Journal of Scientific Research and Development 2 (13): 24-28, 2015
Available online at www.jsrad.org
ISSN 1115-7569

Usability of MobileSchool system for secondary school: quantitative observation approach

Ahmad Sobri Hashim *, Wan Fatimah Wan Ahmad

Department of Computer & Information Sciences, University Technology PETRONAS, Seri Iskandar, Perak, Malaysia

Abstract: Usability of a mobile learning management system (MLMS) is very important to ensure the valuable advantages that will be gained by the users especially the learners. A mobile system with low quality of usability will just make the users suffer from understanding the presented contents. This paper presents the usability study of MobileSchool system for secondary school using quantitative observation approach. This study involves 40 participants including school administrators, teachers, students and parents. Tobii eye tracker has been used as a tool to record the video on interaction between the participant and the system in performing the specified tasks. This video than has been analyzed using quantitative observation approach. Result showed that most of the participants were able to complete the tasks within the required time and this concluded MobileSchool system has passed the usability requirements especially on effectiveness and efficiency factors.

Key words: Usability; M-learning; Quantitative observation; Eye tracker

1. Introduction

The usage of mobile device technology is very widespread today all around the world. Statistically, 91% of world population have a mobile phone, 56% of people own smartphone and 50% of mobile phone users use mobile as primary Internet sources (Hepburn, 2013). This statistics have given the opportunities to expand the access of LMS from PC via Internet connection to the access from mobile devices especially smartphones and tablets. Due to the integration of mobile devices with the existing capabilities of LMS, newly invented area of research was produced which called Mobile Learning Management System (MLMS).

Most weakness of the existing mobile learning systems is they are found to be a bit complex for the users to use. Users especially those who are not too familiar with the technology used in the system found it difficult to use such system (Grasso & Roselli, 2005; Seong, 2006). Complex mobile learning system here refers to the hard time taken by the users to understand how to operate the system in doing their studies. It includes the complexity in terms of navigation, content and structure of system, content management and others (Donnelly & Walsh, 2009). The development of complex mobile learning system can be avoided by taking the user factors into considerations (Seong, 2006). The developers should know the users' level of mobile system familiarity. Besides, different education level of studies will also have different experiences in using mobile system technologies (Sajjad, 2010).

Therefore, the objective of this study is to conduct a usability evaluation on MLMS that has been developed namely MobileSchool system. Generally, MobileSchool system is a platform for managing teaching, learning and administrative activities for secondary schools in Malaysia (Sajjad, 2010). The system had been developed for web and mobile web versions. Web version of MobileSchool system allows school administrators and teachers to manage the contents of the system.

This paper has been organized into five sections; Introduction, Literature Review, Methodology, Results & Discussion and Conclusion.

2. Literature review

2.1. Usability

Usability is one of the important aspects in providing the services of teaching and learning via mobile devices. Usability focuses on the interaction between the computer related applications with human (Ali, 2013; Hartson, 1998; Nielsen, 1993). Generally, there is no deal or agreement upon the definition of usability by researchers and the definition also differed based on the objective measure of specific research. However, several researchers have expressed the usability categorizations definitions and several authors have also proposed various definitions of usability and these can at least be the guidance and consensus to the concepts of usability that will be practiced in the related studies such as m-learning systems

[1] Corresponding Author.

(Gourova, Asenova, & Dulev, 2013; UsabilityNet, 2006; Welie, Veer, & Eliëns, 1999).

Bevan (2001) sets the standard rather than an abstract definition for usability. Three terminologies have been specified under this standard which is efficiency, effectiveness and satisfaction. Efficiency refers to the resources used in providing the accuracy and completeness to achieve specific goals and objectives while effectiveness is referred to the accuracy and completeness during the execution of tasks in achieving the goals. Finally, satisfaction is very relative where it measures the end user's comfort and acceptability to the developed product. However, the given standard approaches usability focuses only on the theoretical perspectives and less focus to the practicality point of view.

In contrast, Nielsen (1993) has given slightly different definition on usability where it was specified to more specific elements. Nielsen (1993) considers some other elements that influence a specific usability factor as one usability factor. For example, learnability element will influence the efficiency factor while errors and safety will influence memorability factor. Therefore, learnability and errors/safety factors have been included as the main usability factors under Nielsen's point of view. Thus, five usability factors emphasized by Nielsen involve efficiency, learnability, memorability, errors/safety and satisfaction.

Shneiderman (1998) gives similar definition on usability where usability is called as five measurable human factors central to the evaluation of human factors goals. Besides, Shneiderman also use detailed terms for usability factors as compared to ISO 9241-11's and Nielsen's. However, the terms are identical with ISO 9241-11's and Nielsen's. Shneiderman's usability factors include speed of performance, time to learn, retention over time, rate of errors by users and subjective satisfaction.

2.2. Eye tracking

Eye-tracking is a technique where eye movement is recorded whilst the user is looking at a stimulus. The eyes do not usually rest on one position for long. They normally move several times per second, with micro-movements sometimes spanning only a few pixels. A fixation is a moment where the eye is relatively motionless, and a saccade is a quick movement between fixations to another element. Both fixations and saccades can be determined by eye-tracking software such as Tobii from data collected by eye-tracker. A gaze plot may be used to show the succession of fixations and saccades on a screen or web page for an individual user, while heat maps show how long each part of a screen has been looked at. These visualisations of eye-tracking data are interpreted by usability practitioners to identify confusion on the part of the user, reading or scanning behaviours, or simply, but interestingly, areas that users are not looking at (Ehmke & Wilson, 2007).

3. Methodology

Usability test of MobileSchool system was conducted in User Experience (UX) Lab, MIMOS Ltd. few screenshots of MobileSchool system are illustraed For this study, a special equipment was used for this test which is called Tobii Eye Tracker. The test had also been conducted by MIMOS staff where a moderator had been appointed to handle and communicate with participants to give the instructions and collecting qualitative data. The main reason of appointing a moderator was to avoid from biasness during execution of test.

For this particular study, eye tracker has been used as a tool to record:

1. The time taken by the participants to complete the given tasks.
2. The number of moves taken by the user to complete the tasks.
3. The number of moves taken by the user to move from one task to another task.
4. The frequencies of using shortcut button/menu.
5. The frequencies of going back to main menu page before moving to another menu.

MobileSchool system was developed for school administrators, teachers, students and parents (refer to Fig. 1). Therefore, representatives of these users are required for this evaluation. Role-based usability evaluation setting had been practiced involving 40 participants including 10 school administrators, 10 teachers, 10 students and 10 parents. Each participant was instructed to perform several predetermined tasks based on their roles. The tasks are presented in Table 1.

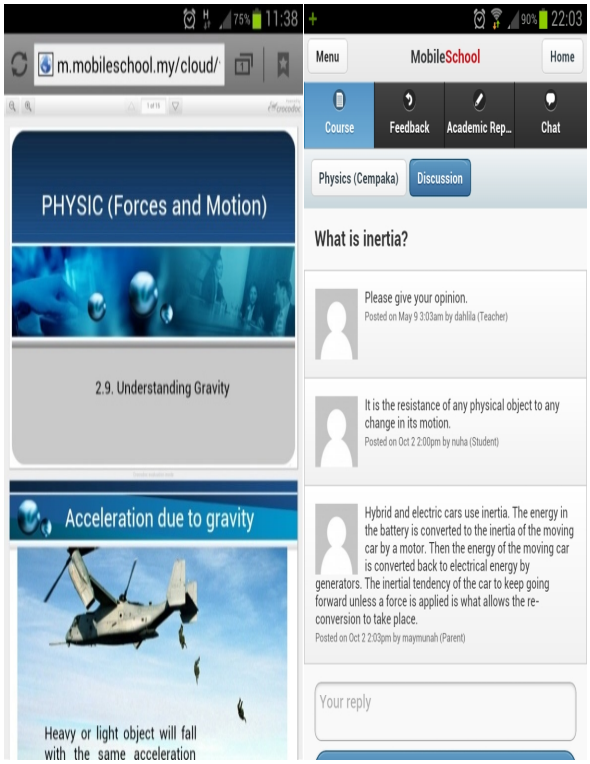

Fig. 1: MobileSchool screenshots on learning material and course online discussion

Table 1: Tasks for all participants

User	Task
School administrator	1. Register new user account using Web version. 2. Post an announcement to the school community using Web version. 3. Upload a student individual academic report. 4. Upload an announcement to the school community using mobile Web version. 5. Send a message to any user using chat menu in mobile web version.
Teacher	1. Create new course using Web version. 2. Upload one course material (either note or exercise) using Web version. 3. Post a course discussion topic related to teacher's taught course using Web version. 4. Post course announcement regarding the taught course to the students and teachers using mobile Web version. 5. Send a message to any user using chat menu in mobile Web version.
Student	1. Enrol new course. 2. Access learning material. 3. Post/Comment in course discussion. 4. Send one feedback either to the course teacher or school administrator. 5. Access academic report. 6. Send a message to any user using chat menu in mobile Web version.
Parent	1. Update your profile/account. 2. Post a comment to the course discussion topic from the course that has been enrolled by your child. 3. Send one feedback either to the course teacher or school administrator. 4. Access child's academic report. 5. Send a message to any user using chat menu in mobile Web version.

Quantitative observation approach has been applied in collecting and analysing the data. Tobii Eye Tracker data contains all recorded interaction between the participant and system while performing the tasks in the form of video. By recording screens while the participant completing the tasks, five items that had been stated previously were measured to prove the usability of MobileSchool system especially effectiveness and efficiency factors. Table 2 presents all items with their measurements.

Table 2: Measured items from Tobii eye tracker

Item	Measurement
The time taken by the participants to complete the given tasks.	mins & secs
The number of moves taken by the user to move from task to another task.	steps
Percentage of choosing the right steps to move from task to another task.	percentage
The number of moves taken by the user to complete the tasks.	Steps
Percentage of choosing the right steps to complete the tasks.	percentage
The frequencies of using shortcut button/menu.	frequencies
Percentage of using shortcut to move to another task.	percentage
The frequencies of going back to main menu page to move to another menu.	frequencies
Percentage of going back to main menu page to move to another task.	percentage

4. Results & discussion

Video recording had been used to record all interactions between participants and the system in completing the given tasks. The video was analysed based on eight items that were used to discuss two usability factors of ISO 9241-11; effectiveness and efficiency of MobileSchool system. The items include average time taken to complete all tasks in minutes and seconds, average time taken to complete one single task in minutes and seconds, average number of steps to complete all tasks, percentage of choosing the right steps in completing the tasks, average number of steps to move from page of the completed task to another task, percentage of choosing the right steps to move from a task to another task, frequency of using shortcut to move from the page of completed task to another task and frequency of going back to the menu page to move to another task. Here, the number of steps, percentage of choosing the right steps, average number of steps to move from a task to another task and percentage of

choosing the right steps to move from one task to another task reflected the effectiveness usability aspect. Meanwhile, the frequency of using shortcuts reflected the efficiency usability factor. The data of the mentioned items were summarized from the raw data. Table 3 presents the summary of the obtained data for the abovementioned items.

As shown in Table 3, the average time taken to complete all given tasks was 10 minutes 20 seconds. This item had been calculated by dividing the total times taken by all participants (40 users) with the total number of given tasks (21 tasks). In connection with the measurement of this item, the average time taken to complete for one task was 1 minute 59 seconds. The time taken to complete the tasks was measured to reflect users' understanding in using the system to perform the tasks. Users' understanding was one of the measured items to determine learnability which is one of the effectiveness factor of system usability (Mazyrah, 2009; Parsons, Ryu, & Cranshaw, 2007).

Table 3: Data of recorded item

Item	Measured	Minimum
Average time taken to complete all tasks	10 minutes 20 seconds	-
Average time taken to complete each task.	1 minute 59 seconds	-
Average number of steps to complete all tasks	57.95 steps ≈ 58 steps	53 steps
Percentage of choosing the right steps in completing the tasks	80%	75%
Average number of steps to move from a task to another task	13.13 ≈ 13 steps	12 steps
Percentage of choosing the right steps to move from a task to another task	90.67%	75%
Frequency of using shortcut to move to another task	139 times	-
Frequency of going to menu page to move to another task.	11 times	-

Based on literature studies that had been conducted, there was no benchmark on the period of time taken to determine the level of learnability. This was because the complexity level of the tested systems and the given tasks were varies. Some systems were very complex which required longer period of time to complete the given tasks while some systems were very straight forward where they required just short time to complete the tasks. Therefore, the alternative way of determining the effective level was by analysing the number of steps used to complete the tasks.

Based on Table 3, the average number of steps to complete all tasks was 57.95 steps which were approximately equal to 58 steps. This item had been calculated by dividing the total steps taken by all participants (40 users) with the total number of the given tasks (21 tasks). Therefore, in average, one participant took approximately equal to 58 steps to complete all instructed tasks (5 tasks for school administrators, 5 tasks for teachers, 6 tasks for students and 5 tasks for parents). This average number of steps taken was compared with the minimum average number of steps that supposedly taken by the participants to complete all tasks which is 53 steps. Therefore, the difference of the number of steps taken by the participants with the supposed minimum number of steps taken was 5 steps. This value represents 9.43% more steps taken by the participants with the minimum supposed steps. Since the difference was less than 10%, it can be said that the learnability of effectiveness usability factor is acceptable where users took only reasonable time to complete the tasks.

This argument had also been strengthened with the percentage of choosing right steps in completing the tasks item. This item was measured by differentiating the number of tasks that had been completed by participants using minimum number of steps with total number of tasks. Out of 210 tasks, 168 tasks were completed using the right minimum number of steps which represents 80%. This percentage was higher than percentage of usability requirement that had been practiced by MIMOS which is 75%. Another item to proof learnability of the system was by measuring the number of steps that had been used to move from the completion of the given task to the beginning of new task. Based on Table 3, the average number of steps used was approximately equal to 13 steps which differ with only one step with the supposed minimum number of steps (12 steps). In the form of percentage, 90.67% of total tasks completed by participants chose the right number of steps to move from the completion of previous task to the beginning of new task. Thus, the abovementioned statistical evidences had proven the excellent learnability of effectiveness factor of MobileSchool system usability.

Flexibility is one of efficiency usability elements which refers to the preparation of more than one way to complete the same task (Donnelly & Walsh, 2009). By practicing flexible design of the system, users would complete the tasks using the system faster. In measuring the effectiveness of the system flexibility, a comparison had been made on the frequency of using shortcut to start with another task and the frequency of going to menu page before starting with the new task. Table 3 shows that out of 150, 139 times (92.67%) the participants used shortcuts as compared to 11 times (7.33%) participants went back to the menu page before starting with new task. This data concluded that the participants used shortcuts more frequent as compared to return back to menu page before accessing other menu to complete the given task. The participants were aware with shortcut ways that had been provided in completing the tasks. Therefore, the participants could navigate to the tasks and complete the tasks faster.

Based on the presented finding and discussion, it can be proven that MobileSchool system has passed the usability requirements especially for effectiveness and efficiency factors.

5. Conclusion & future work

In this study, effectiveness and efficiency usability factors were assessed using quantitative observation approach based on participants' ability to complete the given tasks. Video recording data evaluation showed the users were able to successfully complete the given tasks easily. This conclusion was summarized based on users' time taken to complete the tasks, number of steps taken to complete the tasks and frequency of using shortcut keys to move from completed task to the new task.

For the future works, this study can be expanded the bigger number of participants with various backgrounds. This study also can be conducted using different methods such as think aloud, focus group and pluralistic walkthrough. The implementation of different methods will produce more realistic findings from more angles. Besides, this study can also be expanded by applying different approach of analysing the data. The utilization of Tobii eye tracker in this study can produce more types of data including eye gaze and heat map. By analysing this two different data, discussion on usability of MobileSchool system can be elaborated further.

References

Ali, A. (2013). A Framework for Measuring the Usability Issues and Criteria of Mobile Learning Applications. (Master of Engineering Science), Western University London, Ontario, Canada.

Bevan, N. (2001). International Standards for HCI and Usability. International Journal of Human Computer Studies, 55(4), 533-552.

Donnelly, K., & Walsh, S. (2009). Mobile Learning Reviewed.

Ehmke, C., & Wilson, S. (2007). Identifying web usability problems from eye-tracking data. Paper presented at the 21st British HCI Group Annual Conference on People and Computers: HCI (BCS-HCI '07), University of Lancaster, United Kingdom.

Gourova, E., Asenova, A., & Dulev, P. (2013). M-Learning Systems Design - Technology and Pedagogy Aspects. Paper presented at the IADIS International Conference Mobile Learning, Lisbon. Portugal.

Grasso, A., & Roselli, T. (2005). Guidelines for Designing and Developing Contents for Mobile Learning. Paper presented at the IEEE International Workshop on Wireless and Mobile Technologies in Education (WMTE '05).

Hartson, H. R. (1998). Human-computer interaction: Interdisciplinary roots and trends. The Journal of Systems and Software, 43, 103-118.

Hepburn, A. (2013). Infographic: 2013 Mobile Growth Statistics Retrieved November 13, 2013, from http://www.digitalbuzzblog.com/infographic-2013-mobile-growth-statistics/

Mazyrah, M. (2009). The Development and Usability of A Multimedia Black Cat Courseware Using Storytelling Approach. (MSc.), Universiti Teknologi PETRONAS.

Nielsen, J. (1993). Usability Engineering. Boston: Academic Press.

Parsons, D., Ryu, H., & Cranshaw, M. (2007). A Design Requirement Framework of Mobile Learning Environments. Journal of Computers, 2(4), 1-8.

Sajjad, S. (2010). Effective Teaching Methods at Higher Education Level: Department of Special Education, University of Karachi, Pakistan.

Seong, D. S. K. (2006). Usability Guidelines for Designing Mobile Learning Portals. Paper presented at the 3rd Internatioanal Conference on Mobile Technology, Application & Systems. .

Shneiderman, B. (1998). Designing the User Interface. USA: Addison-Wesley Publishing Company.

UsabilityNet. (2006). Human-Centred Design Processes for Interactive Systems. 2010, from http://www.usabilitynet.org/tools/13407stds.htm

Welie, M. v., Veer, G. C. v. d., & Eliëns, A. (1999). Breaking down usability. INTERACT, 99, 613-620