An Investigation of Effectiveness of Mobile Learning Apps in Higher Education in India

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Abstract

Purpose: The purpose of the present paper is to investigate the effectiveness of mobile learning apps in the higher education in India. It also evaluates the role of mobile learning apps in students' life.

Design/Methodology/Approach: A structured questionnaire was distributed online among students belonging to different Indian universities. The collected data was analysed and presented in tabular form.

Findings: The present research revealed that role of mobile learning apps are increasing among students learning. The results indicated that the mobile learning apps can be very useful in the higher education environment. Furthermore, the results showed that the students had adequate knowledge and awareness to use mobile technology and the Internet in their educational environment.

Practical Implications: The present study is very useful for the policy makers to develop course curriculum which may include mobile learning apps as substitute for classes.

Originality/Value: The findings emphasize the popularity of mobile learning apps among students of higher education in India. It also reveals that mobile learning apps can be used effectively in the higher education

Keywords: M-learning, Mobile Technology, Mobile Devices, Higher Education, Mobile Learning Apps, Mobile Applications

Introduction

Advancements in mobile technology are rapidly changing the nature of learning by allowing flexible and instance access to rich digital content. Mobile learning (m-learning and further mobile learning apps) can also play a significant role in learning. M-learning is the latest education and training method seems to be the fastest developing in education field compared to the traditional e-learning. M-learning is the next form of e-learning using mobile technologies to facilitate education for teachers and learners anywhere and anytime (Alzaza & Yaakub, 2011a). The potential benefits of m-learning have been widely touted from a range of purposes, including cost savings, worldwide communications, easy access, study aids, convenience and location-based services. For example, the U.S. government is seeking to reduce costs by encouraging schools to transition from paper-based to digital textbooks within the next five years (Hefling, 2012). Students can communicate with other students and their instructors through text messages. Mobile Apps can be used as study aids (e.g., anatomical models of human organs for medical students) that students can access from virtually anywhere (Young, 2011). It also facilitates students to have relevant place-based information about nearby buildings or landmarks with Geo-location capability. Despite the importance of the adoption of m-learning apps, very little research has been conducted concerning the factors affecting the acceptance of m-learning apps by students in higher education.

Literature Review

Mobile Learning

Mobile learning or m-learning is an extended version of e-learning by using mobile technology (Naismith, Lonsdale, Vavoula, & Sharples, 2004; Yuen & Yuen, 2008). E-learning is defined as learning experiences to

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support individual learning with various types of computer technologies (Clark & Mayer, 2008). Thus, m-learning embraces many features of e-learning such as multimedia contents and communications with other students (Horton, 2006), but it is unique in terms of flexibility of time and location (Peters, 2007). The characteristics of mobile devices can be categorized into three categories as:

(a) **Portability:** mobile devices can be taken to different locations,

(b) **Instant connectivity:** mobile devices can be used to access a variety of information anytime and anywhere with instant connectivity facility, and

(c) **Context sensitivity:** mobile devices can be used to find and gather real or simulated data (BenMoussa, 2003; Churchill & Churchill, 2008; Klopfer, Squire, & Jenkins, 2002).

These three features of m-learning can change the learning experience of students (Traxler, 2007, 2008, 2010; Wang & Higgins, 2006). In addition, new advanced hardware of mobile devices (e.g., camera, accelerometer) and various software (e.g., learning apps) provide more capabilities to organize, manipulate and generate information for learning (Chen, Tan, Looi, Zhang, & Seow, 2008; Keskin & Metcalf, 2011).

Based on the above mentioned features of m-learning, four types of learning approaches can be supported by mobile devices. First, m-learning supports individualised learning by allowing students to pace learning at their own speed, convenience and place. Second, the situated learning is realised as students use mobile devices to learn within a real context. For example, students can learn about social responsibility through Starbucks Shard Planet (a programme that minimises environmental impact with the use of recycled and reusable cups). Third, m-learning enables collaborative learning when students use mobile devices to easily interact and communicate with other students and teachers. Finally, it supports informal learning and allows students to learn out of class at their convenience.

On the other hand, some studies show that students are not likely to use mobile devices for learning because of the limitations of m-learning. There are many reasons which can act as a hindrance for m-learning. First, some technical limitations of mobile devices have been voiced (Haag, 2011; Huan, Kuo, Lin, & Cheng, 2008; Park, 2011; Wang, Wu, & Wang, 2009), such as the small screens with low resolution display, inadequate and low memory, slow network speeds and dis-connectivity, and lack of standardisation and comparability. Second, users' psychological limitations have been addressed (Park, 2011; Wang *et al*., 2009). For example, students are more likely to use mobile devices for casual uses, such as texting with friends, listening to music, and use of social network services, rather than for learning purposes (Park, 2011; Wang *et al*., 2009). Last, there are some pedagogical limitations (Corbeil & Valdes-Corbeil, 2007). For example, using mobile devices in class may hinder student concentration and interrupt class progress. Some research has proposed for designing of guidelines for m-learning (e.g., Gu, Gu, & Laffey, 2011; Sharples, 2000; Shih & Mills, 2007) to overcome the technical limitations. For example, learning content for m-learning should be adapted to the small screen size for small screen mobile users (Lowenthal, 2010). In addition, the instruction should be provided in the pinpointed manner because generally the amount of data and time to access the Internet is limited with a mobile device. Shieh (2009) and Gu *et al*. (2011) introduced a micro lecture format that contained fewer concepts in one-to-five minute video. The audio format of the contents is suitable for a mobile learning situation.

Mobile Learning in Higher Education

M-learning has the potential to support all forms of education; higher education is a particularly appropriate venue for the integration of m-learning because availability of mobile devices has become very common for college students. Various M-learning attempts have been applied in higher education. For example, college students can receive formative evaluation and feedback from their instructors via a mobile device (Crawford, 2007). A face-to-face course can be supported by Quick Response (QR) codes that offer an Internet link to supplemental resources (Grant & Gikas, 2011). Administrative tasks, such as checking attendance and learning progress, can also be done with the use of mobile devices. Some universities such as Stanford, Abilene Christian, and the University of Washington, have been pioneering m-learning (Keller, 2011), but implementing m-learning in higher education is still challenging because of social, cultural, and organisational factors (Corbeil & Valdes-Corbeil, 2007; Traxler, 2007, 2010).

Few researchers have studied about the adoptability and usability of m-learning for college students (Lowenthal, 2010; Wang *et al*., 2009). Those researchers mainly focus on students' acceptance of m-learning. Liu, Li, and Carlsson (2010) find that perceived usefulness and personal innovation have influenced the adoption of M-learning in their study with Chinese college students using the Technology Acceptance Model (TAM) which explains how people accept a new system (Davis, 1989). Using the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh & Davis, 2000), Wang *et al*. (2009) found that five factors including performance expectancy, effort expectancy, social influence, perceived playfulness, and self-management of learning were significant factors in adopting m-learning with Taiwanese college students. Unlike the study of Lowenthal (2010), Wang *et al*. (2009) employed only three factors including performance expectancy, effort expectancy, and self-management of learning and find that three factors have influenced the adoption of m-learning of U.S. college students. The technology acceptance models used in previous studies focused on users' perception toward m-learning technology's functionality and characteristics (Benbasat & Barki, 2007), but m-learning apps are a whole new approach to learning. Thus, we are particularly interested in the investigation of the effectiveness and usefulness of mobile learning apps in the learning process, not whole m-learning concept.

M-learning's Key Features

M-learning apps have several key features that made it popular among students. These features comprise:

- M-learning apps reduce the barriers of time, place, and distance. It provides learning opportunities to individual learners at their own convenience.
- Mobile technologies potentially create a wide variety of ranges for users that differ significantly from desktop and laptop technologies.
- Some expected benefits of using the mobile device such as mobility which is the primary component of m-learning technology.
- Several access technologies provide Internet access to all kinds of learners via mobile phones
- Mobile network operators probably play the most important role in enabling m-learning services.
- Higher educational institutes need m-learning as an additional component of their education method.
- In developing countries, the majority of people live in deep rural areas or far from campuses where everyone can have a mobile phone to learn new things.
- The rapid evolution of powerful convergent and connected wireless mobile devices and rapid growth of mobile learning apps.
- The availability of advanced mobile systems, boom in mobile learning applications, and rich client interfaces.
- User interface technology that overcomes the limitations of the mobile devices.
- M-learning apps are not only demanded by students of educational institutions but also by individual and autonomous learners focusing special learning objectives (i.e. language learning, technical learning, and additional skills).

Mobile Learning in the Higher Education

M-learning is considered as the next form of e-learning using mobile technologies to enable learners to conduct their learning process anywhere and anytime at their convenience. However, the main difference between e-learning and m-learning is set in the add-on capabilities and limitations in the evolution aspects (Lavoie, 2007). Traditional e-learning system have two main types of services that are pedagogical services such as learning materials and information services such as admission, notification and registration related. The use of m-learning is growing rapidly in the higher education environment because of its dynamic features.

A study (Alzaza & Yaakub, 2011b) investigated the importance of university mobile services among Malaysian higher education students found that exam results and course registration were the highest rank, followed by calendar and schedule services, library services, treasury, and admission status where the international students' services had the lowest rank.

Limitations of M-learning

Limitations of m-learning services are considered as one of the issues that should be taken care of when discussing m-learning. Over the m-learning innovation, scholars have

noted that mobile devices have some limitations such as memory size, battery life, high line cost, and small screen (Rekkedal & Dye, 2007) and these limitations are also applicable on m-learning. Another study (Barker, Krull, & Mallinson, 2005) highlighted some considerations that need to into account when exploring the adoption of m-learning range of limitations of the wireless technologies themselves, to broader issues such as safety and security, as well as training.

However, now these limitations are reduced by enhancement of new technologies and new mobile phone capabilities. Recent developments in technology provide new facilities and interfaces for learners to explore a new paradigm of learning.

Methodology

The survey method was used for the study. A structured questionnaire was prepared and distributed online among people (Karim, Darus, & Hussin, 2006). The questionnaire comprises three sections. Section "A" focus on the users' profile such as gender, age, and education background, affiliation and discipline. Section "B" covers the student's awareness and usage of mobile technologies and the Internet. Finally, section "C" investigates the awareness and usability of mobile learning apps. It also covers the role and impact of mobile learning apps in higher education. For some questions a 5-point Likert scale anchored by "Strongly Disagree" (1) and "Strongly Agree" (5) was used. The ranges of five point Likert-scales were categorised into equal sized categories of low, moderate, and high.

Data Analysis and Results

Respondents' Profile

As shown in Table 1, 57.86% of the respondents were male and 42.14% female. The most (45.36%) of respondents were U.G. students, 37.86 were P.G. students, and 16.78% were enrolled as research scholars. The majority (59.64%) of the respondents were aged between 21-30 years. Commerce students made up the small group of respondents with 18.93%, while respondents studying science & technology were 32.14%. In terms of affiliation, most of the respondents (54.64%) were in the central universities and only 9.29% were from open universities. This data indicates that the findings represent opinions of different levels, age and disciplines of students from different universities.

Table 1: Demographic Profile of the Respondents

Profile	*Classification*	*Total N=280*			*Percentage (100%)*
		Male–162 (57.86%)	*Female–118 (42.14%)*	*Cumulative*	
Study Level	U.G. Students	72	55	127	45.36
	P.G. Students	58	48	106	37.86
	Research Scholar	32	15	47	16.78
Age group	Below 21 years	45	38	83	29.64
	21 – 30 Years	96	71	167	59.64
	31 – 40 Years	21	09	30	10.72
Stream or Discipline	Arts & Humanities	38	25	63	22.50
	Commerce	32	21	53	18.93
	Science & Technology	52	38	90	32.14
	Social Science	31	32	63	22.5
	Medicine	09	02	11	3.93
Affiliation type	Central University	91	62	153	54.64
	Research Institute	16	12	28	10.00
	Open University	15	11	26	9.29
	Private University	24	25	49	17.5
	State University	16	8	24	8.57

Availability of Mobile Devices

Smart phones are very useful in many ways. New technologies facilitate one to use their mobile as a computer. It is popular among people to use smart phones. This research revealed that 77.15% of the participants owned a mobile phone. In a sense that 65.72% of them had smart phones, while 11.43% had normal mobile phones. The 18.57% respondents have tablets and merely 4.28% had E-book readers.

Research question: Which device do you have?

Table 2: Student's Availability of Mobile Devices

Device Ownership	*Respondents N=280*	*Percentage (100%)*
Mobile Phone	32	11.43
Smart Phone	184	65.72
Tablet	52	18.57
E-book reader	12	4.28

Mobile Operating platform

There are many mobile operating systems available in the market and they have their own features. This study reveals that mobile having android operating system is used by most (47.14%) of people. Other operating systems include Windows (16.43%), Apple's iOS (13.93%) Symbian (11.43%) and Blackberry (11.07%) used by respondents.

Research question: Which mobile operating system you have in your mobile?

Table 3: Student's Usability of Mobile Operating Systems

Mobile operating systems	*Respondents N=280*	*Percentage (100%)*
Android	132	47.14
Blackberry	31	11.07
iOS	39	13.93
Symbian	32	11.43
Windows	46	16.43

Internet Usage

New smart devices are useless if it has no Internet connection. Most of the useful features in smart phones are working by using Internet connection. This study (refer to Table 4) also demonstrated that 84.29% of participants use the Internet from their mobile devices (It includes Smartphones, Tablets and Normal mobile Phone). Only 15% of them do not have Internet connection in their mobile device.

Research question: Do you have Internet on your mobile device?

Table 4: Student's Availability of Internet

Response	*Respondent N=280*	*Percentage (100%)*
Yes	236	84.29
No	44	15.71

Purpose of using Internet

Internet has a vast amount of information and people use it according to their need. We measured their purpose of using Internet by permit them to answer multiple option. The study revealed that the majority of people use the Internet for study (96.07%) and social networking (83.21%) purpose. There are 77.17% people use Internet for news, 75.71% for e-mail, 48.57% for research, 16.79% for searching jobs, and 41.43% use for entertainment purpose.

Research question: Purpose of using the Internet (multiple answers permitted)

Table 5: Participant's Purpose of Using Internet

Purpose of using Internet	*Respondent N=280*	*Percentage (100%)*
Social Networking	233	83.21
Study and learning Purpose	269	96.07
News	212	77.14
E-mail	224	75.71
Research Purpose	47	48.57
Searching Job	198	16.79
Entertainment	116	41.43

Awareness of Mobile Learning Apps

This study explored the student's awareness of the various mobile apps names (refer to Table 6). The abbreviations used for this question are NA= Not Aware, SA- Somewhat Aware, NS= Not Sure, A= Aware, VA= Very Aware. The study shows that 69.28% students are aware about mobile learning apps (42.86% A and 26.43% VA).

Research question: Are you aware about mobile learning apps?

Table 6: Student's Awareness of Mobile Learning Apps

Awareness	*Respondent N=280*	*Percentage (100%)*
NA= Not Aware	21	7.50
SA- Somewhat Aware	54	19.28
NS= Not Sure	11	3.93
A= Aware	120	42.86
VA= Very Aware	74	26.43

Duration of using Mobile Learning Apps

Most of the mobile learning apps have not option to get log out. They often work in the background while Internet is connected. Regarding duration, almost 62.14% of respondents use mobile learning apps for 1-3 hour per day. 23.93% of them use for 3-6 hour per day; 9.64% use for 6-10 hours and only 4.29% use more than 10 hour or more per day.

Research question: How much time do you use mobile learning apps?

Table 7: Student's Daily Usage of Mobile Learning Apps

Duration	*Respondent N=280*	*Percentage (100%)*
1-3 Hour	174	62.14
3-6 hours	67	23.93
6-10 hours	27	9.64
10> Hours	12	4.29

Types of Mobile Learning Apps People Use

Mobile learning apps are very popular among people for getting help in their studies and research and update their knowledge. People use different kind of apps for different purpose. Most of the respondents (82.86%) use dictionary and encyclopedia apps. Another kind of apps used by respondents are quiz and news apps (62.14%), cloud storage (60.71%), course materials and digital notes related apps (57.14%), language learning and taking online course apps (54.29%), organiser and other useful apps (48.57%), research related apps (24.64%), and science related helpful apps (18.57%).

Research question: Which kind of mobile learning apps you use? (Multiple answers permitted)

Table 8: Student's Usage of Different Types of Mobile Learning Apps

Type of Mobile learning apps	*Respondent N=280*	*Percentage (100%)*
Research related apps	69	24.64
Course Materials	160	57.14
Dictionary and Encyclopedia	232	82.86
Language learning/ Online Course	152	54.29
Organiser/ other useful apps	136	48.57
Cloud Storage	170	60.71
Quiz and News	174	62.14
Science/ Mathematics	52	18.57

Usability of Mobile Learning Apps

There are many mobile learning apps available in the market. Every mobile learning app has their unique features. People use these mobile learning apps according to their nature of the requirement. Participants were also asked about the mobile apps that they use through their mobile technologies by answering multiple options. The gathered data (refer to Table 9) reveal that Wikipedia (93.93%) app is the most popular app followed by Dictionary.com (72.14%), Quizlet (68.93%), and Document To Go (66.07%). The other popular apps are CourseSmart (38.93%), Evernote (33.93%), Duolingo (32.50%), Keynote (31.79%), Dropbox (28.93%),

Coursera (21.79%), iAnnotate (18.21%), Scanner Pro 6 (14.64%), EasyBib (13.57%), Mendeley (11.07%), Quick Graph (11.07%), and The Elements (7.50%).

Research question: Which Mobile learning app do you use? (Multiple answers permitted)

Table 9: Mobile Learning Applications that Students Like to Use

Mobile Learning Apps	*Category/ Usability of App*	*Respondent N=280*	*Percentage (100%)*
EasyBib (free)	Bibliography	38	13.57
Dropbox	Cloud Storage	81	28.93
CourseSmart	Course Materials	109	38.93
Dictionary.com	Dictionary	202	72.14
iAnnotate	Digital Notes	51	18.21
Wikipedia	Encyclopedia	263	93.93
Mendeley	Research Sharing	31	11.07
Duolingo	Language Learning	91	32.50
Quick Graph	Mathematics	31	11.07
Documents To Go	MS Office	185	66.07
Coursera	Online Course	61	21.79
Evernote	Organiser	95	33.93
Keynote	Presentation	89	31.79
Quizlet	Quiz	193	68.93
Scanner Pro 6	Scanner	41	14.64
The Elements	Science	21	7.50

Effectiveness of Mobile Learning Apps

Mobile learning apps provide facility to learn anytime and anywhere according to the convenience of the users. It is very effective to utilise free and leisure time. In terms of effectiveness, almost 42.64% of respondents find mobile learning apps very effective whereas 34.64% of them find it effective. 15.71% of them find it somewhat effective and 7.50% respondent have not a clear idea and they were neutral.

Research question: How effective you find mobile learning apps

Table 10: Student's Opinion about Effectiveness of Mobile Learning Apps

Measure of effectiveness	*Respondent N=280*	*Percentage (100%)*
Very effective	118	42.14
Effective	97	34.64
Somewhat effective	44	15.71
Neutral	21	7.50

Opinion towards Impact of Mobile Learning Apps in Higher Education

There are many apps available in the market for different purpose. These apps made the learning process very smoothly and effectively. A large number of apps are freely available in the market which can be downloaded and used according to the requirement of the learner. We asked people about integration of mobile learning apps in the higher education and most of the respondents (87.86%) feel that mobile learning apps can make a great impact on higher education whereas some people (12.14%) are not agree with them.

Research question: Do you feel mobile learning apps can have a great impact on higher education?

Table 11: Student's View about Impact of Mobile Learning Apps over Higher Education

Response	*Respondent N=280*	*Percentage (100%)*
Yes	246	87.86
No	34	12.14

Conclusion

In this mobile dependent era, m-learning apps can engage students with their learning environment anywhere and anytime. This study investigated the Indian students' awareness and usability of m-learning apps and its impact over the learning process.

The findings represented the opinions of different levels of students from different universities from different parts of India. The results indicated that the mobile learning apps can be very useful in the higher education environment. Furthermore, the results showed that the

students had adequate knowledge and awareness to use mobile technology and the Internet in their educational environment.

It was also demonstrated that students were quite aware of the mobile technologies and Internet which could be useful in their learning environment. They highly agreed that access of mobile learning apps is very important for their learning and research purpose. This study indeed provides clear evidence of the of student's perception about mobile learning apps.

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