Mobile Experience Evaluation of an e-Reader App

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Abstract—**In recent years, there is a tremendous proliferation and growth in the development of mobile applications. An important aspect in the advancement of this technology is the usability evaluation of these mobile applications. In this study, a laboratory-based mobile usability assessment was conducted on the Amazon Kindle e-book reader app using 15 users who performed five tasks on the mobile app. A post-test questionnaire was administered to capture users' perception of the mobile usability of the app. The outcomes show that most of the participants were satisfied and delighted with the services offered by the app. On all the four user experience factors evaluated, that is, perceived ease-of-use, perceived visibility, perceived enjoyability, and perceived efficiency, the outcome shows that the participants had an excellent mobile experience with the app.**

Index Terms—**E-Book Reader; Kindle; Mobile Application; Usability Testing.**

I. INTRODUCTION

There is a competitive increase in the number of mobile apps in the Google Play and Apple stores today. This scenario has spurred developers to construct apps of high quality in order to fit into this ever-increasing competitive apps market. There are a lot of assessable dimensions on the quality of mobile apps, and a remarkably important one is usability [1],[2],[3],[4],[5],[6]. The construction of these mobile apps should take into cognisance several design constraints, for instance, restricted resources, the Web connectivity problems, data entry models, the smallness of screen size and also the other diverse showings of mobile devices [7]. Nonetheless, the usability of mobile device app has become a significant aspect because the software that hitherto ran using PCs (laptops and desktops) are now run using smartphone technologies. From users' standpoints, usability is fundamentally an assessment of the effectiveness and efficiency of a system. Usability might be classified following the definition of ISO 9241-11 into three main factors, and these include user satisfaction, effectiveness, and efficiency of a product in a specific context of use [8],[9],[10]. Usability testing is also very vital in the measurement of the efficiency, satisfaction and effectiveness of the interface of a mobile device as users interact and communicate with the mobile device in actual usage condition [11],[12]. The non-evaluation of the usability of mobile apps during the development and design phases of such apps often causes users' disappointment, frustration, dissatisfaction, difficulty in the use of the app, much expending of users' valuable resources, denial of use, and sometimes, even outright rejection of the product. Practical usability issues normally come up in actual use of the application. This issue makes usability a very important aspect of software quality. There is the demand for it to be integrated into the design and development phases of all software products [13].

Amazon.com designs and markets the Amazon Kindle which features a series of e-readers. Amazon Kindle devices have the capacity to assist and enable users to browse, download, buy, and go through e-books, newspapers, magazines, and other digital media with the medium of wireless networking for kindling the store. Amazon subsidiary, Lab126 develops the hardware platform. The hardware platform works as a single device, and it has a range of devices that includes e-readers equipped with e-Ink electronic paper displays as well as Android-based tablets along with colour LCD screens. All Kindle devices are integrated with the Kindle store to have the content. Similarly, the Kindle store contains circulation, which includes four million e-books in the USA. This study focuses on the mobile usability evaluation of an e-book reader. An e-book can be an electronic digital edition of printed publications, and it could be read using e-readers, that is, a digital system or app that establishes and presents electronic text to a user. E-books may also be read on an individual computer (PC) and mobile phones. This study is focusing on the amazon kindle e-book app for mobile phones (not the app for PCs) [14]. The objective of the study is to assess the usability of Amazon Kindle mobile app. The remaining part of this paper is organised as follows: Part II is on the related works, part III is on the methods, Part IV is results and discussion, while the last part, Part V is on the conclusion.

II. RELATED WORKS

Mobile devices usage has speedily increased enormously within the past few years. These devices have developed to be more innovative, and they enable users in achieving widespread tasks. Mobile phones and their distinct applications offer expansive payoffs and return to their operators with regard to portability, position consciousness (awareness) and also accessibility. Reasonably priced items and their enhancements within the computer hardware along with software program capabilities relating to smartphones in the market particularly the handhelds have led to the huge extension of mobile phones in the associated marketplaces. This condition has produced an immense number of mobile applications that have been developed within the past couple of years [15]. The crux of using a mobile device is not restricted to only communication, but it has become an essential tool in our everyday activities. Unequivocally, it can be argued that the prospects of the future network lie in mobile devices. Currently, Android operating system is advancing in popularity, particularly in the context of

smartphones. A lot of free access to open sources and development tools are available. This situation has led to the development of many useful and affordable apps. It has also impacted a great number of people to use the Android-operated smartphones. Moreover, it gives better and suitable hardware platform for developers, and throughout the process, developers are able to apply lesser mechanisms to turn their ideas into reality, and further development can be achieved through the Android operating system [16].

Likewise, mobile phones users have the prospect of enjoying movies or playing shared games that are featured on their mobile phones. The innovative features in mobile apps assist users to perform different varieties of activities using their mobile devices. The success of mobile apps hinges on achieving a high level of customers' satisfaction; as a result, usability evaluation is a compulsory process in making sure that mobile applications have the features of acceptable practicality, effectiveness, ease of use, efficiency and usefulness, principally from the users' viewpoint [17]. Similarly, a few publishers admix articles with components of multimedia, and these components incorporate web pictures, videos, links, menus and audio in the creation of interactive e-books. The Nielsen Norman Group performed a usability evaluation for websites and mobile apps that are principally designed for the iPad tablet and users who are able to navigate from page to page looking for a summation of an article by sipping the page or by dragging the surface, can read the whole article [18].

Equally, mobile applications which operate on mobile devices have faster growth and pervasive information access anywhere and at any time. For example, many mobile applications access Internet services via mobile devices. In the business world, some applications are related to mobile commerce, such as the advertising and mobile banking applications. These applications advance and promote electronic business items. Clients can check their bank accounts balance and can carry out other business dealings on their mobile phones [10],[19],[20]. Furthermore, the utilisation of digital devices is quite old. Alan Kay initiated prototypes for e-reading around the year 1960, and a few generations of devices were added later on. Examples include the Rocket e-book, Apple Newton, and the Amazon Kindle. Additionally, there are some improvements, which have taken place in device technology, such as displays, batteries, CPU. Further, publishers are able to provide a number of digitally published solutions, which incline production towards publishing, and the examples include AppCross and others [14].

Novices have the option of choosing the cheapest one and ignoring the characteristics of the application of readers. Even though the topics included in the book is similar, the user interface of the e-textbook application is different. Learning the ways of making a note, searching for a keyword, highlighting, and navigating the book in every application is mandatory for users. Suggestions have been made to standardise e-textbook design guidelines [21],[22], which are not observed as mandatory; as a result, the interfaces have considerable differences. Wilson et al. [22] present the guidelines, which have the basics on the evaluations regarding e-books on the webpage as well as for outdated readers of e-book [22]. Furthermore, manufacturers of mobile devices intend to implement their own usability boundaries. For example, the Guidelines of Apple iOS Human Interface posits that the platform of iOS features need to be taken into account during the process of application construction, and should show different resolutions and dimensions, collaboration with a multi-touch screen, device orientation gestures and changes, such as pinch, flick and tap. Besides, Apple reviews applications that are presented in the App Store, and the basis of their acceptance hinges on conformance with the features and qualities itemised in the guideline. Likewise, Google developed the Android user interface guidelines. These guidelines guide developers to ensure features are properly placed. They provide guidance for the dimension and placement of icons and buttons, touch signals, menus in contexts and their responsiveness, size, simplicity, and formatting of text, and specific pieces of messages, during the design and development of applications. This guidelines also mention the ways these characteristics need to be taken into account at the time of growth and testing of Android applications [7],[23].

Additionally, usability assessment is a part of a larger effort that targets at enhancing the profitability, designing decisions and the minimising of the disappointment and mistakes of users [24]. In order to achieve the goal of evaluation, systems require building a suitable design. A number of formative usability evaluations need to be carried out for all products a number of times before the product gets released. Even after it has been released, several summative usability evaluations should be carried out as well. These evaluations are geared towards removing the frustration and problems related to design from the standpoint of the users. This will enable users to get valuable, effective, efficient and pleasing products in return [21],[25]. Several studies have put emphasis on the usability of mobile devices. Gafni [26] and Ryu [27] argued that difficulties-met or challenges-faced are due to the physical constraints regarding wireless networks and mobile devices, including the time of performing and the designing of usability testing studies for mobile apps [19]. The study of Zhang et al. [19] shows that mobile usability is faced with many mobile-related challenges like mobile context, connectivity, small screen size, different display resolutions, limited processing capability and power, and data entry methods.

III. METHOD

This usability evaluation was done in a quiet and controlled place within the UUM library and at the DPP Proton Student Residential Hall gallery and cafeteria. The users were allowed to carry out the tasks while sitting and/or standing. There were two moderators; one was in charge of giving the study tasks orally to the users while the other was in charge of capturing the test sessions with a mobile phone camera. After the task had been communicated by the moderator to the participants, no constraints were placed on the user during the test session. This condition was set up to provide participants with a conducive environment for the test evaluation.

A. Tools

The participants used the Android phones that were made available by the moderator to carry out the tasks without any further adjustment of settings. Each test session was recorded on video. The camera records the smartphones' screen as well as the respondent's movements throughout the session. Additionally, a stopwatch was used to record the time taken for each task.

B. Task and Test Description

Fifteen (15) participants were used in the test session. All participants were students. Touch screen devices were used to perform five tasks. The moderator recorded the entire sessions on video while the participants were engaged with the tasks. The usability test was done on a one user at a time basis. After completing the tasks, the participants completed a post-test questionnaire. The following were the five tasks carried out in the test: i) Search Text, ii) Bookmarking, iii) Make a Note, iv) Sharing e-books and v) Change Text Size. Before the start of the test, the moderator encouraged participants to use the "think aloud" protocol while they are in the process of executing the tasks. The participants were also instructed to move between tasks and do whatever they would naturally do. This procedure was done to capture users' behaviour at the time of navigating from one part to another. Users' reactions to the Kindle app were obtained using a video camera.

The conduct of the usability test involved the execution of the five tasks by the 15 participations. These participants were randomly selected to test the app. The moderator records all test sessions on a video camera, capturing the errors that occurred and time is taken. The measurement involved the counting of the number of errors the participants made when attempting to complete a task. The operation time is the time taken to complete a task. The time to complete each task was recorded with a stopwatch. Task success (whether or not a participant successfully completes a task) was also recorded. Participants were given up to one minute to complete each task (pilot testing was done to determine that 1 minute is sufficient for task completion). When the five tasks were finished, the participants were immediately given a post-test questionnaire to measure each factor of interest in the usability test. Lastly, the quantitative data collected on the operation (task) time, error frequency, and success rate were computed. The results of this test were analysed using SPSS Version 23. Descriptive statistics such as mean and frequency distribution were utilised to analyse the gathered data and show results [28]. This present paper reports on only the outcomes of the perceived usability captured using the subjective post-test questionnaire.

IV. RESULT

The participants' demographic information is as follows: of the 15 participants involved in the study, ten were male, and five were female. Nine of the participants had their ages ranged from 18 – 29; five were within the age range 30 – 39, while one was aged within the 40 – 49 age brackets. Grouping the participants on the basis of their experience on the use of the application, nine were novice users, and five were moderate users, while only one was an experienced user. One of the participants was an undergraduate; six were master degree students, while eight were PhD candidates. Table 1 indicates the detail demographic information of the participants.

Table 1
User Demographics

User #	Gender	Age	Study level	Experience
1	Female	18 - 29	PhD	Moderate
2	Male	30 - 39	Master	Novice
3	Male	18 - 29	Master	Novice
4	Male	18 - 29	PhD	Moderate
5	Female	18 - 29	Master	Novice
6	Male	30 - 39	PhD	Novice
7	Male	18 - 29	UG	Moderate
8	Male	18 - 29	Master	Novice
9	Male	18 - 29	Master	Novice
10	Female	30 - 39	PhD	Novice
11	Male	18 - 29	PhD	Novice
12	Male	30 - 39	PhD	Moderate
13	Female	40 - 49	PhD	Novice
14	Female	30 - 39	PhD	Experienced
15	Male	18 - 29	Master	Moderate

Perceived Ease of Use: Table 2 indicates the descriptive statistics for the perceived ease of use of the application. Most of the participants agreed or strongly agreed that the application was easy for them to use. The mean and standard deviation per item is as shown in Table 2.

Perceived Visibility: The visibility result is shown in Table 3. Most of the participants either agreed or strongly agreed that the application interface was visible to them. The mean and standard deviation per item is as shown in Table 3.

Table 2
Perceived Ease of Use (PEU)

Item	N	Mean	Standard Deviation	Min	Max	Likert Scale				
						S. Disagree	Disagree	Neutral	Agree	S. Agree
EU1	15	4.33	.816	2	5	0	1	0	7	7
EU2	15	4.33	. 816	2	5	0	1	0	7	7
EU3	15	4.13	.915	2	5	0	1	2	6	6
EU4	15	4.26	.883	2	5	0	1	1	2	1
EU5	15	2.60	1.121	1	5	2	6	4	2	1
EU6	15	4.20	.861	2	5	0	1	1	7	6
EU7	15	4.13	.990	2	5	0	2	0	7	6

Table 3
Perceived Visibility (PV)

Item	N	Mean	Standard Deviation	Min	Max	Likert Scale				
						S. Disagree	Disagree	Neutral	Agree	S. Agree
V1	15	4.20	.861	2	5	0	1	1	7	6
V2	15	4.40	.828	2	5	0	1	0	6	8
V3	15	4.20	.774	2	5	0	1	0	9	5
V4	15	4.26	.798	2	5	0	1	0	8	6

Perceived Enjoyability: The descriptive statistics for perceived enjoyability of the application is indicated in Table 4. The outcomes reveal that most of the participants enjoyed using mobile Kindle e-reader, as the majority agreed or strongly agreed that they enjoyed the Kindle e-book. The mean and standard deviation per item is as shown in Table 4.

Perceived Efficiency: The perceived effectiveness of the mobile application is shown in Table 5. Majority of the participants agreed or strongly agreed that the interface was efficient and that they expend minimal effort using the application. The mean and standard deviation per item is as shown in Table 5.

Table 4
Perceived Enjoyability (PEA)

Item	N	Mean	Standard Deviation	Min	Max	Likert Scale				
						S. Disagree	Disagree	Neutral	Agree	S. Agree
EA1	15	4.26	.961	2	5	0	1	2	4	8
EA2	15	4.40	1.182	1	5	1	0	2	1	11
EA3	15	4.26	1.032	1	5	1	0	0	7	7
EA4	15	4.33	1.112	1	5	1	0	1	4	9

Table 5
Perceived Efficiency (PE)

Item	N	Mean	Standard Deviation	Min	Max	Likert Scale				
						S. Disagree	Disagree	Neutral	Agree	S. Agree
E1	15	4.06	.798	2	5	0	1	1	9	4
E2	15	4.40	.828	2	5	0	1	0	6	8
E3	15	4.46	.833	2	5	0	1	0	5	9

V. Conclusion

This study assessed the Amazon Kindle mobile e-book reader app on four user experience factors, namely, perceived ease of use, perceived visibility, perceived enjoyability, and perceived efficiency. The findings indicate that the application offered an enriching mobile experience to most of the users who participated in the study. Most of the users perceived that the mobile application satisfied their needs in terms of the four usability qualities evaluated in the study.

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