performance component has a value of 0.67, the satisfaction component has a value of 0.54, and the difficulties component has a value of 0.47. The Cronbach alpha of 0.70 and above is treated as largely reliable as given by Nunnally (1978). Among the given variables, the components of performance, satisfaction, and difficulties are less than 0.70. The low-reliability values might be due to the small sample size as reported by Klein et al. (2002) and Lane and Ziviani (2003).

The study uses the logit model to examine the relationship between LMS adoption and different factors associated with blackboard adoption. A logit model is a mean function of the dependent variable Y that is used to estimate. The variable Y becomes a categorical variable; hence the logit model is used to estimate the equation. The logit model is coded as 0 and 1. The logit function of Y is written as

$$\mathrm{Ln}\left[\frac{P}{1-P}\right] = \alpha_0 + \beta_1 \mathrm{FAC} + \beta_2 \mathrm{SATISF} + \beta_3 \mathrm{DIFF} + \varepsilon \quad (1)$$

Among the study variables, the current study has selected LMS adoption as a dependent variable which is Logit of Y as mentioned in Eq. 1. The study uses this logit model to estimate the impact of different blackboard (LMS) adoption factors on the adoption of LMS. Moreover, the robustness of logistic regression is tested with the help of Log-likelihood chi-square and Pseudo R^2. The study has chosen LMS adoption factors, such as facilitating factor, performance factor, satisfaction factor, and difficulties factor. But the study has dropped the

Table 1: Factors and Their Reliability

Factor	Items	Cronbach Alpha
Facilitating Factor	All resources are available on BB	0.79
	I know using BB	
	Direct support in case of a problem	
	Suitable internet speed for using BB	
Performance Factor	Easy to enter from the mobile	0.67
	Using BB on mobile is more productive	
	Save time by using mobile	
	All the tasks are completed on time	
Satisfaction Factor	Follow-up and the study schedule	0.54
	Submission of Assignments	
	Using mobile BB to take exams	
	Follow up on mobile announcements	
Difficulties Factor	Mobile BB application takes longer to load	0.47
	The small screen of the smartphone is inconvenient	
	Use of the mobile phone is weak	
	Cost of the price of mobile internet service providers	
	A signal is weak in the vicinity of the university	

performance factor from the logit estimation model due to its multicollinearity with other explanatory variables.

5. Results and Discussion

5.1. Descriptive Statistics

The current section presents the study results. The demographic results are reported initially followed by the empirical results. Table 2 shows the age of respondents, where 71 percent of the respondents are between the age of 18–20 years, while 22 percent in between 21–23 years, and 7 percent in between 26–28 years of age.

Table 3 shows the experience of students using the blackboard. The result shows that most of the students (58%) have one year of blackboard using experience, while 24 percent of the sample has 1–2 years of experience, and 18% of the sample has 3–4 years of experience.

The biographical data shows that the data was collected from the male students within the range of 18–28 years of age, and having an experience of 1–4 years with students having 100 percent mobile phones. The study divides the data collected into the following factors and checks the reliability through Cronbach alpha.

5.2. Empirical Results

The current section reports the estimated empirical results, such as descriptive statistics, correlation analysis, and results of logistic regression.

Table 2: Age of Respondents

Age	*N*	%
18–20 Years	39	71%
21–23 Years	12	22%
24–26 Years	0	0
26–28 Years	4	7%
Above 28 Years	0	0
Total	55	100%

Table 3: Experience in using Blackboard

	N	%
1 Year	32	58%
1–2 Years	13	24%
3–4 Years	10	18%
More than 4 Years	0	0%
Total	55	100%

Table 4 reports the descriptive statistics. The results show that the mean of LMS adoption which is a dependent variable is 0.29. Further, the mean of independent variables, such as facilitating factor, performance factor, satisfaction factor, and difficulties factor ranges between 2.13 and 2.52. The standard deviation of dependent and explanatory variables shows that the variance in the data estimated is low.

Table 5 reports the correlation analysis. The results show that there is a low correlation between the explanatory variables and the dependent variable. Moreover, the correlation among the independent variables is also low except for the difficulties factor.

Table 6 presents the results of logistic regression, where the study has examined the influence of different factors, such as facilitating factor, satisfaction factor, and difficulties factor on LMS adoption. The results show that the facilitating factor is negative but insignificant. This shows that the negative coefficient on facilitating factor does not have any impact on LMS adoption. The satisfaction factor is positive and significant at the 10 percent level and the difficulties factor is also positive and significant at the 1 percent level. The test parameters, such as LR chi2 show that the model chi-square is highly significant, reporting a good model fit. Further, the Pseudo R^2 shows that the model is good. The results show that the students are satisfied with using the blackboard on mobile, nevertheless facing some difficulties.

5.3. Discussion

The current study examines the factors related to mobile blackboard usage on LMS adoption. The factors, such as facilitating factor, performance factor, satisfaction factor, and difficulties factor are used to examine the mobile blackboard usage effect. The results show that 71 percent of the respondents are between the age of 18–20 years, and 100 percent of students have experience in using blackboard. The empirical results show that the satisfaction factor is positive and significant and the difficulties factor is also positive and significant. This shows that the students are satisfied with the mobile blackboard (LMS adoption). Similarly, the positive relationship between the difficulties factor and LMS adoption shows that the students are facing difficulties in using the mobile blackboard (LMS adoption). The results of the current study support the previous studies of Mathur (2011), Venter et al. (2015), Omalade and Opesade (2017), and Alkhaldi and Abualkishik (2019).

6. Conclusion

The study through LMS becomes an effective and efficient tool in delivering good quality education to the students. The present developments in mobile technologies have made mobile phones perform in a smart manner by holding an

Table 4: Descriptive Statistics

	Obs	Mean	Standard Deviation	Minimum	Maximum
LMS Adoption	45	0.29	0.46	0	1
Facilitating Factor	45	2.18	0.70	1	3.5
Performance Factor	45	2.16	0.74	1.25	3.75
Satisfaction Factor	45	2.52	0.63	1	3.6
Difficulties Factor	45	2.13	0.66	1	3.5

Table 5: Correlation Analysis

	LMS Adoption	Facilitating Factor	Performance Factor	Satisfaction Factor	Difficulties Factor
LMS Adoption	1.000				
Facilitating Factor	0.067	1.000			
Performance Factor	0.313	0.583	1.000		
Satisfaction Factor	0.292	–0.182	–0.068	1.000	
Difficulties Factor	0.377	0.557	0.728	–0.013	1.000

Table 6: Results of Logistic Regression

LMS Adoption (DV)	*α*	*β*	*P*-value
Constant	–7.976		0.008
Facilitating Factor		–0.406	0.554
Satisfaction Factor		1.394*	0.058
Difficulties Factor		1.926***	0.016
Number of Observations	45		
LR Chi 2 (3)	12.41***		
Prob> chi2	0.006		
Pseudo R2	0.229		
Log likelihood	–20.84		

*p-value < 0.1, ***p-value < 0.001.

ample number of applications. The adoption of ICT by the Saudi Arabian higher education institutions was increased in recent years, but there still exists a need to study how best the ICT practices are managed. Hence, it becomes significant to observe the effect of different factors on the adoption of mobile LMS. The data was collected from a sample of 45 students of Prince Sattam bin Abdulaziz University, Saudi Arabia. The reliability of factors was tested by using Cronbach alpha. Moreover, the study considered logistic regression to examine the empirical effect of different factors, such as facilitating factor, satisfaction factor, and difficulties factor. The results report that the satisfaction factor and difficulties factor are positive and significant at 10 percent and 1 percent level of significance, while the facilitating factor is negative but insignificant. This shows that the students are satisfied with using blackboard through mobile, but they face some difficulties in using it. The results of the current study are useful to the policymakers, such as higher education in implementing the ICT adoption, academicians who use the LMS through blackboard, and especially the student community who are the ultimate beneficiaries of blackboard usage. The study can be further extended by examining the LMS adoption by different universities in Saudi Arabia and comparing it with the universities in the other GCC nations.

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