

Usability Guidelines of Mobile Learning Application

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Abstract — One of the computerized activities that can do using mobile devices is educational activities via developing mobile learning application where the student can learn anytime and anywhere using mobile device. Unfortunately the most current mobile learning application does not meet the usability standards. The cornerstone of good usability design is knowledge of having corrected mobile application usability guidelines. This is a major challenge for mobile learning application designers. Furthermore, the usability of mobile learning has four usability attributes namely as adjustability, funability, reliability, and satisfaction attributes. These four usability attributes identify the usability issues of mobile learning application, but the existing usability guidelines for mobile learning application are not applied or mapped to the four usability attributes of mobile learning application. Therefore, this paper will study the usability attributes of mobile learning application and the existing usability guidelines of mobile application and then concentrated more in studying the usability guidelines for mobile learning application. Not only that, it will present the result and finding of the proposed mapping that contains the usability limitation with the existing usability guidelines of mobile learning application and provide recommended solution for indentified limitation.

Keywords – mobile application; mobile learning application; usability guidelines; mobile learning usability attributes

1. INTRODUCTION

Wireless technology with new computing of mobile devices has helped to introduce new way of learning. Also, the rapid development of internet network specially wireless network has encouraged the people to employ the mobile learning application that allow them to learn anywhere and anytime using their own mobile devices [1]. Usage of the mobile application is rapidly growth among the mobile users. Therefore, this has allowed researchers to have new research areas to pursue their studies. The educational activities have revealed many benefits in using them via the mobile devices. This is because the university student can learn anywhere and anytime using their mobile devices with internet connections. Therefore, it is essential to have useable mobile learning application that is used as interface between the organizations and students. [2]. Moreover, it is important to ensure that the interface of the mobile application can be used and do not make the user uncomfortable about its content and appearance and this will affect the mobile learning system since the user will not be interesting to use the system [1].

Therefore, The researcher will study the usability attributes of mobile learning application and the existing usability guidelines of mobile application and then concentrated more in studying the usability guidelines for mobile learning application from various resources such as journals, paper, books and thesis. Furthermore, the usability of mobile learning has four usability attributes namely as adjustability, funability, reliability, and satisfaction attributes. These four usability attributes identify the usability issues of mobile learning application, but the existing usability guidelines for mobile learning application are not applied or mapped to the four usability attributes of mobile learning application where researcher can use these usability attributes to ensure that the usability guidelines covers all the usability issues of mobile learning application.

The content of this paper is categorized to three main sections. The First section will present the overview of the usability by providing its definition, it will provides the background of the usability, and it will present the ISO usability Attributes. The second section will discuss the usability in mobile application, starting with the definition of the mobile application and the usability factors that affect in measuring the mobile application usability, as well as it will introduce the explanation of the challenges that can faced during examining the usability of mobile application. In the third section will present the existing usability guidelines, and attributes for mobile learning application. Some of these usability guidelines , attributes, have been produced based on the previous research or based on the experiments or usability testing for mobile learning usability issues. Also, it will discuss the usability guidelines of the mobile application and related them to the usability attributes of the mobile learning in order to map these guidelines to the mobile learning area. Not only that, the research also has studied the existing usability guidelines of the mobile learning application. Lastly, found usability issues with their solutions in the existing mobile learning usability guidelines.

2. LITERATURE REVIEW

A. What is Usability?

The usability refers to how to make the produced product easy to use for its users. Also, Usability is a quality attribute that assesses how easy user interfaces are to use [1]. The word "usability" also refers to methods for improving ease-of-use during the design process. Moreover, the usability is not simple part in the project development where it can be applied in the last minute of delivering the product to the customer, but it is the most important factor that affected in each stage of application development phases [2]. Based on the International Organization For Standardization , the usability term is defined as the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use[2][3]. Moreover, Jakob Nielsen who is expert in web usability has identified usability guidelines in 1992. Table 1 depicts the how the usability guidelines of Nielsen have been categorized into three guidelines of ISO

TABLE 1: Usability Guidelines by ISO and Nielsen

ISO 9241	Nielsen
Effectiveness	<ul style="list-style-type: none"> ❖ Consistency and Standards ❖ Error prevention
Efficiency	<ul style="list-style-type: none"> ❖ Flexibility and efficiency of use ❖ Aesthetic and minimalist design ❖ Help users recognize, diagnose, and recover from errors
Satisfaction	<ul style="list-style-type: none"> ❖ User control and freedom ❖ Visibility of system status Match between system and the real world ❖ Recognition rather than recall Help and documentation

Efficiency - It is concern on the consumed time for the user to accomplish or perform specific task accurately and completely. Therefore, the user should not spend a lot of time in doing specific task or function which means it refers to how quickly can the users perform tasks.

Effectiveness - It refers to the extent of the application interface to display the desired output as the user expect. If the application interface does not represent the expected output, the user will get confusing and this will lead to the user dissatisfaction.

Satisfaction - It refers to the opinion and responds of the system's users regarding the usability of the interface of the application. The satisfaction of the user can be acquired through the interview and questionnaire. The user can be satisfied with system when it meets their requirement and needs.

B. Mobile Application and Its Usability

Mobile applications can be defined as software system that is functioning in the mobiles devices. In these days, we have variety kinds of mobile application such as financial applications, education applications, advertisement and marketing applications [4]. This mobile application can be available from the mobile distribution platforms that are provided by the owner of the mobile's operating system such as the App store, BlackBerry, and Android Phone. Some of these applications are free while others have a price and the user should to buy it before using it [4][5] .

The usability of these applications seem as to be the most important issue since it helps the mobile applications to be easy to use, increase productivity, reduce the cost for training, and improve the user satisfaction.

Challenges in Usability Testing of Mobile Application

There are some challenges that can be faced during examining the usability of the mobile application. These challenges are identified as following [6]:

- i. **Mobile context :**
It refers to the information that are related to the interaction among the application's user, the application, and the environment that surrounding the user.
- i. **Connectivity**
Wireless internet connection is one of most important factor that mobile devices should have it, since it allow the user of mobile to connect to the internet. Therefore, fast internet connection will guarantee the good downloading process and enhance the quality of the streaming media. The factor of the low connections must be taken during the usability testing of the mobile application.
- ii. **Small screen size**
Browsing the web pages on the mobile devices with small screen may lead to the user to be not satisfied or unpleasant with usability of the application. Small screen of mobile is one of the factors that affect the usability of the mobile application that should be considered in the mobile application usability.
- iii. **Different display resolutions**
The mobile devices provide low display resolution than desktop or laptop has. This low resolution can influence the quality of the multimedia information of the interface.
- iv. **Limited processing capability and power**
Developing application for mobile devices need some considerations such as the application's capacity that will be needed for installing it in the mobile device. This is because; memory capacity and computational power of mobile devices are limited and much less than the desktops memory or laptops memory. As result, the developers have to remove some of functions such as high image resolution, to ensure the usability of the application.

Factors that Affect the Mobile Application Usability

There are some of factors that highly affect on measuring the usability of mobile applications. These factors are in context of use namely as user, task, equipment, and the environment. [5] The Figure 1 represents the explanation of these factors.

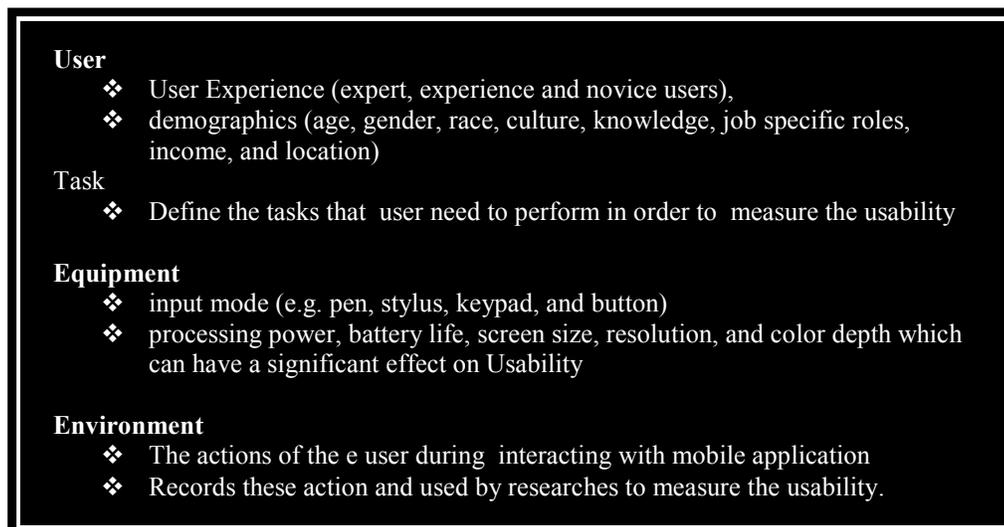


FIGURE 1 : Factors that affect the Mobile Application Usability

C. What is Mobile Learning?

It is new learning method that allows the student to acquire the valuable knowledge through the smart mobile devices or handled devices and it can be briefed to mobile learning. In addition, this learning technique has decrease the limitation by allowing any person who has the smart mobile devices to learn anywhere and anytime not only restricted to certain location or time [11]. Moreover, Costabile define mobile learning as “the combination of e-learning and mobile computing”; Yordanova defines mobile learning as “learning that is wireless and ubiquitous”; while Wains and Mahmood define it as “a type of e-learning which blends wireless and mobile technology for the learning experience [11][12].

Features of Mobile Learning

The features of mobile learning are as following [12]:

- i. Portability and flexibility by allowing users to access the course resources impendent from time and place.
- ii. Allows users to carry out the functions defined as an education component.
- iii. Light weight when compared to books, notebook.
- iv. Enables the access the resources in different formats (Video, Text, and Voice).
- v. Enable learners to construct understanding.
- vi. Low Cost: The cost of the mobile devices is cheaper than the cost of laptop or desktop.

Mobile Learning Usability attributes

The usability of mobile learning has four usability attributes namely as adjustability, funability, reliability, and satisfaction attributes. These four usability attributes identify the usability issues of mobile learning application. They are produced based on the previous prototype testing. [7][8]Theses mobile learning usability attributes are as following:

- i. Adjustability: it refers to the degree of the user acceptability to the used platform as a learning platform that focus on the interaction style and the quality of the content in the platform
- ii. Funability: it refers to the mobile learning platform and the concept pleased the users; the application has less uncertainty which force the users to quite the application.
- iii. Reliability: it refers to the mobile learning platform that should not perform in unexpected ways.
- iv. Satisfaction: it refers to leaner’s satisfaction and leaner have to feel that he /she will be a able to perform tasks with any external activities via their mobile devices.

D. Summarization of the Existing Guidelines for Mobile Application

This section provides summarization of all usability guidelines for mobile application. The researcher studied theses guidelines that have produced for the different domain of mobile application. These guidelines are categorized based on the mobile learning usability attributes by the researcher. Theses usability attributes namely as adjustability and funability, reliability, and satisfaction.

TABLE 2: Summarization of the existing usability guidelines for mobile application

Researcher	Guidelines with mobile usability attributes			
	Adjustability	Funability	Reliability	Satisfaction
Alfredo, Oleg, Eduardo, and Marisol[9]	Provide a “back” option Provide “exit” alternatives Allow for “exit” confirmation Avoid blank lines Make headers look different from regular text Use at most two different font faces per web page Provide thumbnails for images Limit links to one line;			
Webcredible for Websites on Mobile Devices[10]	Design for touch screen and non-touch screen Reduce the amount of content Decide whether you need more than one mobile site	Take the Advantage of inbuilt functionality		Design for touch screen and non-touch screen
Susy , Xiaowen, and Jack Wireless application guidelines[11]	Avoid scrolling, especially horizontal scrolling Use a flat hierarchy. Design a “Back” button with the same function as it has in a regular browser Provide a history list that records the order in which hyperlinks have been traversed. Provide indication of signal strength and downloading progress on every screen Do not require users to remember items Limit the search scope			

	to improve search efficiency.			
Shneiderman Golden Rules for Mobile Interface Design[12][13]	Enable frequent users to use shortcuts Recognize rather than remember		Offer informative feedbacks Error Prevention and Simple Handling Error	Design dialog to yield closure Support internal locus of control Reduce short-term memory load

As shown in the above table, most usability guidelines for the mobile application can be used with mobile learning application but they need some modification in order to cover the issues of the mobile learning application. Moreover, most of the above usability guidelines are categorized under the adjustability attributes. Whereas, some of the above usability guidelines can be categorized to other usability attributes of mobile learning application. The researcher will try choosing suitable guidelines to support the mobile learning application after researcher comes out with limitation of the existing mobile learning usability guidelines which will be discussed in the next sections.

E Summarization of the Existing Mobile Learning Usability Guidelines

In this section, the researcher presents all the existing usability guidelines of mobile learning application and the research proposed the mapping these guidelines with the usability learning attributes as shown in the below Table 3.

TABLE 3: Summarization of the Existing General Mobile usability

Researcher	Guidelines based on the usability attributes of the mobile learning application			
	Adjustability	Funability	Reliability	Satisfaction
Majlinda Fetaji, Bekim Fetaji[14]	# Type of the learner , skills and background. # Visibility of the system status # Match between the mobile learning system and the real world # Recognize rather than remember		# Help users recognize, diagnose, and recover from errors	# Easy perceptible representation of the interface of mobile learning system ## Learner control and freedom
Daniel Su and Jalan Broga-Hossieni[15]	# Long pages should be segmented into smaller chunk and provide effective mechanism to view and jump to the desired page whenever users	# Navigation consistency in navigating and simulates the learning interest reducing page		

	initiate an action or click on it # Extensive scrolling and the number of clicks should be well thought. #The height and width of the display area should not exceed the screen size. # Do not Overuse	navigation by using simple hierarchies #Consistency		
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3. FINDING AND RESULT

Based on the above Table 2 and the discussion of Table 3, the researcher has found usability issues in the existing mobile learning usability guidelines. These issues with their solutions are as following:

- The existing usability guidelines of mobile learning application did not cover all the attributes of the usability guidelines for mobile learning application. This issue has raised when the researcher mapped the existing usability guidelines of mobile learning application, the result of mapping is that such as the funability attribute is not covered by the existing mobile learning application and most of them are under the adjustability attributes.
- The existing usability guidelines of mobile learning application have not provided details information of ways to implement each proposed guideline. whereas , some of them are not provided any way to implement the guidelines , therefore the existing existing usability guidelines of mobile learning application should have details information of ways to implement each guidelines
- The existing usability guidelines of mobile learning application did not cover the issue of designing an application that can be worked efficiently by different type of the screen of the mobile devices that can be used by the learner to interact with the application.
- The existing mobile learning usability guidelines do not discussed the navigation elements that should be covered to have usable navigation system. However, the Existing mobile learning usability guidelines discuss the navigation term only from the consistency side. Therefore, there is need to extend the navigation term in the mobile learning usability guidelines, this is because, the other usability guidelines for another type of mobile application discussed the navigation term in side of the navigation elements such avoiding the scrolling specially the horizontal scrolling because it is not good option for the user to use in the mobile application. Therefore, these guidelines can be added to the existing mobile learning usability guidelines in term of the adjustability attributes or funability attributes.
- Adding suitable guidelines which cover usability issues that are not covered by the existing usability guidelines for mobile application such as reduce short term memory guideline and taking the advantage of the services that provided by mobile devices. These two guidelines have not covered by the existing mobile learning usability guidelines. These new two guidelines will enhance the mobile learning usability guidelines as following :
 - Reducing the short term memory guidelines will help the mobile learning application to be fast since the developer should avoid having much multimedia item in application's interface which will make application to response fast and this guideline will cover the adjustability attributes of the mobile learning usability.
 - Taking the advantage of the services that provided by mobile devices guidelines will help the developer to use the available mobile features that can make the mobile application more usable.

4. CONCLUSION

Wireless technology with new computing of mobile devices has helped to introduce new way of learning. Also, the rapid development of internet network specially wireless network has encouraged the people to employ the mobile learning application that allow them to learn anywhere and anytime using their own mobile devices. This paper contributes by studying the current usability guidelines of mobile application and concentrates more in the mobile learning application domain and map the existing usability guidelines to the usability attributes of mobile learning application namely as adjustability, funability, reliability, and satisfaction attributes. Studying and Mapping the existing usability guidelines of mobile learning application lead to indentify the usability issues with existing guidelines as well as providing solutions for the indentified issues.

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