Penerbit Akademia Baru

Journal of Advanced Research in Computing and Applications

Journal homepage: www.akademiabaru.com/arca.html
ISSN: 2462-1927

The Usability of Mobile Experiment Application in Science Subject for Secondary Student

Open Access

Anis Amilah[1,*]

[1] Faculty of Computer Science, Universiti Teknologi MARA Melaka, Malaysia

ABSTRACT

Conducting experiment can help to increase our knowledge of the subject or concept learned. During experiment, the concept learned need to be applied in order to solve the problem. From applying the concept in experiment, the concept can be further applied in real life. The problems of conducting experiment is some of the teacher might not able to guide them out of school hours, the student does not know how to practice the theory learned in class in the experiment and student did not focus or give full attention to the details in experiment book whether it is because they did not aware of the content or too lazy to read it. In order to replace book used during the experiment, mobile phones emerge as the suitable medium for the replacement. Because of technological awareness among all people and technological advancement had increasing recently, most students now had their own mobile phone. Therefore, mobile phone as a medium of learning seems reasonable. In order to make the learning process on mobile phone more interesting, gamification and game-based learning technique are applied on the application. Gamification and game-based learning technique can help in making learning more fun and challenging. Based on the testing conducted, most student agreed that uses of mobile application as a new learning medium had potential to replace the current learning medium which is using book. For the improvement in the future, the limitation on application need to be overcome and the topic and uses of multimedia element will be further improve to make the learning process more interactive.

Keywords:
ELearning; experiment application; science subject

1. Introduction

Learning is a process of acquiring, modifying and enhancing existing knowledge or skill that may lead to a changing in solving problem, experience or knowledge. According to Editorial [5], student needs to recognize their interest, engage and know what they learn and create a self-learner attitude. Science is a subject that is being taught in primary and secondary school. Through learning science, student can see the world in a new way. Student might able to understand how science world works and able to connect scientific concepts to their daily life. The benefit is, student can build their confidence in their ability to solve challenging problem and finally empowering them towards building a better future for the world. Students are being taught the scientific formula and concepts of science. Aside for learning theory and calculations in classroom, students also need to participate on the experiments that are conducted in laboratory. They also need to run experiments to apply the concepts they had learn. From the experiment, they can learn how to practice the concept in real

* *Corresponding author.*
E-mail address: anisamilah@uitm.edu.my (Anis Amilah)

life. In this 21st century, technology cannot be separated from daily life. The rapid growth of technology make the impossible became achievable. In the past, student use book as a reference, note keeper and doing homework. Nowadays, as a result of rapid growth of technology, electronic items such as mobile phone and computer also have a function like a book. It is even better than book in several factors such as weight, size and ease of use. Nowadays, most people have a mobile phone. One of the reason they use a phone is to play games. According to Robin [20], number of households owning a gaming device keep increasing from years to years. Games today have become one of the popular medium of education. Video games are an example of games. Video games are interactive activities that continually provide challenges and goals to the players, thus involving them into an active learning process to master the game mechanics [11]. According to Watson *et al*., [27], video games provide a fictional context in the form of narrative, graphics and music. They also explained that if video games used appropriately, can encourage the interest of players on non-gaming topics such as history. Student lacks motivation to study because there is no one to teach, guide and motivate them. According to a survey conducted, all surveyed students agreed that interaction between teacher and guider with the students is needed for the students to learn better. This problem statement is supported by the study conducted by Liaw [12] which shown that student lack motivation to study due to the limited capacity of interaction with teacher and classmates Student does not know the how to practice the knowledge they learnt. According to survey conducted, all surveyed students agreed that practicing the knowledge learned can resulting in better understanding of the subject. Therefore, conducting experiment is important because it make the students practice the knowledge they learn. But according to survey conducted, more than half surveyed students failed to involve in all the experiments conducted at school which is caused by their personal problems or inability of the school to conduct the experiments. Students do not able to give full focus for a long time when studying using a book. Lastly, out of 30 surveyed students, most of them failed to focus studying on a book for a long time. According to survey also, only a few surveyed students prefer book than smart phones. In this paper, we analyze the usability of mobile experiment application in science subject for secondary students. The recommendation to replace book with this game based learning application also is accepted by the tester which most of them rated it “good”. Only a few rated it “okay” which mean they did not care whether it a book or application become the medium of learning and only a person rated it “bad” as he or she does not want to use this application as the medium of study. The development of this application had successfully follows the methodology proposed. The requirement for the development had been obtained from survey conducted. The design had been properly designed to meet the entire requirement proposed. The construction and testing had been conducted repeatedly to ensure it able to deliver the proposed objectives. Melaka International Conference on Social Science, Science and Technology 2019

2. Literature Review

2.1 Education in Malaysia

Education in Malaysia consists of multiple levels starting with preschool school until tertiary education level. Malaysian can start joining the education system at 3 years old and further their study as long as they want to increase their knowledge.

2.2 Secondary School: Science Subject

In Malaysia, science subject is being taught starting from the primary school. The science subject will be continued to be taught in secondary school. In secondary school, lower secondary level which

is Form 1 until Form 3 must take the science subject but during entering upper secondary level, they can either choose whether want to take science subject or detailed science subject such as Biology, Physics and Chemistry. For secondary school level, the total topics of science subject covered are 27 which 7 are from Form 1 and 10 are from both Form 2 and Form 3.

2.3 Mobile Application

Mobile application is an application that runs on a mobile device such as mobile phone and tablet. Today, there are varieties of mobile application with variety of purpose. Some of the mobile application has a purpose to entertain the user such as Subway Surfer and YouTube while the other might have different purpose such as OfficeSuite is to help the user in managing their work sheet. The mobile application can be installed by downloading the application on the mobile store which might different from each operating system. Mobile application for Android, Windows and iOS can be downloaded from Google Store, Marketplace and AppStore respectively. According to Budiu [4], there are three types of mobile application which are native application, web-based application and hybrid application.

2.4 Gamification

Gamification is the idea of adding game elements to a non-game situation. Providing reward for a completed task is one of the examples of gamification. According Teyssier [23], even a small reward can enhance and motivate user desire to win or solve the problem. This idea can be implemented during class by rewarding student with point or badges for helping their friend or answering the right answer. Gamification mechanic can be divided into 8 parts which are general, schedules, socializer, free spirit, achiever, philanthropist, destroyer and player. General mechanic consists of tutorials, signposting, loss aversion, progress, theme, story, curiosity, time pressure, scarcity, strategy, flow and consequences. Schedules mechanic consists of random rewards, fixed reward schedule and time dependent rewards. Socializer mechanic consists of guilds, social network, social status, social delivery, social discovery, social pressure and competition. Free spirit mechanic consists of exploration, branching choice, Easter eggs, rare content, creativity tools and customization. Achiever mechanic consists of challenges, certificates, learning new skills, quests, levels and boss battles. Philanthropists' mechanic consists of meaning, caretaking, access, collect and trade, gifting and sharing knowledge. Disruptor mechanic consists of innovation platform, Melaka International Conference on Social Science, Science and Technology 2019 voting, development tools, anonymity, light touch and anarchy. Lastly, player mechanic consists of points, rewards, leader boards, badges and achievement, virtual economy and lottery, anonymity, light touch and anarchy. Lastly, player mechanic consists of points, rewards, leader boards, badges and achievement, virtual economy and lottery.

3. Research Methodology

The study was conducted using Rapid Application Development (RAD) methodology. According to Wave Maker [28] and Morse [17], RAD is a method that depends on repetitive cycles of iterative development and immediate feedback from the users to develop the model. RAD model focus more on developing a prototype rather than in planning tasks. According to Stiner [21], adjusting to shifting requirements is easily done using RAD. According to The Economic Times [24], RAD approach is more

suitable in developing a program with graphical user interface rather than program with non-graphical user interface.

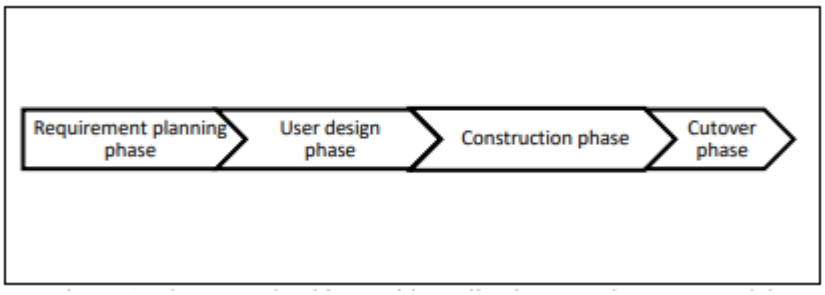

Fig. 1. Phase Involved in Rapid Application Development Model

Figure 1 shows the phase involved in RAD model. The phase started with requirement planning phase. In searching for problem statements, multiple information from various resources is gathered to solidify the problem statement. From the problem statement, project objectives are defined in order to solve the problems. To make the project more specific, project scope is defined so that a clearer project area can be focused. Finally, the project significance is to ensure the project is significance in overcome the problem. Data gathered from the planning will be further analyzed to filter the information to suit the project. After requirement planning phase is complete, the next step is user design phase. In this phase, the developer and the end user work closely together in developing the prototype. The client in this project is school students. In this phase, the prototype will be designed and shown to the client for a feedback. From the feedback, changes and improvements will be made to improve the prototype. This process is repeated until the customer is satisfied. The third phase is construction phase where the actual development starts. In this phase, actual coding, system testing and unit integrating is used. Unity is used as the game engine. Picture used in the project will be designed using Adobe Photoshop while coding for the application will be developed using Mono-Develop. Then the last phase is Cut Over phase. In this phase, the project will be tested to know if the project meets with the objective. Error happened will be fixed in this phase. In this phase, all function, button and interface of the application will be tested to ensure the application work completely and able to meets the objective. If an error occurs, it will be fixed in this phase and the application is retested again. To let the application, Requirement planning phase User design phase Construction phase Cutover phase Melaka International Conference on Social Science, Science and Technology 2019 run smoothly, a well coded program is needed. Aside from testing the function, the application also being test on real user to measure the usability of the application on real user. SAMPLING Usability Testing Usability testing has been conducted where by student from SMK Dang Anum used this mobile apps. This usability testing expose student with the real user's experiences with the application. Figure 2 shows the number of students from secondary school. The target user's age for this mobile application is ranged between thirteen to seventeen years old. In this usability testing, questionnaires were distributed among student after they have tested the application to gain feedback from the user about the product either it can be accepted or not.

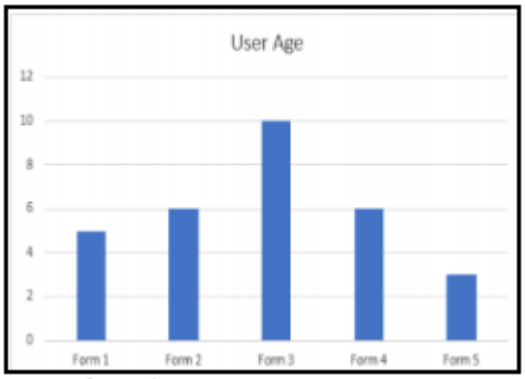

Fig. 2. User Age Group

The next question asked is whether the user can use the application smoothly. Smoothly in this context is without lagging, able to navigate through the application properly and able to use each function properly. From the result obtained, smoothness of the application can be rated as good as it had the most votes with 17 votes out of 30. Figure 3 shows the usability of the mobile application.

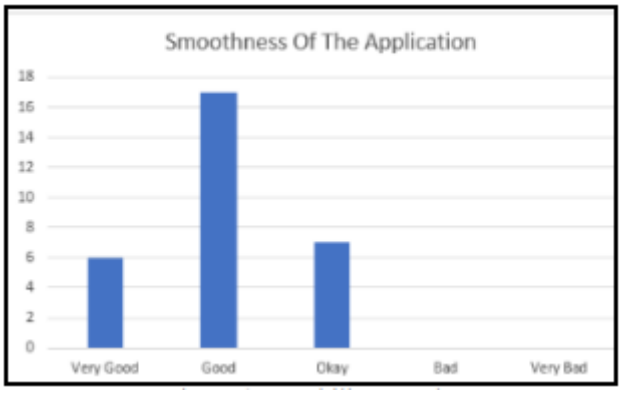

Fig. 3. Usability Result

4. Findings

The findings of this research is focusses on the usefulness of games-based learning application. This part contains the uses of multimedia elements such as text, image, video, audio and animation able to catch the attention of the user. In this application, only three out five elements are used which is text, image and animation. For the first elements which are text, it should be clear and understandable by the user. In term of image, it should be able to deliver the message of the image to the user such as the uses of play button to indicate to start the experiment and cross button to indicate to exit the application. In term of animation, it should be able to animate smoothly and able to stand out among the others to catch the user attention.

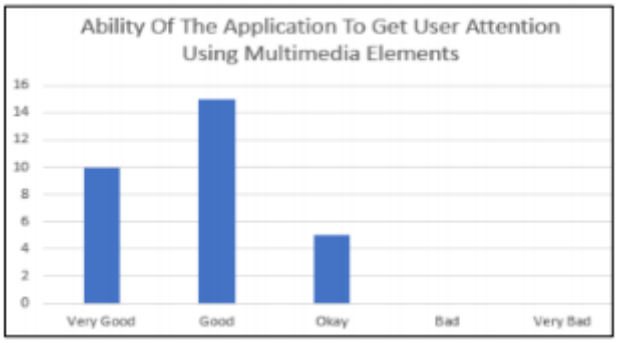

Fig. 4. User Attention

From the result obtained, majority of the users votes the application uses of multimedia elements is good for catching the user attention. Figure 4 shows the result of the ability of the application to get user attention by using multimedia elements.

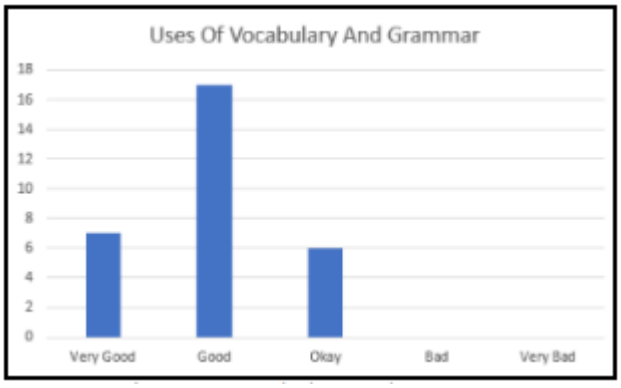

Fig. 5. Vocabulary and Grammar

The third question asked in section two is whether the grammar and vocabulary used in this application is understandable for the level of secondary school student. From the result obtained, most users agreed that the vocabulary and grammar used in the application is good. Figure 5 shows the result of the uses of vocabulary and grammar among secondary students. Figure 6 show the main interface of the application. It inherits common heuristic of mobile GUI to promote usability to the user. Align with the methodology used, RAD provide best practice in developing apps with GUI. This include the use of common button for navigation and process. The color scheme used is obtain for the common template that will attract user attention especially secondary students.

Fig. 6. Main Interface

Among the feature adopted in this apps are the use of mind map technique to enhance user understanding about the selected experiment. Mad mapping technique has been proven as one of the most important technique to help student memorize about the subject. Mind map provide a lot of information about the subject matter with simple graphical notations. Figure 7 show example of mind maps use in the mobile application.

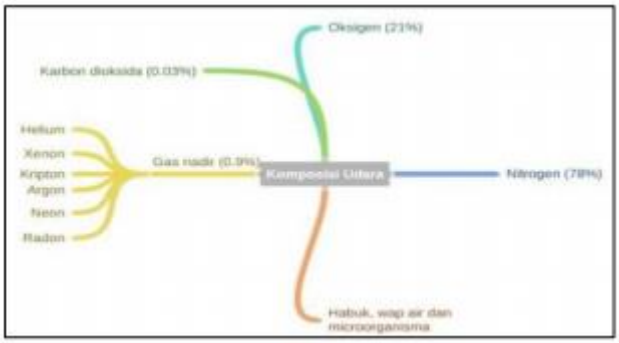

Fig. 7. Mind Map Technique

5. Conclusion

As a conclusion, this project is developed by combining the designed image by using Photoshop, script coded using Mono Develop and GUI developed using Unity. The storyboard can act as a guideline to build the application. To ensure the functionality of the application, the application is tested on multiple phone and by multiple user. This application only covers chapter 5 Form 1 science subjects only. The reason that chapter is chosen as the content of the application is because it contains the most number of experiments than other chapter. Aside from that, this application does not have any sound at all thus making it quite boring and less interactive. This application also will become unavailable at school which prohibit their students from bringing mobile phones to school. Aside from school, students can use this application at home but there will be no apparatus available to do the experiments at home. Some parents also might prevent their students from doing the experiment at home for the safety of their child. But this application can still be used for revision of their study.

References

[1] Aghion, Z. (2014, Jun 24). What are some examples of hybrid native and HTML5 iPhone or Android applications? Retrieved April 20, 2017, from https://www.quora.com/What-are-some-examples-of-hybridnative-andHTML5-iPhone-or-Android-applications

[2] Arsenault, Dominic. "Video game genre, evolution and innovation." *Eludamos. Journal for computer game*

culture 3, no. 2 (2009): 149-176.
[3] BabyBus, K.G. (2017). Earthquake Safety Tips 2 (Version8.21.00.01)[mobile software]. Retrieved from https://play.google.com/store/apps/details?id=com.sinyee.babybus.earthquake II
[4] Budiu, Raluca. "Mobile: Native apps, web apps, and hybrid apps." *Nielsen Norman Group* (2013): 49-53.
[5] Editorial, T. (2013, May 11). 7 Good Examples of Gamification in Education. Retrieved April 19, 2017 from edtechreview.in/news/324-examplesgamification-in-education
[6] Financial, T. (2015). Financial Times (Version2.37.0.11)[mobile software]. Retrieved April 20, 2017 from https://play.google.com/store/apps/details?id=com.ft.news&hl=en
[7] Gerry, G. (1999). Usability Testing. September 6, 2017 from www.infodesign.com.au
[8] Khan, A. (2015). Khan Academy (Version2.6.2)[mobile software]. Retrieved April 20, 2017 from https://play.google.com/store/apps/details?id=org.khanacademy.android&hl= en
[9] Niantic, Inc. (2014). Ingress (Version1.129.2)[mobile software]. Retrieved April 20, 2017 from https://play.google.com/store/apps/details?id=com.nianti cproject.ingress&hl= en
[10] ISTQB Exam Certification, (2017). What is RAD model- advantages, disadvantages and when to use it? Retrieved May 20, 2017, from http://istqbexamcertification.com/what-is-rad-modeladvantagesdisadvantages-and-when-to-use-it
[11] Koster, R. (2005). A theory of fun for game design. Paraglyph Press, Scottsdale, Arizona (2005)
[12] Liaw, Shu-Sheng. "Investigating students' perceived satisfaction, behavioral intention, and effectiveness of e-learning: A case study of the Blackboard system." *Computers & education* 51, no. 2 (2008): 864-873.
[13] Lau, H.Y., Lau, P.Y., Yong, L.K. & Helmi, Y. (2017) Ulang Kaji Sains PT3. Selangor: Sasbadi SDN. BHD.
[14] Marczewski, Andrzej. "Even Ninja Monkeys like to play." *CreateSpace Indep. Publish Platform, Charleston, Chapter User Types* (2015): 69-84.
[15] Marczewski, A. (2015). 52 GAMIFICATION MECHANICS AND ELEMENTS. Retrieved April 21, 2017 from https://www.gamified.uk/usertypes/gamification-mechanics-elements/
[16] Minikler, O. (2017). Math Games (Version2.0)[mobile software]. Retrieved May 5, 2017 from https://play.google.com/store/apps/details?id=com.miniklerogreniyor.quiz.kid s.math
[17] Powell-Morse, Andrew. "Rapid Application Development (RAD): What Is It And How Do You Use It." *Online Document. Updated* (2016).
[18] Office, C.C. (2017). COOKING MAMA Let's Cook! (Version1.31.0)[mobile software]. Retrieved May 6, 2017 from https://play.google.com/store/apps/details?id=jp.co.ofcr.cm00
[19] Rapini, Sarian.(2012). Digital Game Based Learning. Retrieved April 20,2017 from http://www.cee.org/sites/default/files/news-events/digital- gamebasedlearning.pdf
[20] Robin, S. L. (2011, March). Chapter 3: Home Videogame Platforms. Retrieved April 20, 2017 from www.people.fas.harvard.edu
[21] Stiner, (2016, August 24). Rapid Application Development (RAD): A Smart, Quick And Valuable Process For Software Developers. Retrieved May 20, 2017, from https://www.forbes.com/sites/forbestechcouncil/2016/08/24/rapidapplication-development-rad-a-smartquick-and-valuable-process-forsoftware-developers/#3bf9824719e8
[22] Ooi, S.T., Choong, C.H., Peter, L.C.C. & Tan, K.L. (2009). Success Science PMR. Selangor: Oxford Fajar.
[23] Teyssier, Y. (2016). 5 Advantages Of Using Games For Learning. Retrieved March 28, 2017, from https://elearningindustry.com/5-advantages-games-forlearning 62
[24] The Economic Times, (2017). Definition of 'Rapid Application Development'. Retrieved May 19, 2017, from http://economictimes.indiatimes.com/definition/rapid-applicationdevelopment Trybuss, J. (2015).
[25] Game-Based Learning: What it is, Why it Works, and Where it's Going. Retrieved April 20, 2017 from http://www.newmedia.org/gamebased-learning--what-it-is-why-it-works-and-where-its-going.html [
[26] Tutorialspoint, (2017). SDLC - RAD Model. Retrieved May 21, 2017, from https://www.tutorialspoint.com/sdlc/sdlc_rad_model.htm
[27] Watson, William R., Christopher J. Mong, and Constance A. Harris. "A case study of the in-class use of a video game for teaching high school history." *Computers & Education* 56, no. 2 (2011): 466-474.
[28] WaveMaker, (2017). Rapid Application Development Model. Retrieved May 20, 2017, from https://www.wavemaker.com/rapid-application-developmentmodel/ Yeap, T.K. (2010). Essential Science PMR. Selangor: Pearson Longman.