Investigating Students' Behavioral Intention Towards Adoption of Mobile Learning in Higher Education Institutions of Pakistan

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***Abstract*-**With the advent of 3G/ 4G technology in Pakistan, Mobile Learning has become a newly developing educational field, referring to the use of any kind of wireless mobile devices, where these devices allow the learner to acquire knowledge anytime, anywhere, within and beyond the traditional learning environment. Ubiquitous access to mobile devices with low cost and greater functionalities make M-learning an imperative tool, allowing the students to learn irrespective of time and place. In order to assimilate M-learning in higher education institutes (HEIs) of Pakistan, there was a need to analyse and examine the users' acceptance of the system. The aim of this study was to analyse the determinants that affect students' acceptance of M-learning and whether age or gender play a moderating role in this acceptance, based on the unified theory of acceptance and use of technology (UTAUT). In order to achieve this objective, a quantitative approach using a survey based questionnaire was utilised for collection of data. The questionnaire was distributed to a random sample of 625 students from universities operating in the twin cities of Rawalpindi and Islamabad. According to the results, 76.4% of behavioural intention to accept M-learning has been explained through the model. Performance expectancy, effort expectancy, social influence and attitude towards the use of technology were found to be positively associated with the behavioural intention towards adopt M-learning, moderated by age and gender, whereas facilitating conditions and self-management of learning were found to have no significant effect on behavioural intention. The findings of this research will prove to be useful for management of higher education institutes in making decisions when designing and implementing m-learning technology.

***Keywords*-**Mobile Learning, Technology, Acceptance, UTAUT, HEIs, Pakistan

I. INTRODUCTION

The rapid development in information and communication technologies has led to increased investments and remarkable changes in every field of life. Institutions today are now operating in a highly volatile environment, which is changing rapidly being characterized by uncertainty. The new technological era is abound with numerous opportunities and challenges for the educational system across the globe. Educational institutions have been revolutionized as learning changes are elicited by changes in technology [i]. Universities today have incorporated technology in their strategic goals, making it a substantial part of every university's budget [ii]. The technological revolution, with the introduction of 3G/ 4G mobile technologies has helped in capacity building and enhancement of faster communication and information sharing being technology enabled. Resultantly technological change has transformed the traditional ways of learning giving way to Distance learning (D-learning), Electronic Learning (E-learning) and Mobile learning (M-learning).M-learning offers an opportunity for self-study by allowing easy access to learning resources and exchange of information and feedback with the instructors [iii].

The impact of technology on society has changed overall life processes but its impact on learning and diffusion in the educational activities need to be observed with the focus on the user's readiness and acceptance of the new technology. Reluctance of users to accept the latest technology can lead to structural catastrophe and result in no benefit for the institutions [iv-v]. The opportunities and benefits offered by M-learning have not been explored completely [iv].

To ascertain the efficient use of an institute's time and financial resources devoted towards M-learning, it was essential to analyze the determinants influencing students' acceptance of M-learning before its effective deployment in higher education institutes of Pakistan. This study was conducted by applying the UTAUT model to find out the determinants as well as the effect of age and gender on the acceptance of M-learning [v]. The study would help the management to analyze and assess whether mobile technologies, with the aid of the new emerging 3G/ 4G, can become

convenient tools for learners and educators in the existing educational environment of Pakistan. The information and results obtained from this study will assist in developing a theoretical model, enabling the educators, administration and management of HEIs of Pakistan to understand the students' intentions to use M-learning to study academic contents anywhere, anytime. Firstly, this paper describes the literature review regarding the theory and model that can be utilized to predict the acceptance of a new technology. The paper then explains the research methods and hypothesis, followed by the results and conclusion at the end.

II. Mobile Learning in Higher Education

The omnipresent access to mobile devices has inspired higher education institutions to incorporate these technologies in the learning processes through M-learning. According to [vi], mobile learning can be explained as the learning done through ubiquitous communication by using mobile devices and intelligent user interfaces. M-learning employs wireless devices such as mobile phones, smart phones, handhelds, laptops, palmtops, iPods and PDAs in the learning process [vi]. However, some researchers have emphasized on mobility while defining m-learning, eliminating laptop from the definition, restricting to only those particular devices that are completely portable and flexible in the learning process [vii].

Mobile devices today are furnished with newest features that support students in their learning process. Being smaller in size, mobile devices are easier for students to carry everywhere they go. These devices help the students to establish a constant connection with their learning resources while on the go, enabling them to do everything they want to do on a desktop computer such as processing or storing data. Due to lesser cost and ease of use, as compared to desktop computers, these devices have become more attractive for students [viii]. According to [ix], mobile devices have the following five unique educational attributes:

a. Portability: devices provide mobility
b. Social interactivity: devices enable users to interact and communicate easily
c. Context sensitivity: devices enable users to gather real data according to their respective location, time and environment
d. Connectivity: devices can be linked through a shared network
e. Individuality: devices enable discrete education

A number of features are available in mobile devices that can be utilized to enhance learning like messaging, access to the internet, and multimedia convergence [ix]. The widespread use of the internet has enabled most of the institutions to offer online and distance education programs. This has led to the question that whether online programs are equally effective as compared to traditional learning environment. In the past, 688 studies have been analyzed, to identify difference of motivation level of students who were studying in a traditional classroom or were taking distance learning courses [x]. Likewise, 96 studies were carried out which concluded with similar results, indicating that online and traditional learning are both equally motivating [xi]. Thus it can be established that m-learning is motivating for students as it provides them control over their learning goals and supports social interaction making learning entertaining and enjoyable [xii].

Numerous previous studies have been done to investigate about the advantages of using mobile devices to pursue education and promote learning [vii], [xv-xvi], the foremost advantage being that mobile learning can result in improved understanding of the learning contents, through different and interesting methods of teaching that create student's interest in learning contents. Moreover, features such as student group discussions and feedback may increase students' motivation and memory retention. Mobile devices may also serve to be a good assessment tool for students enabling the shy students to express their ideas in a better way [xiv]. Using mobile devices in learning process can also result in enhanced feedback, promoting interaction between the instructors and students [xiii]. M-learning allows an interactive environment, providing constant communication and collaboration in learning activities. The data interchange can take place through different channels such as emails, blogs, forums and messages, enhancing the level of interaction between peers, students and instructors [xiv]. Being a subcategory of E-learning, M-learning has similar advantages to the prior such as the privilege of self-studying, easy access to learning contents, self-assessment and instant feedback [iii], [xvi].

Although m-learning provides multiple learning opportunities for users, providing them the facility to make learning mobile, it has some limitations and issues that need to be resolved for its success, such as physical limitations of mobile devices (small screen size, limited battery life), psychological barriers of students, network speeds, security aspect and cost.

III. Theory Under Investigation

Many theories have been developed in the past in order to explain the users' acceptance of any new technology. The most extensively used model is the Technology Acceptance Model (TAM) illustrated in Fig. 1, which provides a hypothetical basis to elucidate the impact of external variables and intentions to adopt the system [xv]. TAM has gained the reputation of being the most widely used model in the field of IT due to its simplicity and ease of use [xvi]. The key strength

of the TAM model is its consistency as it shows only 40% variance in the use of behavior and intentions of people in organizations [xv].

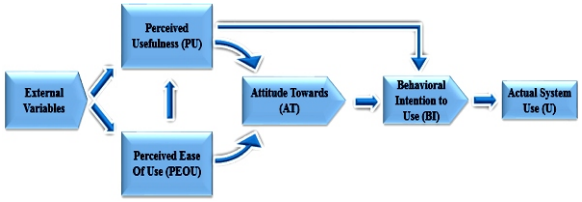

Fig. 1. Technology Acceptance Model (TAM), Davis (1989)

A relatively more recent and prevalent model is the Unified Theory of Acceptance and Use of Technology (UTAUT) model [v] as illustrated in Fig. 2. It incorporates and compares various elements from 8 different models: Theory of Reasoned Action (TRA), Technology Acceptance Model (TAM), Motivational Model (MM), Theory of Planned Behavior (TPB), Model of PC Utilization (MPCU), Innovation Diffusion Theory (ITD), Social Cognitive Theory (SCT) and Combined TAM and TPB (C-TAM-TPB).

The formulation of the UTAUT model is a consequence of merger of eight models/theories, that is useful in integrating the systems' and the users' characteristics to predict the acceptance level of any new technology. According to [v], the model comprises of the following basic constructs: Performance Expectancy, Effort Expectancy, Social Influence and Facilitating Conditions. Operational definitions of these constructs are, Performance Expectancy,"the extent to which a person believes that using the system will assist him in achieving his objectives in job performance", Effort Expectancy"the amount of ease linked with the usage of the system", Social Influence" the extent to which an individual perceives significant that others think that he should make use of the new system", Facilitating Conditions, "the extent to which one believes that a structural and methodological structure exists to support the system usage", Behavioral Intention, "an individual's personal opinion that that he or she will behave in a certain manner". The mediating variables include gender, age, experience and voluntariness of use. The UTAUT model can help managers in assessing the users' behavior intention to adopt any new technology

According to [v], model shows a 70% variance in intention and it can aid the managers in assessing the success of the new technology [xvii]. However, there are still some empty areas in the UTAUT model that require further researches to cater for the technology that falls between the 30% unexplained acceptance [xviii]. Moreover, individual factors such as self-management of learning, attitude towards technology and perceived playfulness are not included, which may prove to be helpful in assessing the users' acceptance of a new technology.

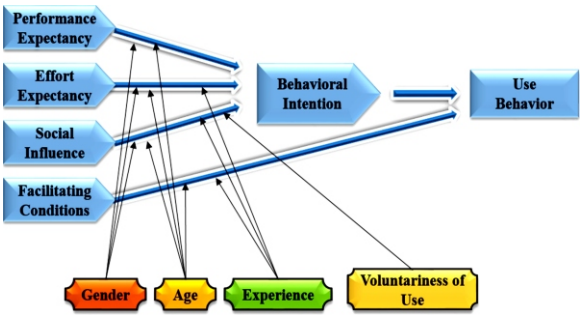

Fig. 2. Research Model UTAUT, Venkatesh (2003)

A. Theoretical Framework

The UTAUT (Fig. 3) model was selected in order to analyze the relationships between the independent and dependent variables. The model exemplified below has been established for the study based on the relationships between Behavior Intentions as dependent variable and Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Condition, Perceived Playfulness, Self-management of Learning and Attitude towards use of technology as independent variables, with gender and age as the moderating factors. Three additional constructs, i.e. Perceived Playfulness: "the degree to which a person perceives that his interest or attention is focused on m-learning, is curious during the interaction, and finds the interaction enjoyable" [xix], Self-management of Learning: "the extent to how much a person perceives that he can maintain self-discipline and can engage in self-directed learning" [xx] and Attitude towards use of technology: "the overall aptitude of an individual towards the use of technology" [v], have been included in the UTAUT model.

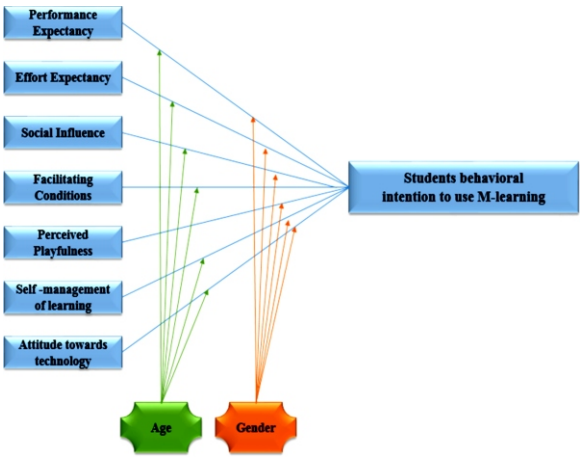

Fig. 3. Theoretical Framework

1) Performance Expectancy (PE)

H0: There is no relationship between Performance Expectancy and behavioral intention to use

M-learning.

H1: Performance Expectancy has a positive relationship with behavioral intention to use M-learning.

H2: The effect of Performance expectancy on behavioral intention to use M-learning will be moderated by gender and age.

2)Effort Expectancy (EE)

H0: There is no relationship between Effort Expectancy and behavioral intention to use M-learning.

H3: Effort expectancy has a positive relationship with behavioral intention to use M-learning.

H4: The effect of Effort Expectancy on behavioral intention to use M-learning will be moderated by gender and age.

3) Social Influence (SI)

H0: There is no relationship between Social Influence and behavioral intention to use M-learning.

H5: Social influence has a positive relationship with behavioral intention to use M-learning.

H6: The effect of Social Influence on behavioral intention to use M-learning will be moderated by gender and age.

4) Facilitating Conditions (FC)

H0: There is no relationship between Facilitating Conditions and behavioral intention to use M-learning.

H7: Facilitating conditions has a positive relationship with behavioral intention to use M-learning.

H8: The effect of Facilitating Conditions on behavioral intention to use M-learning will be moderated by gender and age.

5) Perceived Playfulness (PP)

H0: There is no relationship between Perceived Playfulness and behavioral intention to use M-learning.

H9: Perceived playfulness has a positive relationship with behavioral intention to use M-learning.

H10: The effect of Perceived Playfulness on behavioral intention to use M-learning will be moderated by gender and age.

6) Self-Management of Learning (SML)

H0: There is no relationship between Self-Management of learning and behavioral intention to use M-learning.

H11: Self-management of learning has a positive relationship with behavioral intention to use M-learning.

H12: The effect of Self-Management of Learning on behavioral intention to use M-learning will be moderated by gender and age.

7) Attitude towards Technologies (ATT)

H0: There is no relationship between Attitude towards Technology and behavioral intention to use M-learning.

H13: Attitude towards the use of the technologies for learning is positively related to behavioral intention.

H14: The effect of Attitude towards use of technologies on behavioral intention to use M-learning will be moderated by gender and age.

IV. Research Design

In order to achieve the study objectives, across-sectional study having a quantitative approach was conducted using a survey based questionnaire for collection of data.The unit of analysis of this survey comprises of students from higher education institutes of Pakistan. Due to time, budget and resources constraints, sample frame selected for this study encompasses the chartered universities from twin cities of Pakistan, i.e. Rawalpindi and Islamabad. The questionnaires were distributed among 625 respondents, from ten recognized degree awarding universities of Pakistan, selected on the basis of random sampling.

The questionnaire consists of two main parts: Section A of the questionnaire comprises of 10 questions related to the demographic details and opinion of the respondent regarding internet usage through mobile devices for educational purpose. Section B comprises of 31 questions related to the determinants affecting the behavioural intentions. Five point Likert scale was used for the questionnaire and the data collected was analysed using SPSS V20.

The main constructs and items pertinent to the study were adopted from past studies of [v] whereas the items used to measure perceived playfulness and self-management of learning were adopted from another study [xix-xx]. Furthermore, constructs and items in the questionnaire were verified by a number of experts to validate the language and comprehensiveness of the questionnaire in order to meet the research framework; see Appendix A for question statements in full. A detailed pilot study (Table I) was also conducted by handing out the questionnaire to 55 students of HEIs, resulting in 37 responses, out of which 35 were valid responses, making the response rate 67.9%. The valuable suggestions received were incorporated into the questionnaire and the questions were updated. The items were considered reliable and consistent as the results of the pilot tests showed the reliability being greater than 0.7. Therefore the questionnaire was further distributed to respondents to gain more results.

TABLE I
PILOT TEST RESULTS

Constructs	Cronbach's Alpha	No. of items
Facilitating Conditions	0.856	4
Perceived Playfulness	0.765	5
Self-Management of Learning	0.836	4
Attitude Towards Learning	0.880	3
Behavioral Intentions	0.909	3
Social Influence	0.848	4
Effort Expectancy	0.965	4
Performance Expectancy	0.951	4

V. DATA ANALYSIS AND RESULTS

625 questionnaires were distributed amongst students of 10 chartered universities of Rawalpindi and Islamabad. About 433 filled questionnaires were received back from the respondents, out of which 25 were ineligible (incomplete). Thus a total of 68% active response rate was achieved.

A. Demographic Analysis

The results showed (Table II) that the data has been collected from a total of 408 respondents, out of which 300 were males and the remaining 108 were females. Furthermore, the respondents belonged to different age groups, with 150 respondents belonging to an age group of less than 20 years, 131 respondents having their ages between 20 to 24 years, 83 respondents having their ages between 25 to 30 years and the remaining belonging to the age group of above 30 years. Most of the respondents were undergraduate students, belonging to the age groups of under 20. This is because according to the statistics obtained from HEC, the highest ratio of students in Pakistan belong to the undergraduate group, which will be affected the most by the introduction of m-learning in Pakistan. Thus, it was evidently important to cater to their responses.

The maximum number of respondents are using smart phones. Smart phones are now available in cheap prices and have become affordable for students, enabling them to perform various computational functions. This can lead to more users incorporating m-learning in their education, as they can easily access educational content through their mobiles. A number of users also have access to PDAs and other similar devices that support the use of m-learning. This shows that most of the students studying the higher institutes of Pakistan have the required resources to support M-learning.

The results indicate that a large number of students use their mobile phones daily. This means that if they are offered m-learning, they would be able to use it very frequently. Around 263 respondents i.e 64.5% have the facility to access internet through their mobile phones. This shows that majority of the students can access educational material through their mobile phones, anytime, anywhere, which is the main idea behind m-learning. Thus according to these results, students are well equipped with the facilities required to use m-learning on their own.

A large number of respondents, i.e. 78.2% are already accessing educational applications through their mobile devices. This means that they are already in a habit of using various educations apps for their studies. Moreover, this shows that students are already accessing especially designed educational software or apps for Android or Apple mobile devices. Thus if they are offered the opportunity to learn through their mobile devices, they will be able to excel in this field easily.

About 45.6% of the respondents access educational content through their mobile devices. This includes searching online, reading e-books or papers online, viewing educational lectures and videos, and doing other kinds of educational work such as storing and saving information on their mobile devices. Being already in a habit of reading educational content using mobile technology for educational purposes, if students are offered M-learning, they will accept it enthusiastically.

Respondents around 68.6% have already heard about m-learning and know about its requirements and procedures. This large value can also be because of the explanation of M-learning given in the beginning of the questionnaire which has enabled the respondents to gain knowledge about the subject.

This is further supported by the result of 72.8% respondents think that learning while on move is a decent idea and are ready to practice it in the future, because students consider technology be an important part of their education and find using M-learning tools exciting and flexible. Thus according to the demographic results, we can deduce that most of the students, especially the students belonging to the undergraduate group, have the required resources e.g. smart phones and PDAs with internet access, and are of the opinion that they would like to use m-learning as they are already accessing educational contents through their mobile devices.

TABLE II
CHARACTERISTICS OF THE RESPONDENTS

	Frequency	Percent	Valid Percent	Cumulative Percent
Gender				
Male	300	73.0	73.5	73.0
Female	108	26.5	26.5	100.0
Age				
Less than 20 years	150	36.8	36.8	36.8
20 to 24 years	131	32.1	32.1	68.9
25 to 30 years	83	20.3	20.3	89.2
Above 30 years	44	10.8	10.8	100.0
Qualification				
Under Graduate	220	53.9	53.9	53.9
Graduate	146	35.8	35.8	89.7
Post Graduate	42	10.3	10.3	100.0
"My mobile device can be best classified as"				
Call & Text	103	25.2	25.2	25.2
Smart phone Connectivity	193	47.3	47.3	72.5
PDA	51	12.5	12.5	85.5
Tablet PC	45	11.0	11.0	96.1
Other devices	16	3.9	3.9	100.0
"How often do you use the internet from your mobile device?"				
Daily	247	60.5	60.5	60.5
Weekly	107	26.2	26.2	86.8
Monthly	42	10.3	10.3	97.1
Rarely	12	2.9	2.9	100.0
"Do you access the internet using 3G/4G mobile network?"				
Yes	263	64.5	64.5	64.5
No	145	35.5	35.5	100.0
"Have you used any educational application on your mobile device?"				
Yes	319	78.2	78.2	78.2
No	89	21.8	21.8	100.0
"Do you access educational contents using 3G/4G mobile networks?"				
Yes	186	45.6	45.6	45.6
No	222	54.4	54.4	100.0
"Have you heard about Mobile Learning (M-Learning)?"				
Yes	280	68.6	68.6	68.6
No	128	31.4	31.4	100.0
"What is your opinion of M-Learning?"				
Good idea and like to use	297	72.8	72.8	72.8
Good idea and not like to use	57	14.0	14.0	86.8
Think not a good idea	25	6.1	6.1	92.9
Others	29	7.1	7.1	100.0

B. *Descriptive Analysis*

TABLE III
DESCRIPTIVE STATISTICS OF FACTORS AFFECTING M-LEARNING

Constructs	Mean	Std. Deviation
Performance Expectancy	4.233	0.9987
Effort Expectancy	4.159	0.9656
Social Influence	4.203	1.0605
Facilitating Conditions	4.010	0.9980
Perceived Playfulness	4.169	0.9782
Self-Management of Learning	4.053	0.9902
Attitude Towards Technology	4.181	1.0219
Behavioral Intentions	4.076	0.9722

The average response of the respondents for all variables varies between 4.010 and 4.233 (Table III), with the standard deviation ranging between 0.9656 and 1.0605. The mean value of PE is 4.233 indicating that students find m-learning useful, helping them to increase their learning productivity and increase their knowledge. EE has a mean value of 4.159 implying that students perceive m-learning to be easy and convenient to use, with clear understanding. The mean of SI is 4.203 indicating that students are positively influenced by others to use m-learning. They will be supported by their institution and administrative staff to use m-learning. Facilitating Conditions has a mean value of 4.010, meaning that they have the required resources to use m-learning and they will be able to get help from others whenever they face difficulty in using M-learning. Perceived Playfulness has a mean value of 4.169 indicating that students believe that m-learning will be enjoyable to use and will stimulate their curiosity and exploration. The mean of Self-management of learning is 4.053 showing that most of the students will be self-directed and self-motivated to use m-learning, setting their own pace and time of study and allocating their time responsibly for all the tasks to be performed. Attitude towards the use of technology has a mean of 4.181 indicating use of M-learning is an enjoyable activity, whereas Behavioral Intentions has a mean value of 4.076 implying that students intend using m-learning in the future thinking of it as an attractive option.

C. *Goodness of Fit*

In order to successfully run statistical tests, it is mandatory for the data to be normally distributed. The values of skewness for all the variables, as showing in table below lie in between +1 to -1[xxi], demonstrating that the data distribution is typical/ normal. Moreover, the values of the result for kurtosis for all the variables are within the range ± 2.58 [xxi] demonstrating that the data distribution is normal.

TABLE IV
NORMALITY TEST RESULTS

Constructs	Skewness	Kurtosis
Performance Expectancy	-0.195	2.554
Effort Expectancy	-0.367	1.911
Social Influence	-0.501	1.852
Facilitating Conditions	-0.518	0.600
Perceived Playfulness	-0.520	2.104
Self-Management of Learning	-0.353	1.459
Attitude Towards Technology	-0.240	1.913
Behavioral Intentions	-0.513	1.470

D. Reliability And Validity Analysis

Table V demonstrates the values of the Cronbach's Alpha or reliability coefficient of all the determinants used in this study. All of the Cronbach's Alpha reliabilities of determinants are more than 0.7, lying between 0.826 to 0.927. Therefore, all the variables in this research are good and reliable as meeting the minimum acceptance level which is 0.7 [xxii], implying that the variables can be used for further analysis in the study.

TABLE V
RESULT OF CRONBACH'S ALPHA FOR RELIABILITY ANALYSIS

Variables	Cronbach's Alpha	No. of items
Facilitating Conditions	0.873	4
Perceived Playfulness	0.911	5
Self-Managementof Learning	0.890	4
AttitudeTowards Technology	0.893	3
Behavioral Intentions	0.826	3
Social Influence	0.927	4
Effort Expectancy	0.876	4
Performance Expectancy	0.922	4

E. Correlation Analysis

TABLE VI
SUMMARY OF CORRELATION ANALYSIS

Variables	PE	EE	SI	FC	PP	SML	ATT	BI
PE	1.000	0.568	0.593	0.234	0.586	0.336	0.545	0.552
EE	0.568	1.000	0.554	0.327	0.608	0.371	0.439	0.559
SI	0.593	0.554	1.000	0.279	0.649	0.347	0.454	0.573
FC	0.234	0.327	0.279	1.000	0.320	0.355	0.213	0.281
PP	0.586	0.608	0.649	0.320	1.000	0.398	0.489	0.613
SML	0.336	0.371	0.347	0.355	0.398	1.000	0.342	0.369
ATT	0.545	0.439	0.454	0.213	0.489	0.342	1.000	0.497
BI	0.552	0.559	0.573	0.281	0.613	0.369	0.497	1.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Pearson Correlation analysis is done in order to ascertain the relationship and strength between different variables, identifying whether the relationship is positive or negative. Table VI illustrates that all the variables depict a positive relationships with each other with the strength of the relationship being moderate or weak. Performance expectancy, effort expectancy, social influence and perceived playfulness have a moderate relationship with behavioral intentions (dependent variable), whereas, facilitating conditions ($r = 0.281, p < 0.001$), self-management of learning ($r = 0.369$, $p < 0.001$) and attitude towards use of technology ($r = 0.497$, $p < 0.001$) have a weak relationship with behavioral intentions. Hence all the hypothesis have been found to statistically significant and positively correlated with dependent variable.

Furthermore, results depicted that there is no serious issue of multi-collinearity among independent variables as highest value of correlation is less than 0.9 [xxi] which is 0.649 between Social influence and Perceived playfulness. Thus, regression analysis can be carried out conveniently.

F. Regression Analysis (Main Effect)

Multiple Regression Analysis involves the prediction of an unknown value of a variable, through two or more known variables and analyses the linear relationship between a dependent and two or more independent variables. In order to assess the strength & nature of relationship between variables and statistical significance of each coefficient, regression analysis has been carried out.

TABLE VII
ASSESMENT FOR MODEL FITNESS

Model Summary					
Model	R	R Square	Adjusted R Square	F Value	Sig.
1	.874[a]	.764	.760	184.788	0.000***
a. Predictors: (Constant), ATT, FC, SML, SI, EE, PE, PP					

***Significant at the p = 0.001 level

Table VII shows the summary of the regression model. The value of R = 0.874 signifies a reasonably strong relationship between the independent variables ATT, FC, SML, SI, EE, PE, PP and the dependent variable i.e. BI. Adjusted R Square, which is a modified version of R Square adjusted for the amount of predictors in the model, is 76.4%. The value of R Square specifies 76.4% of the variability of dependent variable (behavioral intentions) is elucidated by independent variables and explanatory power of model is 76.4%. The remaining 23.6% of the variability in dependent variable (Behavioral Intention) is explained by other factors not considered in this research. The F ratio dictates if the regression model is good fit for the data. The value of F (7, 400) is equal to 184.7, with $p < 0.0005$ showing that the dependent variable is significantly predicted by the independent determinants. Thus the regression model can be considered as fit and statistically significant to predict m-learning acceptance amongst the students.

According to the results Performance Expectancy ($\beta = 0.133, p \leq 0.010$), Effort Expectancy ($\beta = 0.176, p \leq 0.001$), Social Influence ($\beta = 0.187, p \leq 0.000$), Perceived Playfulness ($\beta = 0.265, p \leq 0.000$) and Attitude towards use of Technology ($\beta = 0.131, p \leq 0.001$) are significantly and positively related to Behavioral Intensions of M-learning,whereas, results predict that Facilitating Conditions ($\beta = 0.032, p \leq 0.328$) and Self-Management of Learning ($\beta = 0.047, p \leq 0.190$) are positive but insignificant at $p \leq 0.001$ level. Moreover, Perceived playfulness is found to have the highest effect on behavioral intention.

G. Regression Analysis (Moderation Effect)

TABLE VIII
MULTIPLE REGRESSION ANALYSIS (MODERATION EFFECT)

Model	R Square	Adjusted R Square	Change Statistics		
			R Square Change	F Change	Sig. F Change
PE & Age	0.653	0.651	0.007	7.857	0.005
PE & Gender	0.662	0.660	0.010	11.798	0.001
EE & Age	0.649	0.646	0.006	7.447	0.007
EE & Gender	0.663	0.661	0.018	21.765	0.000
SI & Age	0.661	0.659	0.005	6.042	0.014
SI & Gender	0.672	0.669	0.012	15.180	0.000
FC & Age	0.334	0.329	0.001	0.339	0.561
FC & Gender	0.337	0.332	0.004	2.260	0.134
PP & Age	0.696	0.694	0.002	2.738	0.099
PP & Gender	0.699	0.697	0.006	8.530	0.004
SML & Age	0.412	0.407	0.000	0.186	0.666
SML & Gender	0.415	0.411	0.001	0.465	0.496
ATT & Age	0.555	0.552	0.013	11.959	0.001
ATT & Gender	0.583	0.580	0.025	24.308	0.000

Table VIII results depict that age and gender significantly moderate the effect between PE, EE, SI, ATT and BI as the value of change of R-square is significant for these variables. Therefore, age and gender play a moderating role between these determinants, leading to the acceptance of model. However, results depict that age and gender do not significantly moderate the effect between FC, SML, PP and BI as the value of change of R-square is insignificant.

H. Hypothesis Testing

Table IX illustrates the results of the hypothesis testing. Most of the correlation has been found to be positive and significant. Findings show that positive relationship exists between PE, EE, SI, PP, ATT and BI leading to the acceptance of H1, H3, H5, H9 and H13. However, FC and SML do not have a positive and significant relationship with BI resulting in the rejection of H7 and H11.

TABLE IX
SUMMARY FOR HYPOTHESIS TESTING

Hypothesis	Standardize Coefficients & significance	Results
H0: No relationship between PE and BI to use M-learning	($\beta = 0.133, p \leq 0.010$)	Rejected
H1: PE has a positive relationship withBI to use M-learning	($\beta = 0.133, p \leq 0.010$)	Accepted
H0: No relationship between EE and BI to use M-learning	($\beta = 0.176, p \leq 0.001$)	Rejected
H3: EE has a positive relationship on BI to use M-learning	($\beta = 0.176, p \leq 0.001$)	Accepted
H0: No relationship between SI and BI to use M-learning	($\beta = 0.187, p \leq 0.000$)	Rejected
H5: SI has a positive relationship on BI to use M-learning	($\beta = 0.187, p \leq 0.000$)	Accepted

H0: No relationship between FC and BI to use M-learning	(β = 0.032, p≤ 0.328)	Accepted
H7: FC a positive relationship on BI to use M-learning	(β = 0.032, p≤ 0.328)	Rejected
H0: No .relationship between PP and BI to use M-learning	(β = 0.265, p≤ 0.000)	Rejected
H9: PP has a positive relationship with BI to use M- learning	(β = 0.265, p≤ 0.000)	Accepted
H0: No relationship between SML and BI to use M-learning	(β = 0.047, p≤ 0.190)	Accepted
H11: SML a positive relationship with BI to use M-learning	(β = 0.047, p≤ 0.190)	Rejected
H0: No relationship between ATT and BI to use M-learning	(β = 0.131, p≤ 0.001)	Rejected
H13: ATT for learning is positively related to BI	(β = 0.131, p≤ 0.000)	Accepted

Moreover, a moderating effect (age and gender) can be seen (Table X) between PE, EE, SI, ATT and BI leading to the acceptance of H2, H4, H6, and H14. However, age and gender do not play a moderating role between FC, PP, SML and BI resulting in the rejection of H8, H10 and H12.

TABLE X
SUMMARY FOR HYPOTHESIS TESTING (AGE AND GENDER)

Hypothesis	Standardize Coefficients (β)		Sig.		Results
	Age	Gender	Age	Gender	
H2: The effect of PE on BI to use M-learning will be moderated by gender and age	0.353	0.428	p≤ 0.005	p≤ 0.001	Accepted
H4: The effect of EE on BI to use M-learning will be moderated by gender and age	0.344	0.578	p≤ 0.007	p≤ 0.000	Accepted
H6: The effect of SI on BI to use M- learning will be moderated by gender and age	0.295	0.457	p≤ 0.014	p≤ 0.000	Accepted
H8: The effect of FC on BI to use M-learning will be moderated by gender and age	0.096	-0.238	p≤ 0.561	p≤ 0.134	Rejected
H10: The effect of PP on BI to use M-learning will be moderated by gender and age	0.196	0.339	p≤ 0.099	p≤ 0.004	Rejected
H12: The effect of SML on BI to use M-learning will be moderated by gender and age	0.069	0.105	p≤ 0.666	p≤ 0.496	Rejected
H14: The effect of ATT on BI to use M-learning will be moderated by gender and age	0.524	0.685	p≤ 0.001	p≤ 0.000	Accepted

VI. DISCUSSION AND FINDINGS

To investigate the intentions of students to adopt M-learning, this study was conducted using the UTAUT model, by incorporating three additional determinants to the traditional model, i.e. Perceived Playfulness, Self-Management of learning and Attitude towards the use of Technology. This study is amongst the first ones conducted in Pakistan to analyse the students' behavioural intentions to adopt M-learning in the higher education institutes of Pakistan. According to the results achieved, Performance Expectancy, Effort Expectancy, Social Influence, Perceived Playfulness and Attitude towards the use of Technology were positively related to behavioural intention to adopt M-learning, while Facilitating conditions and Self-Management of Learning were found to beinsignificant. The results acquired from this research revealed several important findings and repercussions for the successful acceptance and implementation of m-learning in the higher institutes of Pakistan.

Consistent with the earlier findings [xxiii-xxiv], performance expectancy was found to be positively related (β= 0.133) to behavioural intentions. This means that students with greater level of performance expectancy have a greater inclination towards the adoption of m-learning [xxv-xxvi], [v]. Thus students are ready to accept and adopt m-learning because they believe that mobile learning is valuable and will enable them to complete their tasks quicker and more efficiently. Students also have the perception that m-learning will aid in improving their learning

productivity and achieve superior results [xxiii]. Thus to promote performance expectancy, it is important for educators to design m-learning tools that facilitate students in learning, are convenient and efficient to use, are less costly, and enable the students to complete important tasks in less time. Moreover, the developers should incorporate the demands and suggestions of the students while designing m-learning tools and facilities in order to meet their performance expectations.

Effort expectancy was also found to have a positive effect ($\beta = 0.176$) on behavioural intentions to adopt m-learning, consistent with the findings of past studies [xxiii-xxv], [v].This indicates that most of the students are of the opinion that m-learning systems should be convenient to use and should be comprehensible [xxiv] and the students possess the required skills to use M-learning. Mobiles however do have the limitations of a smaller screen size, less memory, limited computational power, short battery life and smaller keyboards which may cause difficulties for users [xxv]. So if the students think of M-learning systems as complicated and difficult to use, they may feel discouraged to use them. Thus in order to effectively meet the effort expectancy of the students, developers should create user-friendly, easy to use m-learning interfaces that are simple to understand and require least amount of storage space so that students become more willing to accept them.

Social influence was also found to be positively related ($\beta = 0.187$) to behavioural intention to use m-learning [xxiii], [xxv-xxvi], [v]. The implementation of m-learning by peers and educators can persuade students to accept its usefulness and ease of use, motivating them to adopt M-learning as well. Thus it is important for M-learning practitioners to motivate their peers and friends to adopt M-learning, as the opinions of the early adopters will positively encourage other users as well. Moreover, according to previous literature, when the amount of users reach a critical mass point, M-learning adopters will then start increasing rapidly [xxv].

According to the results of this study, Facilitating Conditions has no significant effect on the behavioural intention to use M-learning. This insignificance is not a new concept as past literature also illustrates varying findings with reference to the effect of facilitating conditions on the adoption of M-learning [xxvi-xxvii]. The original concept explained that the effect of facilitating conditions becomes insignificant on behavioural intentions, when the determinants of performance expectancy and effort expectancy are present [v]. The main reason behind this concept is that facilitating conditions when considered in the light of providing access, technical sustenance or other issues would affect the frequency of use but not the behavioural intention to adopt m-learning. The same concept is also supported by other studies [xxvi] that explain that the effect of facilitating conditions on the adoption of technology is not direct in developing countries. This is mainly because of the fact that technology users in developing countries are mostly late in the adoption of innovative technologies such as m-learning, whereas users in developed countries are quick in the adoption of pioneering technologies. However, research regarding the effect of facilitating conditions on behavioural intentions requires further work, as this relationship has been found to be positive in some past studies [xxxii], [xxviii], although it is inconsistent with the original UTAUT model.

Perceived playfulness was found to be the strongest predictor ($\beta = 0.265$) of m-learning, having a strong positive relationship with behavioural intention to use M-learning,Consistent with the studies conducted in the past studies [xix], [xxv], [xxxi-xxxii]. If the students enjoy M-learning, then they will be motivated more to use it. Thus in order to attract greater number of users, it is imperative for developers to design M-learning in such a way that it is enjoyable and fun to use for the students. Being the strongest predictor of adoption of M-learning amongst students, it is imperative that more stress should be laid on making M-learning interface such that it is entertaining, leading to increased curiosity and exploration of the students, enabling them to spend extensive time learning while enjoying the activity.

The results of this study indicated that no significant relationship exists between Self-Management of learning and behavioural intention to use M-learning inconsistent with past study [xxvii]. This additional construct has also been used in past studies as well [xxxi-xxxiii]. This non-significant relationship can be due to the fact that Pakistan, being a developing country, mostly comprises of students that are in favour of traditional classroom environment, perceiving that it will be difficult for them to set their own pace without any supervision or guidance from any teachers. M-learning can also be incorporated together with traditional methods of learning such as a blended education system [xxviii] by introducing mobile devices in traditional classroom environment to promote the concept of self-management.

According to the results of the study, Attitude towards the use of the technology for learning was found to be positively related to behavioural intention, which is in consistency with other studies conducted in the past [xxix-xxx]. However, this result contradicts with the original UTAUT model that predicts that when a strong relationship exists between performance expectancy and intention and effort expectancy and intention to adopt new technology, then attitude towards the use of technology will not have a significant relationship with behavioural intention to adopt M-learning. The positive relationship found in this study can be because of the fact that most of the students perceive M-learning as enjoyable (leading to the significant relationship between perceived

playfulness and behavioural intention to adopt m-learning), and are motivated towards using M-learning.

It was further found that age and gender play a moderating role between most of the determinants of m-learning and the behavioural intention to adopt M-learning in Pakistan. According to the results, Performance expectancy and Effort expectancy are moderated by the effects of age and gender leading to the fact that the students belonging to different age groups, whether they are males or females, perceive that their performance will increase and it will be easy for them to use m-learning. This means that age differences will be taken into account while designing the M-learning systems. This is further supported by previous researches [xxix-xxx] that identify that a person will perform his best, and enjoy his experience if he meets challenges that are matched according to his age capacity. Similarly, Social influence and Attitude towards the use of technology are both moderated by age and gender, signifying that students belonging to different ages, both males and females, will be affected by the opinion of others to adopt M-learning. Facilitating conditions and self-management of learning were both found to be insignificant, thus no moderating effect was found on their relationships with behavioural intention to adopt M-learning. However, the relationship of perceived playfulness with behavioural intention to adopt M-learning was found to be moderated by age but not by gender.

Thus it is substantial for M-learning developers and educators to design M-learning programs that are easy to use, matched according to the educational level of the students, providing contents that match the user's needs and requirements, leading to increased performance and greater satisfaction of students making M-learning an enjoyable experience.

VII. Conclusion and Recommendations

This study was conducted to analyze the behavioral intentions of students to accept M-learning in Pakistan, based on the UTAUT model and the past studies. According to the results, 76.4% of behavioral intention to accept M-learning has been explained through the model. Most of the determinants included in the study (i.e. performance expectancy, effort expectancy, social influence, perceived playfulness and attitude towards the use of technology) were found to be positively associated with the behavioral intention to adopt M-learning whereas facilitating conditions and self-management of learning were found to be negatively related to behavioral intention.

Due to the fact that M-learning is currently in its early stages being a new means of education, educators need to lay stress upon the aspects that increase students' acceptance of the new mode of learning. Thus m-learning programs should be planned in such a way that they are easy and fun to use, leading to increased curiosity and learning capability of the student. Faculty members and peers positively influence the students' perception. Therefore, they should emphasize upon the importance of m-learning, motivating their students to incorporate it in their daily lives as m-learning can be used together with traditional modes of learning to increase the learning effectiveness.

In today's ever changing environment, it is vital for every organization, including the educational sector to constantly upgrade to newer technologies to combat the requirements of the global market. M-learning presents an excellent opportunity for learners, especially in developing countries such as Pakistan, to adopt new modes of education which are convenient and easy to use, making the learning process pleasurable and motivating for students, increasing their yearning to learn constantly.

VIII. Limitation and Future Research Work

Mobile learning is a new emerging field in Pakistan. This study contributed towards the investigation to determine the acceptance of M-learning amongst students of higher education institutions of Pakistan, with the help of past empirical studies. The scope of this study is limited to ten universities (i.e engineering, business management, social sciences). Thus the results cannot be completely generalized, therefore future researchers can include more universities from different cities and varied fields of education, such as engineering, medicine, business administration and fine arts to further advance this research. Age and gender have found to play a moderating role in this study. However, additional research work can be carried out to identify the differences between the moderating effect of different age groups and different genders. Mobile devices are prone to security and privacy hazards this aspect was not covered in this study conducted therefore a future study can include these areas and investigate their impact on the acceptance of mobile learning.Future studies can also include the investigation of acceptance of mobile learning among students who are currently using D-learning or E-learning tools in their education. Other technology acceptance models can also be employed in the future to further investigate the determinants affecting the students' acceptance of mobile learning.

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Appendix A: original survey items used in the study

Performance Expectancy
PE1: I would find m-learning useful in my education.
PE2: Using m-learning enables me to accomplish learning activities more quickly.
PE3: Using m-learning increases my learning productivity.
PE4: If I use m-learning, I will increase my chances of getting better education.

Effort Expectancy
EE1: My interaction with m-learning would be clear and understandable.
EE2: It would be easy for me to become skilful at using m-learning.
EE3: I would find m-learning easy to use.
EE4: Learning to operate m-learning is easy for me.

Social Influence
SI1: People who influence my behaviour will think that I should use m-learning.
SI2: People who are important to me will think that I should use m-learning.
SI3: The lecturers and other staff at my institution will be helpful in the use of m-learning.
SI4: In general, my institution will support the use of m-learning.

Facilitating Conditions
FC1: I have the resources necessary to use m-learning
FC2: I have the knowledge necessary to use m-learning
FC3: The m-learning application are going to be similar to other systems use in mobile devices

FC4: I can get help from others when I have difficulties using m-learning

Perceived Playfulness
PP1: When using m-learning, I will not realise the time elapsed.
Pp2: When using m-learning, I will forget the work I must do.
Pp3: Using m-learning will give enjoyment to me for my learning.
PP4: Using m-learning will stimulate my curiosity.
PP5: Using m-learning will lead to my exploration.

Self-management of Learning
SL1: When it comes to learning and studying, I am a self-directed person.
SL2: In my studies, I am self-disciplined and find it easy to set aside reading and homework time.
SL3: I am able to manage my study time effectively and easily complete assignments on time.
SL4: In my studies, I set goals and have a high degree of initiative.

Attitude towards use of Technology
ATT1: Using m-Learning is good idea.
ATT2: I like to use m-Learning.
ATT3: Working with m-Learning is fun.

Behavioral intention to use m-learning
BI1: I intend to use m-learning in the future.
BI2: I predict I would use m-learning in the future.
Bi3: I plan to use m-learning in the future.