

## **Little Muslims: An Educational Mobile Game based on Islamic Study Textbook**

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**Abstract:** Little Muslim is an educational mobile application developed for autistic students of Sekolah Kebangsaan Jelapang Jaya. It is aimed to resolve the issue of student limitation to study from textbook and notes at class. This is by providing alternative interactive learning medium to facilitate students learning out of class. The learning content used in Little Muslims is based on Islamic Study for First-Grade and Second-Grade Special Need Student which is the target user. The methodology used for development is Agile which involves planning, implementation, designing, developing, testing, and feedback analysis. The observable results of the project are the application is functioning properly, require low navigational skill from user, and facilitate target student's retention. The testing result shows that the project was success in both development and its implementation. However, some improvement were required especially in program optimization and wider learning chapter coverage.

**Keywords:** Little Muslim, Mobile Application, Sekolah Jelapang Jaya, Students, Autistic, Agile

### **1. Introduction**

The term E-learning stands for electronic learning which comprises of learning using digital medium such as computer, kiosk, tablet, mobile and such. Nowadays, it is such a prevalent method of learning that a lot of company and institute uses it to facilitate teaching and learning. Both online and offline learning are often supported by electronic hardware and software [1]. Since people in general are vastly interconnected and tech-savvy nowadays, E-Learning was made plausible and reasonable given it provides a lot of advantages and flexibility. One of its benefit is provide the user with ability to control their time and area of learning. This also further enhanced by the capability of e-learning to provides its learner various form of learning approaches by the utilization of interactive content available through digital media [2]. Albeit, E-learning is not a method of teaching and learning without

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flaws and challenges. There are several cases of E-learning implementation that loses its effectiveness due to lack of engagement from its user. Therefore cautious measurement and actions are still required when developing and using the medium to maintain its purpose and effectiveness. It is necessary to take into consideration regarding the individual differences of students and personalized design to build effective online learning experiences [3].

Sekolah Kebangsaan Jelapang Jaya (SK Jelapang Jaya) is a primary school at Kampong Dato' Ahmad Said Tambahan 3, Ipoh Perak. SK Jelapang Jaya comprises of students from age seven to thirteen. While the school primarily takes normal student, there are also classes for students with special needs. One of the teacher, Miss Julizatul Mariam Binti Abdul Akiz teaches Islamic Education (Pendidikan Islam) for students with autism, cerebral palsy and down-syndrome through books and class education. For these students, notably those with special needs, there is a potential to provide an alternate learning style that is more engaging and interactive. Therefore, Little Muslim was proposed as an educational mobile application developed for autistic students of SK Jelapang Jaya. It is aimed to resolve the issue of student limitation to study from textbook and notes at class. This is by providing them alternative interactive learning medium to facilitate their learning.

Little Muslims is aimed at 1<sup>st</sup> grade and 2<sup>nd</sup> grade autistic students of SK Jelapang Jaya. This application focuses on the subject Islamic Education for 1<sup>st</sup> grade and 2<sup>nd</sup> grade students exclusively. The content of this application will be based on the Islamic Education books for special students provided by Kementerian Pelajaran Malaysia (KPM) and used by teachers at SK Jelapang Jaya. The language used in this application will be in Malay. This application has two module which are learning module and game module. In learning module, two chapters and its sub-topic from 1<sup>st</sup> grade and 2<sup>nd</sup> grade Islamic Study textbook were arranged and simplified. The stated chapters were also combined respectively due to their similarities content-wise. In game module, students are able to play a game that related to the topics they have learned. The application is in 2D and heavily emphasizes on Visual and Aural aspect of learning based on VARK model. Users are able to navigate the interfaces through interactive button. Certain interactive button were standardized within their respective category to facilitate new user familiarity. Besides that, audio cues are also provided for related graphic to facilitate aural learning.

For paper organization, Section 1 discusses the project introduction which includes statement to motivations of the current study, problem statements, issues, objective, scope, hypotheses and the expected outcome. Section 2 discusses the related work involved in project research. This includes information regarding autisms, android mobile technology, and comparison of three reviewed application. Section 3 discusses the methodology used in the project which is Agile. Since Agile comprises of several development phases, they are also discussed in-depth. Section 4 discusses the result and finding of this application. The data collected from testing is presented and analyzed to measure the project accomplishment. Section 5 is the closure to this paper. The result of testing was concluded and several notable weakness and improvement are specified to contribute similar future works.

## **2. Related Work**

This section discusses topic on autism, which will be the basis for the application development and the technology that will support the installation. In addition, some of the applications that has have relevancy and relation to this project are also discussed, in order for the developer to learn and improve the methodology approach during Little Muslims development.

## 2.1 Autism Syndrome Disease (ASD)

Autism Spectrum Disorder (ASD) is a neurobiological disorder that significantly impairs reciprocal social relations, verbal and nonverbal communication, and behavior of an individual [4]. Individual that suffers ASD often requires more effort to learn, behave in social expectation, or in general communication. Due to that, ASD diagnosed individual requires immense care and consideration by people around them to perform their activity. This especially crucial in the case of a child or young individual that suffer from ASD during their learning session. Students with ASD often do not achieve the same academic results as normal students who are typically developing [5]. Despite the fact that their implicit learning capacities appear to remain unaffected, their social and communication issues prevent them from making the best use of the teachers support during their learning process. Besides that, a study shows that (41.4%) of youths with ASD spent most of their free time playing video games [6]. Because of that, Little Muslims was proposed to incorporate 2D gamification of learning to enhance the student learning experience and improve their retention.

## 2.2 Android mobile technology

Android is an operating system (OS) widely used in smartphone nowadays. Android serves as a system that enable software to run and perform on kernel level for many uses. Generally, people uses Android mobile devices in their daily life for communication, business, profession, entertainment, and education. This also applied to E-Learning which has become more prevalent and recognized since Coronavirus pandemic during 2019. Moreover, Android has been the choice of many big tech companies to work with due to their robustness and popularity. This causes the Information and Communication Technology (ICT) along with Information and Technology (IT) sectors expand very rapid globally. The surge of the amount of mobile application in Google Play in recent years also proven that the Android mobile application industry is expanding and will continue for more years ahead.

## 2.3 Comparison of similar application

There are three application reviewed and analyzed as a research to develop Little Muslims. The applications were compared based on their unique characteristics and advantages.

### 2.3.1 Autism ABC App

Autism ABC App is a mobile application for autistic kids that comprises of puzzle, object matching, alphabet learning, object memorizing, object comparing and as such [7]. It is a freemium model application. Some of the contents are free while few others require paid membership to access. In most of its game content, the application observably often uses imagery, graphic and audio to interact with users. Texts were considerably used, for an instance on main menu interface and such. Also, most of the media element such as button are easy to navigate and learn. Meanwhile, certain access to information of the application are locked by a pop-up of multiplication question. Example of case is when signing up and paying for a subscription. Based on these findings, this application may serve as exemplary to develop an application that is minimalistic and easy to understand by users especially kids. The use of popup is also unique to the application. It may be serve as a confirmation to the individual mental capability. Hence, the Little Muslim application also replicate some of Autism ABC App user interface (UI) and user experience (UX) key design and implemented it. One of it is the use of audio cues for relevant content such as alphabet learning and interactive button feedback. The interactive button of the application was also design in standardized form to improve and maintain user familiarity with the UI during navigation.

### 2.3.2 Belajar Hijaiyah

Belajar Hijaiyah is a mobile application for hijaiyah or Arabic alphabet learning [8]. The application comprises of learn and game mode. It is a freemium model application. Some of the contents are free while few others require paid membership to access. In its learning mode, users are able to learn how to read and write the alphabet letters. In game mode, users are able to play mini-game related to the alphabet learned. There are variety of game type available which differs and unique from one to another. The graphic and media used in the application are also bubbly or round corner in appearance. The button are responsive and gives feedback when pressed. The accessibility between the UI is also easy to navigate and understand. Based on these findings, this application may serve as exemplary to develop an application that is relaxing, captivating, and easy to understand by users especially kids. Hence, the Little Muslim application also replicate some of Belajar Hijaiyah UI and UX key design and implemented it. Most of the graphic used in the application have round edges. Little Muslims also splits the two module which are learn and game to facilitate UI navigation and the continuity of type of content standardization. Other than that is the presence of a character or an avatar as a form of companion to the user when navigating.

### 2.3.3 AutiSpark

AutiSpark is a mobile application for autistic students to train their cognitive thinking [9]. The application comprises of several module including game, daily activities, and social video. It is a freemium model application. Some of the contents are free while few others require paid membership to access. In game menu, users are able to select the game they desired which varied from object matching, puzzles, learning word, letters, and more. In regards to interface, most of the graphic were animated. Other than that, the content inaccessible by free users are marked with darken colored background and locked icon. Besides that, the accessibility between interfaces were intuitive and responsive. Based on these findings, this application may serve as exemplary to develop an application that is fluid with animation. The transition used in this application invokes a feeling of continuity to users when navigating different interfaces. Hence, the Little Muslim application also replicate some of AutiSpark UI and UX key design and implemented it. The amount of unique mini-games available helps inspire Little Muslims game module. Besides that, the animations that were used in AutiSpark also served as good example for Little Muslims when changing interfaces or moving graphics components.

### 2.3.4 Comparison between reviewed applications

Table 1 shows the summarized comparison of reviewed applications.

**Table 1: Comparison table between reviewed applications**

	Autism ABC App	Belajar Hijaiyah	AutiSpark	Little Muslims
Operating System	Android and IOS	Android	Android	Android
Exclusivity	Freemium	Freemium	Freemium	Free
Module/ Content	Learn and game	Learn and game	Learn and game	Learn and game
Internet Requirement	Online and offline	Online and offline	Online and offline	Offline
VARK Model Elements	Visual and Aural	Visual, Aural, and read or write	Visual, Aural, and read or write	Visual and Aural
Demographic	Kids below age of 13 and autistic	Kids below age of 13	Kids below age of 13	Kids below age of 8 and autistic

## 3. Methodology/Framework

The methodology used for this project is Agile. It comprises of several phases throughout the weeks of development including planning, implementation, designing, developing, testing, and feedback analysis.

### 3.1 Planning Phase

During planning phase, information regarding the project initiation were gathered and analyzed. This includes the problem statement, hypothesized solution, objective, target user, scope and expected outcome (refer to Section 1). A Gantt chart was created to facilitate time management and flow of the project development. Flowchart of the proposed application was also designed to envision the expected product. Lastly, the submission of proposal containing details of the project based on the information and requirement gathered throughout the planning phase.

**Table 2: Software requirement**

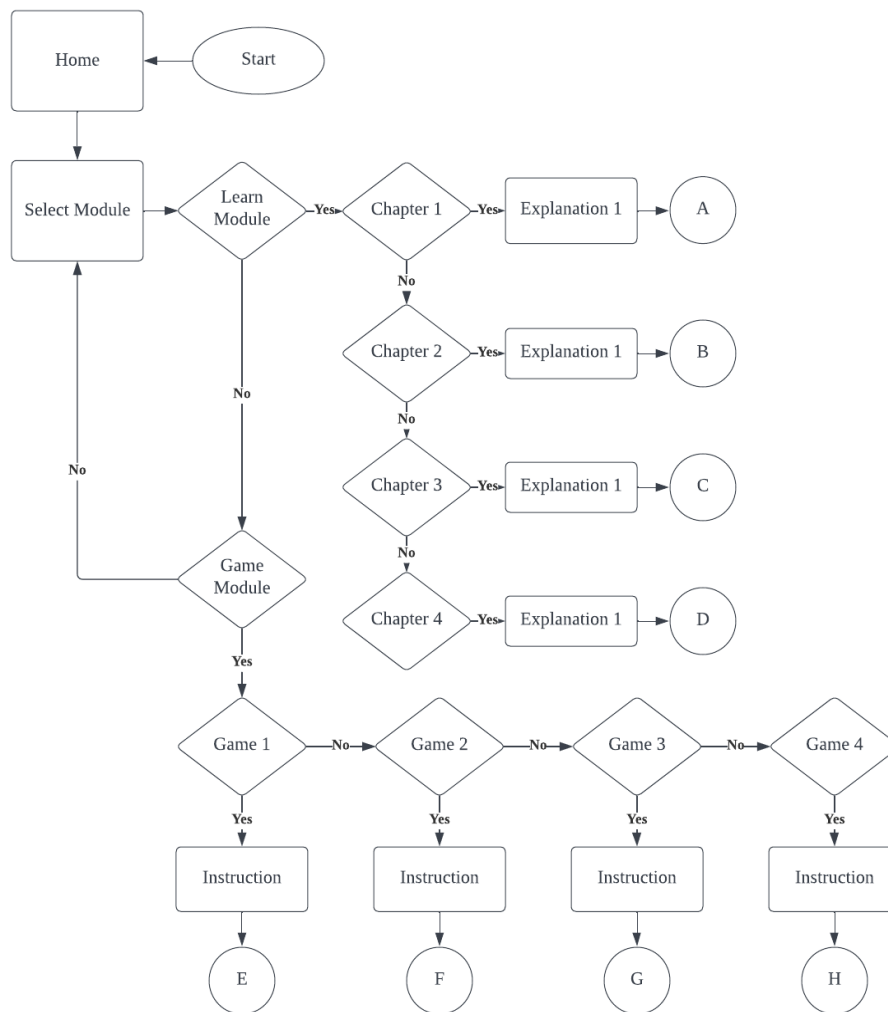
No.	Component	Function
1	Adobe Illustrator	To design storyboard
2	Adobe Photoshop	To edit graphic and images
3	Unity	To develop Little Muslims
4	Microsoft Visual Studio	To program and compile C codes

As shown in Table 2 Adobe Illustrator is the primary tool to arrange and design storyboard for Little Muslims. Meanwhile, Adobe Photoshop is the essential tool for modifying and editing some graphic to suits the application design. As for Unity, it is the primary tool for developing Little Muslims. The assembly of assets and functional components were mostly done in Unity. Whereas Microsoft Visual Studio facilitate the C programming and scripting for objects in Unity.

**Table 3: Hardware requirement**

No.	Component	Specification	Function
1	Computer	<ul style="list-style-type: none"> <li>• Windows Operating System</li> <li>• Ryzen 5 2600 CPU</li> <li>• Radeon RX580 GPU</li> <li>• 250GB SSD Storage</li> <li>• 16GB RAM</li> </ul>	To design and develop Little Muslims
2	Mobile	<ul style="list-style-type: none"> <li>• Android Operating System</li> <li>• Model: POCO X3</li> </ul>	To conduct functionality test

As shown in Table 3, computer is required to run the developer software and to test Little Muslims. Besides that, mobile phone is also required as a testing device and platform when running Little Muslims.

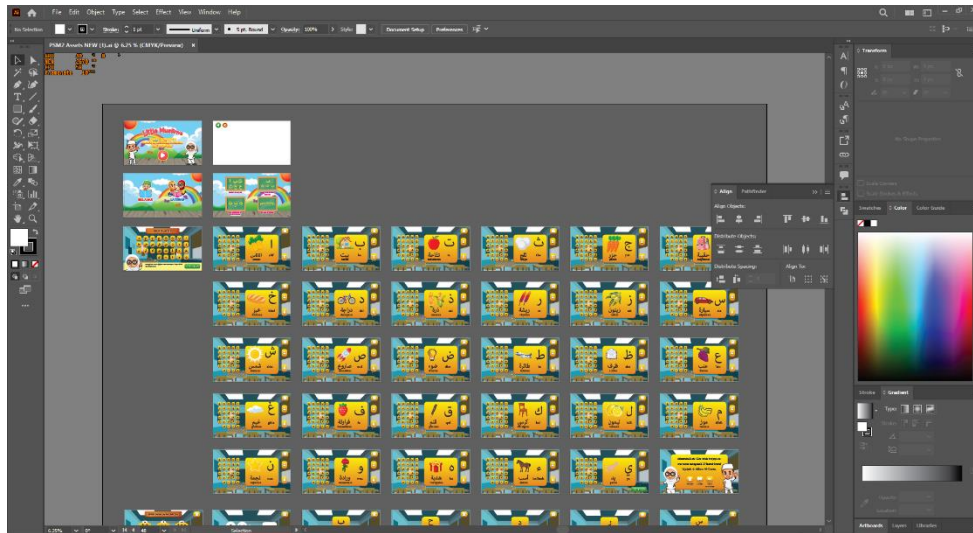


**Figure 1: Flowchart of Little Muslims**

Figure 1 shows the flowchart of Little Muslims which dictate the structure of the storyboard. User are initially directed into home page automatically. User then can click a button to enter the Select Module page to pick a mode. User can choose between Learn Module and Game Module. In Learn Module, user are given four different choices. User can choose between Chapter 1, Chapter 2, Chapter 3 and Chapter 4. Each selection have different and designated content. Upon entering any of the Chapters, user are given the choice to finish the topic or exit prematurely in any page. Exiting any of the Chapter through any possible method will bring the user back to Home. Meanwhile, upon entering game module, users are given four different choices. User can choose between Game 1, Game 2, Game 3, and Game 4. Upon entering any of the selection, user are able to play games which are related to the learning module. During the game, users are also given the choice to finish the game or exit it prematurely.

### 3.2 Designing Phase

During designing phase, the project UI and UX were designed. High-Fidelity storyboard were created using a software like Adobe Illustrator. The storyboard comprise of all user interfaces both learn module and game module (refer to flowchart at Figure 1). The graphic component comprise of natively designed assets in Adobe illustrator and free royalty graphic source. Some of the graphic component includes interactive button, images and texts. These graphics then were each isolated to export as assets for Unity.



**Figure 2: Storyboard designing**

Figure 2 shows the workspace of Adobe Illustrator where storyboard assets were designed. As shown, each interface or page of Little Muslims were separated to different artboard. Using this method, the assets can be arranged in a fixed position within a specific screen ratio in order to maintain its consistency.

### 3.3 Developing Phase

During developing phase, the designed assets were assembled in Unity. Unity is a developer software to create game, application and such across many platform. In this project, Unity was used to assemble the assets from storyboard and programmed to make it functional. Unity also uses C# as programming language. Table 4 shows the specification for Little Muslims.

**Table 4: Little Muslims specification requirement**

No.	Specification	Description
1	Operating System	Android
2	Screen-orientation	Landscape
3	Resolution	1920 x 1080 pixel (16:9)

Little Muslim is an Android mobile application. This specification was set based on the prioritization that Android mobile are more popular and accessible in general. The application was also oriented only for landscape. This specification was made based on the learning content of the application. Arabic alphabetic letters are connected and require wider space for their arrangement. Therefore, wider screen facilitate seamlessness in the student reciting surah or navigating their eye movement. Lastly, the

application uses 1920 x 1080 pixel resolution which is a standard mobile screen size by 16:9 ratio. Figure 3 shows the workspace of Unity for assets assembly.

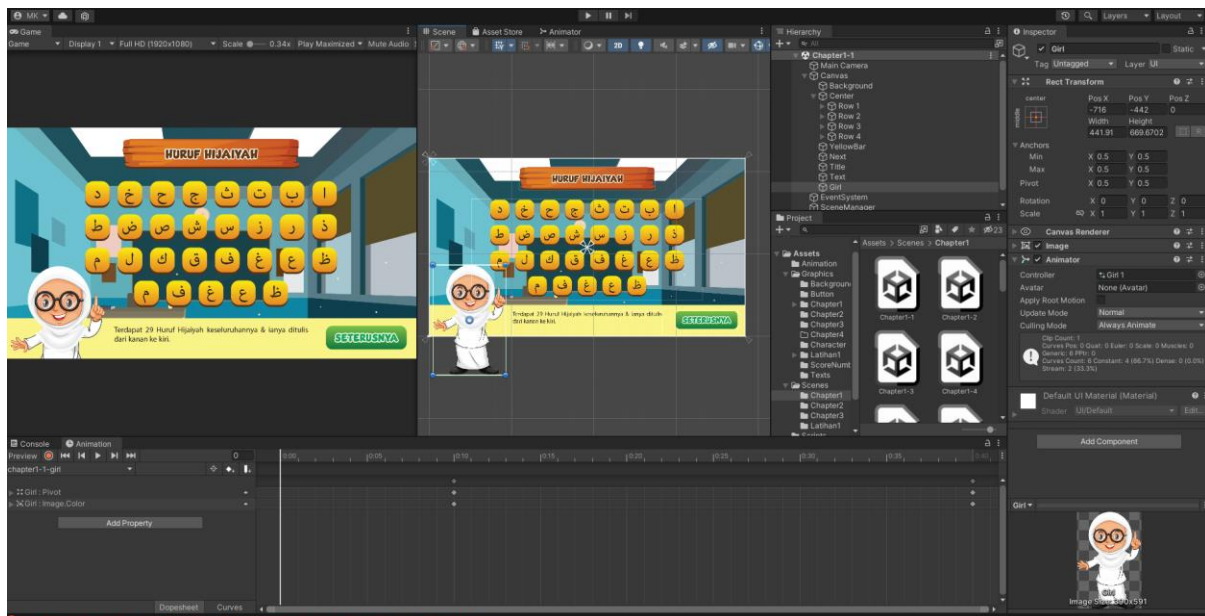


Figure 3: Assets assembly in Unity

To create interactive interface in Unity, the assets from storyboard were imported. The assets were then organized into their respective type, uses and location in storyboard. Graphic component such as button were given C program script to be functional. Figure 4 shows the C script used for button that issue scene change.

```

1  using System.Collections;
2  using System.Collections.Generic;
3  using UnityEngine;
4  using UnityEngine.SceneManagement;
5
6  public class SceneChange : MonoBehaviour
7  {
8      public void btn_change_scene(string scene_name)
9      {
10         SceneManager.LoadScene(scene_name);
11     }
12 }
13
    
```

Figure 4: C scripting for interactive button

Besides scripting command, additional object components are added to the asset to further improve their interactivity. For example, asset such as home or next button were attached with audio component. This audio serves as feedback for user to identify if the action was registered. Figure 5 shows the audio attachment of game object.



**Figure 5: Audio attachment to interactive button**

### 3.4 Testing Phase

During testing phase, the functionality and non-functionality test were carried out to measure the application performance. This include the test of stability, responsiveness, reliability and such of the application. Table 5 details the list of functional test and while Table 6 details non-functional test conducted on Little Muslims.

**Table 5: Functional test**

No.	Type of Test	Description
1	Alpha	Test was conducted internally by the developer and selected end-user to test its functionality and UX.
2	Beta	Test was conducted externally by limited group of end-user to test its functionality and UX.
3	Acceptance	Test was conducted to end-user with evaluation from developer regarding Little Muslims accomplishment in its project objective.

**Table 6: Non-functional test**

No.	Type	Description
1	Reliability	To test Little Muslims capability to run without error
2	Availability	To test Little Muslims capability to run especially on limited capable hardware.
3	Usability	To test Little Muslims ability to read, perform and plan inputs and outputs by user.
4	Flexibility	To test Little Muslims speed when running on different type of devices specification
5	Reusability	To test Little Muslims adaptability in changing or upgrade later

### 4.0 Results and Discussion

This section discusses the test that has been conducted to Little Muslim. The testing was conducted internally among selected participant to test the application usability and effectiveness. The data of the test was collect through observation.

#### 4.1 Alpha testing finding

Based on the test results of Little Muslims during alpha test, the application is functioning properly and as expected. The button in every interfaces were responsive and able to run its instruction. However, further testing found that some of the program or codes still suffers from lengthy or bugged codes. Table 7 shows the respond of users from using the application during alpha testing.

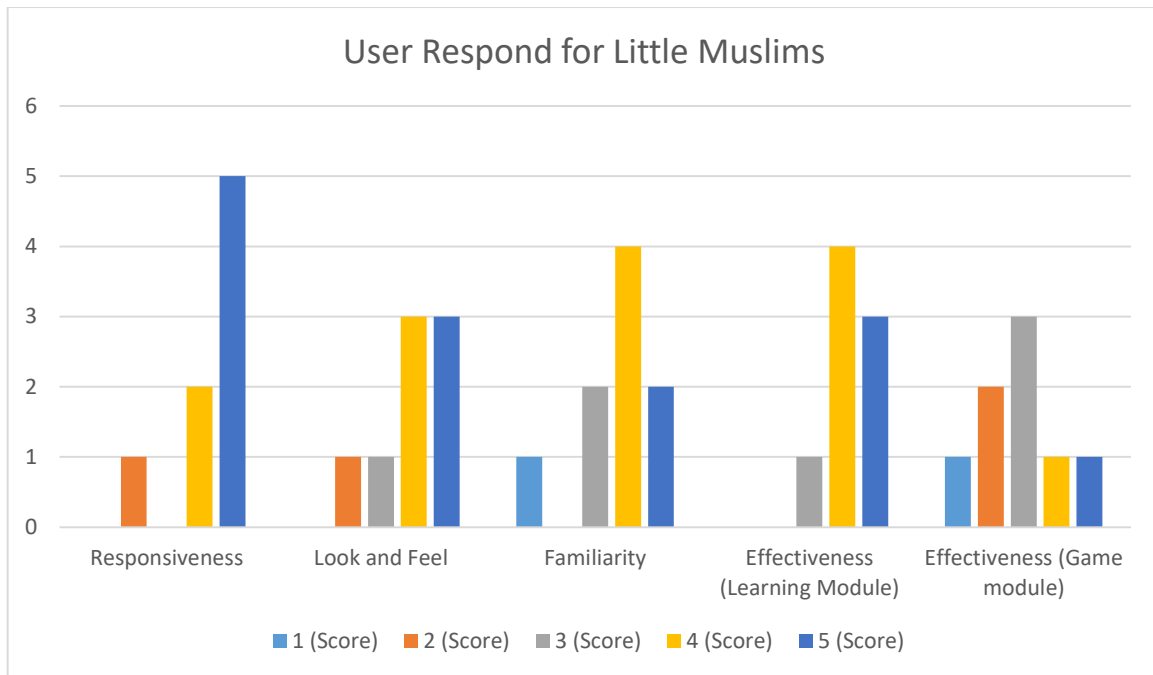
**Table 7: User respond**

No.	Aspect	1 (Score)	2 (Score)	3 (Score)	4 (Score)	5 (Score)
1	Responsiveness	0	1	0	2	5
2	Look and feel	0	1	1	3	3
3	Familiarity	1	0	2	4	2
4	Effectiveness (Learning module)	0	0	1	4	3
5	Effectiveness (Gaming module)	1	2	3	1	1

In Table 7, several data were collected from user respond in form of score. A total of 8 participant gives their score on 5 different aspect of the application which is:

- i. Responsiveness
- ii. Look and Feel
- iii. Familiarity
- iv. Effectiveness (Learning module)
- v. Effectiveness (Game module)

Responsiveness relates to the application speed in running user input or command at a given time. From the collected data, majority of the users scores responsiveness 4 and 5 which collectively are 7 votes. This indicates the application is performing above average in terms of responsiveness. Look and feel relates to the suitability of design used for the application. From the collected data, majority of the users scores look and feel 4 and 5 which collectively are 6 votes. This indicates the application is performing above average in terms of look and feel. Familiarity relates to users capability to adapt quickly to the UI arrangement of the application. From the collected data, majority of the users scores familiarity 4 while the score 3 and 5 is tied by 2 users respectively. However, the graph trend still indicates the application is performing above average. Effectiveness in learning module relates to if users felt fulfilled and the application is success in relaying knowledge to students. From the collected data, majority of the users scores it 4 and 5 which collectively are 7 votes. This indicates the application is performing above average in terms of effectiveness in learning module. Effectiveness in gaming module relates to if users feel the game content are well-tied with the learning content presented in learning module. From the collected data, the score distribution for effectiveness in gaming module were almost equally voted by 1 except in score 3. Majority of the users gave score 3 which was 3 users total. This indicates the application is performing poorly average for game module.



**Figure 6: User respond bar chart**

From Figure 6, the trend of the data shows that this application is performing above average. However, given that the gaming module does accomplish its purpose, it requires fix and improvement in the future. This can be done by revising the content again and restructure of the gameplay. Other than that, the game can be improved further by expanding or adding more dynamic game mechanic that more different and unique than current game.

## 6. Conclusion

In conclusion, Little Muslims development was a success to a certain degree. The result of testing shows that the application is functioning as intended but still require optimization and fix. Although, it accomplished its goal. Users were able to benefit from using Little Muslims for both education and game purpose. However, there are still countless of room for improvement. Considering there are few similar application in Google Play Store at the moment. The application can be expanded in terms of its application feature, content and uses in the future.

## Acknowledgment

On end note, the authors would like to take the opportunity to express countless gratitude to Faculty of Science Computer and Information Technology and University of Tun Hussein Onn Malaysia for supporting throughout this project development.

## Appendix A

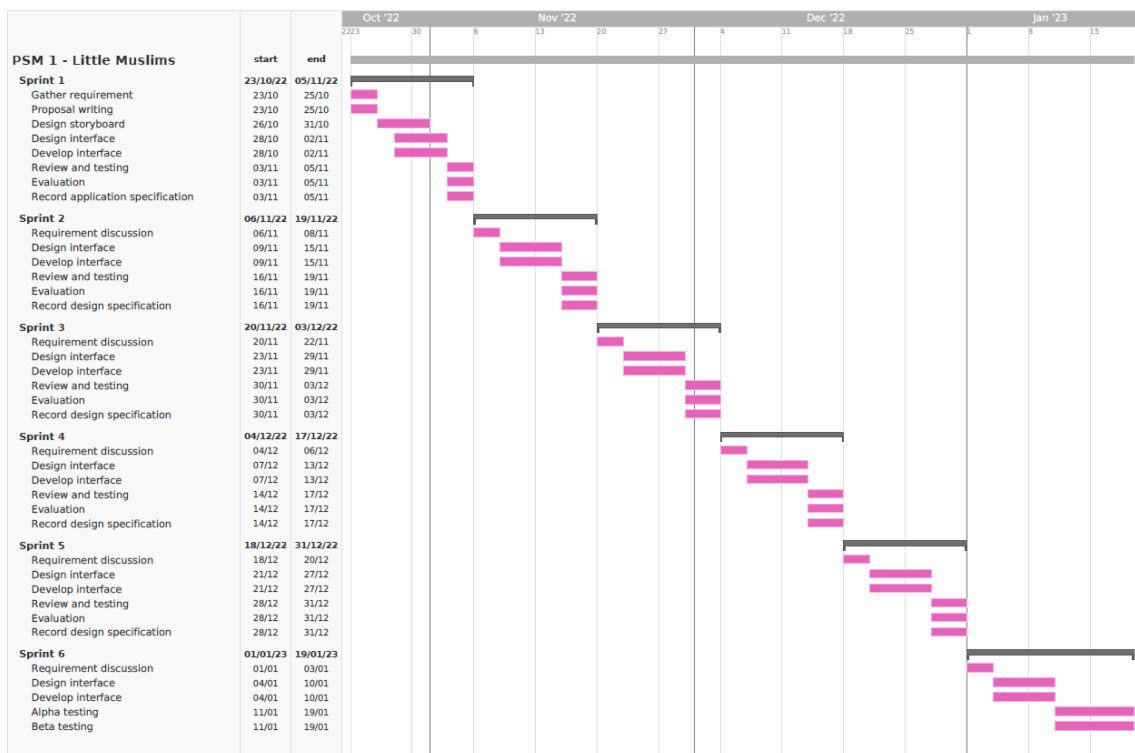


Figure 7: Gantt chart of project

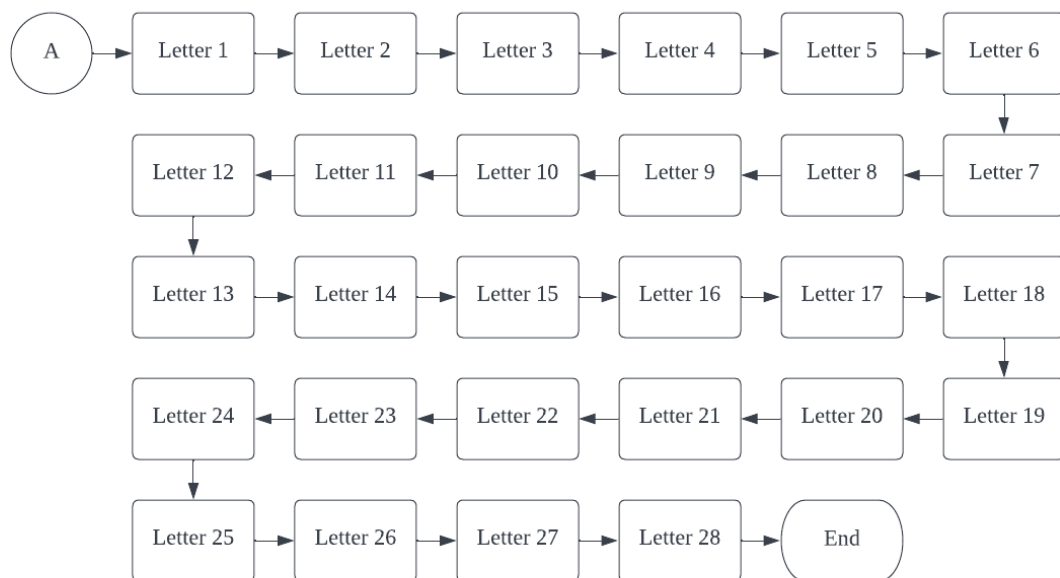


Figure 8: Flowchart for chapter 1 in learning module





Figure 12: Storyboard for chapter 4 in learning module



Figure 13: Game 1 in game module

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