MATHEMATICS PRACTICE MOBILE APPLICATION

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I hereby declare that this project report entitled

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STUDENT : _____elona_____ Date:19.8.2016_____

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I hereby declare that I have read this project and found
this project report is sufficient in term of the scope and quality for the award
of Bachelor of Computer Science (Interactive Media) With Honours.

SUPERVISOR : _____ Date: ____19.8.2016_____

(DR. IBRAHIM BIN AHMAD)

DEDICATION

To my beloved parents and family, thank you for your unconditional support with my studies. I am honoured to have you as my parents and family. Thank you for giving me a chance to prove and improved myself through all my walks of life.

To my supervisor, Mr. Ibrahim Bin Ahmad, thank you for guidance and encouragement during project implementation.

To my evaluator, Encik Muhammad Helmy Emran, thank you for providing advice during presentation and evaluating my Final Year Project.

To my friends who always give me support and together we can pursue a broad knowledge.

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This Final Year Project is the end of my journey in pursuing my degree in Universiti Teknikal Malaysia Melaka. This project has been completed on time with the support of numerous people including my supervisor, my friends and my family. At the end of my Final Year Project, I would like to take this opportunity to say thank you for all those people who are willing to lend their hands for me. Without them, this Final Year Project would not be finished on time.

First and foremost, I would like to express my deepest gratitude to my supervisor, Mr. Ibrahim, who has supported and guidance me throughout the progress of Final Year Project with her patient and knowledge. Without her, this report and product would not have been completed on time.

Next, I would like to thanks my parents who have always supported and encouraged me when I encountered bottleneck during the progress of Final Year Project. Without their support, I would not have the motivation to continue it.

Last but not least, I would like to thanks my friends as well. Thanks you for listening, offering me advice and supporting me throughout this entire semester. Thanks again for not stingy on sharing their knowledge and lending their hands for me.

ABSTRACT

The aim of this study was to design a mobile application of mathematics, both to develop training applications of mathematics to help students to practice math using a mobile phone, a third to evaluate the effectiveness of training students in the application of mathematics. The project is using ADDIE methodology, ie analysis, design, develop, implementation and evalution. Users involved is from 7 to 10 years old. Studies show mathematics practice this mobile application gives 80% of students using the kepda effect in increasing the level of mathematical calculations. In conclusion, mathematics practice this mobile application is intended to achieve the objective

ABSTRAK

Tujuan kajian ini adalah untuk merekabentuk matematik mobile application, kedua untuk membangunkan aplikasi latihan matematik untuk membantu pelajar dalam membuat latihan matematik menggunakan telefon bimbit, ketiga untuk menilai keberkesanan pelajar dalam menggunakan aplikasi latihan matematik. Projek ini menggunakan kaedah ADDIE, iaitu analysis, design, develop, implementation and evalution. Pengguna yang terlibat adalah dari berumur 7 hingga 10 tahun. Kajian menunjukkan mathematics practice mobile application ini memberikan 80% kesan kepda pelajar yang menggunakan dalam meningkatkan tahap pengiraan dalam matematik. Kesimpulannya, mathematics practice mobile application ini mencapai objektif yang ditujukan.

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LIST OF ABBREVIATIONS

SDK-	Software Development Kit
2D-	Two-Dimensional
ADDIE -	Analysis, Design, Develop, Implement and Evaluation
WWW -	World Wide Web
ID -	Identification

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CHAPTER I

INTRODUCTION

1.1 Project Background

Games are an integral part of all cultures and are one of the oldest forms of human social interaction. Furthermore, games capture the ideas and worldviews of their cultures and pass on to the next generation. According to the Mathews, Ryan, in the book "Let the Games Begin." Progressive Grocer (April 1997, 25) Games were important as cultural and social bonding events, as teaching tools and as markers of social status.

The as children grow older, their play becomes more complicated, and requires increasingly more social skills**.** According to the Brandenburger, Adam M, and Barry J. Nalebuff. Co-opetition (New York: Doubleday, 1996) Games for children should have very few restrictions but as players grow older, the games have more rules and regulations appear.

Therefore, Mathematical Practice is about to test mind how people think to solve mathematical problem follow the timing given, so this game will test how player solve the solution in the faster way, and to test the mind how to think in logic way. The purpose game that requires is a great way to focus attention, and thinks in logic way and to improve skill and interest student in mathematics subject. This projects brings to

improve a great number of mental math and often bring with them a lot of significant benefits. For this mobile application mathematical practice, all exercise are arranged in four operation, which is addition, subtraction, multiplication, division and each operation have three level which is easy, medium, and hard.

1.2 Problem Statements

In Malaysia, most children prefer to learn using computational methods rather than on paper . And will make an interest to learn more and more reduced. Moreover in mathematical subject, where what we know , exercise is very important for improving the level of our knowledge in mathematical subject

The next problem is, according to statistics in the book Warsh, David. "Game Theory Plays Strategic Role in Economics' Most Interesting Problems" Boston Globe (24 July 1994) people often easily bored when make practice on paper and the interest in learning become less and less.

According to research also those of primary and secondary are more likely to use medium of mobile in learning or to get the knowledge.

1.3 Objective

i. To design of mathematical practice learning mobile application

ii. To develop application for help student practicing in Mathematics by using mobile application

iii. To evaluate effectiveness of student use Mathematics Practice mobile application.

1.4 Project Scopes

This project primary designed for age from primary to secondary school in range age 10 years old and below. This is because this project include child concept question. From the observation range age 10 years and below is toward the practice in mobile application rather than in book.

Next, this project is focuses on mobile device only. The platform that chosen for this project is Android platform which must acquire those minimum features: Android version 1.6 for android and 1.4.69 for ios or higher, script in C#, Unity Script which is call JavaScript. Since this project is for android so the size of texture is 320x480 pixels for 1–3rd gen devices.

Furthermore, there have four operation and each operation have random question provided. The reason that random question is because to avoid student from memorize, the purpose of random question is to urge student calculate by self rather than memorize. Hence, they are have three level each operation, if student think they excellent in easy level, so they can go to medium level or hard level.

1.5 Project Significance

According to the Fischer, Stanley, and Rudiger Hornbusch. Economics. (New York: McGraw-Hill, 1983). "It's Only a Game." Economist, (15 June 1996). This game mobile application is suitable for student have problem study on paper. This project also provide four operating that student age 10 years and above should master with this operation before enter into to hard level operation. It is designed to give fun and enjoy in mathematical subject. Target ranged age for this mathematical practice is 4 years old and above. This aims to let them release tension after studying in school easily by using Android device at once improve skill in math.

Other than that, by developing this mobile application, student will obtain the benefits. For the student they will easily solve the mathematician equation if they practice everyday. Hence, with this application, they will begin their interest to the mathematical subject and understand how to solve the equation in faster way.

1.6 Expected Output

The expected output of this project is the mobile application which name Mathematical Practice game they can install successfully in Android mobile device with version 1.6 or higher. Besides that, this project mobile application can function well give fun and automatically attract the student in math subject.

For the first time user, students have to download the the application from the google application or internet. For the next, they need to install the mobile application in their own Android mobile device. Lastly, student can start to access the mobile application by choose menu of subject they want. Other than that, they can also can choose the level by clicking the option provided in mobile application.

After the mobile application is finished to develop, the testing will conduct among the students and this mobile application can help to attract the interest student in mathematical subjects.

1.7 Conclusion

The conclusion is this Mathematics Practice there have four operation and each operation have three level, which is easy, medium and hard. It is also will bring fun and happiness to student want spare time with practice at anywhere anytime. Besides that, it can increase the interest student in mathematics subject. In addition, this is a convenience mobile application and help student problem play in a variety mathematics learning of game in one downloading.

For the next chapter, the activities will be developed is literature review and project methodology. The literature review will discuss the technology and technique that being applied in the game to attract the player. Besides that, the comparison of the other game and technique applied on other game before and this Android mobile application will be discussed in the next chapter too. While the project methodology is identified the method that used to develop this project and discussed the method used. Project schedule and milestones of this project will provide and explain in the next chapter in order to ensure the progress of this project is step by step and in time that planned.

CHAPTER II

LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 Introduction

In this chapter, a literature review and project methodology for developing this Mathematics Practice mobile application would be discussed. Literature review plays an important role in developing this project. It is about gathering, analyzing and conducting the reading about the related topics of the project that implemented. For this project, most of the reading sources for the literature review are from the reference books, articles, journal, and Internet. The literature review will be done by searching articles about previous technology used in museum, reference book about Android Software Development Kit (SDK) in library, and information about the technology that is going to implement in my system through the internet.

Besides that, project methodology that used to develop the mobile application is Multimedia Production. A project methodology needs to be followed to avoid project failure and as a framework to tell developers what have to do, and to manage the project from beginning to end of the project. Every phases and processes will discuss in detail in order to help developer to structure, plan and control the process of developing the project systematically. Other than that, software and hardware requirements are listed and functionality of each of the software and hardware requirements is explained in detail. Milestone of the project is also provided in the end of this chapter to demonstrate the whole progress of the project and duration of the task to be done.

2.2 Facts and Findings

Facts and findings for this project include the definition and evolution of computerized and mobile application, what kind of question that has applied in mathematics subject, the existing mobile application of the mathematics practice and the comparison between the existing mobile application of mathematics subject.

2.2.1 Mobile Application Development

Concept of Mobile Application Development is a term used to denote the act or process by which application software is developed for handheld devices, such as personal digital assistants, enterprise digital assistants or mobile phones. According to C. Wang, W. Duan, J. Ma and C. Wang, (2003) "The research of Android System architecture and application programming", ICCSNT, (2011) more people access the web via mobile devices than from personal computers. As the number of devices expands dramatically, users are becoming accustomed to having both web and computing access via small, mobile devices and phones. According to International Journal of Multimedia and Ubiquitous Engineering (Japan: 2002), this has resulted in a significant increase in demand for developers with experience using multiple platforms such as iOS and Android. At the same time, the growth in popularity of cloud computing has increased the ability for these devices to perform functions that previously required computation power unavailable on mobile devices.

Next is, According to D. Gavalas and D. Economou, (2005), "Development Platforms for Mobile Applications: Status and Trends", Software, (While developing mobile applications), the developer should take care so as to make the application platform independent. This means that the application can run on any platform irrespective of the software or programming language in which it was developed. There are mobile applications written in Java, which run on iPad, Android, BlackBerry, iPhone, Symbian and Windows Mobile devices. Once the software is successfully developed, it should

pass a testing phase where it is checked for proper functionality or any errors and after that, it is released on a large scale basis to the customers.

2.2.2 Existing System

Different types of mobile application for mathematics practice are available in App Store or Google Play Store which allow user to download and do the mathematics practice through their device. Math Flash Card, are the examples of mobile application for mathematics practice learning.

2.2.3 Other Techniques

Math Flash Card and Kid's Math are the famous mathematics practice that applied mobile application in device for student to access it. Math Flash Card are to improve essential math skills in addition, subtraction, multiplication and division. Math Flash Card also provide time bar and twenty question for each operation and score when student finished answer the question the score display at the last. Many student were using this kind of interactive mathematics learning in their study and to attract the student in mathematics subject.

In the Math Flash Card, each operation provide random question and limit time bar. Besides that in setting part of Math Flash Card, there have setting to show correct answer, random cards, and can repeat missed cards. Next, if the student answer the question provided correctly, the time limit is increase. Figure 2.1 shows the interface after clicking start play button.

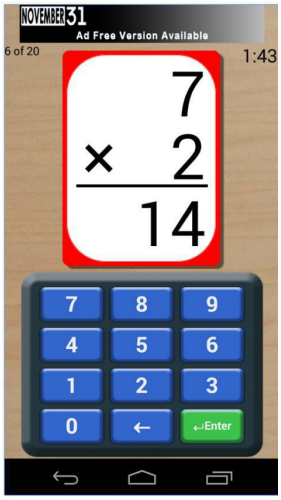


Figure 2.1 : Math Flash Card

Another example is the Kid's Math. Kid's Math is the game provide three level which is easy, normal and hard, Maximum Number, Minimum Number, Sort Number from smallest number to the biggest number and children also can learn number typing. The scopes of this game is about 9 years and below. Kid's Math also provide learning in numbering. There is also shows correct and incorrect answer. Figure 2.2 shows interface after clicking begin exercise(2.) and learning numbering(2.3) respectively.

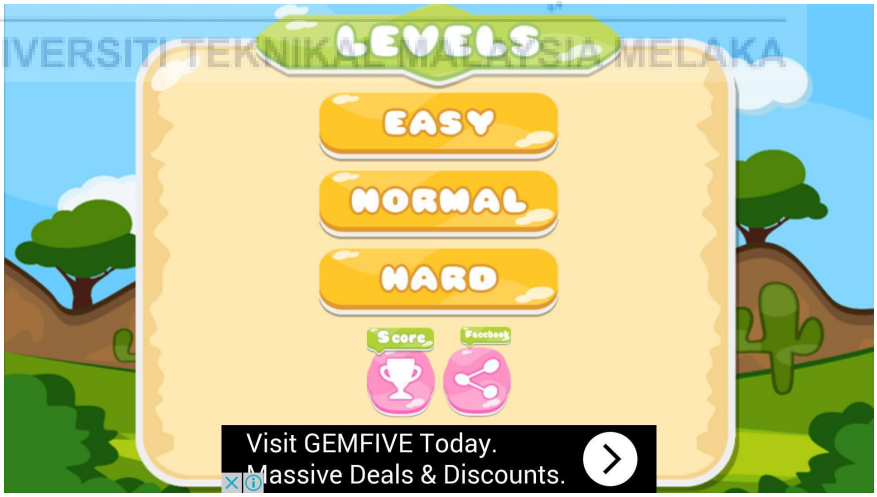


Figure 2.2: Kid's Math

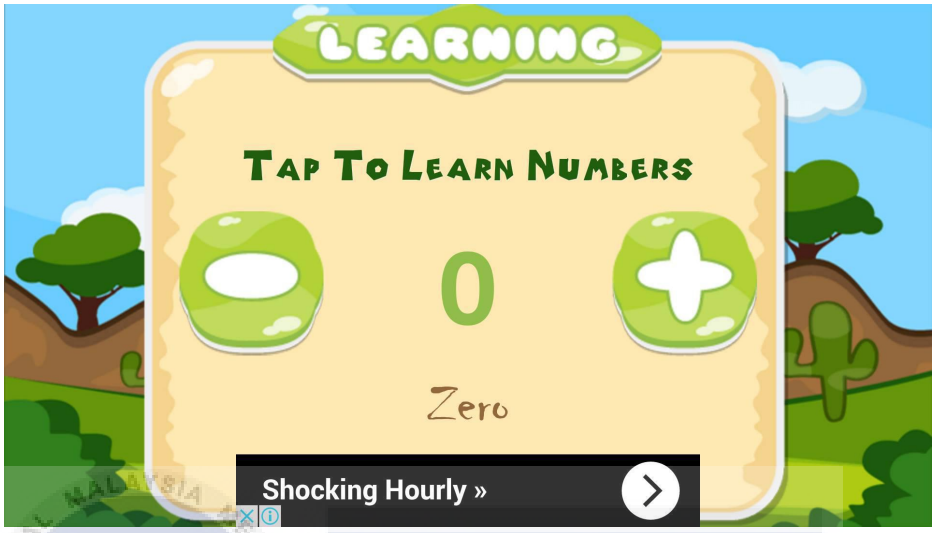


Figure 2.3 : Learning Numbering is the one of the part in menu of Kid's Math

Kid's Math have Additions is ringing two or more numbers (or things) together to make a new total, Subtractions is taking one number away from another. Thirdly, Multiplications is repeated addition, next is Divisions for Splitting into equal parts or groups. It is the result of "fair sharing" and Sorting, sorting number as descending and ascending. Finally is Counting , Counting number from 1 to 100. Based on that, Kid's Math is developed to educated through a series of educational stages.

2.3 Project Methodology

ADDIE model is the generic process traditionally used by instructional designers or training developers. This model consist of 5 phases which are analysis,design,development,implementation and evaluation. The details of the phase is stated as below:

Analysis

Problem is clarified, goals and objectives are established, the learning environments and learner's existing knowledge and skills are identified.

Design

Create storyboards, design the user interface and user experience,prototype creation and apply the graphic design fro this product.

Development

Create and assemble the content asset s that were created in design phase. The to programming language is develop suit the technology.In addition, the debugging phase. process must be perform in this The product must be tested and reviewed according to the feedback given.

Implementation

Train the learner;s with the new tools. In addition, the books and the smart-phone with the apps must be ensure to be in functional state.

Evaluation

Provide the opportunity for the feedback from the user.

Figure 2.4 : ADDIE Process

2.4 Project Requirements

Project requirements are discussed about software and hardware requirements that used for developing the application.

2.4.1 Software Requirement

Software requirement is divided into two categories which are development tools and documentation tools.

2.4.2 Development Tools

I. Android SDK

Android SDK is a SDK that allows developers to build a mobile application for Android platform. Android SDK includes a debugger, emulator, documentation, development tools, and supported libraries

II. Autodesk Maya 2012

Autodesk Maya is 3D computer graphic software that enables developers to create object or character in 3 dimensional. In this project, this software is used to create artifacts in 3D with texture.

III. Adobe Photoshop CS4

Adobe Photoshop is one of the professional graphic editing software that provides various types of effects and technique to edit the original image. This software is used to edit any original images that obtained from internet or capture and require used in the brochure.

IV. Adobe Illustrator CS4

Adobe Illustrator CS4 is vector graphic editor or creator that allows developer to create a new logo or graphic. In this project, this software is used for design logo and buttons that needed in the user interface.

V. Unity

Unity is a cross-platform game engine developed byUnity Technologies and used to develop video games for PC, consoles, mobile devices and websites. First announced only for OS X, at Apple's Worldwide Developers Conference in 2005, it has since been extended to target twenty one platforms.

VI. Android Studio

Android Studio provides the fastest tools for building apps on every type of Android device. World-class code editing, debugging, performance tooling, a flexible build system, and an instant build/deploy system all allow you to focus on building unique and high quality apps.

2.4.3 Documentation Tools

i. Microsoft Office Word 2007

Used to prepare the documentation of proposal, report and information required for question to put in the mathematics practice mobile application.

ii. Microsoft Project 2010

Used to prepare the Gantt Chart for the project in proposal and report.

iii. Microsoft Visio 2010

Used to draw the flow chart of the overall progress of the project.

iv. Microsoft Office PowerPoint 2007

Used to prepare the presentation slide for presentation.

2.4.4 Other Requirements

i. Hard disk

Used for extra storage and back up all the information and materials of the project.

ii. Printer

Used to print the proposal, report, and information related to the project.

2.5 Project Schedule and Milestones

Project schedule plays important roles in developing of a system or product. It includes the tasks that needed to do and to be done within a certain time period. The existence of the project schedule is to ensure that the process of developing the product is work according to the time that planned and to make sure the product is completed in time.

Table 2.1 : Milestone of the project

Mathematics Practice Mobile Application Development	Start	Finish
Proposal submission and presentation	22/2/2016	26/2/2016
Proposal correction and improvement		
Planning the target user	1/3/2016	2/3/2016
Report chapter 1&2	3/3/2016	5/3/2016
Analysis		
Analyze the user needs	5/3/2016	10/3/2016
Report chapter 3&4		
Demo project	20/3/2016	21/3/2016
Design		
Creating an end design	1/4/2016	14/4/2016
Project demo		

Report chapter 4	24/4/2016	28/4/2016
Project demo and PSM report	23/5/2016	27/5/2016
Presentation	6/6/2016	9/6/2016

For the further understanding of the project progress, please refer to the Gantt chart at Appendix A.

2.6 Conclusion

This chapter discussed about the literature review and methodology for this project. The literature review is done by gathering, analyzing and concluding the technology and technique that being applied on other mathematics practice, which found from Internet, reference books and articles. From the research, many mathematics practice are started to implement different kinds of methods to attract student to use this system. Other than that, in order to attract more student and user to download and do the practice through mobile device. Moreover, comparison between the previous technique and the current technique are carried out in this chapter to make summary of each technique. This is important to compare the technique used in order to optimize the satisfaction of students.

Next, ADDIE Process is chosen as the project methodology for developing this application. It includes three main stages which are Analyze, Design, Develop, Implement and Evaluation. All activities are divided and listed in the stage respectively. Besides that, based on the previous chapter, the required hardware and software that used to develop this application have listed and explained in detail in this chapter. Other than that, milestone of the project is stated and provided as a guide for developer.

Lastly, activities that will be discussed on the next chapter are analysis. Chapter analysis is analysis the product by identifying the requirement of the product and how it will be accomplished. Hence, next chapter will includes user requirement, functional requirement, non-functional requirement, and system architecture of this project.

CHAPTER III

ANALYSIS

3.1 Introduction

The Analysis Phase is also the part of the project where to identify the overall direction that the project will take through the creation of the project strategy documents. Gathering requirements is the main attraction of the Analysis Phase. Another view sees systems analysis as a problem-solving technique that decomposes a system into its component pieces for the purpose of the studying how well those component parts work and interact to accomplish their purpose. The analysis phase will find the best solution to solve the existing system's problem that stated previous. There are two parts of analysis phase that is the current scenario analysis and requirement analysis. Current scenario analysis is about the generic flow of existing scenario representation and the information that gathered in help to determine the problem of existing system. Besides that, in the requirements analysis part, it will describe the problems of the existing system, the functional requirements that will be included in the current system and defines the ways of gathering information.

3.2 Current Scenario Analysis

Current scenario analysis is identified the flow chart and architecture of the three current existing mobile applications that stated in the previous chapter. Nowadays, there have different types of SDK for GAME in mobile are available to download such as Marmalade SDK, Unity, String, Autodesk and much more. Hence, in order to understand the architecture and flow process of the current existing mobile applications, the types of the GAME SDK that used by the current exiting mobile applications will be identified and explained in sub-section.

3.2.1 Analysis of Math Academy

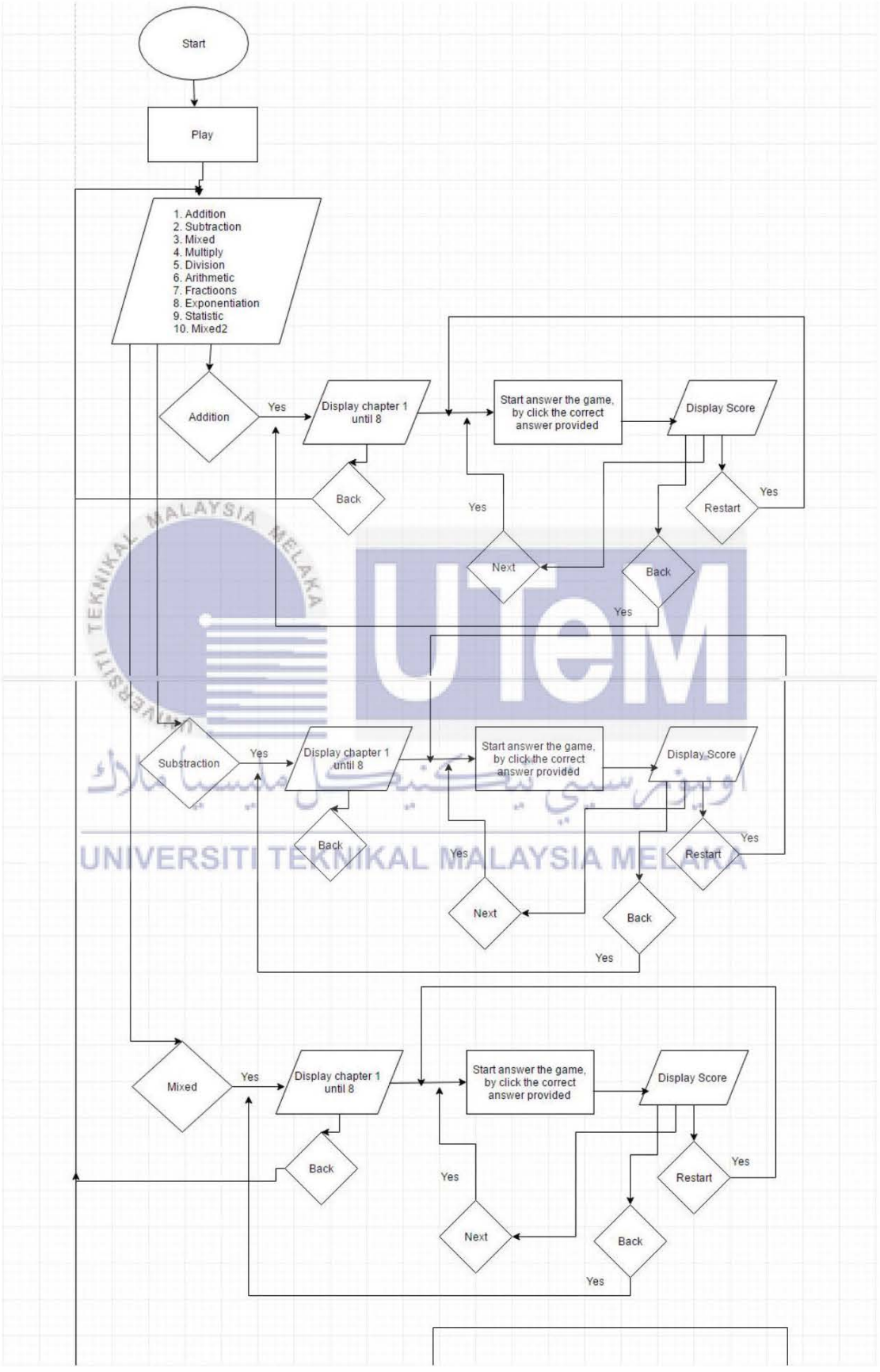
Math Academy mobile application game was using Unity SDK to implement game technique. Unity SDK is another well known game SDK for mobile devices that enables the creation of game applications. Unity provides Application Program Interface (API) in C# language, Dialect of JavaScript and Boo languages through an Unity game engine. Unity supported for iOS and Android platform.

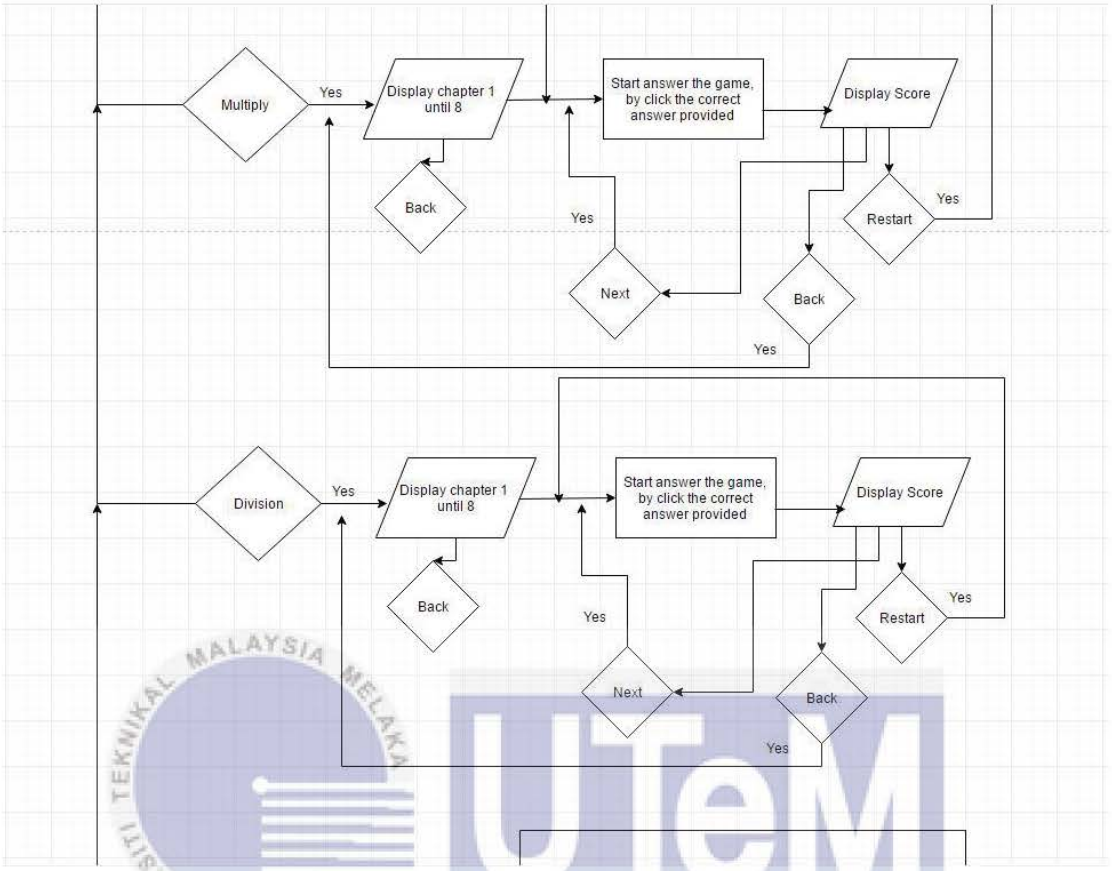
There have ten options provided in Math Academy. Table 3.1 explained each function of the options and Figure 3.1 is explained the flow of the mobile application of Math Academy. For this mobile application, the content type that used is practice mathematics. There are have ten operation and each operation have chapter by chapter. Chapter by chapter is easy to medium to difficult.

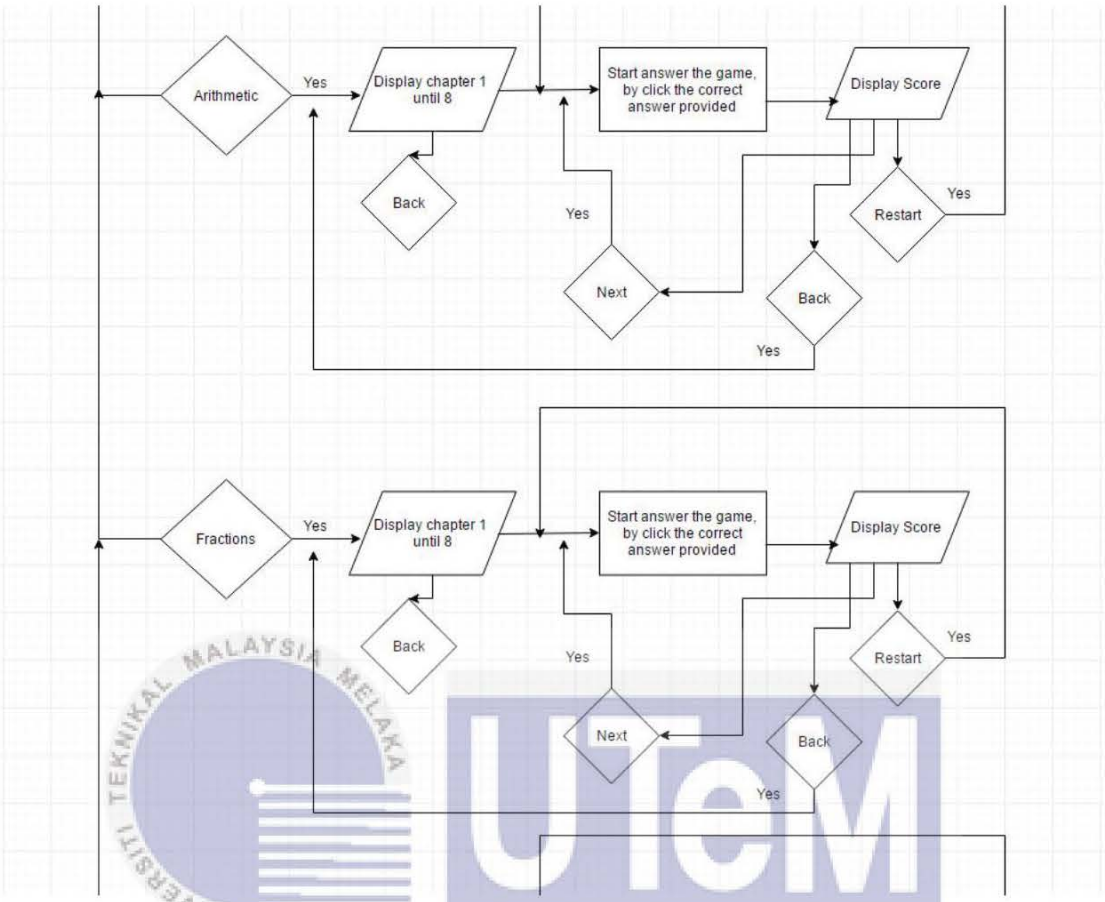
Table 3.1: Options in Math Academy game

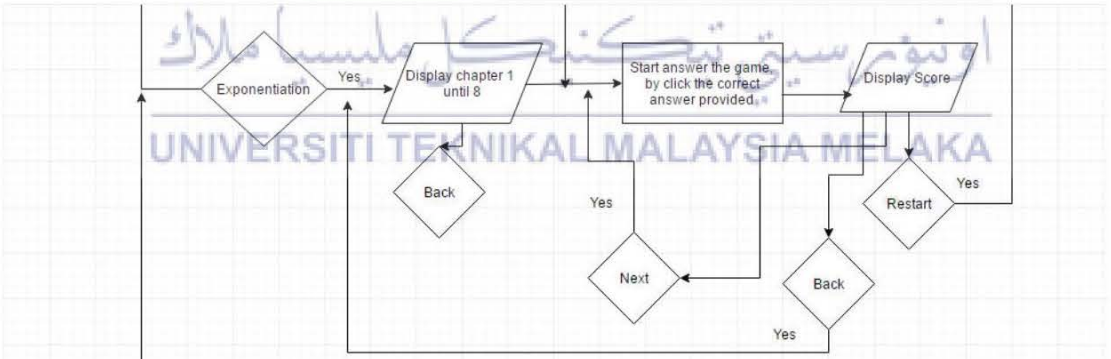
Options	Description
Play	Button display Start the game
Addition	Addition have eight chapter, and each chapter have random question provided. Must end until last chapter before go to subtraction level. The star will give based one the correct question answer
Subtraction	Subtraction have eight chapter, and each chapter have random question provided. Must end until last chapter before go to Mixed level. The star will give based one the correct question answer
Mixed	Mixed have eight chapter, and each chapter have random question provided. Must end until last chapter before go to Multiply level. The star will give based one the correct question answer
Multiply	Multiply have eight chapter, and each chapter have random question provided. Must end until last chapter before go to Division level. The star will give based one the correct question answer
Division	Division have eight chapter, and each chapter have random Arithmetic provided. Must end until last chapter before go to subtraction level.
Arithmetic	Arithmetic have eight chapter, and each chapter have random question provided. Must end until last chapter before go to Fractions level. The star will give based one the correct question answer
Fractions	Fractions have eight chapter, and each chapter have random Exponentiation provided. Must end until last chapter before go to subtraction level. The star will give based one the correct question answer
	Exponentiation have eight chapter, and each chapter have

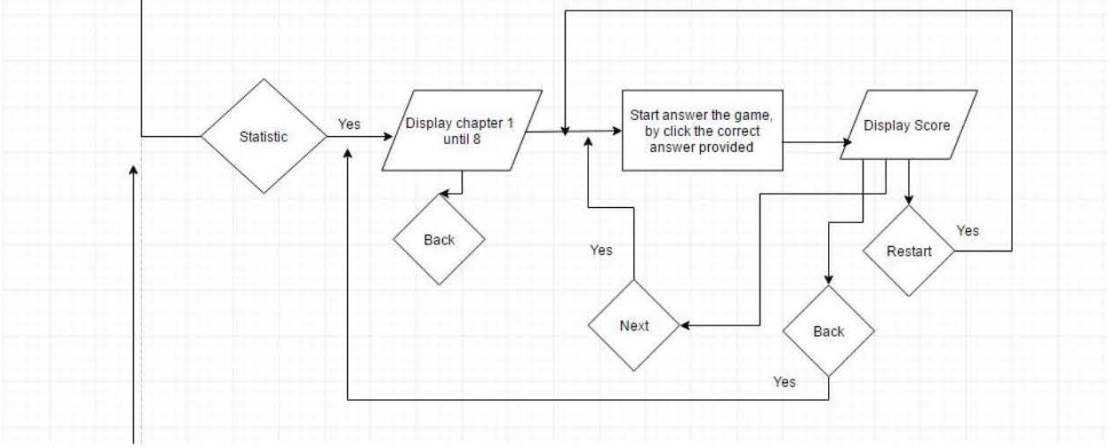
Exponentiation	random question provided. Must end until last chapter before go to subtraction level. The star will give based one the correct question answer
Statistic	Statistic have eight chapter, and each chapter have random question provided. Must end until last chapter before go to static level. The star will give based one the correct question answer
Mixed2	Mixed2 have eight chapter, and each chapter have random question provided. Finished level of Math Academy and the star will give based one the correct question answer











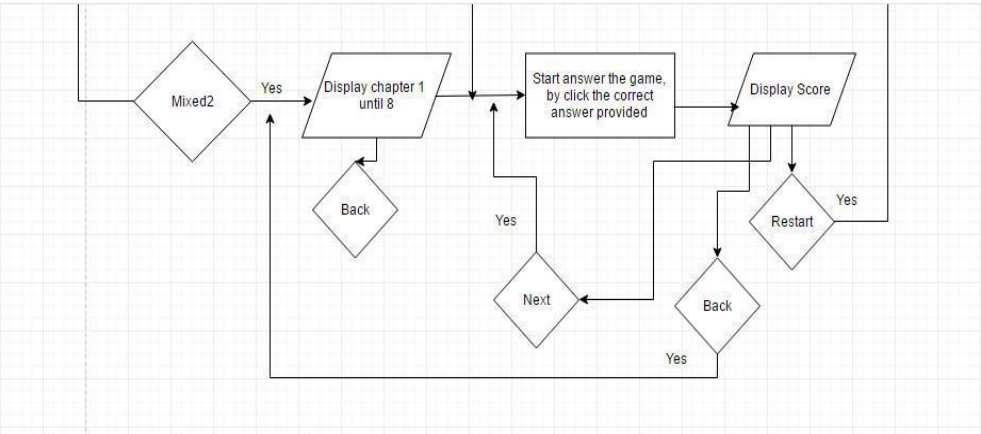


Figure 3.1 Flow process of the Math Academy game

3.3 Requirement Analysis

In this section, project analysis is divided into several categories which are need analysis, data requirement, Functional Requirement and non-functional requirements and other requirement.

3.3.1 Project Analysis

The problem analysis will help to identify and determine the problem that encountered on the existing mobile application. There are some problems for the three of the existing mobile application which are listed in the Table 3.4.

Table 3.2: Problems of the existing system

Existing Mobile Application	Problems
Math Academy game	● In this mobile application, the content type that used is practice exercise. However, there is only suitable for age 10 years and above because the content contain the

	chapter of secondary and high primary school ● User need fast adapt how to answer the question given, because each chapter contain different method to field the answer. ● Too many chapter each operation mathematics before go through the next operation, and student will quite boring to complete the chapter.

With those deficiencies of the existing mobile application, current mobile application is aims develop a new mobile application which applies mathematics practice to improve the interest of the mathematics subject in mobile games. Besides that, current mobile application is developed for 10 years and above students. Hence, ease to use is another target.

3.3.2 Need Analysis

From the one of the existing system that compared on Table 3.4, it is found that students need to pay for purchase the practice book in subject mathematics. Besides that, the fee sometimes that needs to pay is not cheap. Therefore, in order to let students can practice without any burden; a free mobile application will be develop for students to practice in mathematics subject. Besides that, this Mathematics Practice mobile application is developed with the many question provided.

The content in the brochure should have random question, and interactive. The question provided plays important roles in this project because to prevent students from memorize. In addition, interaction with in mobile application making this mobile application becomes more interesting.

3.3.3 User Analysis

This project is developed for Android platform only. Every user especially students that possesses an Android device is able to install this mobile application as free. The purpose that this mobile application developed for Android device is because frequency of users use mobile device is higher compare to others. Mobile device will always bring along by them no matter where they went. Besides that, from the observation, was distributed for ten years and below students. Hence, it can conclude that mobile application developed for mathematics subject and implemented in mobile device will attract the users especially students if compares to other ways for attracting the students to read on paper and buy book.

3.3.4 Technical Analysis

In technical analysis part, all the device and development tools that used when develop this mobile application. The purpose of technical analysis is to establish baseline technical capabilities and estimate the development cost, effort and implications of the mobile application.

Android platform is chosen for this project because it is an open source, with a very good development and debugging environment. With its openness of the Android platform, the development costs of this mobile application are free. As long as students possess an Android device, they have a chance to get this mobile application. In contrast, if the students do not possess an Android device, they cannot use the Mathematics Practice mobile application.

There have many IDEA which provides tools to allow a developer to writes, tests and deploys applications into the target platform environment. Besides that, in this project, Unity is chosen because Unity well known and do have many tutorials available in

WWW if compared to others. Unity is open source software for developer to use and create the mobile application. Besides that, it helps developer to save a lot of time because developer has to download, install and configure the package of Android version that needed. All free source codes are free and available.

To develop Mathematics Practice mobile application, it is required the SDK and SDK studio. Marmalade SDK, Autodesk, Scaleform Mobile SDK and Unity plug-in for iOS, Corona SDK, and Unity are the famous engine use for develop game. Unity SDK has provides free tutorials for beginners to develop game mobile application which available at Unity official website. In addition, it allows developer to include different types of content which have images, 3D animation, movie, and audio. Hence, Unity SDK is chosen and used to develop AR mobile application because capability of Unity SDK is better than others.

3.3.5 Resource Analysis

There have four operation mathematics practice application. The each operation have three level, which is easy, medium and hard. The operation which is are addition, subtraction, multiplication, and division. Besides that, the each operation is random because to prevent student from memorize but urge student to calculate by self. Besides that, the question of each operation is collected from book Mathematics practice for 10 years and below.

3.4 Others Requirement

In this other requirement point, will describe each software, hardware and requirement will be used and the usage justification. In this project, for software used is Unity, SDK, Android SDK, Adobe Illustrator, Adobe Photoshop, Kingsoft and Acrobat PDF. Firstly to develop this mobile application game should use Unity as medium platform to

develop game and to implement the game use C# coding. Secondly, SDK and Android SDK is to set the setting for mobile in Unity. Thirdly, for Kingsoft and Acrobat PDF is to make report. For hardware section, computer Acer Aspire E 15 with 4gig RAM and 64-bit is used. This is because for Unity SDK is only supported for 64-bit.

3.5 Conclusion

As a conclusion, this chapter consists of two main part that been discussed which are current scenario analysis and requirement analysis. The current scenario analysis analyzes the current existing mobile applications which are Math Academy with the aims to get the requirements from existing mobile application. And then design and develop a new mobile application to solve the deficiency of the existing mobile application.

For the requirement analysis, it is analysis the requirements of the system that need to be developed. As a summary, Mathematics game in mobile application is a new technique and new types of platform which can attract the students and helps to solve the problem that students faced such as the transportation issue.

For the next chapter, the activities that will be developed are design phase. Design phase is related to the architecture and flow of the mobile application. Other than that, the user interface design of the mobile application will also be included in the next chapter.

CHAPTER IV

DESIGN

4.1 Introduction

In this chapter, system architecture, preliminary design and user interface design will be defined. In the design phase, the process continues move from "what" questions of the analysis phase to the "how" questions. The Mathematics Practice mobile application is develop for primary students school. Therefore, the design of the interface and content will be discussed based on the student's attraction The overall of process will be described in picture to explain the flow of the mobile application. After defining the system architecture, next section is to develop the user interface design.

4.2 System Architecture

System architecture is the conceptual design that defines the structure of the mobile application. In this project, the main platform that used to develop the mobile application is Android SDK for Unity Developer. This project is targeted for Android smart-phone by applying the mobile technology. Therefore, Unity has to integrate two types of SDK to develop the mobile application which are Android SDK and Android Studio SDK. Android SDK is used to create the mobile application environment in smartphone.

Android SDK is chosen in this project because it is well known, free source and it provides tutorials in Unity website which easier for beginner to learn.

Other than that, this Mathematics mobile application is marker-based application. Figure 4.1 shows the system architecture of Mathematics Practice.

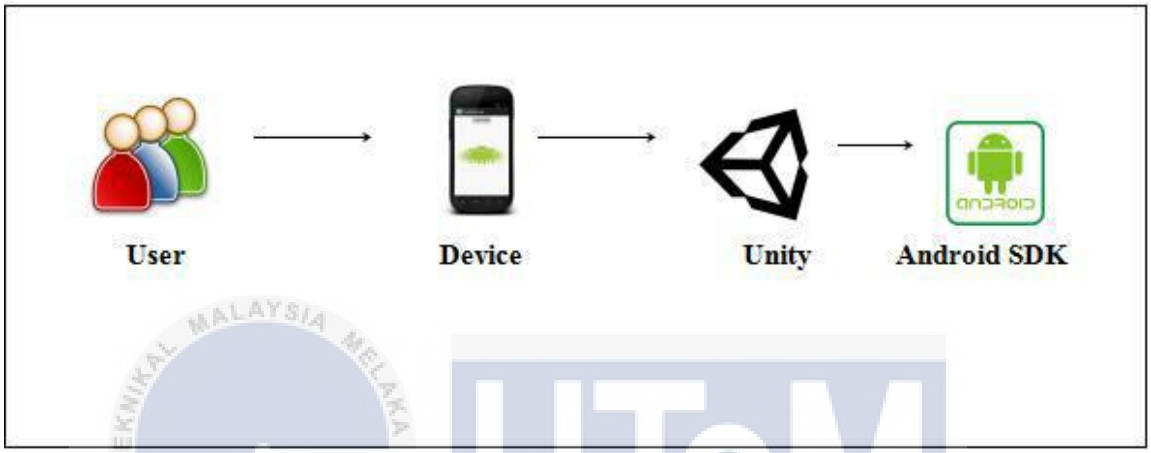


Figure 4.1: Mobile application architecture

4.3 Preliminary Design

Preliminary design is the analysis and storyboard which contains a rough sketch representation of the system. Early design phase is important for developer when developing the mobile application to ensure developer develop the mobile application in the right way and meets the requirements of students. In this phase, several designs are needed to develop the system such as flow of the mobile application and storyboard design.

4.3.1 Flow Chart

Firstly is the overall flow of the mobile application which shown in flow chart. Flow chart that designed can be known as the conceptual flow of the mobile application and

used as guidance for developer to follow when develop the mobile application. Figure 4.2 (a) and (b) are the flow of the main process of the mobile application and refer to Appendix C for the flow chart of the content of Mathematics Practice game monile application.

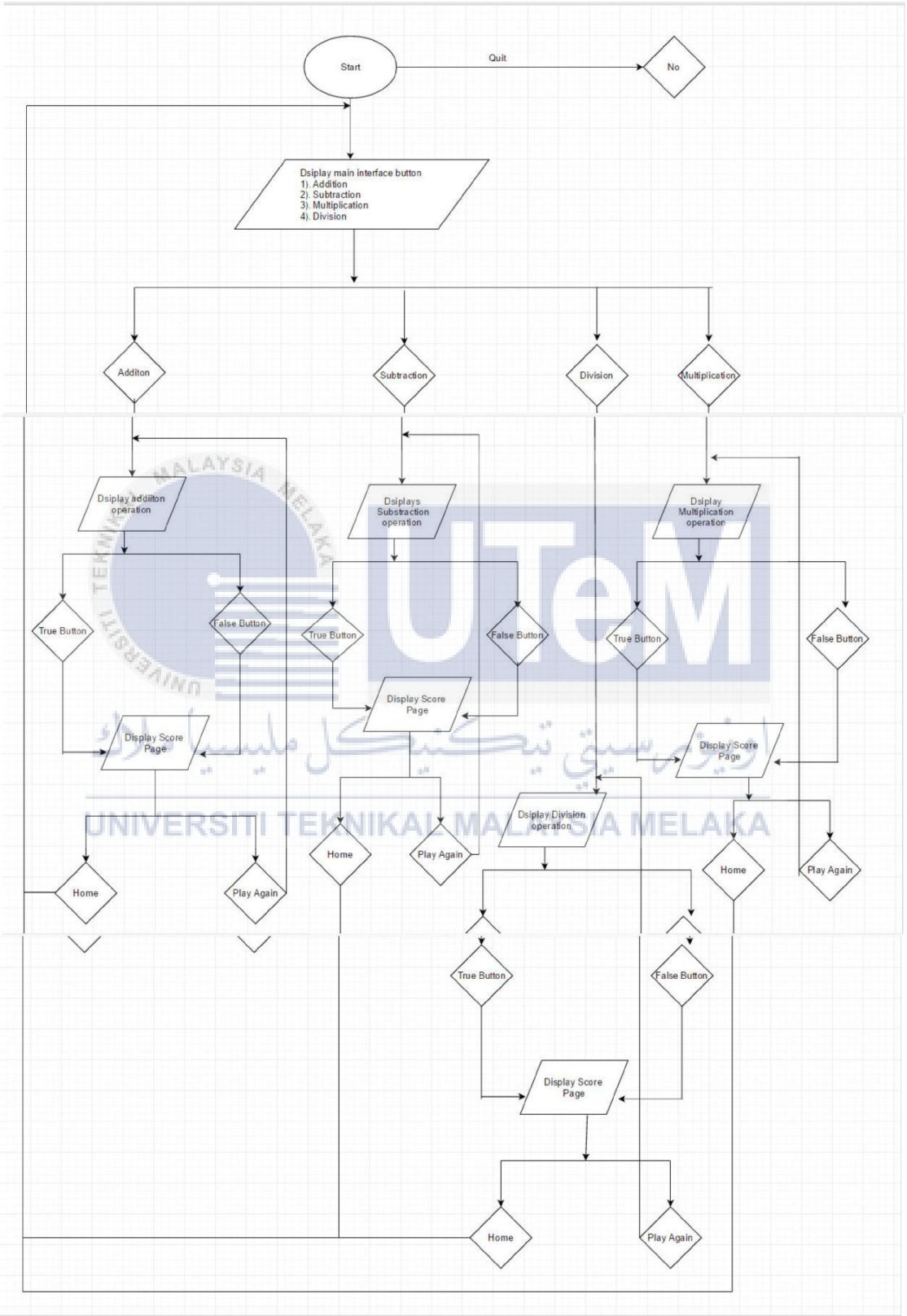
The mobile application is started by displaying a menu screen with one buttons which are button “Start”. While after enter Mathematics Practice interface, there have four buttons display. Each button have three level, which is easy, medium and hard. Table 4.1 explained the functionality of the buttons in Mathematics Practice mobile application.

Table 4.1: Functionality of buttons

Interface	Buttons	Functionality
Menu Start Button	Button “Start”	Bring users to the Mathematics Practice environment
Interface of About Mathematics Practice	Button “Addition”	Navigate to the Addition Level
	Button “Subtraction”	Navigate to the Subtraction Level
	Button “Division”	Navigate to the Division Level
	Button “Multiply”	Navigate to the Multiply Level
Interface Level of each operation	Button “Easy”	Navigate to the medium operation, for example : 3+3, 3-3, 3/3, 3x3

	Button "Medium"	Navigate to the medium operation, for example : 31+31, 31-31, 31/31, 31x31
	Button "Hard"	Navigate to the medium operation, for example : 3 +3 +1, 3-3-0, 3/3/1, 3x3x1
Interface of operation of Mathematics Practice Learning	Button "TRUE"	Click the correct answer
	Button "FALSE"	Click the correct answer
	Button "Exit"	Exit the Mathematics Practice environment in the Main Menu.
	Virtual button "Instruction"	Click to know the instruction.

(a) Flow of main process of the Mathematics Practice application



4.3.2 Storyboard Design

The quality of game design ultimately depends on a developer's creative vision. However, evaluating how close the final game experience is to the original developer's intent is often hard. Games User Research (GUR) is an emerging field that aims to get the product closer to the developer's intention in terms of the player experience. GUR analyzes the interaction between players and games to get insights from players to improve game design

4.4 User Interface Design

In this section, it is divides into several designs which are brochure design, navigation design, input and output design and icon design.

4.4.1 Navigation Design

Navigation design is a basic flow that provides a logical flow of the whole system. This Mathematics Practice is a mobile application which provides question mathematics learning Figure 4.5 shows the navigation of Mathematics Practice mobile application.

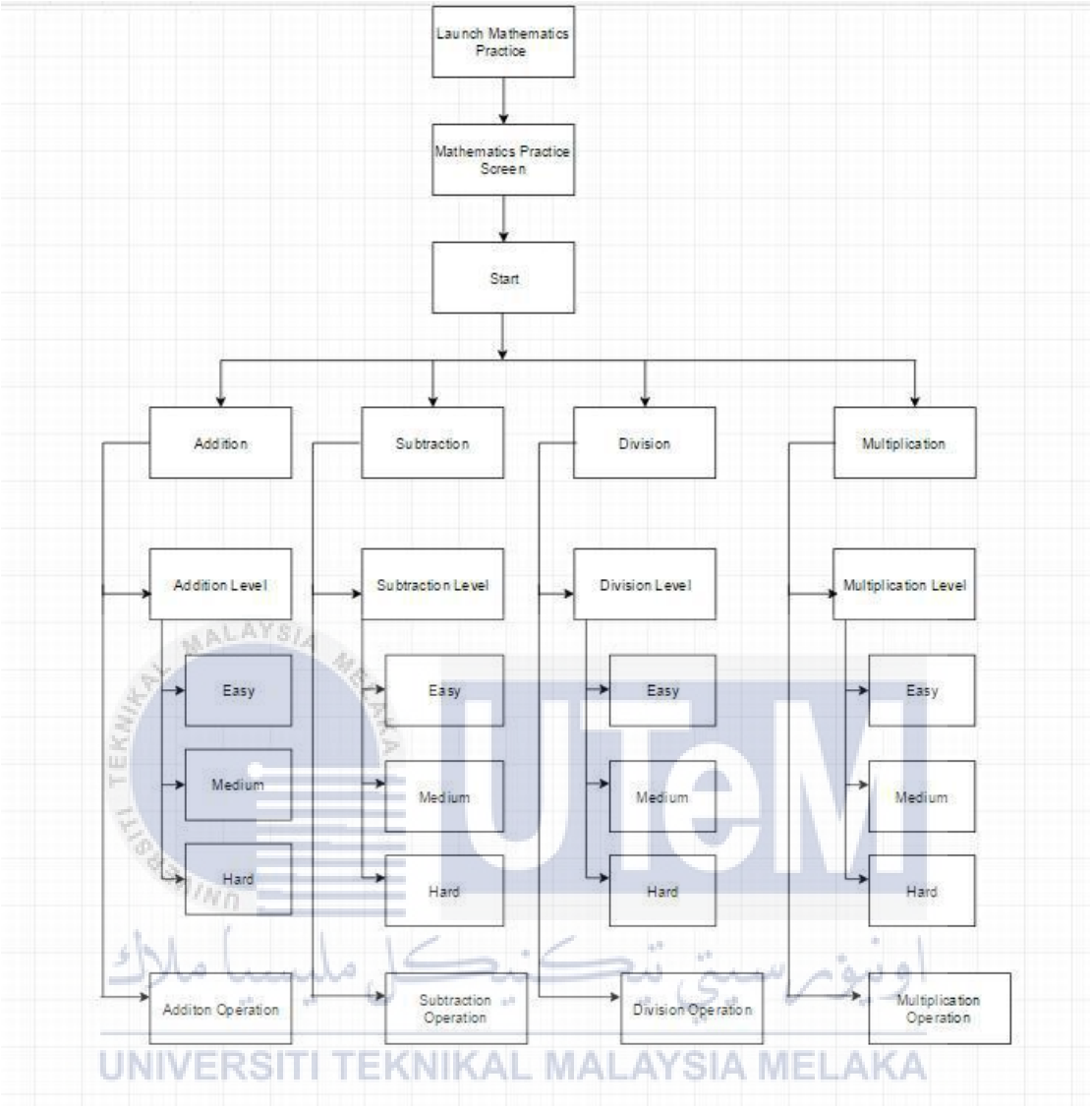


Figure 4.2: Navigation design

4.4.2 Input and Output Design

In this Mathematics Practice mobile application, the input tool is Unity Developer, which provided by developer of Android SDK. The resolution in the Unity is 720x1280 and it is size in the android.

In contrast, the outputs of this Mathematics Practice mobile application are show random question which is included addition, multiplication, subtraction, and multiplication. Firstly, each question provided random question, and it will game over if player choose the wrong answer.. Next, the purpose of the random question is to prevent student from memorize but urge student to calculate.

<table>
<tr><th>Input Design</th><th>Output Design</th></tr>
<tr><td> 

If click Start Page display Operation Page</td><td> 

Operation page</td></tr>
<tr><td> 

If Click Add/Subtraction/ Division/Multiplication Button, level scene each operation will display</td><td> 

Level Scene Add/ Subtraction/ multiplication or division will display</td></tr>
</table>

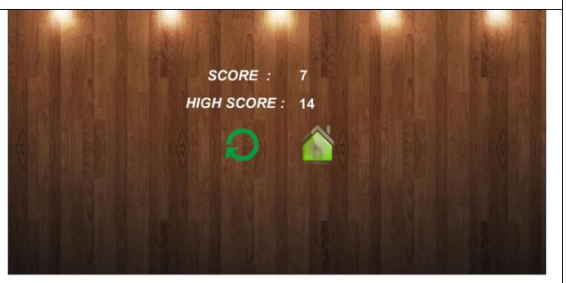
If Click Level Easy/Medium or hard, page operation will display

Easy level (Easy level which is the one number plus one number)

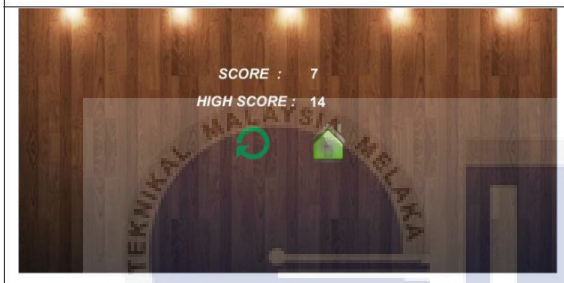
Medium level (Medium level which is the two number plus two number)

Hard level (Hard level which is the three number plus three number)

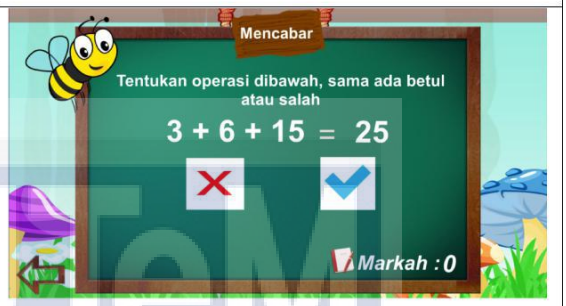
After finish answer the question the score page is display



Page Score display



If click Play Again Button, will show play again scene, and home is go to home back.



Play Again scene

Home Scene

Figure 4.3 Input and Output design

4.5 Conclusion

In a nutshell, this chapter summarizes the design used in order to develop the mobile application includes system architecture, flow chart design, user interface design, navigation design, input and output design. System architecture is illustrated in “picture” to illustrate the architecture of the mobile application. Besides that, flow chart is also discussed in this chapter which illustrated the flow of the process of the system. Other than that, the navigation design is clearly layout with the navigation control in the navigation flow chart. Lastly is the input and output design. The input design is about the input that needed for system to generate the output; while output design is the possible output that will visualize by the students.

For the next chapter, implementation phase will be discussed. The activities that will include in the next chapter are the media creation, media integration, product configuration management as well as the implementation status. Media creation is all about the content creation for the system and media integration is determine the process of integrating the created content. Next, product configuration management will discuss the configuration setup of the system and lastly describe the progress of the development status of the system.

CHAPTER V

IMPLEMENTATION

5.1 Introduction

During implementation phase, it deals with issues of quality of the media creation. The activities that will include in this chapter are the media creation, media integration, product configuration management as well as the implementation status. Media creation is all about the content creation for the system and media integration is determine the process of integrating the created content. Next, product configuration management will discuss about the configuration setup of the system and lastly describe the progress of the development status of the system.

5.2 Media Creation

The media creation process is focus on the text production, graphic production and animation production.

5.2.1 Production of Text

Text is an essential element to provide a way to let user understand the information of artifact in this mobile application. A consistent and dynamic of the font family, font size and font color will let students feel comfortable to read. Hence, production of text plays important roles when developing this mobile application. This is because the target user of this mobile application is primary student. The selection of text must easier to read by them. Table 5.1 shows the details of the production of text.

Table 5.1: Productions of text

Material	Type of Text	Font Color
Start interface		
Start Button	Arial San Serif font	Chocolate, after press change to white color
Interface of Main menu Mathematics Practice		White
Addition Button	Arial San Serif font	
○ button EASY level	Arial San Serif font	
○ button MEDIUM level	Arial San Serif font	
○ button HARD level	Arial San Serif font	
Subtraction Button	Arial San Serif font	
○ button EASY level	Arial San Serif font	
○ button MEDIUM level	Arial San Serif font	
○ button HARD level	Arial San Serif font	
Multiplication Button	Arial San Serif font	
○ button EASY level	Arial San Serif font	
○ button MEDIUM level	Arial San Serif font	
○ button HARD level	Arial San Serif font	

Division Button ○ button EASY level ○ button MEDIUM level ○ button HARD level	Arial San Serif font Arial San Serif font Arial San Serif font Arial San Serif font	
Operation page of addition, subtraction, multiplication, or division Marks display **Operation page of score page** Score and HighScore	Arial Sans Serif Arial sans serif with bold and italic Arial Sans Serif with italic	White White White

5.2.2 Production of Graphic

In this project, bitmap graphic is used to store all the images that needed used. Original image of the artifacts are downloaded from the official website of National Museum and WWW. However, the images that downloaded are not in transparent background and the image's size is bigger. Hence, Adobe Photoshop and Adobe Illustrator is used to clear the background of the images and reduce the image's size in order to increase the performance of the mobile application. All of the original images are saving in PNG,GIF or JPEG format.

Each of the image backgroundand the original image are imported into Adobe Photoshop CS4 or Adobe Illustrator to produce an image that will use in the Mathematics Practice application. This image is saving in JPEG format in order to increase the performance of the mobile application. Figure 5.2 is shows the process of

graphic production for this mobile application.

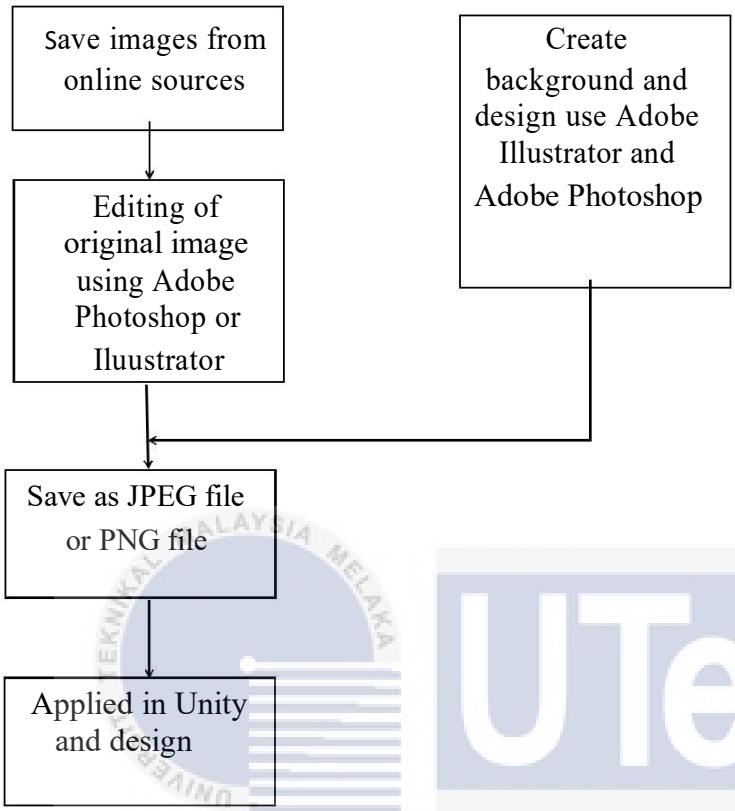


Figure 5.2 : Process of graphic production

5.3 Media Integration

Media integration is the process that integrates all the media creation such as texts, graphic and animation with Unity Developer. In the previous chapter, the system architecture design of Mathematics Practice mobile application has been explained. Hence, in this section, it will explained the how to integrated all components of this mobile application.

In this project, developer develops the mobile application by using Unity. While in this mobile application, C# language is for the mobile application.

The integration of the process will start after the production of text, graphic and animation are done. The integration process for this mobile application is through importing, arranging and scripting by using Unity and next, linking the main menu, and all operation in the Mathematics Practice. Firstly, all the components such as images in the Mathematics Practice mobile application needed to save in the folder of Assets which inside the folder of Backup PSM, as shown in Figure 5.3.

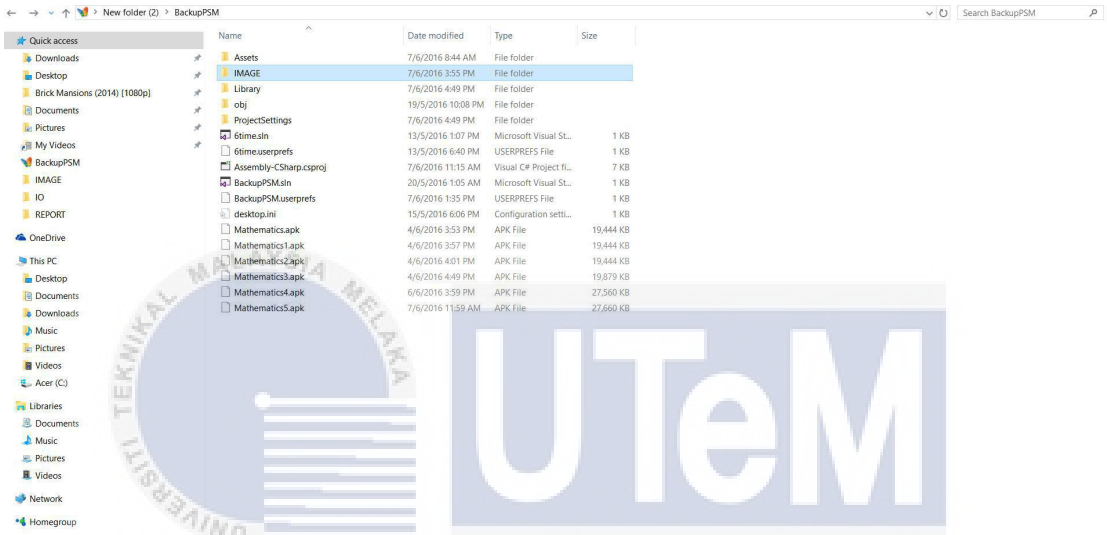


Figure 5.3: Path of saving all components

Next, after all components have saved in the folder of Assets, developer has to declare meaningful variable for each components in Unity before import to the Unity. Other than that, after the design is implemented, the coding is start implement to make the process in Mathematics learning. Three folder scripts is used to develop the Mathematics Practice and 12 script folder to develop each level.

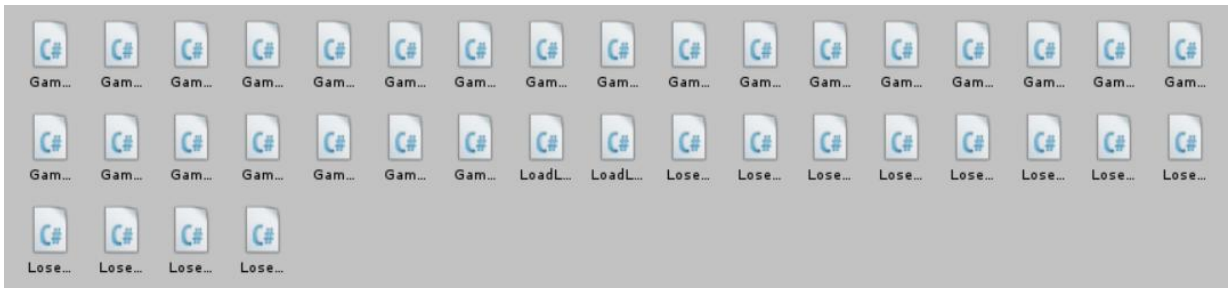


Figure 5.4: File each script in Unity

After create each file script the code is implement each file. Main script name is GameController which is main code, LoseGame for implement cide score and high score, and game values for implement code currentScore. Other than that, script change scene use Load Level.

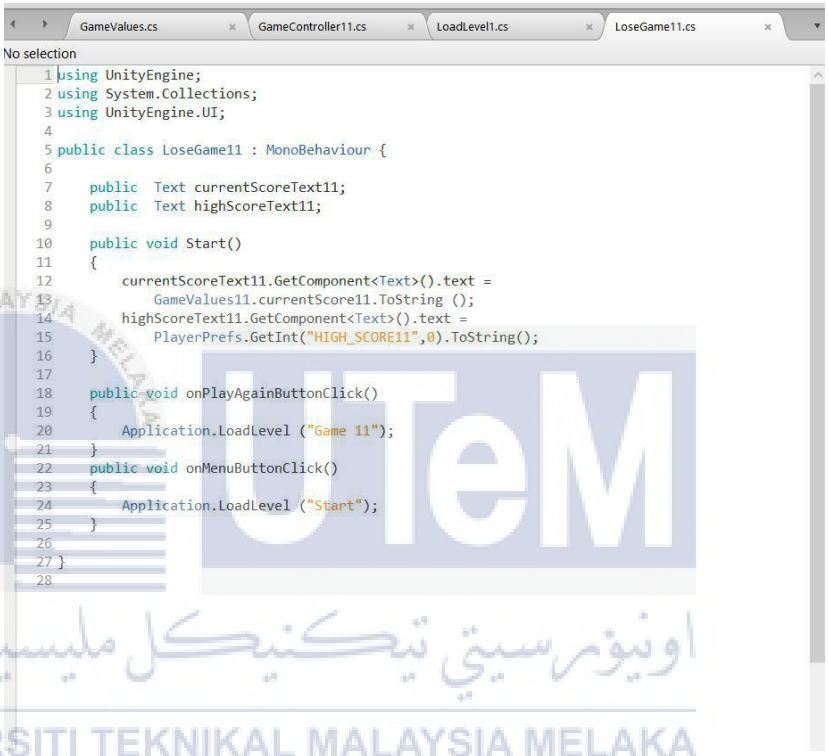


Figure 5.5 : Code for Lose Game

GameValues.cs | GameController11.cs | LoadLevel1.cs | LoseGame11.cs

No selection

```
1  using UnityEngine;
2  using System.Collections;
3
4  public class LoadLevel1 : MonoBehaviour {
5
6      public void ChangeScene (string scenename)
7      {
8          Application.LoadLevel ("Level Tambah");
9      }
10 }
11
```

This file has line endings (UNIX) which differ from the policy settings (W... Convert to Windows line endings OK

Figure 5.6 : Code for Load Level

GameValues.cs | GameController11.cs | LoadLevel1.cs | LoseGame11.cs

No selection

```
1  using UnityEngine;
2  using System.Collections;
3
4  public class GameValues : MonoBehaviour {
5
6      public static int currentScore;
7  }
8
```

Toolbox | Properties | Document Outline | Unit Tests

This file has line endings (UNIX) which differ from the policy settings (W... Convert to Windows line endings OK

Figure 5.7 : Code for Game Values

```
using UnityEngine;
using System.Collections;
using UnityEngine.UI;

public class GameController11 : MonoBehaviour {

    public Text mathText;
    public Text resultText;
    public Text scoreText;

    public GameObject timeProgress;
    private float limitTime;
    private float currentTime;


    private int leftNumber;
    private int rightNumber;
    private int thirdNumber;

    private int mathOperator;
    private int trueResult;
    private int falseResult;
    private int currentScore11;

    public void Start()
    {
        limitTime = 160.0f;
        currentTime = 0.0f;

        currentScore11= 0;
        createMath ();

    }

    public void Update()
    {
        currentTime += Time.deltaTime;
```

This file has line endings (UNIX) which differ from the policy settings ... Convert to Windows line endings OK

Figure 5.8: Code for Game Controller

5.4 Product Configuration Management

In this section, configuration environment setup and version control procedure will be discussed in detail. Configuration environment setup is explained about how the developer design and configures or installs the required software for this mobile application. While for the version control procedure is explained about the steps of procedure and control in managing the version of the mobile application.

5.4.1 Installation of Android SDK

Install Android Studio

1. Setting up Android Studio takes just a few clicks. While the Android Studio download completes, verify which version of the JDK you have: open a command line and typejavac -version. If the JDK is not available or the version is lower than 1.8, download the Java SE Development Kit 8.

2. To install Android Studio on Windows, proceed as follows:

3. Launch the .exe file you downloaded.

4. Follow the setup wizard to install Android Studio and any necessary SDK tools.

5. On some Windows systems, the launcher script does not find where the JDK is installed. If you encounter this problem, you need to set an environment variable indicating the correct location.

6.Select Start menu > Computer > System Properties > Advanced System Properties. Then open Advanced tab > Environment Variables and add a new system variable JAVA_HOME that points to your JDK folder, for example C:\Program Files\Java\jdk1.8.0_77.

Install the Android SDK

The Android SDK provides the API libraries and developer tools necessary to build, test and debug apps for Android.

1. Start the Android SDK Manager in Eclipse by navigating to Window > Android SDK Manager.

2. The Android SDK Manager will open. In the Android SDK Manager menu, navigate to Tools > Manage Add-on Sites….

3. Click the tab for User Defined Sites.

4. Click New… on the displayed dialog.

5. Enter the following URL in the Add Add-on Site URL dialog:
http://dl.developer.sony.com/wearables/sdks/Sony_Add-on_SDK/Sony-Add-on-SDK.xml

6. Click OK.

7. Click Close and confirm that you are sorting the SDKs listed by API level.

8. Expand the field that displays the SDKs available under Android 4.4.2 (API 19), select the checkbox for theSony Add-on SDK, then click Install 1 package… The Sony Add-on SDK will now install.

5.5 Implementation Status

Implementation status is explained about the development progress of this mobile application which is managed in order to finish the task according to the project milestone. The implementation status for each task is stated in the Table 5.6.

Table 5.2 : Milestone of the project

Mathematics Practice Mobile Application Development	**Start**	**Finish**
Proposal correction and improvement		
Planning the target user	1/3/2016	2/3/2016
Report chapter 1&2	3/3/2016	5/3/2016
Analysis		
Analyze the user needs	5/3/2016	10/3/2016
Report chapter 3&4		
Demo project	20/3/2016	21/3/2016
Design		
Creating an end design	1/4/2016	14/4/2016
Project demo		
Report chapter 4	24/4/2016	28/4/2016
Project demo and PSM report	23/5/2016	27/5/2016
Presentation	6/6/2016	9/6/2016

5.6 Conclusion

Implementation phase is the major phase for developing a mobile application because it includes a detailed of the product development process. It describes the production of text, graphic and animation clearly. After the media creation was done, the integration process of the product also explained in detail. Other than that, the configuration management are explained about the software tools that required by the developer for managing the development of the mobile application. Lastly, the implementation status for each task will be defined to indicate the progress of the project.

For the next chapter, the Mathematics Practice mobile application is ready to be tested by the user to validate and verify the user requirements. Besides that, the activity in the testing phase is to detect any error or deficient of the mobile application. Therefore, test plan will be discussed in the next chapter which includes test organization, test environment, test schedule and test strategy. Besides that, test design will also develop in the next chapter. For the test design, it is included the test description which the test of each module will be designed and the test data will collect from the user. Lastly, the entire test that collected will be analysis.

CHAPTER VI

TESTING

6.1 Introduction

The final phase of Mathematics Practice mobile application development is testing. The purpose of testing is to estimate to what extent the project had successfully achieved the objective and able to transfer the information to the target audience.

Mathematics Practice mobile application testing will conducted in two ways, which are black box testing and user acceptance testing, Black box testing will test for the functionality of the mobile application, while user acceptance testing is about how target users feel about the application. This chapter explains how this testing process is planned and implemented. The result collected from target users is analyzed to view the testing expected outcome.

6.2 Test Plan

Before both of the testing are conducted, proper planning need to be done to ensure the operation runs smoothly and eliminate any deficiency from affecting data collection. Therefore, test plan is the first stage of the testing phase. It plays important roles as it is a document detailing a systematic approach to test a mobile application. It documents

the strategy that will be used to verify and ensure that the mobile application or product meet its objectives, design specifications and other requirements. In this test plan, test organization, test environment and test schedule will be determined.

6.2.1 Test Organization

Test organization is to determine the personnel who are involved in the testing phase of the Mathematics Practice mobile application. In this testing phase, the personnel who commonly involved are developer, project supervisor, evaluator and students. Table 6.1 shows the responsibility of the personnel during testing phase.

Table 6.1: The detail of the test organization

Criteria	Alpha Version	Beta Version
Profession	BITM third year students	Primary school students
Responsibility	Testing was done after the final version of alpha version by the developer of this mobile application was completed. Respondents will the tests functionality of mobile application which is the navigation, interactivity, interface design, content and functionality of AR.	Responsible for testing the mobile application according to the questionnaire prepared by developer (refer to Attachment I: User Acceptance Testing Form).
Age (years old)	20 and above	7 to 10
Gender	Male – 2 persons Female – 3 persons	Male – 2 persons Female – 8 persons
Ethnic	Chinese – 3 persons Malay – 2 persons	Malay – 10 persons

Total of respondents	5	10

6.2.2 Test Environment

Test environment is concerned about the configuration setup and the location that the testing will be conducted. The location must be a suitable place so that the testing can be carried out smoothly and completely.

Besides that, the platform that needed to run the product and the minimum requirement needed to run the product are specified. The smartphones with Android operating system are needed to carry out the testing. Table 6.2 demonstrated the test environment for the testing phase.

Table 6.2: Test environment

Testing	**Alpha Version**	**Beta Version**
Profession	BITM third year students	Primary students
Location	UTeM, Melaka	Sekolah Rendah Kebangsaan Semabok
Environment	A room.	Quite room is prepared for this testing so the student can make the practice question smoothly.
Hardware	One smartphones with Android platform o Version 4.4.4 (Gingerbread) or higher o With processor Qualcomm MSM8939 8Core 1.5GHz o RAM 2.00GB	

Testing activities is recorded using a digital camera to record the respond of students when they using Mathematics Practice mobile application. Figure 6.1 display the layout

of music laboratory when conducting the testing. Figure 6.1 show the layout of music laboratory when conducting the testing.

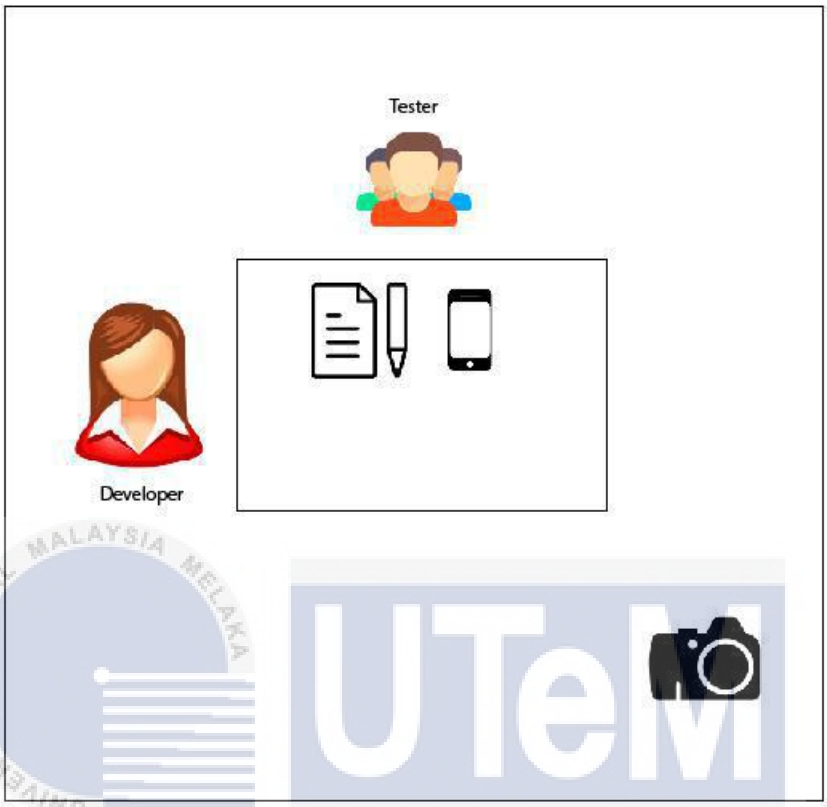


Figure 6.1: Layout of music laboratory when conducting the testing

6.2.3 Test Schedule

Test schedule organized the duration and timeline of testing to be conducted which as shown in Table 6.3. This testing is carried out based on the test scripts that prepared in Appendix H.

Table 6.3: Test schedule

Testing	Alpha Version	Beta Version
Profession	Multimedia developer	Primary students
Total of participants	10	10
Date	27 July 2016	29 July 2016
Duration per session (minutes)	10	15
Number of participants per	1	1

session		
Total time spent (minutes)	10 minutes	15 minutes

6.3 Test Strategy

Test strategy is a guideline to the testing plan where it is a method that selected to do the test plan. There are many test strategies such as Bottom-Up Testing, Top-Down Testing, Black-Box Testing, White-Box Testing and so on. In this project, the test strategy that chosen for this testing phase is black-box testing.

Black box testing is a testing method that examines the functionality of an application without looking its internal structures or workings. This method is attempts to find errors such as incorrect or missing features, interface errors, behavior or performance errors as well as initialization and termination errors. This testing will be carried out by following the testing form which is prepared to test specific functions of this mobile application. Although there have different types for black-box testing, functional testing and integration testing will be chosen for this project.

The product will be tested based on alpha version and beta version. Functional testing and integration testing will be carried out for alpha version while User Acceptance Testing (UAT) is prepared for beta version. A set of questionnaire will prepared for each testing. UAT consists of four parts: Part A, Part B, and Part C (refer to Table 6.7). Two different rates may choose for Part A, Part B, and Part C. Tester need to answer the questions in the testing form by giving the rating as shown in the table below.

Table 6.4: Test rate indicate and description

Description	Rate of Score
Strongly disagree	1
Disagree	2
Somewhat or not sure agree	3
Agree	4
Strongly agree	5

i. Alpha Version

Functionality testing is a testing process used within mobile application in which software is tested to ensure that it conforms to all requirements. Functional testing is a way of checking software to ensure that it has all the required functionality that's specified within its functional requirements.

The questionnaires that prepared for both of the testing are designed based on the four criteria which are visual clarity, navigation and interaction, functionality of Mobile Application and accuracy of the content. Refer to the questionnaire of black-box testing in Appendix I.

ii. Beta Version

UAT consists of a process of verifying that a solution works for the target user. It is not a system testing, but rather is there to ensure that the solution will work for the target user. This testing is carried out to test whether the target user will accepts the solution that provided.

UAT is carried out based on the test script and a set of UAT questionnaire is to allow them to use the Mathematics Practice mobile application and answer the questions that

prepared. The questions are designed based on four principals which are visual clarity, navigation and interactivity, functionality of mobile application and content as well as effectiveness. Refer to the questionnaire of UAT in Appendix J.

6.4 Test Design

Test design discussed the test description and test data for the testing phase. In this section, test description and test data will be focused on black-box testing and UAT that mentioned in test strategy.

6.4.1 Test Description

The description is a part where the case status description for alpha version was measured and expected result for the beta version.

i. Alpha Version

Table 6.5 and Table 6.6 show the aspect or modules that tested for functional testing and integration testing respectively.

Table 6.5: List of questions for functional testing

No.	Aspect / Module
	PART A : DESIGN
1.	Well organized of the layout
2.	Text legibility on the screen
3.	Screen color schemes did not interface with readability
4.	Neutral choice of colors
5.	Button labels are clear and understandable

PART B: INTERACTIVITY	
1.	Navigation is clear and concise
2.	Menu is easy to control
3.	Button return anticipated response
	PART C: CONTENT
1.	The question of the practice is easy to understand.
2.	The question provide the level follow from the easy to hard for each operation that is suitable to user age range.
3.	Instruction on how to play this product is clear
4.	The question in the mobile application is follow the syllabus in the school

ii. Beta Version

Table 6.7 shows the module and description of expected results for beta testing. It shows what expected output from the testing. For more detail of the complete questionnaire of UAT, please refer to Appendix J.

Table 6.6: List of questions for UAT

No.	Aspect / Module
PART A: DESIGN	
1.	Layout is well designed.
2.	Easy to recognize the type of font and size used.
3.	The color used is suitable for the button and mobile application.
4.	The graphics of the system in interesting and suitable for the game.
5.	The font size and color for the label are suitable and understandable.
PART B: INTERACTIVITY	
1.	Respond time to interact with all the buttons is fast and smooth.
2.	The menu in the mobile application is easy to control.
3.	System navigation is intuitive and easy to use.
4.	Button return anticipated response.

PART C: FUNCTIONALITY AND CONTENT	
1.	The question of the practice is easy to understand.
2.	The question provide the level follow from the easy to hard for each operation that is suitable to user age range.
3.	Instruction on how to play this product is clear
4.	The question in the mobile application is follow the syllabus in the school

6.4.2 Test Data

Test data is the collected results from all the testing. The result of black-box testing and UAT that collected are attached in Appendix K, Part A and Part B respectively. Please refer to the appendix for more information.

6.5 Test Results and Analysis

This session will display the test results that were collected from the testing. From the overall test result, the application developed has meets the intended user requirement. The results output were divided into mean, mode and median.

6.5.1 Test Results

This section is the results that collected from the testers and calculated into mean, median and mode.

i. Alpha Version

The result of functional testing and integration testing from BITM third year students is

shown in Table 6.8 and Table 6.9.

A. Result of Functional Testing

Table 6.7: Result of Alpha function testing

No.	Aspect / Module	Mean	Median	Mode
	PART A : DESIGN			
1.	Well organized of the layout	4.7	4	4
2.	Text legibility on the screen	4.4	5	5
3.	Screen color schemes did not interface with readability	4.6	5	5
4.	Neutral choice of colors	4.7	5	5
5.	Button labels are clear and understandable	4.8	5	5
PART B: INTERACTIVITY				
1.	Navigation is clear and concise	3.9	4	4
2.	Menu is easy to control	4.0	4	3
3.	Button return anticipated response	3.7	4	4
	PART C: CONTENT			
1.	The question of the practice is easy to understand.	4.9	5	5
2.	The question provide the level follow from the easy to hard for each operation that is suitable to user age range.	5.0	5	5
3.	Instruction on how to play this product is clear	4.2	5	5
4.	The question in the mobile application is follow the syllabus in the school	4.2	5	5

ii. Beta Version

There have one types of test results in beta testing. Table below shows the result of UAT from 10 testers.

Table 6.8: Result of Beta function testing

No.	Aspect / Module	Mean	Median	Mode
PART A: DESIGN				
1.	Layout is well designed.	4.6	5	5
2.	Easy to recognize the type of font and size used.	4.7	5	5
3.	The color used is suitable for the button and mobile application.	4.8	5	5
4.	The graphics of the system in interesting and suitable for the game.	4.7	5	5
5.	The font size and color for the label are suitable and understandable.	4.4	4	4
PART B: INTERACTIVITY				
1.	Respond time to interact with all the buttons is fast and smooth.	3.7	4	4
2.	The menu in the mobile application is easy to control.	4.0	4	4
3.	System navigation is intuitive and easy to use.	3.9	4	3
4.	Button return anticipated response.	4.0	4	3
PART C: FUNCTIONALITY AND CONTENT				
1.	The question of the practice is easy to understand.	4.5	5	5
2.	The question provide the level follow from the easy to hard for each operation that is suitable to user age range.	4.6	5	5
3.	Instruction on how to play this product is clear	4.9	5	5
4.	The question in the mobile application is	5.0	5	5

	follow the syllabus in the school			

6.5.2 Analysis Results

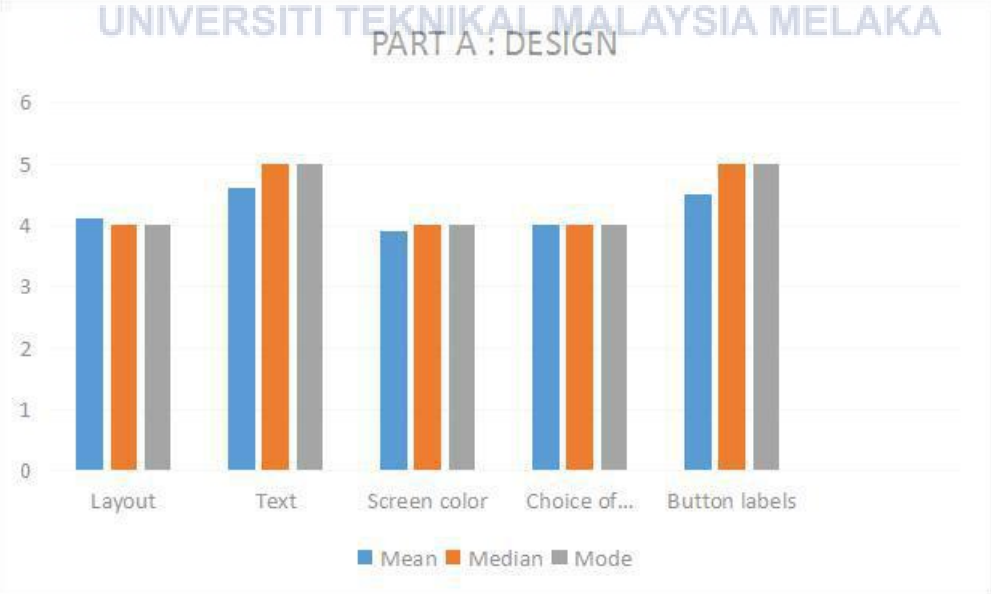
ii. Results of Beta Version

UAT is the only testing for beta version. Bar chart is chosen to demonstrate the data collected from the testers. After analyse the result collected, a summary of testing result for beta version is detailed.

i. Results for Alpha Version

There have one parts of testing are analysed in alpha version which are functional testing to demonstrate the data collected from the testers. After analyse the result collected, a summary of testing result for alpha version is concluded.

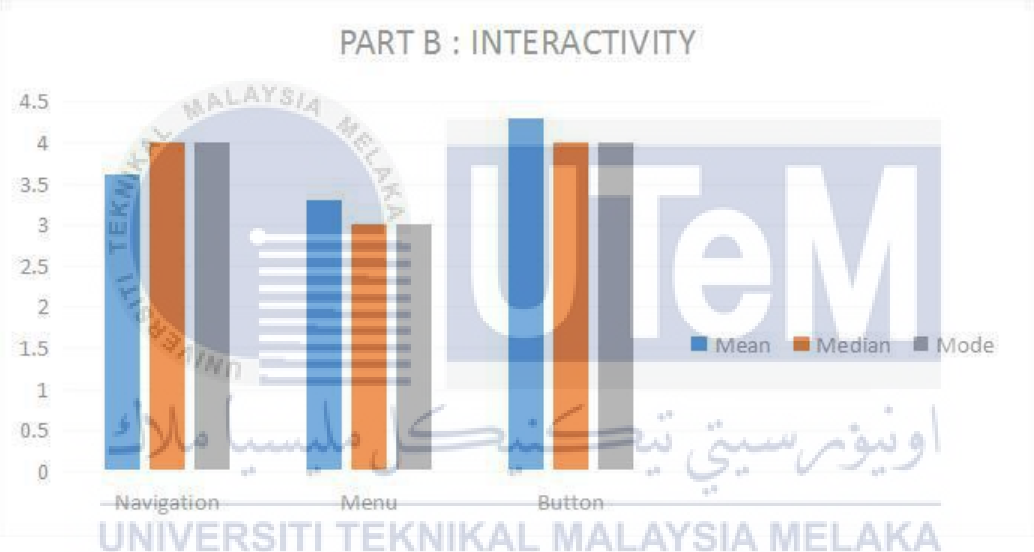
A. Results of Functional Testing



Question related to Design

Figure 6.2: Statistic of Design for functional testing

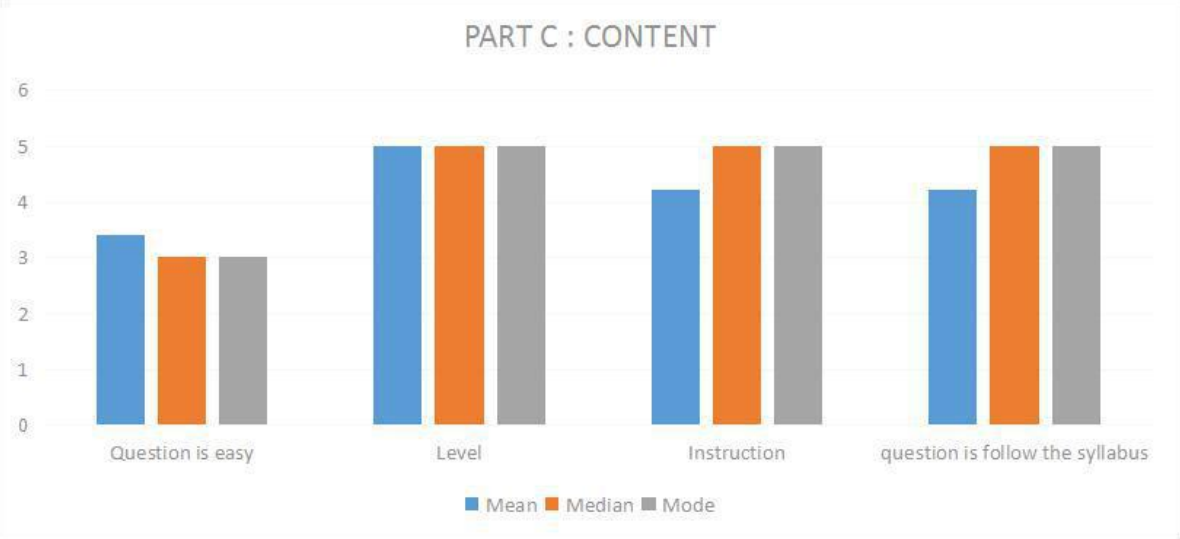
Figure 6.2 show the criteria related to the design of Mathematics Practice mobile application which related to the layout, text and color used. From the bar chart above, the level of the rate for all criteria is achieve 4 and above which mean that the testers are agreed that the design is suitable for children. Hence, it can prove that the layout of Mathematics Practice mobile application is appealing and acceptable.



Question related to Interactivity

Figure 6.3: Statistic of Interactivity for functional testing

Figure 6.3 explained the questions related to the interactivity of the mobile application. These principals related to the respond time when navigating or controlling the menu. From the bar chart, it is obviously demonstrated that the level for all of the categories highest and achieve 4.3 and above which equals to agree. This result proves that Mathematics Practice mobile application is user friendly.

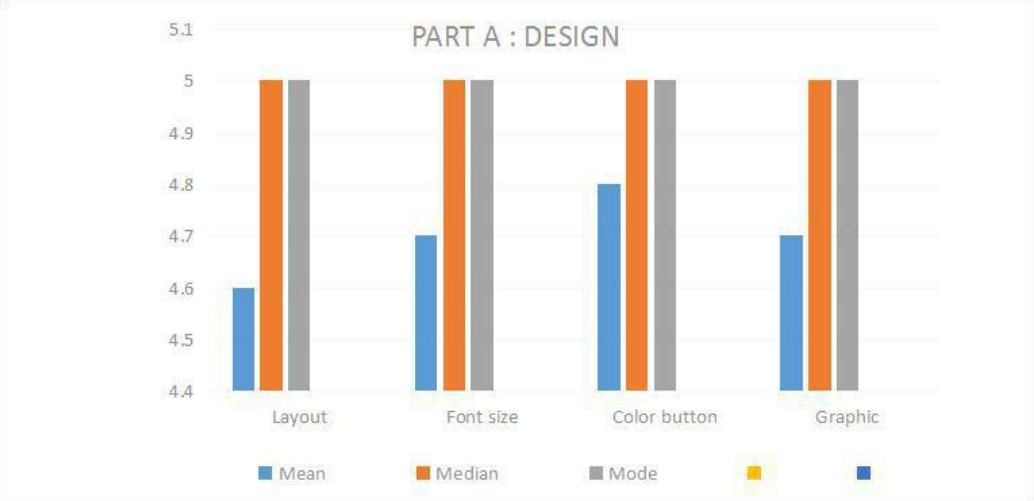


Question related to Content and Functionality

Figure 6.4: Statistic of Content and Functionality for functional testing

Figure 6.4 related to the content of the Mathematics Practice mobile application which consist syllabus and content of in school . Almost of the categories achieved 5 and above. And this result define that the information provided in the Mathematics Practice mobile application. This statement is proof because the level of rate is achieving 5 which mean testers are agreed with this.

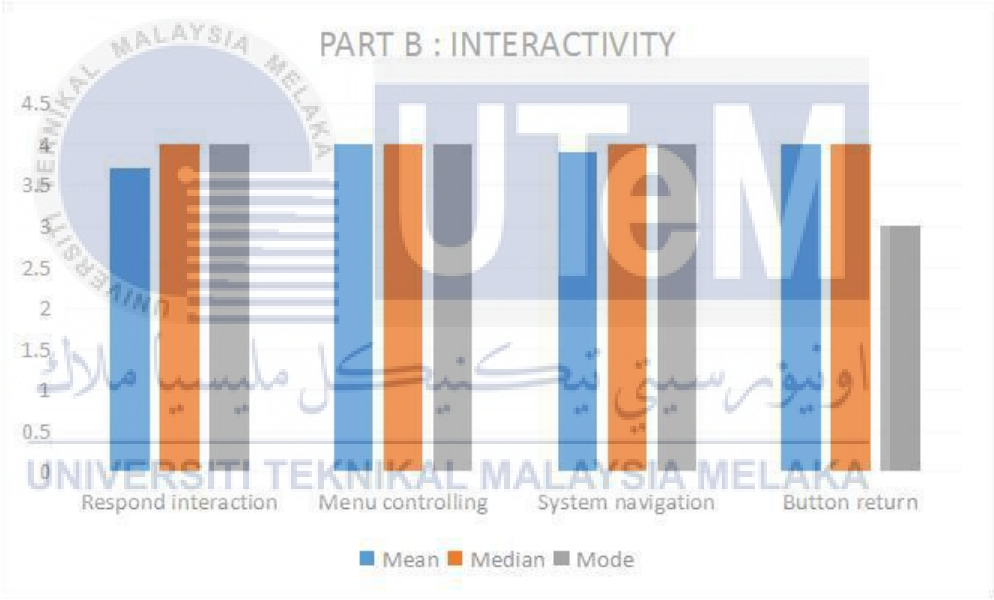
ii. Results for UAT Testing.



Question related to Design

Figure 6.5: Statistic of design for functional testing

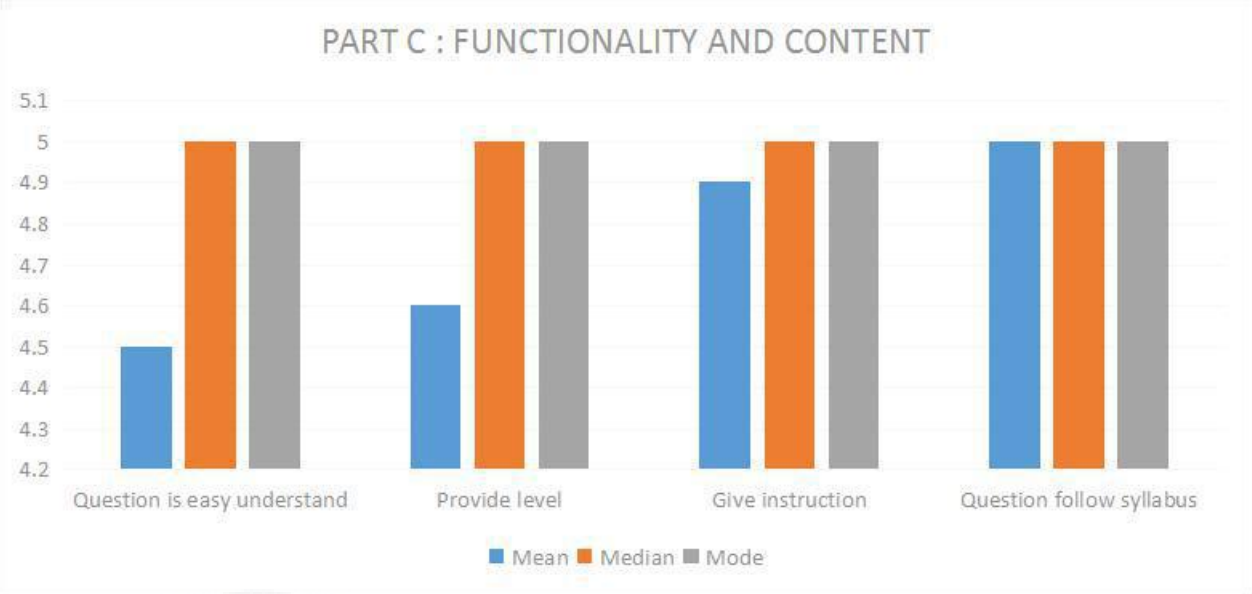
Figure 6.2 demonstrated the questions related to the design of Mathematics Practice mobile application. From the bar chart above, it is clearly shows that almost all of the students are agreed with all the aspect of the design of this mobile application. The highest range of layout is the color used is suitable for the button and mobile application, the font sized used and graphics is achieved 5. While the other aspects are achieve 3 and 4. Hence, it can prove that the design of the Mathematics Practice application is acceptable by students.



Question related to Interactivity

Figure 6.6: Statistic of Interactivity for functional testing

Figure 6.3 explained the questions related to the interactivity of the mobile application. For this aspect, it is testing the respond time when interact with buttons, ease of use menu of the Mathematics Practice. Almost all of students are agreed with the part navigation and interactivity of the mobile application. This is proved and demonstrated in the Figure 6.3. In a nutshell, it can prove that Mathematics Practice mobile application is user friendly.



Question related to functionality and content

Figure 6.7 : Statistic of functionality and content for functional testing

Mathematics Practice is applied for student year 7 to 10.. In Figure 4, it explained the principal of the functionality if Mathematics Practice and the contents provided in the mobile application. From the bar chart above, students are agreed that all question is provided in syllabus that studied in school. and it is achieved 4.0. Students are agreed with this aspect and this is proved in Figure 6.4 which depicted 5. Hence, it can prove that the functionality of Mathematics Practice and content mobile application is easy for student to access and understand.

A. Summary of Testing Result for Beta Version

From the three of the principals that tested which are design, interactivity, functionality and content of Mathematics Practice as well as the effectiveness of mobile application, it is obviously show that Mathematics Practice mobile application is able to act as a medium to deliver the knowledge to them. Almost all the aspects are agreed and acceptable by students. In conclusion, it is obviously shown that Mathematics Practice mobile application is accepted by primary students and is achieved the third objective which mentioned in Chapter I.

6.6 Conclusion

In a nutshell, the testing process is carried out very smoothly and successfully at Sekolah Rendah Kebangsaan Semabok. From the result that collected and analyzed, it is shown that the product is able to work with mobile application for the target users and it is able to deliver the knowledge for the pre-teen age students. Other than that, the contents that delivered to them are easily to understand.

However, this Mathematics Practice mobile application still is a new concept of technology in Malaysia and the awareness of syllabus among Malaysian is low compare to foreign country. Therefore, observation on weaknesses and strengths, prepositions for improvement and contribution of the project will be discussed in the next chapter.

CHAPTER VII

PROJECT CONCLUSION

7.1 Observation on Strengths and Weaknesses

Mathematics Practice is an Android mobile application that developed using Android SDK. Android SDK is software that is suitable for developer to develop an interactive game or application. For this Mathematics Practice application, there still have its own strengths and weaknesses.

7.1.1 Strengths

The strengths of this application are listed as following:

i. Use of Mathematics Practice concept to attract children

   Mobile Application concept is applied on Mathematics Practice mobile application to attract children. Mobile application is an advanced concept that can use for practice in children daily life to improve their skill of Mathematics.

ii. Tool to delivering knowledge

   This application can act as the tool of delivering knowledge because it contains the question provided in syllabus. Besides that, combination of use of mobile application as android technology attract the attention and interest of children.

iii. Save time and save money

Mathematics Practice mobile application is an application which installed in Android smartphone. Hence, children just need to install the application on their smartphone and can do the practice of a through this mobile application. They not need to find or buy a book Mathematics Practice. They can save the time and make practice the Mathematics Practice through mobile application.

7.1.2 Weaknesses

There are some weaknesses in this application even this project is known to be successfully developed. This mobile application is based on the real time system, it by any mean that this mobile application need to be run with capturing device and recognize by the mobile application itself.

i. Do not own a smartphone

Mathematics Practice needs to install on Android device to function. However, not every student does possess a smartphone or possess an Android platform smartphone. Hence, they have to use their family's smartphone or friend's smartphone to access the mobile application.

7.2 Proposition for Improvement

By referring to the strengths and weaknesses that have been stated in previous section, there have some improvements need to be done to improve this Mathematics Practice mobile application.

Firstly, the graphics and button respond need to improve to be more alike, fast and respect. Lastly, developer needs to put the more question or guide in the practice.. This is

because Mathematics Practice mobile application will display the 3D artifact when the marker is detected.

7.3 Contribution

This project will certainly be beneficial for children that age range between 7 and 10 years old who want to get more practice about the Mathematics Practice without buy or borrow library book to make the practicing.

Teachers can apply this method to teach students and can let them to understand easily and practicing himself.

By developing this mobile application, it creates a medium to deliver knowledge to the children without the need to buy the book. This application is developed based on the early analysis in primary school. All related information that gathered becomes the guide for developer to develop this mobile application successfully. Besides that, Mathematics Practice mobile application is compatible for teachers because this mobile application reduces the burden of teachers when teach in school.

7.4 Conclusion

After few months of development, Mathematics Practice had evolves from idea to reality. From the testing, children are able to practice by their own and automatically they familiar with the numbering.

REFERENCE

Assembly, I. G. (2010). INTERNATIONAL MATHEMATICAL UNION . *Best Current Practices*, 7.

DiMarzio, J. a. (2008). Programmer Guide. *Android*, 337.

Dobbs, D. F. (2011). Android Development. *Education*, 388.

Kumar, L. A. (2012). Mobile Application for News and Interactive Services. *f Science and Technology* , 6.

Li Ma, L. G. (2014). Android Platform. *Journal of Multimedia* , 198.

Rakestraw, T. L. (2011). The mobile apps industry. *Applications*, 26.

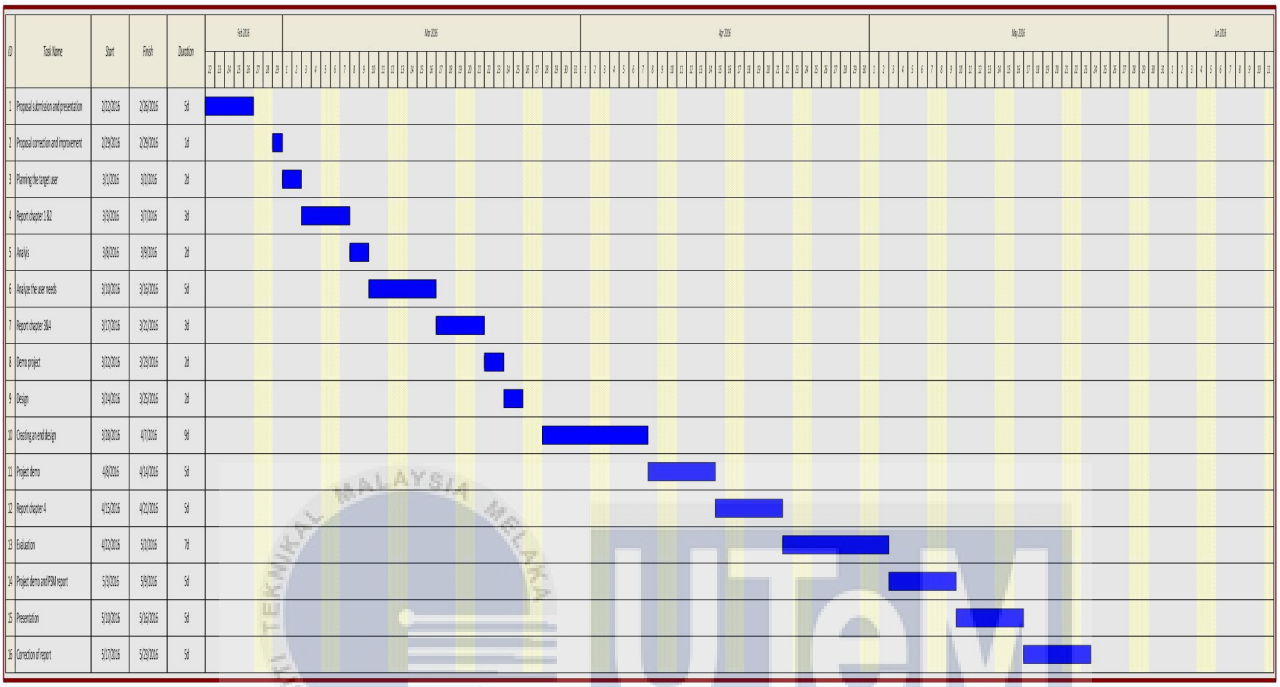
Shulman, C. (2001). Applied Mathematics. *Education*, 44.

Venkata N Inukollu, D. D. (2014). FACTORS INFLUENCING QUALITY OF MOBILE. *Software Engineering & Applications* , 20.

LIST OF APPENDICES

APPENDIX A: GANTT CHART

The following shows the Gant Chart of the progress of Final Year Project



Mathematics Practice Mobile Application Development	Start	Finish
Proposal submission and presentation	22/2/2016	26/2/2016
Proposal correction and improvement		
Planning the target user	1/3/2016	2/3/2016
Report chapter 1&2	3/3/2016	5/3/2016
Analysis		
Analyze the user needs	5/3/2016	10/3/2016
Report chapter 3&4		
Demo project	20/3/2016	21/3/2016
Design		
Creating an end design	1/4/2016	14/4/2016
Project demo		
Report chapter 4	24/4/2016	28/4/2016
Project demo and PSM report	23/5/2016	27/5/2016
Presentation	6/6/2016	9/6/2016

APPENDIX B: QUESTIONNAIRE

TITLE:

MATHEMATHICS PRACTICE USING MOBILE EDUCATIONAL GAMES

BLACK-BOX TESTING FORM

Please circle (O) for your own choice aspects level score based on your observation for this mobile application's function.

Strongly Dissatisfied	Dissatisfied	Not Sure	Satisfied	Strongly Satisfied
1	2	3	4	5

SECTION A: BACKGROUND INFORMATION

Please tick (/) for the appropriate choice.

1. Age:

○ 7 years old ○ 8 years old ○ 9 years old

○ 10 years old

2. Ethnic:

○ Chinese ○ Malay ○ India

○ Other

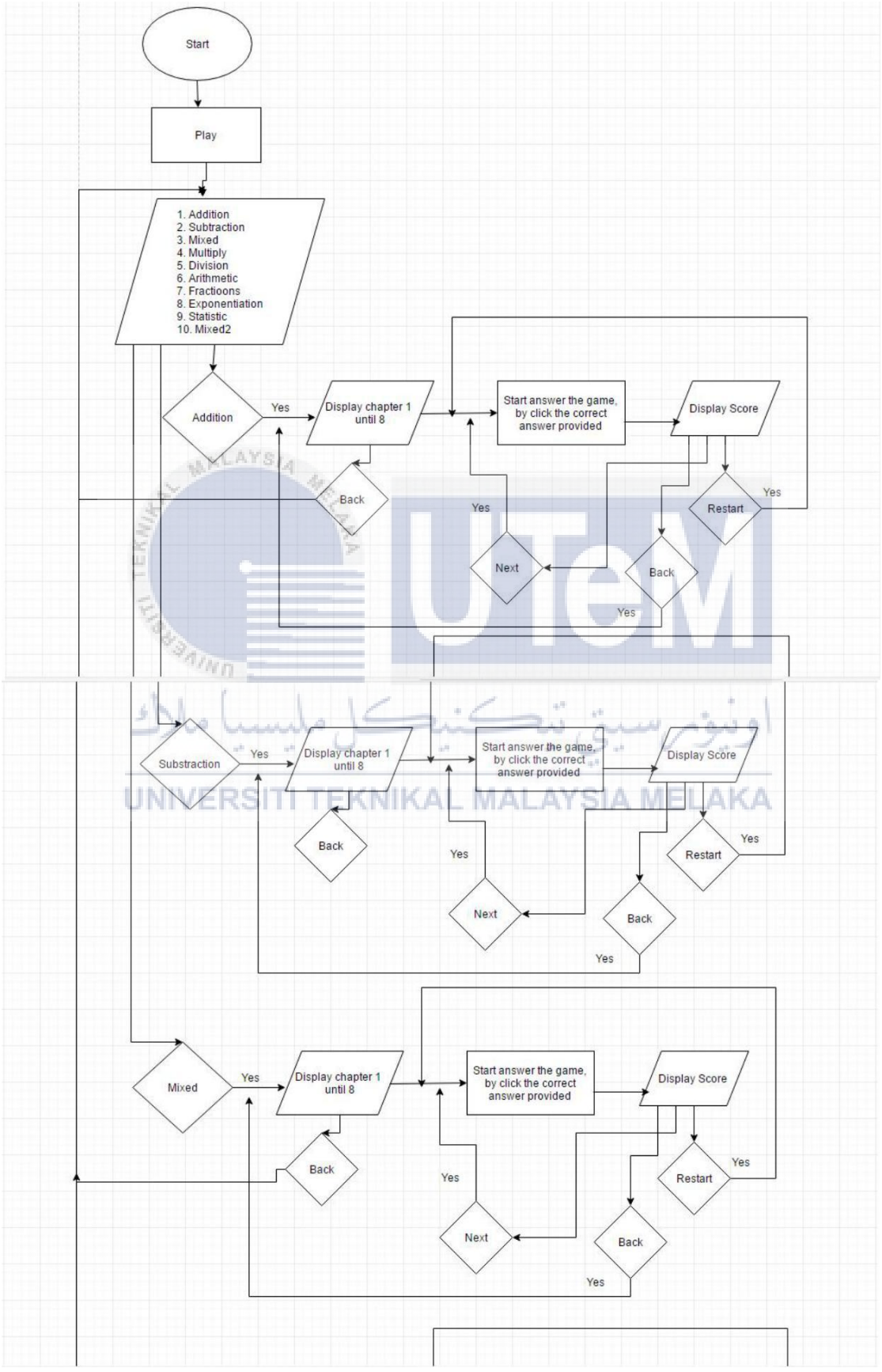
3. Gender:

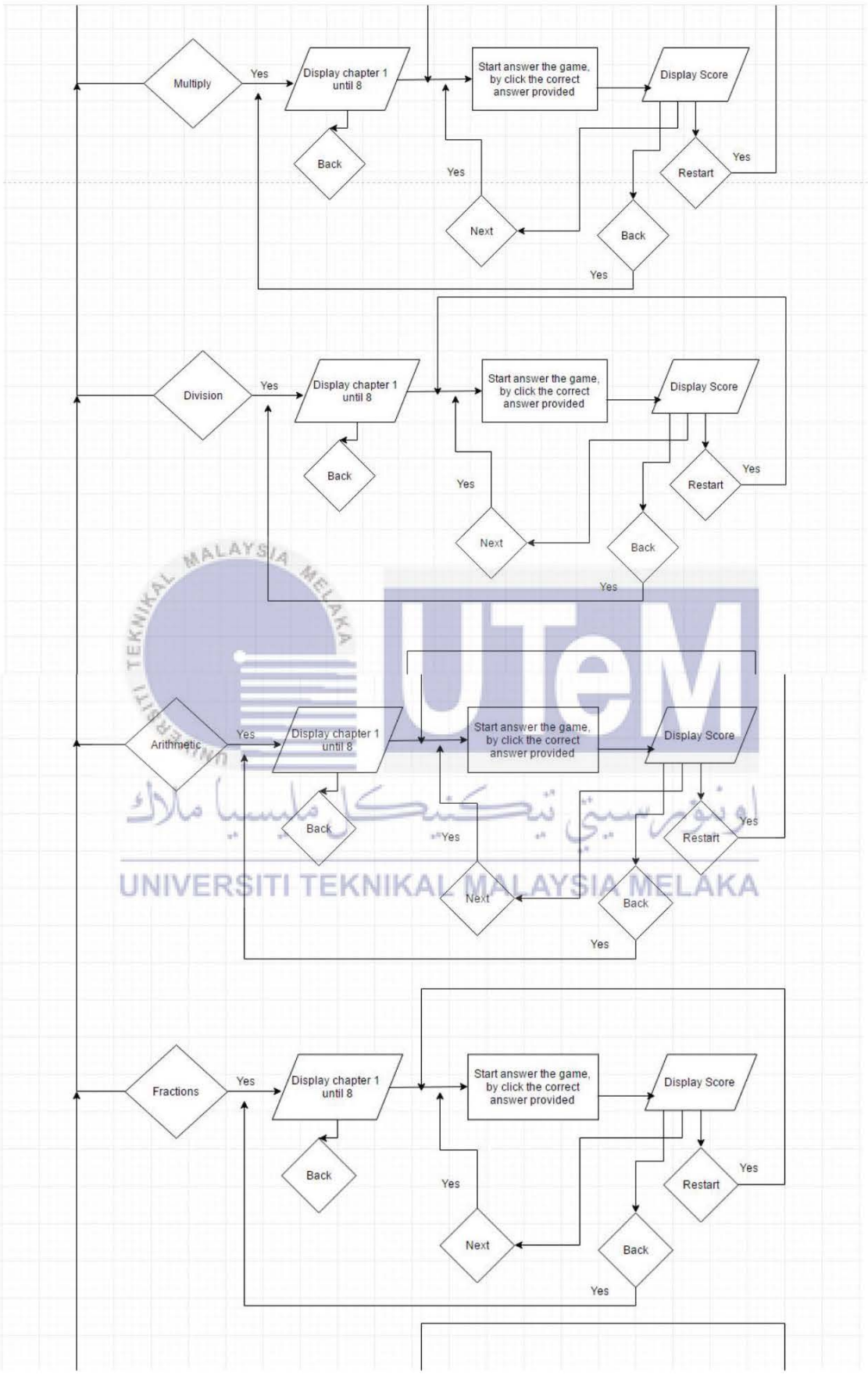
○ Female ○ Male

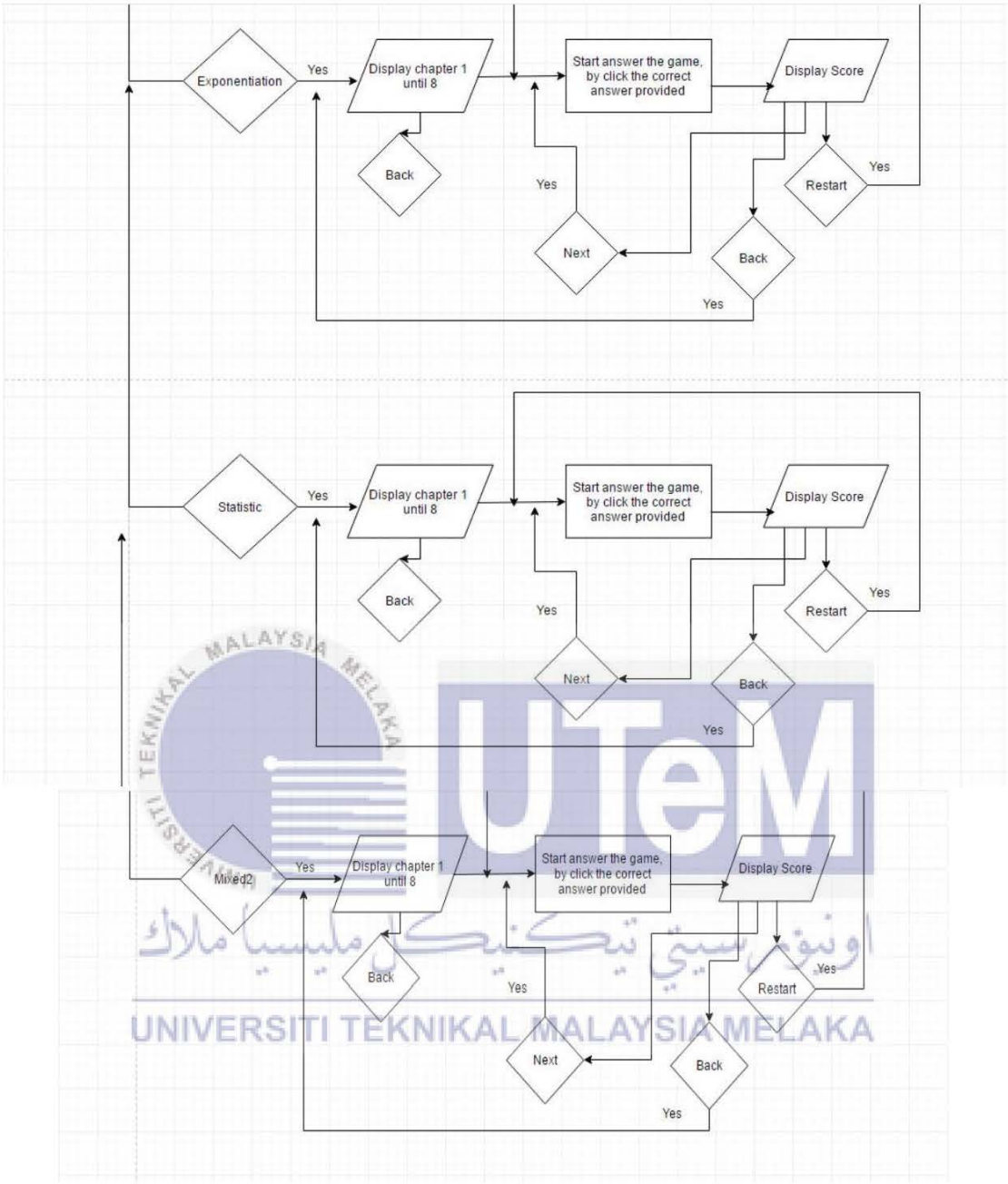
4. Do you play the mobile application related to Mathematics Practice before?

○ Yes ○ No

APPENDIX C: FLOW CHART







APPENDIX D: CODE

A. Coding for Production of Process of Calculation

```
public void createMath()
{
    leftNumber = Random.Range (0, 10);
    rightNumber = Random.Range (0, 10);

    mathOperator = Random.Range (0, 1);

    switch (mathOperator)
    {
    case 0:
        trueResult = leftNumber + rightNumber;
        falseResult = trueResult + Random.Range (-2, 3);
        mathText.GetComponent<Text> ().text =
        leftNumber.ToString () +
        " + " +
        rightNumber.ToString ();
        resultText.GetComponent<Text> ().text = falseResult.ToString ();
        break;
```

Figure D1 : Codes for Calculation Process

B. Code to level

```
using UnityEngine;
using System.Collections;
using UnityEngine.UI;

public class LoseGame : MonoBehaviour {

    public  Text currentScoreText;
    public  Text highScoreText;

    public void Start()
    {
        currentScoreText.GetComponent<Text>().text =
            GameValues.currentScore.ToString ();
        highScoreText.GetComponent<Text>().text =
            PlayerPrefs.GetInt("HIGH_SCORE",0).ToString();
    }

    public void onPlayAgainButtonClick()
    {
        Application.LoadLevel ("Game");
    }
    public void onMenuButtonClick()
    {
        Application.LoadLevel ("Start");
    }

}
```

Figure D2 : Codes for Level Process

APPENDIX E: TEST SCRIPT

Details:

10 testers for the testing.

3 testers per section, divided into 1 group.

Around 10 minutes per cycle.

Instructions

1. Let one by one students test the application.
2. Answer few questions that prepared before starting the testing [Questionnaire Part A].
3. Let students navigate the interface of the Mathematics Practice mobile application [2 minutes].
4. Pause them for answering the question prepared [Questionnaire Part B Question 1 - 3].
5. Testing is finish.

SECTION B: USER ACCEPTANCE TESTING

Instructions : Please tick the appropriate boxes.

Strongly Dissatisfied	Dissatisfied	Not Sure	Satisfied	Strongly Satisfied
1	2	3	4	5

No.	Aspect / Module	Rate				
PART A: DESIGN						
1.	Layout is well designed.	1	2	3	4	5
2.	Easy to recognize the type of font and size used.	1	2	3	4	5
3.	The color used is suitable for the button and mobile application.	1	2	3	4	5
4.	The graphics of the system in interesting and suitable for the game.	1	2	3	4	5
5.	The font size and color for the label are suitable and understandable.	1	2	3	4	5
PART B: INTERACTIVITY						
1.	Respond time to interact with all the buttons is fast and smooth.	1	2	3	4	5
2.	The menu in the mobile application is easy to control.	1	2	3	4	5
3.	System navigation is intuitive and easy to use.	1	2	3	4	5
4.	Button return anticipated response.	1	2	3	4	5
PART C: FUNCTIONALITY AND CONTENT						
1.	The question of the practice is easy to understand.	1	2	3	4	5
2.	The question provide the level follow from the	1	2	3	4	5

	easy to hard for each operation that is suitable to user age range.					
3.	Instruction on how to play this product is clear	1	2	3	4	5
4.	The question in the mobile application is follow the syllabus in the school	1	2	3	4	5

APPENDIX F: USER MANUAL

1. Copy application package file “SDK_Example.apk” from the CD into Android Smartphone through connecting cable with computer or Bluetooth.
2. Search the apk file inside Android directory and click on it.
3. A dialog box will appear, proceed by select “Install”.
4. After the installation had completed, the application named “Museum Artifact” can be seen in the application list.

Note:

1. Please ensure that your phone setting is configured to install of non-market applications.
   a. Navigate to Setting > Applications.
   b. Check the box for “Unknown sources – Allow install of non-marker applications”

APPENDIX G : IMAGE TESTING