



Mobile Phone Usage and Students' Perception towards M-Learning: A Case of Undergraduate Students in Pakistan

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Abstract: Mobile phones are increasingly becoming part of the daily life of today's youth. This widespread usage of mobile technology has attracted the attention of researchers and academicians to explore the ways and means of using it in formal and informal education. This study investigates the mobile phone's ownership pattern and usage among undergraduate university students in Pakistan. Moreover, students' choice of mobile service provider is explored. The objective of this study is to investigate m-learning potential among university students and their perceptions towards this emerging learning technology. Quantitative data is collected by means of a survey in which 320 undergraduate students enrolled in four academic disciplines (business, engineering, arts and medicine) participated. SPSS software is used for data analysis. Primarily, descriptive statistics (frequencies, percentages, and pie and line charts) are used for describing the data on different attributes obtained from the questionnaire. In addition, to check the significant difference between the students' perception towards m-learning, ANOVA followed by the Post Hoc Tucky test was used. The results indicate that, overall, students have a very positive attitude towards m-learning; however, the perceptions of Arts and Engineering students were found significantly different from those of Medical and Business students. The results of this study have practical implications for the policy-makers, educators and developers of m-learning programs, specifically in the case of developing countries.

Keywords: m-learning, mobile phones ownership and usage, undergraduate students, perceptions towards m-learning, developing countries.

Résumé : Les téléphones portables occupent une place de plus en plus grande dans la vie quotidienne de la jeunesse actuelle. La diffusion de l'usage des technologies mobiles a attiré l'attention des chercheurs et universitaires et les a amenés à explorer les manières et moyens de les utiliser dans l'éducation formelle et informelle. Cette enquête porte sur les types d'usages des possesseurs de téléphone portable parmi les étudiants de premier cycle universitaire au Pakistan. De plus, le choix de l'opérateur de téléphonie mobile fait par les étudiants est exploré. L'objectif de cette étude est d'enquêter sur le potentiel de l'apprentissage mobile parmi les étudiants universitaires et leurs perceptions de cette technologie émergente. Des données quantitatives sont collectées par le biais d'une enquête à laquelle ont participé 320 étudiants de premier cycle inscrits dans quatre disciplines universitaires différentes (commerce, ingénierie, arts et médecine). Le logiciel SPSS a été utilisé pour réaliser l'analyse de données. Tout d'abord, des statistiques descriptives (fréquences, pourcentages, diagrammes circulaires et graphiques linéaires) sont utilisés pour décrire les données résultant de différentes catégories du questionnaire. Puis, pour tester les différences significatives des perceptions des étudiants concernant l'apprentissage mobile une ANOVA suivie du test post-hoc de Tukey est utilisée. Les résultats indiquent que, dans l'ensemble, les étudiants ont une attitude très positive envers l'apprentissage mobile. Cependant, les étudiants en arts et ingénierie sont apparus significativement différents de ceux en commerce et médecine. Les résultats de cette étude ont des implications pratiques pour les décideurs politiques, les éducateurs et les développeurs de programmes d'apprentissage mobile, tout particulièrement dans le cas des pays en développement.



Mots-clés : apprentissage mobile, possession et usage du téléphone portable, étudiants de premier cycle, perceptions de l'apprentissage mobile, pays en développement.

Introduction

Widespread usage of mobile phones, specifically amongst youth, is the main motivating factor for researchers to look into their utility in formal as well as informal education. A large number of students nowadays can be witnessed carrying smartphones (such as the iPhone and Blackberry) on college campuses. Students not only use their mobile phones for making voice calls but for viewing course related material, finding locations, checking weather forecasts, acquiring traffic updates and connecting to social networking platforms such as Facebook, Twitter and WhatsApp. Venkatesh et al. (2016) found a majority of the students accessing the Internet using mobile phones.

Competition in the mobile markets and compatibility with user-specific needs (i.e., awareness, efficiency in performance of routine tasks, etc.) played an important role in the innovation surge in mobile technology. The rise in users' demand for innovative mobile phones is evident from the fact that the worldwide shipment of smartphones is expected to exceed 1.7 billion by 2018, which is approximately a ten fold increase in the shipments made in 2009 (Statistica, 2015a). Furthermore, it is expected that 34% of the world population will have a smartphone by 2017, whereas, it was only 10% in 2011. The top 10 smartphone markets for 2015, in terms of growth by value are India, China, Indonesia, South Africa, Brazil, Pakistan, Nigeria, Egypt, Vietnam and Bangladesh; the majority of the countries included in this list are from emerging markets which have overtaken developed markets (in terms of growth by value) as the smartphone market is approaching saturation in the developed countries (GFK, 2014).

Portability and wireless connectivity are the two main reasons for the popularity of mobile devices. These functionalities allow the users to communicate on the go. Intense competition among the manufacturers is forcing them to be extremely innovative and always looking for new features in order to gain a competitive advantage (Rothaermel, 2016). Mobile devices include mobile phones/smartphones, MP3 players, iPods and PDAs. Out of this list of mobile devices, it can be argued that smartphones and MP3 players are more likely to be personally owned and hence, more thoroughly familiar to their users. Users' thorough familiarity with a mobile device reduces several usability related issues as indicated by Antoniou and Lepouras (2005). Currently mobile phones are cheaper than desktop computers or laptops and hence, can be a suitable candidate as a low-cost teaching and learning tool (Haug & Tumbo 2016; Dawson, 2007).

In recent times, mobile broadband (MBB) has emerged as a useful medium to extend the reach of the Internet. Rather it has become the primary medium for accessing the Internet globally. By the end of 2010, the number of MBB subscribers surpassed the number of fixed medium broadband subscribers (ITU, 2010). According to an estimate there will be 5 billion global MBB connections by 2018 (Statistica, 2015b). Both developed, as well as developing nations, are experiencing a shift in desktop Internet access to an "on-the-go" experience. A vast majority of mobile operators have offered 3G and many more are offering 4G services. Such improvements in the speed and ease of data transfer over the Internet has made m-learning flexible and exciting for the university students.

Mobile learning (or m-learning) can be defined as learning through a mobile device (such as mobile/smartphones, iPods, MP3 players, personal digital assistant (PDAs)) which is delivered using mobile technology (Iqbal & Bhatti, 2016). In adult learning, mobile phones can be a suitable tool enabling autonomous or collaborative learning (Burden & Kearney 2016; Callum & Kinshuk, 2006). Mobile devices offer an opportunity to carry knowledge and learning outside of the boundaries of the classroom, since students can interact with fellow students and teachers outside the classroom as well as capture the learning material using audio and video options and bring the same into the classroom (Ekamayake & Wishart, 2010; Wishart, 2015). The students can capture any event or activity related to their courses, which can be very helpful in connecting their previous knowledge with reality and clarifying different misconceptions about a particular topic. The main advantages of m-learning for tertiary education include fostering innovation in teaching and learning practices,

enabling 'authentic learning', i.e., helping anytime, anywhere, student-centered learning, offering an opportunity to students to benefit from Web 2.0 technologies (social networking, mobility, podcasting, geo-location, connectivity, etc.), bridging the digital divide (since mobile devices are more affordable and widely owned by students) and moving towards a wireless computing paradigm from fixed, dedicated computing, thus, converting any space into potential learning (Cochrane & Bateman, 2010).

Although m-learning is not new, it is only recently that governments, educators, and commercial enterprises have started taking serious interest in it. There are billions of users of mobile devices who use them for communication and other tasks but only a minority of them use these devices on a regular basis for education (UNESCO, 2012). The educationists view these devices as a distraction, rather antithetical: primarily due to the excessive entertainment options compared to the educational options. A serious effort is required on the part of governments, as well as educationists, to dispel this misconception. Ways and means need to be explored to encourage constructive use of mobile devices, specifically smartphones at the university level. Prensky (2005) wondered why we are fighting the trend toward using cell phones in education. He maintained that students could learn anything from a cell phone if the educators design the material properly. People learn in many ways,

...but among the most frequent, time-tested, and effective of these are listening, observing, imitating, questioning, reflecting, trying, estimating, predicting, speculating, and practicing. All of these learning processes can be supported through cell phones. In addition, cell phones complement the short-burst, casual, multitasking style of today's "Digital Native" learners. (Prensky, 2005).

Developing countries are embarking on some national Information and Communication Technology (ICT) in education policies but most of these policies fail to address or accommodate the needs of m-learning, since these policies were formulated in a pre-mobile era (UNESCO, 2012). The development and implementation of sustainable policies requires empirical substantiations (Svensson et al., 2016). This study is an attempt to provide a base for policy makers in policy assessment, development and implementation regarding mobile phone ownership patterns and its respective usages in the context of an emerging economy. Pakistan is the sixth largest populated country in the world, with a population exceeding 180 million. According to the Pakistan Telecommunication Authority (PTA) the number of mobile subscribers—after the application of the Biometric Verification System (BVS) — surpassed 140.5 million in May 2017, whereas the mobile penetration in April 2017 was approximately 70.95%. There are approximately 40.5 million MBB subscribers as of April 2017 (PTA, 2017). According to Pakistan Economic Survey 2016-17, the enrolment in higher education (universities) is expected to reach 1.28 million in 2016-17. There were 164 universities with over 85 thousand teachers in both private and public sectors by the end of year of 2017 (Pakistan Economic Survey, 2016-17).

Education for all is a serious concern in developing countries including Pakistan. The governments in these countries are spending a lot of money to promote the use of ICTs to spread education. Despite all these efforts the use and ownership of personal computers (PCs) in developing countries is still very low. On the contrary, many developing countries have experienced widespread adoption of mobile phones in recent years. Mobile phones with advanced features are becoming very popular. These have the capability of being used as small computing platforms, which make them a potential educational tool. The widespread adoption of mobile phones among university students is the main motivation behind this study. The students of both public and private universities in Pakistan were surveyed to find answers to the following research questions:

- 1) What is the current mobile ownership pattern among university students in Pakistan? What kind of mobile phones do they have and what is their average monthly expenditure for mobile services?
- 2) Who is the preferred mobile service provider for university students in Pakistan? What is the reason for this preference and what problems (if any) are they facing from their mobile service provider?
- 3) What is the current mobile phone usage pattern among university students as far as research, communication, generating contents/artefacts and organizing is concerned?

- 4) What is the students' perception towards mobile phone usage for educational purposes?
- 5) Is there a significant difference in the perception of students belonging to different degree programs towards m-learning?

Following the introduction in the first section, this study is organized as follows. Section 2 explains materials and methods employed. Section 3 presents the results followed by a discussion of the results in section 4. Section 5 concludes the study.

Materials and Methods

Previous Studies with Similar Methodology Employed

This study has its foundations in Roger's diffusion of innovation (DOI) that describes how innovations or technology become accepted and spread through (large or small) societies (Rogers, 2003). The process of choosing to use a technology, according to DOI, is known as the innovation-decision process and Roger defined the following five stages (steps) which are integral to this theory: knowledge, persuasion, decision, implementation, and confirmation. M-learning is at an infancy stage in Pakistan and several other developing countries, therefore, it is important to understand potential adopters and their decision-making process.

This study employs a survey-based approach, which has widely been used in the literature of MIS across the globe. Several studies have been conducted in different countries of the world to investigate mobile phone usage among students and their perception towards m-learning by using the similar approach that was selected for this study. For example, Thornton and Houser (2004) conducted a survey on mobile usage among 333 university students in Japan: 100% reported owning a mobile phone, 99% sent email on their mobile phones (exchanging some 200 email messages each week), 66% emailed peers about classes; 44% emailed for studying. By using a survey-based approach, another study conducted on youth in India by Jha (2008) provided a summary of usage of different functions of a mobile phone. The sample of the study consisted of 208 mobile phone users in the age group of 20-29 years. The study focused on how gender, years of ownership and monthly invoice voucher influenced the usage pattern of mobile devices.

Valk, Rashid & Elder (2010) conducted a study to explore the results of six m-learning pilot projects introduced in five Asian countries – India, Bangladesh, the Philippines, Thailand and Malaysia. The focus of the researchers was to find out how mobile phones helped in improving access to education and how much they contributed in promoting new learning. In another study conducted in Panama on mobile phone usage and potential for m-learning, Valderrama Bahamóndez and Schmidt (2010) surveyed 300 school children and 85 teachers and reported a high proliferation of mobile phones among school children, and that teachers and pupils were all able to envision using mobile phones for learning purposes. A study conducted by Kukulska-Hulme et al. (2011) provides a cross-country account of usage of mobile devices with reference to learning, entertainment, social interaction and work. Their study covered students enrolled in master's and doctoral programs in the United Kingdom, Sweden, Hong Kong, Portugal and Australia and was particularly helpful in clarifying the misconception that mobile phones were not suitable for educational purposes. In the context of Pakistan, Ahmed and Qazi (2011) conducted a study on mobile phone usage among university students there. Following the above mentioned studies, this study also employs a survey approach to investigate the mobile phone ownership and usage patterns among university students. There are only a few studies investigating university students' readiness towards m-learning in Pakistan and this study fills that gap. Moreover, this study is unique in the sense that it not only explores the students' perceptions towards m-learning but also determine how these perceptions are different among students belonging to different fields of study. This study contributes to the literature of M-learning in several respects. Firstly, for a developing country like Pakistan, with a huge population and a majority in the youth age group, m-learning has a very significant potential. However, there is a shortage of studies showing the current ownership and usage of mobile phones among youth in Pakistan, particularly among university students. This study will be helpful in describing mobile

phone ownership and usage as well as students' perception towards using mobile phones in formal education. Further, it will be useful for different stakeholders in m-learning projects, which include the policy makers (e.g., PTA), academicians and developers of m-learning programs. The policy makers can devise policies that enhance the productive use of mobile phones. Academicians can enhance their outreach and bridge communication gaps with students, irrespective of time and space gaps. And, finally software developers can develop applications matching the needs of specific disciplines.

Population and Sample

The target population of this study was the university students who represent the end users of m-learning. A survey based on a structured questionnaire was conducted in the twin cities of Rawalpindi/Islamabad. Four universities, two each from the public and private sector, were selected for the survey and an equal number of responses from each of the four disciplines (i.e., business, engineering, medicine and arts) were considered for data analysis. The reason for selecting four different universities was that each of the targeted degree programs was offered in a different university. The total population was approximately 8,000, the confidence level considered was 95% and confidence interval 5%, therefore, a sample size of 360 was considered adequate. In order to ensure a high response rate and accuracy of the data the questionnaires were distributed and retrieved in a classroom environment. The faculty explained the purpose and contents of the questionnaire to the students and 320 (80 from each of the four degree programs) completely filled-out questionnaires were selected for further analysis.

Instrument and Measures

The questionnaire used for collecting data was divided into four sections. Section One was designed to record information about the demographics (gender, age, degree program) as well as mobile phone ownership (number of mobile phones owned, preferred brand of mobile set, number of mobile phones changed during the last two years, monthly mobile expenditure and reason for purchasing the preferred mobile set). Section Two gathered information regarding preferred mobile network of respondents (current mobile service provider, type of contract — prepaid or postpaid — reason for selecting the preferred network, problems being faced in selected network and the intention to switch to another mobile service provider). Section Three gathered data related to current mobile usage for education/learning. Section Four enquired into the perception of the students related to educational use of mobile phones.

Prior to data collection, a pilot study of the questionnaire was conducted with 50 participants. Reliability of the questionnaire was checked by means of Cronbach Alpha (Cronbach, 1951). The overall reliability of the questionnaire was 0.80, well within the acceptable range (Nunnally, 1978). The analysis of the data was done using Statistical Package for Social Sciences (SPSS v. 20.0).

Primarily, descriptive statistics (frequencies, percentages, and pie and line charts) is used for describing the data on different attributes obtained from the questionnaire. In addition, to check the significant difference between the students' perception towards m-learning, ANOVA followed by the Post Hoc Tucky test was used.

Results

Table 1 shows the demographic profile and mobile phone ownership pattern of participants for this study. Table 1 shows that 58% of the respondents were male and the remaining 42% were female. More than 71% of the respondents were in the age bracket of 18 years and above. The respondents were from four different degree programs — medicine, engineering, arts and business — with 25% from each. Sixty-one percent of the students owned only one mobile set and 39% owned more than one mobile set. Samsung was found to be the most popular brand of mobile set among the students since 33% of them had one. The other popular brands were Nokia, Apple and Q-mobile. More than 27% of the students changed three or more mobile sets within the previous two years. More than 51% of the participants of the study reported their monthly phone expenditure to be more than Rs. 500.

Approximately 70% of the respondents owned a smartphone. The type of mobile phones does indicate the affordability, scope and familiarity with m-learning tools and technology.

Table 1: Demographic Profile and Mobile Phone Ownership Pattern

		Frequency	Percent
Gender	Male	186	58.1
	Female	134	41.9
	Total	320	100
Age	Below 18 years	92	28.8
	18-20 years	120	37.5
	20-22 years	86	26.9
	Above 22 years	22	6.9
	Total	320	100
Majors	Medical	80	25.0
	Engineering	80	25.0
	Arts	80	25.0
	Business	80	25.0
	Total	320	100
Number of mobile phones owned	One	196	61.3
	Two	84	26.3
	Three	27	8.4
	more than 3	13	4.0
	Total	320	100
Brand(s) of mobile phone(s) under use	Apple	44	13.7
	Nokia	64	20.0
	Samsung	104	32.5
	Blackberry	6	1.9
	Q-Mobile	48	15.0
	HTC	23	7.2
	Sony Ericsson	18	5.6
	Other	13	4.1
	Total	320	100
Number of mobile phones changed during the last two years	One	104	32.5
	Two	123	38.4
	Three	52	16.3
	Four	16	5.0
	Five	14	4.4
	More than 5	5	1.6
	None	6	1.9
	Total	320	100

Monthly mobile phone expenditure/bill	Less than Rs. 300	58	18.1
	Rs. 300 to Rs. 500	96	30.0
	Rs. 500 to Rs. 700	94	29.4
	Rs. 700 to Rs. 1000	40	12.5
	More than Rs. 1000	32	10.0
	Total	320	100
Smartphone ownership	Yes	221	69.1
	No	99	30.9
	Total	320	100

Figure 1 summarizes the responses of students with respect to the main reasons for buying their current mobile phone sets. The majority of the students (27%) stated reasonable price to be the main reason for selecting a mobile phone. Twenty-three percent reported suitable functionality (what functions are available in a mobile phone), 15% stated attractive appearance, 11% stated appropriate size and weight, and 10% stated the latest trend to be their reason for purchasing their mobile set.

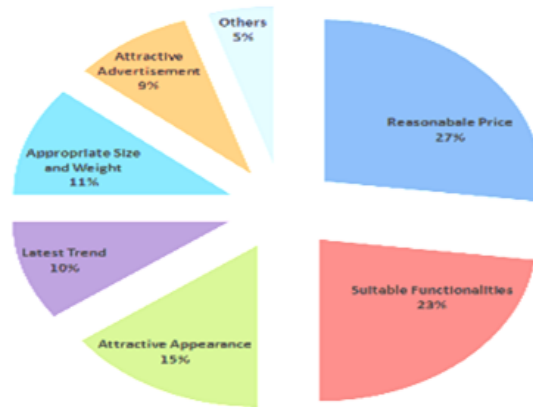


Figure 1: Reasons for Purchasing a Mobile Phone

As shown in Table 2, the most popular mobile service provider among the participants in this survey was Telenor as approximately 31% of the students were using it. The second popular mobile company was Ufone (26%) followed by Mobilink (16%) as the third popular mobile service provider. Eighty-seven percent of the respondents were prepaid customers, whereas, the remaining 13% were postpaid customers. Forty-three percent reported lower rates as the main reason for selecting their preferred mobile service provider. Better coverage was the second most popular reason for selecting a mobile service provider. The top three problems being faced by the students from their current mobile service provider were frequent changes in rates, poor connectivity and noisy and frequent SMSs.

Table 2: Mobile Service Providers' Characteristics

		Frequency	Percent
Current service provider(s):	Mobilink	51	15.9
	Warid	45	14.1
	Ufone	84	26.3
	Zong	42	13.1
	Telenor	98	30.6
	Total	320	100
Customer Type	Prepaid	278	86.9
	Postpaid	42	13.1
	Total	320	100
Reasons for selecting your preferred mobile service provider	Lower rates	138	43.1
	Better coverage	79	24.7
	Better customer service	43	13.4
	Family and Friends	54	16.9
	Other	6	1.9
	Total	320	100
Problems in your preferred mobile connection	Frequent changes in rates	104	32.5
	Poor connectivity	86	26.875
	Poor customer service	36	11.25
	Noisy and frequent SMSs	46	14.375
	Other	48	15
	Total	320	100

Figure 2 summarizes the current usage of mobile phones by students for conducting research, communicating, generating contents, organizing, using MS Office tools and applications and note-taking. More than 60% of the students have familiarity with and are regularly conducting research using Internet/Google on their mobile phones, communicating through SMS, generating contents by taking pictures, using the alarm function and the calculator. The functions never used by more than 60% students are voice/lecture recording, note-taking, accessing Learning Management Systems (LMS) and using MS office via mobile phone.

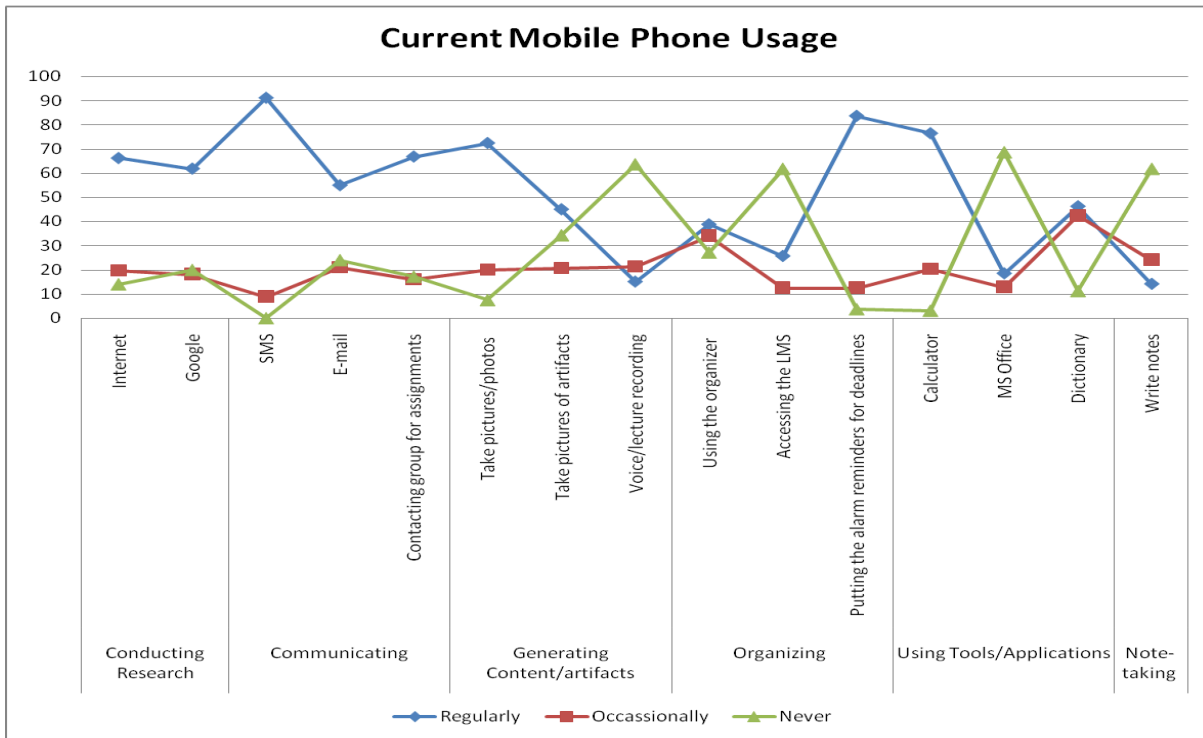


Figure 2: Current Mobile Phone Usage for Education /Learning

As far as the students' perception towards using mobile phones in education is concerned, the majority of them had a positive attitude. Table 3 shows a summary of those who agreed or strongly agreed with different statements related to mobile phone usage in an educational context.

Table 3: Students' Perceptions Towards m-learning

	Frequency (Strongly Agree/Agree)	Percent
Mobile phones are a useful medium of imparting knowledge	268	84%
It is convenient to access information using mobile phones	258	81%
It is a good idea for university to contact students via mobile phones for educational purposes	266	83%
Mobile learning is more flexible method of learning as it can be done anytime, anywhere.	208	65%
Mobile phones can improve communication between students and teachers	218	68%
Mobile communication is a quicker method to get feedback in learning	204	64%

In order to find out the difference in perception towards m-learning among students enrolled in different degree programs a one-way ANOVA test was conducted. The three assumptions of ANOVA, i.e., independence of scores, data normality and homogeneity of variances were checked before running ANOVA. The data was gathered from independent samples whereas the normality of

data was checked using Skewness and Kurtosis values, which were found within the recommended range of +1 to -1, suggesting that data was normally distributed. Lavene's scores were used to determine the homogeneity of variances. Since all the values of Lavene's Statistic were above 0.05 significance level (0.664, 0.237, 0.123, 0.582, 0.386 and 0.391), the assumption of homogeneity of variances was satisfied. The results of the test are shown in Table 4.

Table 4: Results of One-way ANOVA Test

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
Mobile phones are a useful medium of imparting knowledge	Between Groups	27.338	3	9.113	17.084	.000
	Within Groups	168.550	316	.533		
	Total	195.888	319			
It is convenient to access information using mobile phones	Between Groups	7.125	3	2.375	4.642	.003
	Within Groups	161.675	316	.512		
	Total	168.800	319			
It is a good idea for university to contact students via mobile phones for educational purposes	Between Groups	1.684	3	.561	.817	.485
	Within Groups	217.188	316	.687		
	Total	218.872	319			
Mobile learning is more flexible method of learning as it can be done anytime, anywhere.	Between Groups	10.234	3	3.411	5.073	.002
	Within Groups	212.487	316	.672		
	Total	222.722	319			
Mobile phones can improve communication between students and teachers	Between Groups	6.013	3	2.004	2.840	.038
	Within Groups	222.975	316	.706		
	Total	228.987	319			
Mobile communication is a quicker method to get feedback in learning	Between Groups	2.275	3	.758	1.137	.334
	Within Groups	210.725	316	.667		
	Total	213.000	319			

The results of one-way ANOVA indicates that there is a significant difference in the perception of students belonging to different degree programs with respect to four questions: Are mobile phones are a useful medium of imparting knowledge? ($F = 17.084$, sig. value = .000), Is it convenient to access information using mobile phones? ($F = 4.642$, sig. value = .007), Can mobile phones improve communication between students and teachers? ($F = 2.840$, sig. value = .016), Is mobile learning a more flexible method of learning as it can be done anytime, anywhere? ($F = 5.073$, sig. value = .000).

As in our case there are more than three groups having an equal number of observations and the data exhibit equal variance (as suggested by Lavene's Statistics), Post Hoc HSD was selected to determine which groups were significantly different from others. The results are shown in Table 5.

Table 5: Results of Post Hoc Tukey Test

		Multiple Comparisons					
Tukey HSD							
Dependent Variable	(I) Majors	(J) Majors	Mean	Std. Error	Sig.	95% Confidence Interval	
			Difference (I-J)			Lower Bound	Upper Bound
Mobile phones are a useful medium of imparting knowledge	Medical	Engineering	-.675*	.115	.000	-.97	-.38
		Arts	-.675*	.115	.000	-.97	-.38
		Business	-.225	.115	.210	-.52	.07
It is convenient to access information using mobile phones	Medical	Engineering	-.350*	.113	.011	-.64	-.06
		Arts	-.338*	.113	.016	-.63	-.05
		Business	-.113	.113	.753	-.40	.18
Mobile learning is more flexible facilitating anytime, anywhere learning.	Medical	Engineering	-.400*	.130	.012	-.73	-.07
		Arts	-.425*	.130	.006	-.76	-.09
		Business	-.138	.130	.714	-.47	.20
Mobile phones can improve communication between students and teachers	Medical	Engineering	-.288	.133	.135	-.63	.06
		Arts	-.338	.133	.056	-.68	.01
		Business	-.100	.133	.875	-.44	.24

* The mean difference is significant at the 0.05 level.

The Tukey post hoc tests indicate that medical students' perception with respect to the statement that mobile phones are a useful medium for imparting knowledge differ significantly from arts ($p = 0.000$) and engineering ($p = 0.000$) students but not from business students ($p = 0.210$). Similarly, the medical students' perception with respect to the statement that it is convenient to access information using mobile phones differ significantly from arts ($p = 0.016$) and engineering ($p = 0.011$) students but not from business students ($p = 0.753$). Finally, medical students' perception with respect to the statement that m-learning is a more flexible medium facilitating anytime, anywhere learning is significantly different from arts ($p = 0.006$) and engineering ($p = 0.012$) students but not from business students ($p = 0.714$). No significant difference between the perceptions of students belonging to all four groups is indicated in the Post Hoc test with respect to the statement that mobile phones can improve communication between students and teachers.

The results confirm that Arts and Engineering students' perceptions differ significantly from those of medical and business students with respect to three questions as shown in Table 5.

Discussion

On the basis of the results of this study it can be stated that mobile phone usage among university students is widespread. This finding is similar to the finding of Pollara and Broussard (2011) who carried out a review of studies conducted on students' perception towards m-learning and concluded that the most pervasive form of m-learning is the mobile phones. A review of the literature on m-learning provides a long list of candidate devices that can be used in an m-learning context (Fetaji, 2008). However, PDAs and mobile phones stand out as the choice of many researchers for conducting research related to m-learning (Garrett & Jackson, 2006; Venkatesh et al., 2006; Manair, 2007; Clarke, Keing, Lam & McNaught, 2008; Hsu, Wang & Comac, 2008; Cavus & Ibrahim, 2009; Wang, Shen, Novak & Pan, 2009). More than seventy percent of students in this study reported owning a mobile set suitable for m-learning by having wi-fi connectivity, Bluetooth, camera, color display, audio/video recording capability. Students own both expensive as well as inexpensive mobile sets, however, low-cost, android-based smartphones are becoming popular in Pakistan, as reported by Iqbal & Bhatti (2015) as well. The latest generation of smartphones has powerful on-board computing capability, larger memories, bigger screens and open operating systems that encourage application development and, due to these reasons, they are increasingly viewed as handheld computers rather than as phones.

Owning mobile phones and using them on a daily basis for several other purposes besides receiving and making calls shows that students are ready, at least as the beginners, since mobile phones are not foreign to them. The new generation – Net-Generation as it is called – are born with the technology and have the capability to explore and adopt emerging technologies available in the market (Duffy, 2008). Students are technologically ready since they are already familiar with the technological advancements, economically ready since they are ready to use their own mobile devices for learning and psychologically ready as they have a positive attitude towards m-learning; a finding similar to several other studies which concluded that students demonstrated strong and positive reaction toward integrating m-learning into the classroom (Garrett & Jackson, 2006; Clarke et al., 2008; Cavus & Uzunboylu, 2009; Uzunboylu, Cavus & Ercag, 2009;). Moreover, students reported learning with mobile devices to be enjoyable (Clarke et al., 2008; Rogers et al., 2010; Shih, Chen, Chang & Kao, 2010; Iqbal & Bhatti, 2016).

The results of this study suggest that more than 51% of the students' monthly mobile bill exceeds Rs. 500. It means students generally have a monthly mobile budget suitable for subscribing to Internet/SMS packages and thus are in a position to engage in m-learning. The majority of the students are prepaid customers; the reason could be that they want to have better control over their mobile expenses. Lower call rates and better coverage are the two main reasons for selecting a mobile service provider. Frequent changes in call rates, poor connectivity and noisy SMSs are three main problems related to mobile service provider reported by students. The mobile service providers need to focus on resolving these issues to retain their customers. More than 90% of the students were not using mobile phones for MS office, accessing LMSs and audio/video recording of lectures. The reason for low usage of these functions/features could be the small size of the screen, which makes it difficult to read large documents, and the small sized keypad makes data entry cumbersome.

The findings of this study indicate that, overall, students have a positive attitude towards m-learning, but a significant difference is found in the perception of students belonging to different degree programs towards the usage of mobile phones in an educational context. It means educators and developers need to keep in mind these differences when designing any m-learning program. One-size fits all types of m-learning initiatives will not serve the purpose. M-learning programs need to be tailor-made. The requirements of engineering students can be different to a great extent from the requirements of medical or arts students. These differences should be kept in mind when introducing any mobile-based learning program. The difference in perception of students belonging to different degree programs is in line with the findings of Percival and Percival (2008) who concluded in their study that m-learning programs should be tailored according to the type of program. They pointed out that the requirements of liberal arts and business programs are different from that of engineering and information technology (IT) programs and suggested a school-managed m-learning program for engineering because of the highly complex needs of engineering. Furthermore, for liberal arts and business programs they suggested more flexible programs because of the less complex and somewhat routine requirements. One of the possible reasons for this difference could be arts and engineering students require more practical and hands-on types of problems/examples to understand a specific concept, whereas, business and medical students rely more on listening, observations and discussions for clarifying their concepts.

The results of our study are somewhat contrary to the results of the study conducted by Al-Emran, Elsherif & Shaalan (2016) in which they surveyed five universities of UAE and Oman to determine whether there was a significant difference in the perception of students and teachers towards m-learning with respect to age, gender, country, major, smartphone ownership and level of study. They reported a significant difference in the perception of students towards m-learning with respect to age, country and smartphone ownership, however, no significant difference was found in one-way ANOVA due to majors (i.e., IT, project management, business management and English). One of the possible reasons for this difference in the results of the two studies could be the difference in smartphone ownership. Since UAE and Oman are economically stable countries compared to Pakistan, a higher degree of smartphone ownership as well as familiarity with mobile technology is expected in those countries, resulting in less variation in the perception towards m-learning. The

findings of the study conducted by Arif, Yasi, Radzi, Husin & Embi (2013), who reported a significant difference in the basic physical and skills readiness towards m-learning between the students majoring in science and social science, also support this logic. The main contributing factors towards this difference in readiness towards m-learning were reported as the science students' eagerness to try new technologies, the influence of peers, teachers and surrounding environment.

The findings of this study are extremely useful for teachers, who can use student friendly mobile devices to make learning fun and enjoyable. As pointed out by McAlister (2009) teachers can blend their pedagogical knowledge with ICT in teaching to produce "well grounded, engaged students" who can go beyond the four walls of the class to explore the borderless world of information. Pierson (2001) emphasized that integration of ICT in education is an essential element of good teaching. Since the findings of this study suggest students' readiness and willingness to adopt m-learning, the teacher should grab this opportunity to make learning more enjoyable in order to promote lifelong learning. The policy makers should play an active role in charting out mobile conducive national education policy. According to Shuler (2009), "*A national 'best practices' initiative to disseminate effective uses of mobile technology for education should be established with support from philanthropic and policy leaders*" (p. 10). Educational institutions can lower the costs of m-learning programs by moving away from school provided hardware towards students' owned mobile devices. Obviously, for any initiatives to be effective, the professional development of teachers to enable them to introduce mobile devices and applications within a particular curriculum is essential. Educationists and software developers can support any m-learning initiative by providing content formatted for mobile devices and by educating students on its benefits (Iqbal & Qureshi, 2012). There are many universities in Pakistan that are currently offering an LMS (e.g., COMSATS, NUST, SZABIST and Iqra) but only a few of them are offering a mobile friendly LMS. M-learning cannot be successfully extended without appropriate university support, which can be in the form of technology acquisition, training and the availability of support staff. Secondly, faculty attitude towards m-learning can play a crucial role in development of this medium of learning. Faculty support can be in the form of encouraging students to use m-learning as well as developing appropriate course content suitable for m-learning. Faculty can be instrumental in promoting m-learning, since they can communicate 24/7 with their students, convey messages/announcements, share reading material and audio/video content, create discussion forms, blogs and wikis, all of which are tools to engage students in m-learning.

Conclusion

From the findings of this study it can be concluded that majority of students (69%) owned a mobile phone suitable for usage in m-learning, i.e., a smartphone. Samsung (33%), Nokia (20%), Q-mobile (15%) and Apple (14%) were found to be the most popular brands of mobile phone sets. As far as the reason for selecting a mobile set is concerned, 27% indicated reasonable price, 23% indicated suitable functionalities and 15% indicated attractive appearance to be the main reason for selecting a mobile set. The monthly expenditure pattern of students indicates that Internet packages offered by mobile service providers are within reach of majority of them. The two main reasons indicated by the students for selecting their mobile service provider were lower rates and better coverage; whereas, the two major problems faced by them from their current service provider were frequent changes in rates and poor connectivity. More than 60% of the students were familiar and were regularly conducting research using the Internet/Google on their mobile phones, communicating through SMS, generating contents by taking pictures, using the alarm function and the calculator. The functions never used by more than 60% students included voice/lecture recording, note-taking, accessing Learning Management Systems (LMSs) and using MS office via mobile phone. More than 60% students surveyed indicated a positive perception towards m-learning. However, a significant difference was found in the perception of students belonging to different disciplines towards m-learning.

One of the limitations of this study is its limited sample size, which primarily consists of students coming from the urban class; hence the results cannot be generalized to all situations. Secondly, the results are based on self-reported responses from the undergraduate students belonging to only four disciplines. For future studies, it is recommended considering students from other disciplines as well

and to included graduate and post-graduate students in the sample. Longitudinal studies and cross-country comparisons are also recommended to improve the generalizability of the results.

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