

Development of an M-learning Application for Postgraduate University Students

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Abstract

The advancement in the field of mobile computing has introduced many new research topics, one of them being mobile learning. Mobile learning or “m-learning” plays an important role in education nowadays. It could provide fast access to any learning site and resources without limited time and space. This paper describes the development of a mobile learning application, focusing on a course offered at Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia, named Research Methodology. The method used in this research is the application development approach using ADDIE (Analysis, Design, Development, Implementation, and Evaluation). This mobile learning application (app) enables the students to access the research methodology notes and slides, at the same time providing a user interface that is friendly for the user. The application is also a modular platform where the course content can be edited by anyone without coding knowledge. It can be concluded that the m-learning application will become one of the main options for learning in the future.

Keywords: m-learning, application development, postgraduate students, Android OS

INTRODUCTION

Mobile devices are becoming more accessible and have become more of a necessity nowadays. This optimistic view of digital technology came about with the introduction of the personal computer, then the Internet mainly in the 1990s, and is still reverberating and very much amplified with the possibilities brought by the pervasive and ubiquitous access to mobile devices and social media platforms in the 2000s (Pedro, Barbosa, & Santos, 2018). While mobile devices have many uses, a

mobile device has the potential to enhance informal learning. M-learning is also known as mobile learning. Fouzdar and Behera (2017) defined mobile learning as the idea that a student can learn from any place at any time using portable learning devices. M-learning or 'mobile learning', is any sort of learning that takes advantage of learning opportunities offered by mobile technologies (Fouzdar & Behera, 2017). Mobile learning combines e-learning and mobile computing. Mobile learning is sometimes considered merely an extension of e-learning, but quality m-learning can only be delivered with an awareness of the special limitations and benefits of mobile devices (Fouzdar & Behera (2017).

The advantages of mobile learning are not only limited to portability and accessibility but also put less pressure on students to learn because it allows students to learn at their own pace. Prokofiev and Boltunova (2018) stated most of the time the mobile device is close to its owner, thereby it allows the owner to conduct the learning process at any time and in any place. Mobile learning applications give the user a choice whereby the user can perform an exercise that requires several minutes or completely concentrate on the task for several hours (Prokofyewa & Boltunova, 2018).

The past studies on mobile learning are abundant but are mostly focused on primary, secondary, and undergraduate scenarios, but little on postgraduate students. Therefore, this study aims to develop a mobile learning application geared toward postgraduate students using the ADDIE model. The application has been developed in Android OS and held the most market share during the development of this application.

LITERATURE REVIEW

Generally, mobile learning could be defined as informal learning through mobile devices. A mobile device is defined as a portable device that can be held and operated by hand. This device is usually all in one and incorporates a System on a Chip or most commonly known as SoC. A mobile device usually has a display of certain types from Liquid Crystal (LCD) to organic light-emitting diode (OLED) and usually has touchscreen functionality that combines input and output methods.

Many researchers defined mobile learning differently from each other. The definition of m-learning seems to have progressed in different ways and directions. For example, Martono and Nurhayati (2014) describe mobile learning as part of electronic learning (or e-learning) that provides wider opportunities in mobile and more capabilities for student learning. Meanwhile, Fouzdar and Behera (2017) define mobile learning as the idea that a student can learn from any place at any time using portable learning devices, and any sort of learning that takes advantage of learning opportunities offered by mobile technologies. Thereafter, Pedro, Barbosa, and Santos (2018) report m-learning as a method that intersects mobile computing and e-learning; adopts the use of mobile technology to achieve anytime, anywhere, ubiquitous learning, and emphasizes learners' mobility and personalized learning. Regardless of the differences in definition, the common theme by researchers is that mobile learning is a form of portable learning.

Mobile Learning in Postgraduate Scenario

During the COVID-19 pandemic, the use of mobile devices increased due to restrictions on face-to-face learning. According to the study conducted by Biswas et al. (2020) more than two-thirds of students (69.2%) think that mobile learning gives them the flexibility to learn anytime and anywhere. 74.5% of university students think to seem that mobile learning is a good idea to minimize the study gap during the COVID-19 pandemic time, while 78.3% believe that mobile can act as a learning companion in any situation and be very relevant in any unexpected situation during COVID-19 pandemic period. 81.3% of university students mention that mobile is easier to find relevant information, while 71.2 % state that it is easier for them to find out study materials through mobile phones, and 73.1% mention that they can easily share class-related documents and discussions both online and offline by using their mobile during COVID-19 period.

In the research literature, mobile learning is limited to screen size as claimed by El-Hussein et. al. (2010). In addition, the limitations of mobile cellular hardware (i.e., the very limited size of its screen) provided the impetus to design personal instruction and learning, and utilize a new format for text communication as well as imbue traditional forms with different meanings. In the year 2021, mobile phones are not limited to processing power and screen sizes, thus the said limitation should no longer pose a problem.

The development of mobile devices has allowed most people to start getting connected anywhere and anytime. Sulisworo, Ishafit, and Firdausy (2016) asserted that mobile device technology is becoming more and more sophisticated but at a cheaper price. The advancement of these technologies allows for mobile learning. Hinze, et. al. (2017) stated that the research literature on using mobile apps for research purposes is sparse, and most academic staff and doctoral students at universities are using mobile applications for academic purposes. Likewise, in the undergraduate environment, the students at university are embracing the idea according to Jumaat et. al. (2018), that is, the students are willing to use m-learning if it is available and implemented on and off the campus.

The same method used in undergraduate classes can also be applied in postgraduate scenarios, especially in courses that are usually assessed based on tests and final exams. In the undergraduate scenario, the development of an e-learning application that is also mobile-compatible has been tested by researchers at Diponegoro University. Their application serves only one subject and the satisfaction from the application is 95% (Martono & Nurhayati, 2014). The literature on using mobile learning for postgraduate study is still scarce, and therefore there is still a need for more research on the development of m-learning in a postgraduate setting.

METHOD

The application (apps) developed in this research is a Research Methodology mobile learning application. The targeted demographic is postgraduate students who could use the mobile learning

application to learn the Research Methodology course anywhere and anytime. The application is designed for Android OS only using a popular framework in Android named Flutter. The development of this application follows the ‘Analysis, Design, Development, Implementation, and Evaluation’ approach or process also known as the ADDIE model as seen in Figure 1.

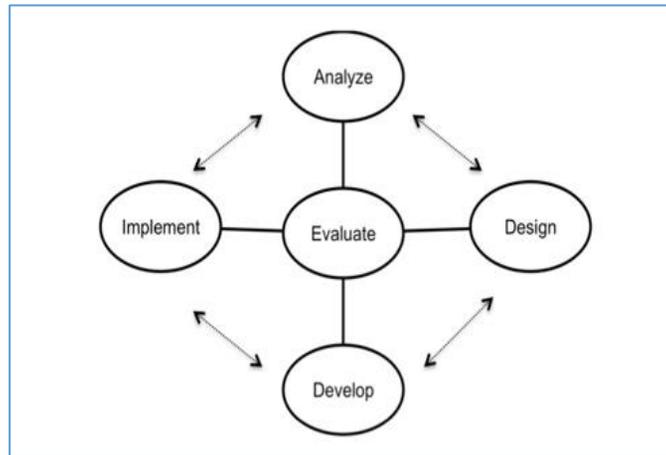


Figure 1: The ADDIE Model

Phase 1 – Analysis

The users of this application are postgraduate students who will enroll in the course Research Methodology as a part of their program curriculum. It is a compulsory course for all postgraduate students in research so targeting this course will allow feedback from various perspectives. Additionally, similar mobile applications are evaluated to understand their uniqueness.

To evaluate application similar applications, we used Nielsen Usability Principles. Nielsen describes usability as a quality attribute that assesses how easy user interfaces are to use. The word ‘usability’ also refers to methods for improving ease-of-use during the design process.” (Usability Testing 101, 2021). There are five usability principles which are learnability, efficiency, memorability, errors, and satisfaction. Learnability is described by how easily the user can complete tasks when they first counter the design. Efficiency: Once users have learned the design; how quickly can they perform tasks? Memorability: When users return to the design after a period of not using it, how easily can they reestablish proficiency? Errors: How many errors do users make, how severe are these errors, and how easily can they recover from the errors? Satisfaction: How pleasant is it to use the design?

To analyze the application, we selected a few similar applications in Google Play. Google Play is a service provided by Google for Android OS to download applications for android-based devices regardless of the architecture. Among the similar applications are:

- Research Methodology: learning app for student
- Research Methodology notes: Nessa Apps Studio
- Research Methodology: Alatoo University

- Research Methodology: Light of Learning

To summarize the analysis phase, paragraphs of information are not suitable to present, accessibility features should be provided such as zooming in on the text. The content presentation should be in a creative manner and they should allow slides rather than text. Additionally, quizzes can be added as a feature to the application for revision purposes. Furthermore, the design of the application should follow modern standards.

To define the features, functional requirements have been created from the analysis that has been conducted with applications similar in nature. The system provides various features as shown in figure 2.

- The Research Methodology application provides the students with content ranging from slides to text-based notes.
- The application also provides tips for the subject.
- The application is also modular because the text-based content is in HTML meaning that non-developers could change the content with ease.

The use case model for the application is presented in the following Figure 2.

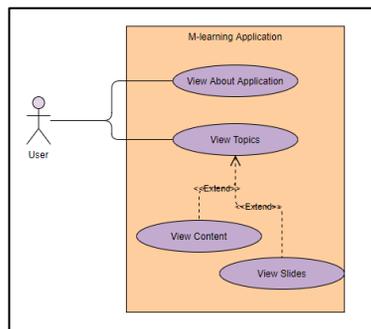


Figure 2: Use Case Diagram

Phase 2 – Design

Based on the usability study performed, several mock user interfaces have been created. Based on Seraj and Wong's (2012) research, to design a mobile application there are a few principles that are needed to adhere to which are: navigation should be simple and clear from a page to any particular section. In short, the navigation should be consistent throughout all pages in an application. Complex navigation needs to be avoided by the developer on the application, and the application should be user-friendly and allow learners to understand how the application works in a few minutes. Figures 3 and 4 show the mock or sample design of the application.

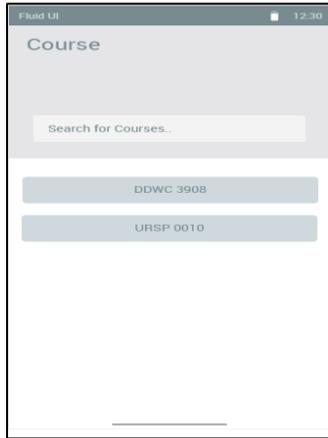


Figure 3: Mock UI Model

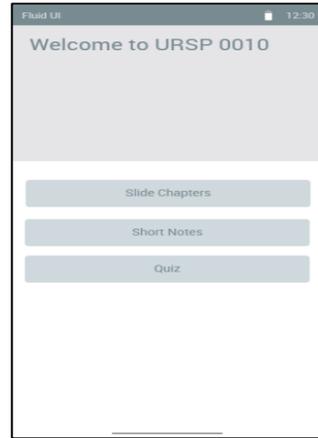


Figure 4: Sample UI Model

Phase 3 – Develop

The development of the mobile application is using a framework widely used in the industry which is the flutter framework.

The hardware utilized to develop the mobile learning application is as follows:

- i. Computer
 - a. Intel Xeon E5-2620 v3
 - b. 24GB DDR4 ECC RDIMM RAM
 - c. 240GB SSD + 3TB HDD
 - d. Monitor 3x 24” inches
- ii. Android Device:
 - a. Xiaomi Mi 9T Pro
 - b. Emulator (Pixel 3 XL)
 - c. Emulator (Tab 10” inches)

To develop the application, the software utilized consists of:

- a. Flutter Framework
- b. Android Studio
- c. Android AVD

The target operating system is Android Operating System. This mobile operating system is based on a modified version of the Linux kernel. Android is an open-source operating system and this operating system has the most market share at the current time of conducting this research at around 70 percent (Seraj & Wong, 2012).

Testing

To test the application, White-box testing, also known as structural testing is employed in this research. It provides a clear expectation of how the application system is supposed to react under various inputs provided by the tester. Figure 5 shows the White-box testing approach, and Figure 6 illustrates the test results or cases.

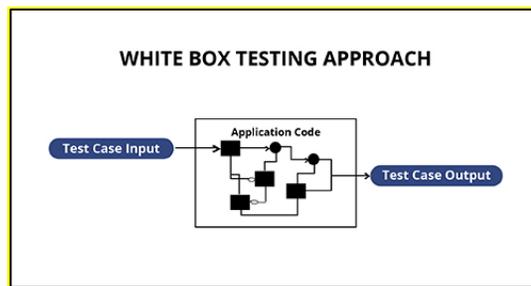


Figure 5: Splash Screen

4.0.6.1 - Test Case 001 - (CHAPTER REDIRECTION)						
Test Case ID	Date Tested	Tester	Input data	Expected result	Actual result	Pass/Fail
TC001_01	23/2/2021	Ahmad Faris Aiman bin Arizal	Click on Chapter 1 button	Redirect to Chapter 1 menu	Redirect to Chapter 1 menu	Pass
TC001_02	23/2/2021	Ahmad Faris Aiman bin Arizal	Click on Chapter 2 button	Redirect to Chapter 2 menu	Redirect to Chapter 2 menu	Pass
TC001_03	23/2/2021	Ahmad Faris Aiman bin Arizal	Click on Chapter 3 button	Redirect to Chapter 3 menu	Redirect to Chapter 3 menu	Pass
TC001_04	23/2/2021	Ahmad Faris Aiman bin Arizal	Click on Chapter 4 button	Redirect to Chapter 4 menu	Redirect to Chapter 4 menu	Pass
4.0.6.2 - Test Case 002 - (SLIDE REDIRECTION)						
Test Case ID	Date Tested	Tester	Input data	Expected result	Actual result	Pass/Fail
TC003_01	23/2/2021	Ahmad Faris Aiman bin Arizal	Click on Chapter 3: Writing a Research Proposal button	Redirected to Chapter 3: Writing a Research Proposal slide	Redirected to Chapter 3: Writing a Research Proposal slide	Pass
4.0.6.3 - Test Case 003 - (ABOUT)						
Test Case ID	Date Tested	Tester	Input data	Expected result	Actual result	Pass/Fail
TC004_01	23/2/2021	Ahmad Faris Aiman bin Arizal	Click on about application	Redirected about application	Click on about application	Pass

Figure 6: Test Cases

Phase 4 – Implement

In the ADDIE model, this phase is where we distribute our end product to our audience, hence uploading it to the learning management system (LMS and others). However, this study still not reach this phase.

Phase 5 – Evaluation

In the ADDIE model, this phase is where we evaluate whether our end product is effective and meetings its goal (for example, by a survey of users when they finished their course). However, this study still not reached this phase yet.

RESULTS

This section presents the results of this research, that is, how the mobile application could be executed. The interface of the application is as follows:

1) **Splash Screen**

This page is simply the splash screen for the application, it will display the application logo upon startup as seen in Figure 7.



Figure 7: Splash Screen

2) **Dashboard**

This dashboard page will display the available topics for the user to access, quiz and tips as seen in Figure 8.

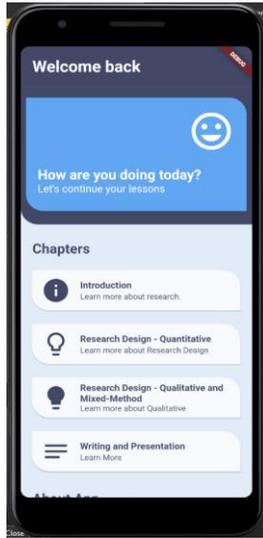


Figure 8: Dashboard

3) Subtopic Dashboard

This subtopic dashboard shows the subtopics available in a topic, usually, it contains the notes in HTML format as shown in Figure 9. Users can also view PDF files which are the slides as shown in Figure 10.



Figure 9: Subtopic Dashboard



Figure 10: Slides

4) About the application

This screen will show application information as shown in Figure 11.



Figure 11: About Application

5) Content Viewer

This content viewer shows the content depending on what the user selects as shown in Figure 12 and Figure 13.

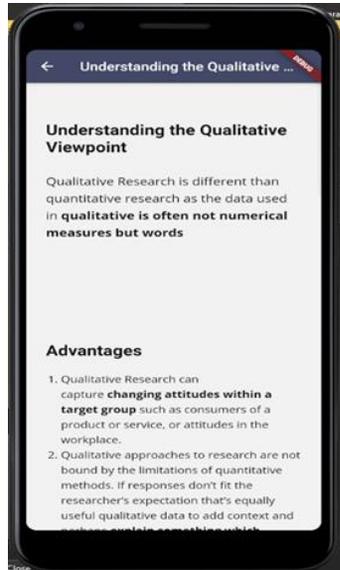


Figure 12: HTML Content

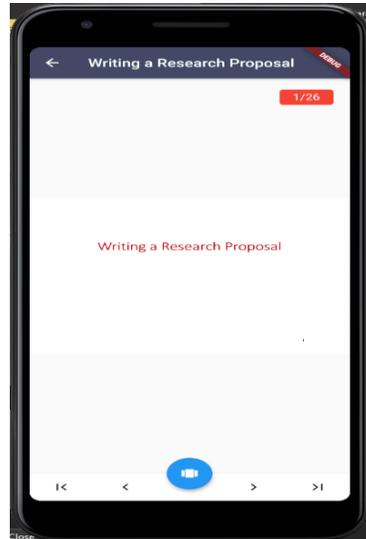


Figure 13: Slide Content

CONCLUSION

Utilizing mobile devices such as smartphones as learning device is an excellent idea as postgraduate students are well-equipped with a smartphone. Information is accessible anywhere and at any time. The result of this study is an m-learning application focusing on the course of Research Methodology. This course is targeted at students due to it being a compulsory course amongst postgraduate students. The application incorporates modular HTML files so that more topics can be added and can allow a variety of notes as well. Future slides can be added due to the modularity of the coding. Students could test their knowledge by doing quizzes embedded in the application. The user interface was developed based on the usability outlined by Nielsen. The evaluation phase is not yet conducted because the application is partially completed. In the future, the Nielsen Usability Study and assessment of students' reception towards the application would be measured. From the evaluation phase, an application could be improved before it could be released to students.

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