A Review of the Challenges and Issues in Mobile Learning

Mohd Ishak Bin Ismail

Faculty of Computer Systems and Software Engineering, University Of Malaysia Pahang
Gambang, Malaysia

ABSTRACT

Nowadays, mobile learning becomes popular trend of learning. Mobile learning refers to the use of mobile technology to facilitate, to enhance and expand learning. Mobile learning is the new version of D-learning and E-learning. With the presence of mobile learning in our education world, learning can be conducted anytime and anywhere. However, the wide implementation of mobile learning has led to the critical issues related to the mobile devices, software design and connectivity. Thus, this paper will discuss on the characteristics of the mobile learning in order to get better understanding about the critical issues in mobile learning. Based on these issues, suitable recommendations are proposed to improve the overall performance of mobile learning.

Keywords: Mobile learning; E-learning; D-learning; mobile technology.

I. INTRODUCTION

The widespread of mobile technology such as smart phones and other mobile devices has obviously altered the trend of current education. Mobile technologies enable learning to be conducted anytime and anywhere. With this feature, students could distribute their studies in terms of place, time and pace. In addition, instructors have more opportunities to interact with students rather than just face-to-face. In brief, mobile learning (M-Learning) refers to the learning process that takes place through mobile devices such as smart phones, PDA, tablet. The idea of mobile learning is an extension of the previous trend of learning especially on Distance Learning (D-Learning) and Electronic Learning (E-Learning). Both trends of learning have close similarities. However, E-Learning is designed with enhanced features such as electronic media, variety of learning application and more interactivity (face-to-face online conference) [1]. In the past, both D-learning and E-Learning are conducted in a traditional learning environment such as classroom or lecture hall as they are required internet service and computers to establish online connection.

The introduction of mobile learning had brought the new concept in learning, which learning become mobile and yet accessible. As the result, learning session is not necessarily being conducted in the classroom or lecture hall as it can take place in many settings and contexts [2]. The implementation of mobile learning has enriched learning activities to be conducted individually or in groups [3]. Also, mobile technologies can be used to develop collaborative learning activities.

As mobile learning is widely adopted by people around the world, the critical issues regarding to the implementation of mobile learning have been addressed. These critical issues include the device conflicts (hardware) [4], software design [5], and connectivity. The main question regarding to these issues is how to improve the overall quality of mobile learning. In order to understand these issues, this paper will discuss on the concepts and the characteristics of the mobile learning. At the same time, this paper will discuss the critical issues addressed in mobile learning. Based on the discussion on the critical issues, suitable recommendations are made to improve the overall performance of mobile learning.

II. OBJECTIVES

The main goal of this paper is to highlight the critical issues in mobile learning. Thus, this paper will give focus on these objectives to achieve the main goal:

 a) to explain the main concept and characteristics of the mobile learning.

 b) to discuss the critical issues in the implemantation of mobile learning

 c) to discuss available solutions to improve performance of mobile learning

III. CONCEPT OF MOBILE LEARNING

Mobile learning has been defined differently by different researchers or organization. However, all of these definitions refer to the same meaning. The gist of mobile learning definition refers to the use of mobile devices to facilitate or expand learning using the most efficient ways. According to [6] mobile learning can be defined as learning that is delivered or supported solely or mainly by mobile technologies. Based on these definitions, one will find out the main concepts underlie beneath the mobile learning is mobility. The concept of mobility that embedded in mobile learning is described in Table I.

Table I: Mobility Concepts in Mobile Learning

Dimension	Description
Physical	Learning can take place anywhere.
Technology	Use portable devices to access and store resources.
Conceptual	Learning contents are managed and administered using certain applications, so that users can easily zone into the needed information.
Social	Users able to perform social groups and connect to each other.
Learning dispersal	Allow learning to expand across various context in short time.

IV. CHARACTERISTICS OF MOBILE LEARNING

The main characteristics in mobile learning must be able to support anywhere and anytime learning. These characteristics are essential when designing devices or application for mobile learning. Researchers [7] have considered equipment mobility, learning conveniences, learning individualization and environment relativity as the main characteristics of mobile learning. On the other hand, researchers [8] have mentioned the characteristics of mobile learning as ubiquitous, portable sized of mobile tools, blended, private, interactive, collaborative and instant information. Research by [9] has drawn out that the characteristics of mobile learning as the increasing portability, ubiquity, personal ownership, social interactivity, connectivity and personalization. Based on these characteristics, the basic characteristics of mobile learning are shown in the Fig.1.

Fig. 1. The basic characteristics of mobile learning

A. Ubiquitous

Mobile learning can happen anywhere and anytime which it is more spontaneous than other type of learning. In other words, mobile learning is more flexible and portable. Spontaneous learning means that users proactively direct their learning instead of expecting or waiting for someone to prepare the materials or resources for their learning. Basically, learning can be conducted across the different context and environment.

B. Portable

The resources can be easily carried and moved. In order to become portable, the devices are usually designed to fit pocket-sized and become light-weight. This characteristic enables users to easily carry the devices as they travel from one place to another place. The storage capacity in the devices allows most of the information to be stored in the devices. As a device coupled to a user, he or she can access information anywhere and anytime.

C. Interactive

Learning contents should be well-organized in the proper manner so that users can easily browse the required information. The interaction design of mobile learning is essential for distance users to interact smoothly with the instructors, learning resources and other users within the environments. The functionality, usability and performance should be considered at the first place when designing interactive mobile learning applications.

D. Private

Mobile learning offers privacy to its users. Meaning that only one user can access the information via a mobile device at a time. With this characteristic, first priority is given to the authorized mobile owners to independently access the data compare to others.

E. Collaborative

Mobile learning can be used to collaborate between instructors and students. It also can be used to make collaboration among students. Nowadays, mobile devices are widely used for social networking. Therefore, users can easily connect to the groups or individual as they wished at anytime and anywhere.

F. Instant information

Information in mobile learning can be available in various forms such as text, graphics, audio, video and simulation. Mobile learning should be able to provide quick response to the users especially to get the correct definitions, equations or formulas. Quick response time is important factor in supporting goods academic interaction and users' satisfaction.

G. Connectivity

The mobile devices must be able to get connected to the internet anytime and anywhere in order to let anytime and anywhere learning. However, this connectivity is not limited to the internet connection only but mobile devices should be able to be connected to the external data storage (memory card, thumb drives, etc.), other mobile devices and shared networks. With this feature, ubiquitous mobile learning is possible.

V. ISSUES IN MOBILE LEARNING

The implementation of mobile learning has met several barriers, which may affect its overall performance. The first issue related to mobile learning is the technical problems imposed by the design of the mobile devices. In mobile devices, the issues can be related to the physical features of the mobile devices and the short life cycle of the mobile devices [10]. The limitation of screen size, short battery life, insufficient storage capacity and uncomfortable backlight are the popular examples of problems related to the hardware design. Regarding to this low screen resolution, unresponsive touch screen and low camera resolution affect the overall performance of mobile learning [11].

The small screen size may affect the viewing quality [4], which some information cannot be loaded in one view. Although certain information is designed to fit the screen view but the presentation of the information is dissatisfied and not attractive. The font might appear too small for reading purpose. Also, the graphic is not clearly viewed. Therefore, users need to zoom in and zoom out while browsing the information. This might not seem so convenient to the users and probably takes more time.

As the mobile devices become a dispensable tool for mobile learning, they must be able to operate in all time and conditions. In order to make it possible, mobile devices requires reliable and portable power sources. The demands for reliable power sources have brought up another alternative ways to sustain the mobile devices operation. Nowadays,

power bank has been widely used to power up our mobile devices. However, overcharging might shorten the battery life of mobile devices.

Limited storage in mobile devices caused the new information cannot be saved into the internal storage. Various format of the shared information such as video files, audio files and graphic files usually consume large storage space. Therefore, users will go for external storage, which they need to pay extra. Backlight of mobile devices consumes more power as the increasing of screen size. The brightness level of backlight directly affect users' eye and in certain condition it might become unpleasant to users' eye. The common problem regarding to the touch screen is delay in response or unresponsive.

Another issue related to the mobile devices is the short life cycle due to the fast over changing of technology. In this case, the release of a new version of mobile devices will encourage users to upgrade their mobile devices. Every time users upgrade their mobile devices, they have to spend their time to explore the new functionalities as well as to become familiar with those functionalities. For every new replacement, users need to pay high for the cost [12].

Poor interaction design of the mobile learning software contributed to the usability and functionality issue among mobile learning's users. Basically, usability of the software refers to the ease of use of the functionalities embedded in mobile learning. The failure to meet the requirements of every role of participants in mobile learning might contribute to the usability issue. The requirements might include the relevancy of environment and learning; pedagogic role of tools; responsibility for learning process and goals; social setting; previous knowledge and level of achievement [13].

As mobile learning becomes ubiquitous, the violation of privacy becomes the main issues that need attention [14]. The ability of making social interaction through mobile technologies will easily disclose users' locations and other valuable information over the networks. The information stored in the cloud servers can be exploited by malicious parties for evil intention such as to commit crimes or to make embarrassment. The violation of privacy in mobile learning is easily happened due to the availability of sensors that come with the mobile devices. Behavior such as taking photos or record user's activities without permission also can be considered as the violation of privacy.

Like other digital devices, mobile devices are vulnerable to the common security threats such as thief of the devices, infections via applications, misappropriation of data, interception of communication, Bluetooth intrusions, viruses, payment fraud, automatic data transmission and tracing [15]. The adverse outcomes from these threats might cause loss of the devices, loss of data and loss of service access.

Aside of privacy and security concern, slow connectivity can be the barrier in implementing successful mobile learning. Basically, mobile learning materials are information oriented services and products, which it requires fast connectivity in order to give quick response to the needs of learning. Good connectivity requires high bandwidth to allow vast amount of data to be transferred, which users need to pay high for that services.

Based on the discussion, the critical issues in mobile learning can be categorized into the devices issues; software design issues; privacy and security issues and infrastructure. Further description of discussed issues in mobile learning is shown in Table II.

Table II. Critical Issues in Mobile Learning

Category	Critical Issues
Devices	Small screen size Short battery life Insufficient storage Backlight consume more power Unresponsive touch screen Low camera resolution Short life cycle High upgrade cost
Software design	Less interactivity Lack of functionality
Privacy	Information misuse or exploitation Vulnerable to the current security threats.
Infrastructure	Slow connectivity High cost of service

VI. RECOMMENDATIONS

As discussed before, devices, software design, privacy, security and infrastructures may affect the engagement of users in mobile learning. Therefore, it is important for us to find solutions to those issues in mobile learning for better performance. Encouraging users to participate mobile learning is not an easy thing since every user has different needs. For successful mobile learning, we need to identify those needs at the first place and try to come out with the suitable methods to meet users' requirements.

Mobile devices are fundamental tool in mobile learning. All information required for learning is solely accessed and sent through mobile devices. Therefore the physical design of the mobile devices must be able to get users emotionally connected to the products at the first place they saw the products [4]. To achieve this purpose, mobile devices can be designed by adopting Kansei elements. In order to maintain users' engagement, it is highly recommended to apply "playfulness" elements in the mobile interaction design [4]. As a result to this, users can have better experience in their learning and avoid boredom.

As privacy and security in mobile learning become critical issues, we need to consider ways to protect user from security attacks and privacy violation. For example, users can use password or PIN code to lock their devices. Users also can choose VPN (virtual private network) to get connected to the internet instead of using public networks. The good thing about VPN is it allows authorized users to join the network. Tracking system can be installed in mobile devices in case of the devices loss. With this ability, users can easily locate their mobile devices once it is activated. Antivirus is another solution to the security threats like malware, viruses and worms. Education program such as campaign can be used to raise the awareness among mobile learning users regarding to the current security issues.

The quality of mobile learning software influences the performance of mobile learning. The characteristics of good mobile learning software are described in Table III.

Table III. Quality of Good Mobile Learning Software's [16]

Quality	Description
Availability	Ready to use at any time.
Quick response	Able to process users' request and give response in a short time.
Flexibility	Adaptive to any learning environment across different platforms.
Scalability	Ability to accommodate the changes made by the system.
Usability	Ability to utilize the user interfaces in the most effective ways.
Maintainability	Ability to accept future enhancements and modification.
Functionality	Ability of the functions to meet the specific requirements.
Reliability	Consistency to perform under the different environments.
Connectivity	Ability to get connected to the networks
Performance	Response time, devices capabilities, connectivity
User interface	Use simple and understandable user interface.
Security	Protect the confidentiality, integrity and availability of information.

Mobile connectivity is very important in order to permit real-time collaboration and provide access to the online information. The selection of network connectivity infrastructure depends on the number of users, the need for range, connectivity and data access, the time and place of use, possible interference with other devices, security requirements and network configuration [17]. Thus, it requires Good Corporation from both government and private company to provide good quality of infrastructure with reasonable price.

CONCLUSION

Mobile learning requires intensive researches especially on its applications. Although there are numbers of model or frameworks for application development, but the current requirements of mobile learning is keep on changing. Thus, the current model is not suitable for future use. For future research, more focus should be given to the privacy and security issues in mobile learning. Today, privacy and security concern come at first especially when users are required to surrender their information to the third parties. Thus, the future research should be able to find solution to the privacy and security issues among mobile learning users.

REFERENCES

[1]. S. G. Rosenblit. "Distance education' and 'e-learning': Not the same thing". Higher Education. Springer, Volume 49, Issue 4, pp. 467-493, 2005.

[2]. M. Sarrab, L. Elgamel, and H. Aldabbas, "Mobile Learning (M-Learning) and Educational Environments," Int. J. Distributed Parallel Syst. 3 (4), 31–38, 2012.

[3]. I. Boticki, J. Baksa, P. Seow, and C.-K. Looi, "Usage of a mobile social learning platform with virtual badges in a primary school," Comput. Educ., vol. 86, pp. 120–136, 2015.

[4]. N. F. Taharim, A. Mohd Lokman, W. A. R. Wan Mohd Isa, and N. L. Md Noor, "A relationship model of playful interaction, interaction design, kansei engineering and mobile usability in mobile learning," 2013 IEEE Conf. Open Syst. ICOS 2013, no. i, pp. 22–26, 2013.

[5]. U. Lucke and C. Rensing, "A survey on pervasive education," Pervasive Mobile Comput., vol. 14, pp. 3–16, Oct. 2014.

[6]. A. Kukulska-Hulme and J. Traxler, "Learning design with mobile and wireless technologies". Retrieved September 17, 2015. From http://kn.open.ac.uk/public/getfile.cfm?documentfileid=9882

[7]. H. Li and F. Qiu, "Analyzing theory characteristic and studying application mode about mobile learning," 2011 Int. Conf. Electr. Control Eng., pp. 6327–6330, 2011.

[8]. F. Ozdamli and N. Cavus, "Basic elements and characteristics of mobile learning," Procedia - Soc. Behav. Sci., vol. 28, pp. 937–942, 2011.

[9]. N. Pachler, B. Bachmair, and J. Cook, "Mobile Learning:Structures, Agency, Practices," New York: Springer, 2010.

[10]. R. Vrana, "The developments in mobile learning and its application in the higher education including libraries," IEEE, no. May, pp. 25–29, 2015.

[11]. L. Shuib, S. Shamshirband, and M. H. Ismail, "A review of mobile pervasive learning: Applications and issues," Comput. Human Behav., vol. 46, pp. 239–244, 2015.

[12]. F.A. Kutluk amd M. Gülmez, "A research about mobile learning perspectives of university students who have accounting lessons", Procedia- Social and Behavioral Sciences, vol. 116, pp. 291–297, 2014.

[13]. G. Fulantelli, D. Taibi, and M. Arrigo, "A framework to support educational decision making in mobile learning," Comput. Human Behav., vol. 47, pp. 50–59, 2015.

[14]. L. Shuib, S. Shamshirband, and M. H. Ismail, "A review of mobile pervasive learning: Applications and issues," Comput. Human Behav., vol. 46, pp. 239–244, 2015.

[15]. B. Markelj and I. Bernik, "Safe use of mobile devices arises from knowing the threats," J. Inf. Secur. Appl., vol. 0, pp. 2–7, 2014.

[16]. M. Sarrab, M. Elbasir, and S. Alnaeli, "Computers in Human Behavior Towards a quality model of technical aspects for mobile learning services : An empirical investigation," Comput. Human Behav., vol. 55, pp. 100–112, 2016.

[17]. S. Kitnav, and D. Davcev, "Mobile learning in cloud computing environment" .International Transactions on Systems Science and Applications, 8, 27e39, 2012.