The Development of Fire Prevention Basic Learning Application

Nur Syamimi Mohd Razali[1*], Nur Atiqah Rosetadman Sidek[2] & Nur Fatin Farhanah Mohd Rosli[3]

[1,2,3]Faculty of Technical and Vocational Education, Universiti Tun Hussein Onn, Malaysia
*syamimi@uthm.edu.my

Received: 1 May 2020
Received in revised form: 11 June 2020
Accepted: 15 June 2020
Published: 1 July 2020

ABSTRACT

Fire prevention skills are necessary for preventing a person from being caught in uncontrollable spread of fire. Therefore, every person has to equip him/herself with the basic knowledge of handling fire at the early stage. The aim of this study is to develop an application on basic fire prevention. The study seeks to achieve the following two objectives: (i) to develop and design a basic fire prevention application with embedded multimedia elements and (ii) to test the functionality of the application in terms of content, interface, and interaction aspect. The rapid prototyping model (analysis of needs, objectives, designs, testing and implementation) was selected as a development model and the behaviourism learning theory was applied. Adobe Flash Professional CS6 was chosen as the development platform. The application consists of three modules: "You Need to Know," "Mind Test," and "Guide." To test the functionality of the application, the developer collected data from three experts from the Faculty of Technical and Vocational Education and Malaysia Civil Defence Force Officer, Batu Pahat. The three experts were selected through targeted sampling. The result concluded that the application was smooth in terms of functionality thus is suitable for new learners to learn about basic fire prevention.

Keywords
Basic fire preventions; Knowledge and Skill; Learning application

Introduction

Nowadays, the way of teaching and learning (T&L) has evolved from the conventional teaching and learning (classroom) to more advance methods, such as by using the social media, a website, or an educational application. Numerous studies have reported on the positive effect from using an education application among students (Farrah & Abu-Dawood, 2018). For instance, Pechenkina et al. (2017) found that students' retention and academic performance increased after they used a gamified mobile learning application for T&L. A positive correlation was also found between students' scoring highly on the application and the achievement of higher academic grades.

A mobile application can also be used to educate people about general knowledge and awareness. In a study by Sharifah Nurkhadijah et al. (2018), sfor example, knowledge score was found to increase when a user used a mobile application to learn about improving safety and health among university students. This finding indicates that an educational application can be used in various approaches to educating people. However, despite the thousands applications that have been developed, what remains questionable is how an application can be develop to meet its purposes. Choosing or developing an inappropriate application can be problematic to students and educators (Papadakis & Kalogiannakis, 2017). Therefore, this study intends to develop an application that can educate students about fire prevention.

Fire and Safety

Fire represents a severe hazard in both developing and developed countries and poses significant threat to life, structures, properties, and environment (Kodur, Kumar & Rafi, 2019). In Malaysia, fire is one of the most frequent catastrophic disasters across the country. According to a report, as of July 2019, 36,043 calls had been recorded as an emergency call on fire, which indicates an increase from the record in 2017 (28,853 calls) (Selangorkini, 2019). The current statistic shows that fire disasters increase approximately 25% within two years. Fires have caused adversities in terms of financial and property losses. The significant increase in fire is alarming because the disaster has led to a

total loss of RM3.3 billion in 2018 and RM5.2 billion in 2017. The most recent statistics indicated that 107 victims had died and 477 victims were injured in a fire (Fire and Rescue Department Malaysia [FRDM], 2016). Therefore, there is a need for the general public to be educated to handle and face a fire.

Fire safety for a building is primarily a priority of three principles: protecting lives, preventing the fire from spreading to the next buildings, and protecting property (Sulaiman, 2009). In Malaysia, FRDM prioritises human safeness as a priority in a building's fire safety (Bakar, 2006). Knowledge on fire safety includes learning the basics of fire, fire classes, types of fire, fire-fighting methods, and fire prevention components. However, past case-studies have shown that building occupants are generally incapable of escaping in time and often undermine the precautionary measures required to avoid or escape a fire (Noah &, ISIWELE & Adamolekun, 2017).

Although the FDRM has launched the Fire Prevention Campaign to raise public awareness on fire issues (Berita Harian, 2010), the department also identified that one of the weaknesses among the occupants is the lack of understanding of (i) a building, particularly in the procedure of emptying the building, and (ii) the features of a fire prevention system of a building. According to Athanasius (2000), a fire is easier to control within the first four minutes, yet, it reality, fire fighters could reach the scene within four minutes after the fire. Therefore, a preliminary action is needed in the event of a fire before the arrival of the FDRM team.

Problem Statement

Fire prevention skill is rarely taught in classroom but is rather gained through guidance and informal experience. Having the basic knowledge and skills of fire evacuation are necessary for a building occupant to decide the first action to take in the case of fire. Yet, what remains unknown is the adequacy of people's knowledge on the subject due to the lack of specific training on fire handling. The failure to take fire prevention measures might risk building occupants being caught in a fire.

Given the above points, it is necessary that people be educated on fire prevention measures in order for them to prepare themselves for early evacuation. Therefore, this study aims to develop an educational application on fire prevention, the purpose being to raise awareness of fire prevention. In doing so, the application will be designed to (i) increase the fundamental understanding of the cause of the fire and (ii) provide basic preventive education on the placement of emergency exits during the fire, fire preparedness, and safety tips.

The Behavourism Learning Theory

The behaviourism learning theory emphasises that a behaviour shown is the result of an interaction between a stimulus and response during a learning process (Slavin, 2000). The main principles of the behaviourism learning theory are stimulus, response, and reinforcement. According to Skinner (1965) when there is repeated stimulation and response there will be learning.

The application of the behaviourism learning theory in a learning application can be seen as making a learning material as the stimulus and what the user receives as the response. Reinforcement is the exercise or assessment given to a user at the end of a learning session to strengthen the information that he or she has learnt. Each right or wrong answer is given an appropriate response. Such notion is in accordance with the learning application developed in the reinforcement section, which uses the answer concept to be reviewed after successfully answering the question and being able to repeat all the questions. If positive reinforcement is given to the student, then the behaviour will be repeated and become a habit. As such, it enhances students' understanding on a given subject and motivates them not to choose the wrong answer as a result of answering past questions such as the concept of behaviourism.

Research Objective

This study, therefore, sought to achieve the following objectives:

(i) To develop and design a basic fire prevention application with embedded multimedia elements
(ii) To test the functionality of the application in terms of content, interface, and interaction aspect.

Research Methodology

The rapid prototyping model (Tripp & Bichelmeyer, 1990) was utilised as a guideline for developing and testing the functionality of the application. The model proposes five steps for managing a development process, namely requirement analysis, setting of objectives, designing, testing, and implementation. These steps provide the developer with a clear path to follow to reach a goal.

Requirements analysis is a process in which a developer caters to all the issues regarding the development of an application. In this study, the analysis began with the identification of the target user of the application. The developer first sought information about the target users' awareness and knowledge on fire handling as well as their perceptions on the development of the application. This step was achieved by interviewing three higher- education students. At the same time, the developer reviewed the existing literature and applications on learning a language through a mobile application. Then, the developer selected the most appropriate software for developing the application. Several softwares were identified to be suitable, namely Microsoft Word, Adobe Photoshop CS6, Adobe Illustrator CS6, Audacity Sound Editor, and Adobe Flash CS6.

The subsequent step was to state the objectives of the development. The objectives of the development were determined to be threefold: (i) to design the content including the interface design in learning basic fire prevention; (ii) to develop the application; and (iii) to test the functionality of the application among experts. Objective one and two are interrelated since the development was performed by referring to the content and interface design (objective one).

The third step was to design the application, which is also the development phase. The design stage involved designing the structure of the application; applying the theory; developing the multimedia elements; as well as creating the storyboards, flowchart, navigational structure, and learning content. The storyboards and flowchart served as preliminary guidelines for the developer during the development. Both the storyboards and flowchart contained the draft of the placement of the multimedia elements, such as graphics, audio, animation, video and text. With the storyboard, the developer could decide the placement of the interactivity elements, including the buttons that control the application. The multimedia elements were developed separately; the graphics and animations for the application were created by using Adobe Photoshop CS6 and Adobe Illustrator CS6, while the audio was composed with Audacity Sound Editor. With these applications, the developer managed to create a red-and-orange theme colour and two-dimensional animations. The following three modules were incorporated into the application: "You Need to Know," "Mind Test," and "Guide." These modules were designed to cover the knowledge of basic fire prevention, quizzes, and guideline for using the application. Because the elements for this application were developed separately, they were integrated into Adobe Flash CS6 and were then published as an application. The outcome was then exported to an .apk format prior to installation to an Android mobile for testing.

The next step was to test the application. The testing involved testing for the functionality of the application and performing the maintenance of the application. Assessing the functionality was performed by seeking the agreement from the experts by using validation form which is a set of questionnaires. The questionnaire consists of four main sections: Section A (demographic details), Section B (content design), Section C (interaction design), and Section D (interface design). Three experts were chosen through targeted sampling for the assessment step. Two of them are lecturers at the Faculty of Technical and Vocational Education, and another expert is a Malaysia Civil Defence Force Officer based in Batu Pahat. The respondents were asked to rate their validation for each of the items in the questionnaire. The data obtained were then analysed by means of frequencies.

The "You Need to Know" module is about learning the basics of a fire, such as the situation of a fire followed by the actions that need to be taken if there is a fire. The "Mind Test" module aims to test users' comprehension of the basics of a fire. Two types of test are provided: multiple-choice questions and simple drag-and-drop games. Six multiple-choice question are provided, requiring the user to choose "right" or "wrong" as the correct answer. As for the drag-and-drop games, the user needs to drag the right statement to the right space, for which they can check the correct answer. The last module, "Guide," was designed to guide users on how to use the application. Figure 1 and Figure 2 illustrate the interfaces of the application.

Figure 1: Main interface of Basic Fire Prevention application

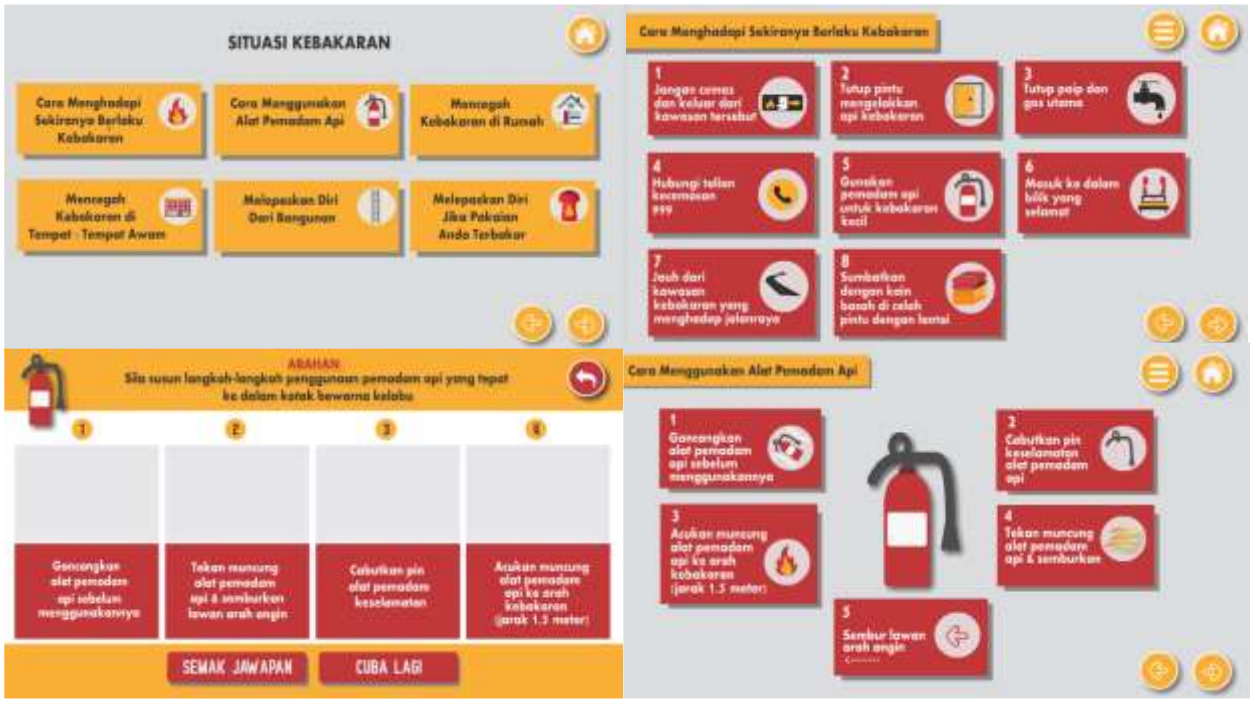

Figure 2: Interfaces of "You Need to Know", "Mind Test," and "Guide"

In assessing the functionality of Basic Fire Prevention, the experts were required to answer all the four sections of the questionnaire: Section A (Demographic details), Section B (Content design), Section C (Interaction design), and Section D (Interface design).The data were analysed by means of frequencies and percentages.

Table 1 shows the result of the assessment. All the experts agreed (by ticking "yes") that the application's content design fulfils the requirement, thus indicating a 100% level of acceptance on this feature.

Table 1: Acceptance of Application's Functionality of Content Design

No	Item	Frequency		Percentage
		Yes	No	
1	Can the game app attract user's interest?	3	0	100 %
2	Does the game app provide guidance to users?	3	0	100 %
3	Is the identity page placed inside the game app easy to understand?	3	0	100 %
4	Are the notes used able to help users to improve their knowledge on basic fire skills?	3	0	100 %
5	Is it easy to understand the guidance in this game app?	3	0	100 %
6	Is the use of the Malay language suitable to the users of this game app?	3	0	100 %

Table 2 shows the result of the assessment of the functionality of the application's interaction design. All the experts agreed that the content design fulfils the requirement, except for item 4, to which one expert disagreed in terms the comprehensibility of the navigation button.

Table 2: Acceptance of Application's Functionality of Interaction Design

No	Item	Frequency		Percentage
		Yes	No	
1	Is the game application easy to handle?	3	0	100 %
2	Is this game application user-friendly?	3	0	100 %
3	Does the exit button / icon make it easy for users to get out of this game app?	3	0	100 %
4	Do navigate buttons / icons easy to understand?	2	1	66.7 %
5	Is the use of buttons / icons used accordingly?	3	0	100 %
6	Are all the buttons / icons contained in this game app working properly?	3	0	100 %

Table 3 shows the result of the assessment of the functionality of the application's interface design. All the experts agreed that the application's content design fulfils the requirement, except for item 3, to which the expert disagreed in terms of suitability (level of acceptance = 66.7%).

Table 3: Acceptance of Application's Functionality of Interface Design

No	Item	Frequency		Percentage
		Yes	No	
1	Is the writing size used suitable for this game app?	3	0	100 %
2	Is the font type used for this game app?	3	0	100 %
3	Is the background used appropriate?	2	1	66.7 %
4	Are graphics / images used make this game app look interesting?	3	0	100 %
5	Are graphics / images used appropriate?	3	0	100 %
6	Is the color choice used interesting?	3	0	100 %
7	Is the color choice used appropriate?	3	0	100 %
8	Is audio used interesting?	3	0	100 %
9	Does audio used do not disturb the user's concentration?	3	0	100 %
10	Is consistency in terms of "layout" used from page to page making this game app look interesting?	3	0	100 %
11	Is consistency in terms of buttons used from site to site making this game app look interesting?	3	0	100 %
12	Is consistency in terms of the 'font' used from page to page making this game app look interesting?	3	0	100 %

At the same time, the experts wrote their comments for the improvement of the application. Their feedback was important because could facilitate the technical maintenance and amendments of the application. Table 4 below shows the experts' comments and amendments that have been made based on the respective comments.

Table 4: Experts' Comments and the Amendments Made

No	Expert Position	Views and Reviews	Improvement Action
1	**Expert 1** Malaysia Civil Defence Force Officer (13 years working experience)	i. The background used in the quiz does not fit.	i. The developers used yellow for the background to conform to the theme's theme of the game
		ii. Additional notes for emergency treatment during minor accidents involving fire or non-heat	ii. Added additional info in (you want to know)
2	**Expert 2** Senior Lecturer, Department of Education Faculty of Technical and Vocational Education Universiti Tun Hussien Onn Malaysia (UTHM), Parit Raja, Johor (11 years working experience)	i. In the mind test section, it needs to be changed 'description' to 'command'	i. The developer changed the word description to the instructions.
		ii. Review the use of button navigation	ii. Developers arranged navigation by order
3	**Expert 3** Senior Lecturer, Department of Education Faculty of Technical and Vocational Education Universiti Tun Hussien Onn Malaysia (UTHM), Parit Raja, Johor (12 years working experience)	i. The Update quiz room section incomplete	i. The developer updated the quiz room section
		ii. Addition to back button and home page in mind test section	ii. The developer added the back button and homepage to the mind test section

Discussion

The rapid prototyping model was utilised during the development of the fire prevention application. The model suggests the importance of the requirement analysis step as the first step. During this step, the developer analysed the aspects that need to be considered prior to the designing process. The process included analysing the target users. For this purpose, the developer identified higher education students as the target users in the early interview for initial insight. A few softwares were identified during the development phase, such as Microsoft Word, Flash CS6, Adobe Illustrator CS6, and Audacity Sound Editor. The process was followed by stating the objective of the study, which are to design and develop the Basic Fire Prevention application and to assess the functionality of the application. Subsequently, the designing and developing processes took place. As mentioned, a number of softwares were used to produce the multimedia elements part by part until all of them were integrated. The storyboards served as the framework for the whole development process. Finally, the application was published in an .apk format. After the application was developed completely, three respondents were chosen as experts to evaluate the functionality of the application. The last step was to amend the application based on the experts' suggestions. The rapid prototyping model serves as a guideline for application development and can be one of the solutions for the instructional designer to develop an application as well as software (Jones & Richey, 2000; Baharuddin, 2004).

Three modules were created in the Basic Fire Prevention application: "You Need to Know," "Mind Test," and

"Guide." The "You Need to Know" modules comprises the basic knowledge on fire prevention. User can learn on the different types of fire situations and how to handle each situation. The "Mind Test" module enables the users to test their comprehension on what they have learnt. The activities include answering multiple-choice questions and playing mini drag-and-drop games. Rewards are available for users who are able to answer the question correctly. The "Guide" module provides a guideline for user on how to operate the application.

In the functionality test, the experts were asked to assess the functionality of the application. The following three aspects were assessed in this study: content design, interaction design, and interface design. As shown in Table 1, the application's content design received 100% level of acceptance from the experts, thus indicating that the content of this application is well developed as planned. The content of the information is delivered through text, audio, and graphics. Clearly presented multimedia elements ensure the effectiveness of content delivery. Information about the basis steps are supplemented with graphics or visual presentations, which facilitate user's understanding and processing information. According to Pavithra (2018), the use of various types of multimedia elements will provide a more realistic learning condition and hold user's attention. Another study by Kim & Gilman (2008) also supports the idea that the use of visual media helps the students in learning. While a study by Li & Yang (2018) found that students who are visual learners gained high scores in concentration during learning.

The second aspect is the interaction design. Interaction design is about how the interactivity elements of an application are well developed. The elements include the button and navigation flow in the application. Table 2 shows that all the interaction aspects are nearly well developed. Only one expert disagreed that the navigate buttons or icons are easy to understand. This finding is in line with the comment from Expert 2, who recommended that the navigation button be revised. Interactivity is an important aspect of learning with the use of an application. This is because interactivity relates to how the users control the application, such as for navigating and browsing. In the application developed in this study, the button used is a medium for a user to navigate through the application. Interactive elements can help users to foster their learning process and create their own pace of learning (Cairncross & Mannion, 2001; Etim et al., 2016; Jumaat, et al., 2018).

The last aspect of the functionality test was the interface design aspect. As shown in Table 3, one expert disagreed with the background used in the application, particularly the background for "Mind Test." Other than that, all the experts agreed that the interface design fulfils the requirement. According to Ali et al. (2014), a mobile learning application must be easy to use, learnable, understandable, and attractive. It must also provide an enjoyable experience for users. The integration of multimedia elements, such as text, graphics and audio, make the interface more appealing. A study carried by Almaiah, Jalil, and Man (2016) found that interface design is one of the factors that satisfy students' requirement in achieving a high-quality mobile learning system.

Conclusion

In conclusion, the development of the Fire Prevention Basic Learning Application was considerably successful. The high percentage of acceptance from the experts indicated that the application is acceptable with minor amendments. Since the mobile application is different with others e-learning, there is a concern that need to be paid attention in order to avoid dissatisfaction and frustration for learners (Song, 2014). The rapid prototyping (Tripp & Bichelmeyer, 1990) utilised was found to be useful. It is hoped that the application can be used to create awareness among users on the importance of having knowledge on basic fire prevention.

Acknowledgment

This study was funded by PPG Research Grant at Universiti Tun Hussein Onn Malaysia (K018)

References

Akhimien, Noah & A.J., ISIWELE & M.O., Adamolekun. (2017). Fire safety. 4. 63-79. Pechenkina, E., Laurence, D., Oates, G. et al. Using a gamified mobile app to increase student engagement, retention and academic achievement. Int J Educ Technol High Educ 14, 31 (2017). https://doi.org/10.1186/s41239-017-0069-7

Ali, Abdalha & Alrasheedi, Muasaad & Ouda, Abdelkader & Capretz, Luiz. (2015). A Study of The Interface Usability Issues of Mobile Learning Applications for Smart Phones from the User's Perspective. International Journal on Integrating Technology in Education. 3. 10.5121/ijite.2014.3401.

Almaiah, Mohammed & Jalil, Masita & Man, Mustafa. (2016). Empirical investigation to explore factors that achieve high quality of mobile learning system based on students' perspectives. Engineering Science and Technology, an International Journal. 19. 10.1016/j.jestch.2016.03.004.

A., Pavithra. (2018). Multimedia And Its Applications. 10. 271-276.

Athanasius L.A. (2000). Managing homeworking: health and safety resposibilities. Employee Relations. 22 (6), 540 – 554.

Baharuddin Aris, R. S. S. dan M. S. (2004). Reka Bentuk Perisian Multimedia. Penerbit UTM, Skudai, Johor

Bakar.A, (2006). Amalan Keselamatan dan kesihatan Pekerjaan di Telekom Malaysia Berhad. Projek Sarjana Muda Universiti Teknologi Malaysia Skudai

Berita Harian, (2010). Retrieved from http://www.beritaharian.sg/dunia/punca-kebakaran-di-hospital-sultanah-aminahdi-johor-belum-dapat-dipastikan

Etim, A., Etim, J., Robinson, A. & Smith, P. (2016). Mobile Learning Apps to Support Students Learning Goals. International Journal of Computing, Communications & Instrumentation Engg. (IJCCIE) Vol. 3, Issue 2, 389-391.

Farrah, Mohammed & Abu-Dawood, Ala. (2018). Using Mobile Phone Applications in Teaching and Learning Process. International Journal of Research in English Education (IJREE). 3. 10.29252/ijree.3.2.48.

Selangorkini (2019). Retrieved from https://selangorkini.my/2019/07/peningkatan-kadar-kebakaran-sangat-ketara-bomba/

Jones, T.S., & Richey, R.C. (2000). Rapid prototyping methodology in action: A developmental study.Educational Technology Research and Development, 48(2), 63–80.

Jumaat, Nurul & Tasir, Zaidatun & Che Lah, Noor Hidayah & Mohamad Ashari, Zakiah. (2018). Students' Preferences of M-Learning Applications in Higher Education: A Review. Advanced Science Letters. 24. 10.1166/asl.2018.11078.

Kim, D., & Gilman, D. A. (2008). Effects of Text, Audio, and Graphic Aids in Multimedia Instruction for Vocabulary Learning. Educational Technology & Society, 11 (3), 114-126.

Kodur, V., P. Kumar, and M. M. Rafi (2019). "Fire Hazard in Buildings: Review, Assessment and Strategies for Improving Fire Safety." PSU Research Review. https:// doi.org/10.1108/PRR-12-2018-0033.

Lu, T., & Yang, X. (2018). Effects of the visual/verbal learning style on concentration and achievement in mobile learning. EURASIA Journal of Mathematics, Science and Technology Education, 14(5), 1719-1729. https://doi.org/10.29333/ejmste/85110

Slavin, R.E. 2000. Educational Psychology: Theory and Practice. Massachusetts: Allyn and Bacon.

Malaysia Fire and Safety Department (2016) http://www.data.gov.my/data/ms_MY/dataset/statistik-kematian-dan-kecederaan-akibat-kebakaran/resource/fa73f4a8-57fc-4a50-8b38-9761750e5e04 retrieved on 29th March 2020

Sharifah Norkhadijah Syed Ismail, Josfirin Uding Rangga, Irniza Rasdi, Umi Raihana Abd Rahma , and Mohd Armi Abu Samah (2018). Mobile Apps Application to Improve Safety and Health Knowledge, Attitude and Practice among University Students Malaysian Journal of Medicine and Health Sciences (eISSN 2636-9346)

Skinner, B. F. (1965) [1953] Science and Human Behavior. New York: The Free Press. Originally published by Macmillan.

Papadakis, Stamatios & Kalogiannakis, Michail. (2017). Mobile educational applications for children. What educators and parents need to know.. International Journal of Mobile Learning and Organisation. 11. 1. 10.1504/IJMLO.2017.10003925.

Pechenkina, E., Laurence, D., Oates, G. et al. Using a gamified mobile app to increase student engagement, retention and academic achievement. Int J Educ Technol High Educ 14, 31 (2017). https://doi.org/10.1186/s41239-017-0069-7

Sandra Cairncross & Mike Mannion (2001) Interactive Multimedia and Learning: Realizing the Benefits,Innovations in Education and Teaching International, 38:2, 156-164, DOI: 10.1080/14703290110035428

Song, D. (2014). A Framework for Mobile Learning App Design: DCALE.

Sulaiman, (2009). Pelan Tindakan Menghadapi Kebakaran. [Online]Availableat:www.treasury.gov.my/pdf/warga_mof /sop/kebakaran.pdf [Accessed 28 5 2019].

Tripp, S.D., Bichelmeyer, B. Rapid prototyping: An alternative instructional design strategy. ETR&D 38, 31–44 (1990). https://doi.org/10.1007/BF02298246 News report https://selangorkini.my/2019/07/peningkatan-kadar-kebakaran-sangat-ketara-bomba/. Retrieved on 29th March 2020