A Review on Usability Issues in Mobile Applications

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Abstract : *Mobile technologies are a useful platform for the delivery information and content to the users. Due to easily to develop and so widely distributed in the market, mobile apps are no longer a novelty. However, many of these applications suffer from the usability issues. Basically, usabilityconcern about user experience, satisfaction, and perceiveness. The aim of thispaperis to review the usabality issues in mobile appsforeducation, health, and tourismsectors. Based on literaturereview, wefoundvarious issues like ease-of-use, convenience, learnability, user satisfaction, task-technology fit, accessibility, coverage, accuracy, orientation clues, conciseness, and cultural. From our findings, we concluded the main issues across these 3 sectors are flexibility, visibility, satisfaction, consistency, and aesthetics.*

Keywords *-Usability, Interaction Design, User Experience, Mobile Design, Perceive Usability*

I. INTRODUCTION

The usability in mobile applications is still a great challenge. Due to the importance of usability in mobile apps success, this research aims to review common usability issues that have been discussed in the literature that categorized into education, health and tourism sectors. The rapid growth of mobile devices is a key factor driving researchers and practitioners incorporated the technology into these three sectors and the usability of mobile applications is becoming a critical factor[1]. According to [2], due to physical constraints of mobile devices such as screen size and available interaction mechanisms, it contribute to the existence of several usability issues for mobile applications. Thus, this paper will identified usability issues in designing mobile applications for education, health, and tourism sectors to achieve efficiency, effectiveness, and users satisfaction.

This paper is organized as follows. Section 2 explained a review method that has been used in this research. Section 3 briefly defines usability, interaction design, and user experience definition. Section 4 discusses some usability issues that highlighted in the literature associated with mobile applications in the context of education, health, and tourism sectors. Section 5 presents some findings on the usability issues and Section 6 discusses on the conclusion and suggestion works in the future.

II. REVIEW METHODOLOGY

This research will focus on topic regarding usability issues in mobile applications development specifically for education, health, and tourism sectors. We searched the academic journals and papers in various databases such as Google Scholar, IEEE Explorer, Science Direct, Emerald Insight, and Research Gate. The academic journals and papers used in this study are according to the latest published paper within 2011 to 2016. Fig. 1 below shows the review method that has beenused in this paper:

Fig. 1: Research review framework

III. USABILITY, INTERACTION DESIGN AND USER EXPERIENCE DEFINITION

In order to have understanding on the current issues discussed in this paper, we presents some definition of usability, interaction design, and user experience as follows:

(a)   Usability

Approaching the definition of the term usability, this paper will use a definition, which is taken as a point of reference for many researchers. International Standard ISO 9241-11 has defines usability as the capability of the product to be understood, learned, operated, and ease of use to users and can be used by specified users in order to achieve certain goals with effectiveness, efficiency, and satisfaction [3]. The usability of the product must consider on these three aspects as mentioned by [4]:

i.   Efficiency: not much times or efforts to complete a particular tasks.
ii. Easier to learn: operations can be done and learned by observing the object.
iii. User satisfaction: meets user expectations and objectives.

Giving the increasing deployment of mobile technologies, a number of researchers have focused on the usability challenges of mobile devices[5].Highlighted a number of usability issues that related to the mobile devices such as mobile context, connectivity, small screen size, different display resolution, limited processing capability and power and also data entry methods for mobile users. All of these limitation will give impact on the usability of mobile apps thus will further discuss in this paper.

(b)   Interaction Design

Interaction design is related with interface design as both are correlated together to ensure that there is interaction between user and interface and it is part of system development process [6]. The important area when designing the interface of applications is the design for user to access the digital information. Since application is in digital environment, it is important to provide link between the user and the application. This process allows user to perform task and increase the involvement of users in the application. Interaction design is one of the research subjects in Human Computer Interaction (HCI) because HCI studies the human interaction with any product or technology [7].

Interaction design phase used user experience in the designing the interface design of the product. It is a process where they need to define whether that product was easy to use or learn and avoid ambiguous features. The operation involves in interaction design such as cognition, perception, ergonomics, quality experience and semantic need will be integrated in design process. All of the operations involves will need usability testing to ensure that it can support user interaction [8][9][10]. Interaction design is important phase in system development as it provides significant interaction between user and the product based on user experience. Usability testing will be used in order to determine the effectiveness of the interaction design.

(c)   User Experience

User experience (UX) is a growing research field where UX often emphasized in any website and application development. Many different definitions have been suggested for UX stressing different aspects and factors. In 1990's, Donald Norman was amongst the first authors to use the term UX in order to describe all aspects of a person's experience with a system [11]. According to [12], UX is the field concerned with improving people's interactions with technology. Whereas [13] agree that UX involves emotions, psychological needs, values, well-being, and task load. Some authors define UX relates to usability for example [14] described UX as a ''counter-movement to usability thinking''.

In recent years, many research focus on UX design. Basically, UX design involved interaction design, information architecture, visual design, usability, and human computer interaction [15]. The goal of UX design is to improve customer satisfaction and loyalty through the utility, ease of use, and pleasure provided in the interaction with a product [16]. UX design focuses on having a deep understanding of users, what they want, what they need, and their feelings. [17] state that users only takes 50 milliseconds (0.05 seconds) to form an opinion of the website or application. Then the user can determine whether they like or not, whether they will stay or leave. Therefore, a good design is important where gives high significant impact to the users. According to [18], users generally prefer designs that are fast and easy to use. As human beings, different people have different preferences. If the users are unable to perceive the interface design as easy to use, problems in UX may arise [19].Finally, we can conclude that UX concerns about user's response, behavior, and expectations.

IV. MOBILE APPLICATION USABILITY IN EDUCATION, HEALTH AND TOURISM SECTORS

4.1 EDUCATION

The wide used of technology have cause higher education institution to incorporated technology in their learning curricula. Most convenient tools to adopt learning environment is mobile phone [20] because it brings out a new way of learning in order to gain ideal learning advantages [21] [22]. Mobile learning applications or known as m-learning equips with more flexible environment for computer-based assessment compare with traditional assessment (paper and pencil). Due to the high number of mobile applications and

diversity of user, it is important to test the usability of the applications. This can ensure that the applications are able to boost learner learning outcomes when participates in learning activities. Besides, any application should have good interaction design to support interaction between user and the applications. Thus, the usability testing can ensure that the interaction design and interface design are well performed in order to support the interaction.

Based on [23] studies, they found out the most important element in reading usability of m-learning is flexibility and design for limited and split attention. M-learning must ensure that the interface designs are not causes the user attention engage in somewhere else. While [24] studies concerned in affordance, visibility, ease-of-use, user friendly and consistency. The features provided in the application must be consistent to avoid user from getting confused and visibility of the features must be presented clearly. [25], stated that there are three usability factor involves which is flexibility, learnability and minimal action. This finding almost similar with [24] studies, as both points out flexibility and minimal action are important in m-learning usability testing. In m-learning usability it is important to make sure that the user interface or content are adaptable to the leaner

[26] studies on the usability for E-Book and APP (mobile application) in learning environment and found that the most usability element that received the highest score is aesthetics followed by intention of use, convenience, user satisfaction and task-technology fit. Similar studies also done by[27] on determining usability of mobile E-Book application. They had identified the main elements involves in determining the usability of E-Book application and categorize it into four principles which is visibility, ease, efficiency and enjoyment. The categorization of the principle are made through heuristic evaluation of several author onusability principles and applied into their research. They also found out that visibility principle is related with user personal perception while others principle is related to user previous experience. The interface attributes that gives significant impact to the user are aesthetics, achievement and friendliness of the m-learning application. Table 1 shows the detail for each element including interface attributes.

Table 1: Usability Principles.

Usability Principles	Interface attributes
Visibility	Simple presentation
	Obvious prompts
	Visible buttons
	Readable color scheme
Ease	Easy to use
	Easy to read
	Easy to understand
	Easy to return
Efficiency	Smooth operation
	Cognitive match
	Consistent processes
	Memorable operation
Enjoyment	Graphic design
	Overall visualization
	Interesting operation

Overall, in m-learning application, the main factor should be consider during usability testing are flexibility, minimal action, affordance, visibility, user friendly, consistency, aesthetics, intention of use, ease-of-use, convenience, learnability, user satisfaction and task-technology fit. This can ensure user perceived usability of the applications and it purpose.

4.2 HEALTH
Now a day, handheld medical apps are changing the healthcare landscape and scenarios. In the past, life science companies concentrated on manufacturing medical equipment and devices for hospitals and doctors. Now, they are switching to mobile apps as their mainstream offering [28]. Today's mobile health (mHealth) apps are becoming increasingly smarter, multi-functional, and user-friendly. According to IMS Institute for Healthcare Informatics (2015), there are more than 165,000 mHealthapps on the market. Fig. 2 portrays mHealth apps statistic by category.
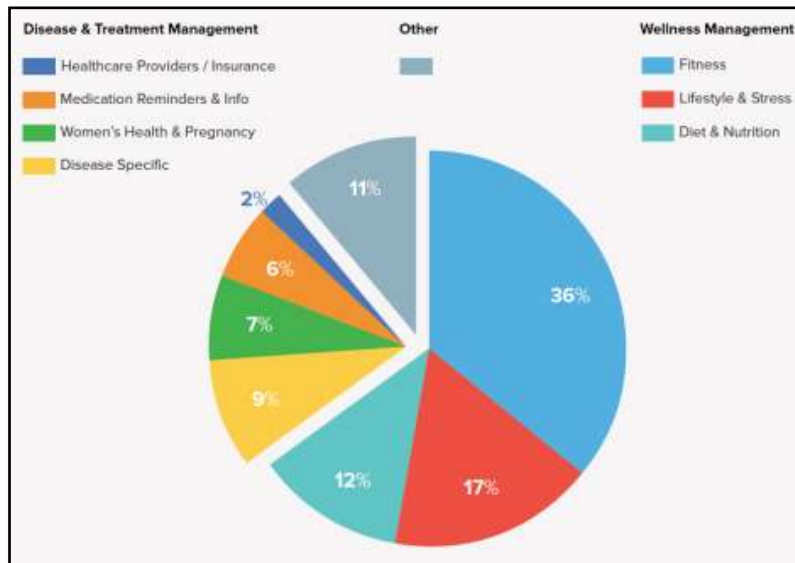
Fig.2: mHealth apps by category (IMS Institute, 2015)

Among the 165,000 mHealth apps, two thirds are focused on general wellness issues like fitness, lifestyle & stress, and diet. The remainder focused on disease specific (9%), women's health & pregnancy (7%), medication reminders and info (6%), and healthcare providers/insurance (2%). Due to easily made and so widely distributed, mHealth apps are no longer a novelty. Therefore, the main concern is the usability of the mHealth apps.

According to [29], visibility, user control and freedom, consistency and standard, error prevention, flexibility, efficiency, and aesthetic are the main issues in usability. During usability testing in certain mhealth apps in their study, the participants suggest the label on the button should be changed to reflect its function. Other than that, the participants also give feedback on color, graph presentation, position of the icons, prompt message, and visual layout. Otherwise, A study by [30] found that one of the usability issues in mHealth apps is insufficient to carter specific needs such as the ability to change font size or have text read out loud. For the mHealth apps information standard, [31] used VMware to establish a cloud computing environment to improve the effectiveness of mHealth apps Information Recommendation System. They discovered that satisfaction is the most concern issue by their participants then followed by expectation, perceived trust, perceived usefulness, and perceived value. Where in mHealth apps to assist diabetes patients, the participants consider about mobile platforms, feasibility, integration of mobile apps with existing diabetes equipment and focus on how to make it cost-effective [32].

Overall, usability issues in health sector are visibility, user control and freedom, consistency and standard, error prevention, flexibility, efficiency, aesthetic, user needs, information standard, satisfaction, expectation, perceived trust, perceived usefulness, perceived value, mobile platforms, feasibility, integration, and cost.

4.3 TOURISM

Currently, the use of mobile technologies in tourism sector is increasing dramatically due to availability on accessing information online. Mobile technologies allow the tourist to access the information everywhere and at any time, which they can use the apps on the move. [33] identified 12 service categories that a mobile tourist application has to fulfill in order to satisfy tourist information needs as follows:

Accommodation.	e. Entertainment.	i. Navigation and Orientation.
Emergency, Safety, Security.	f. Gastronomy.	j. News.
Practical Information.	g. Shopping.	k. Sports.
Tourist Attractions.	h. Transport.	l. Weather.

Thus, giving the growing importance of mobile technologies in tourism sector, this section will identified the usability issues of mobile tourism applications. Usability is crucial for any mobile application success due to the limitation size of the mobile devices. [34]has identified top five usability issues through heuristic evaluation

in their research as listed in Table 2. Accessibility and coverage, both are the usability issues that have been cited most in the literature that found out by the researchers.

Table 2: Top 5 Usability Issues in Tourism Mobile Apps

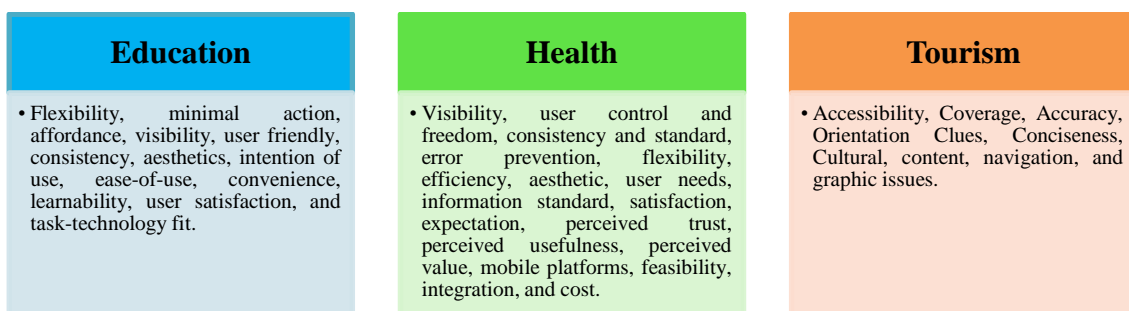| Type of Usability Issue	Description	ssues Out
Accessibility	It should be clear for users on how to obtain a general overview topic in the apps and where to get the information.	5
Coverage	It should be clear on what the text is supposed to cover, by defining the borders of the topics.	5
Accuracy	Description of the content is not complete and not consistent.	4
Orientation Clues	The navigation position is not recognizable within the app.	4
Conciseness	Presences of long descriptions areineffective and not concise.	4

Other than usability issues discussed above, [35] has stated that cultural as one of the usability issues in tourism mobile apps. Cultural differences such as beliefs, attitudes, and values does effect the usability of mobile apps in order to provide better ease-of-use for mobile users. Based on the heuristic evaluation done by [36], the researcher has identified 44 usability issues: (i) 22 content, (ii) 13 navigation and (iii) 9 graphic issues. Most of the issues highlighted are accuracy, text errors, and consistency.

[37] has studied the usability issues in term of user satisfaction which refer to the attitude of users toward using the application, simplicity that refer to the degree of comfort with which users find a way to accomplish tasks, comprehensibility referring to how easily users can understand content that present on the mobile device and perceived usefulness which referring to what extend the application has met its implementation objectives.

V. FINDINGS AND DISCUSSION

Based on the literature review, usability issues as shown in Fig. 3. There are 5 similar issues empathized by different authors which is flexibility, visibility, satisfaction, consistency and aesthetics. Even though the issues are various, similar terms such as user friendly and user control and freedom brings same meaning.

Fig. 3: Usability issue in Education, Health and Tourism

Education
- Flexibility, minimal action, affordance, visibility, user friendly, consistency, aesthetics, intention of use, ease-of-use, convenience, learnability, user satisfaction, and task-technology fit.

Health
- Visibility, user control and freedom, consistency and standard, error prevention, flexibility, efficiency, aesthetic, user needs, information standard, satisfaction, expectation, perceived trust, perceived usefulness, perceived value, mobile platforms, feasibility, integration, and cost.

Tourism
- Accessibility, Coverage, Accuracy, Orientation Clues, Conciseness, Cultural, content, navigation, and graphic issues.

VI. CONCLUSION

This study has aimed to present a set of usability issues of mobile application so that other researchers and practitioners can take into consideration in designing mobile application in education, health and tourism sectors. On the other hand, this study will provided practitioners to determine which usability issues should be take into account when they do a testing and measuring the usability level for mobile applications. For future work, werecommend other researchers to explore more about usability issue in others sectors. From there, usability issues from different angle and perspective will be identified.

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