Interactive Learning

for Lower-Secondary Student:

C++ Language

by

AIZUDDIN BIN SA'IMAN

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Supervised by:

Razol Mahari Bin Ali

Universiti Teknologi PETRONAS

Bandar Seri Iskandar

31750 Tronoh

Perak Darul Ridzuan

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By

Aizuddin Bin Sa'iman

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Approved by,

_____

(Razol Mahari Bin Ali)
UNIVERSITI TEKNOLOGI PETRONAS
TRONOH, PERAK
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CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

AIZUDDIN BIN SA'IMAN

ABSTRACT

Interactive learning is one of the methods to acquire knowledge and information through hands on. It is the opposite of passive learning which is merely a process of observing a learning process or listening to knowledge or information. My Final Year Project, "Interactive Learning for Lower-Secondary Student: C++ Language", aims to provide a revolutionary learning process of learning programming language, specifically C++ language, through a simple and interactive way. Throughout this report, I will discuss in details on my project. This report will first describe the motivation and objective of my project, and also introduced the concept of Interactive Learning.

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CHAPTER 1

INTRODUCTION

1.1 Background

Interactive learning is, by definition, a learning process through experience. The opposite of interactive learning is passive learning which is learning something through listening or seeing the process. Both processes of learning are faced by a person in each and every single day of their life. From the day we were born till the day that we will die, we are faced with both interactive and passive learning.

Nowadays, there are many interactive learning applications available in the markets for all levels of educations. The study conduct shows that passive learning like seeing and listening is not enough to engulf student to the main concept of a subject [1]. That's why the market is flooded with interactive learning as parents have realized that they can help their children to discover their potential by interactive learning.

Although the market is flooded with interactive learning applications and education facilities, there are none that can helps students learn programming. Programming is the basic of engineering and computer science courses in university levels. Introducing the secondary school with the fascinating world of programming is a good way to prepare them for their university level as in their secondary schools; they have a much more free time compared to when they will be in a university.

1.2 Problem Statement

In this era of technology, educators have been doing research on how to engage with the students in their learning process. This is as results from Astronomy Diagnostic Test (ADT), the astronomical equivalent to FCI, confirmed that students simply were not learning fundamental conceptual information [1]. From what I understand, the students are actually not getting the main concept of the real information when learning something passively. Without a proper balance of passive and interactive learning, the main concept of a subject may be misunderstood by the students, especially if they were just listening to it, and not having a proper hands-on concept.

Not only that, because of different personalities in each one of a person, they have a different style of learning something new. Some people can understand objects by reading and imagining it in their mind, some need to read and sketch what they pictures while others may need to practice or feel the learning process [8]. Thus, selecting the correct genre for the application is also a problem, as not all students may benefit this application if it only operates in one genre.

1.3   Objectives

The objectives of this project are:

- To understand the different in learning styles of students in the lower-secondary school
- To make use of the understanding in different learning style to create the effective interactive learning program
- To understands and differentiate the basic of C++ language.
- To interpret the understanding in a simplest form possible
- To take the simplest form of codes into a learning-game-based
- To make sure that the game is beneficial to new learners and understandable
- To prepare a design requirement as well as system design necessary to the completion of the final product of this project
- To create a workable application by the end of FYP 2 period based on the design requirement and make sure that the information used and given in the application is suitable for new learner.

1.4   Scope of Study

This research covers the use of C++ programming language as the medium of information, from application-to-student, through other programming software such as OpenGL, and GameMaker which are all can be obtained easily. This project will focused on creating an application that can convey the C++ programming language simplest form to the student who will use the application. Surveys will be conduct to recognized the different style of learning and choosing which style of learning is the best to be use for the application

Due to the expense and lack of experience in OpenGL software, I will attempt and begin my self-study on both of the software to create a simple application first. Simulations and testing of the real application will be made to emulate the effectiveness of the application and try to figure the alternative design solution for upcoming problems. Any outcomes of the testing will be evaluated, validate and benchmark.

1.5   Significant of the Project

- This project will be used for new beginners to learn and understand C++ language
- This project targeted the lower-secondary school student so that the scope of learning is the most basic and even a lower secondary student can understand it.
- Basic knowledge of programming language is taught among lower-secondary students for their future preparation when entering higher education level.

1.6 Feasibility of the Project

"Feasibility study is the analysis of specific aspects in the project environment to help determine whether to proceed with the project. The developer uses it to uncover important risks associated with the project."[12] (Dennis, Wixom & Tegarden, 2005). With regards to this project, a technical and operational feasibility analysis has been conducted.

1.6.1 Technical Feasibility

The project is feasible technically, although there are some risks.
User's risk regarding familiarity with the software application is medium.

- Users are mostly without the background of any programming basics and some with C++ background.
- Majority of the users that will use have no basic knowledge with C++ language and will use the project to learn them.

Developer's risk regarding familiarity with the technology is medium.

- Developer has developed some program with Microsoft Visual Basic during his internship with his internship company.
- Developer has no experience in creating any interactive program or game for education.
- Developer needs to approach some lower-secondary students to try his program.

The project size is considered medium.

- The project timeframe cannon exceed the third quarter of the year.
- Number of features and functions are set and limited.

1.6.2 Economic Feasibility

- There are no special hardware is being needed for the development of the simulation which requires a high price to purchase

- All the hardware and resource needed are readily available

1.6.3 Legal Feasibility

- No legal problems are expected throughout the development and distribution of the simulation system as the system is free from ambiguities and the acknowledgements are specified clearly.

1.6.4 Operational Feasibility

- With the available resources and technology, the to-be simulation system is expected to operate well on completion and meet all the system requirements specified in the scope definition.

1.6.5 Organizational Feasibility

- The project is coordinated by highly professional UTP FYP committee hence no specific organizational problems are an issue to be addressed.

1.6.6 Schedule Feasibility

- A period of one semester is feasible enough for the simulation system to complete

1.7   Findings of Data Gathering

For this project, I have done a survey to the targeted audience which is lower secondary school student. The survey was done so that I can understand more about the newer generation of lower secondary school student. By understanding them better, I am hoping that I am able to get their attention to use my project as part of their learning experience in life. So, the statistics that I get is a hundred percent (100 %) from a lower secondary school student.

1.7.1 Do you know what is programming?

Figure 1: *Pie Chart of Survey Question 2.*

From the figure above, it shows that almost 94 percent of lower secondary school students did not know about programming and only a few know (6%) what programming is.

1.7.2 Have you ever heard of C++?

What is C++?

■ Yes
■ No

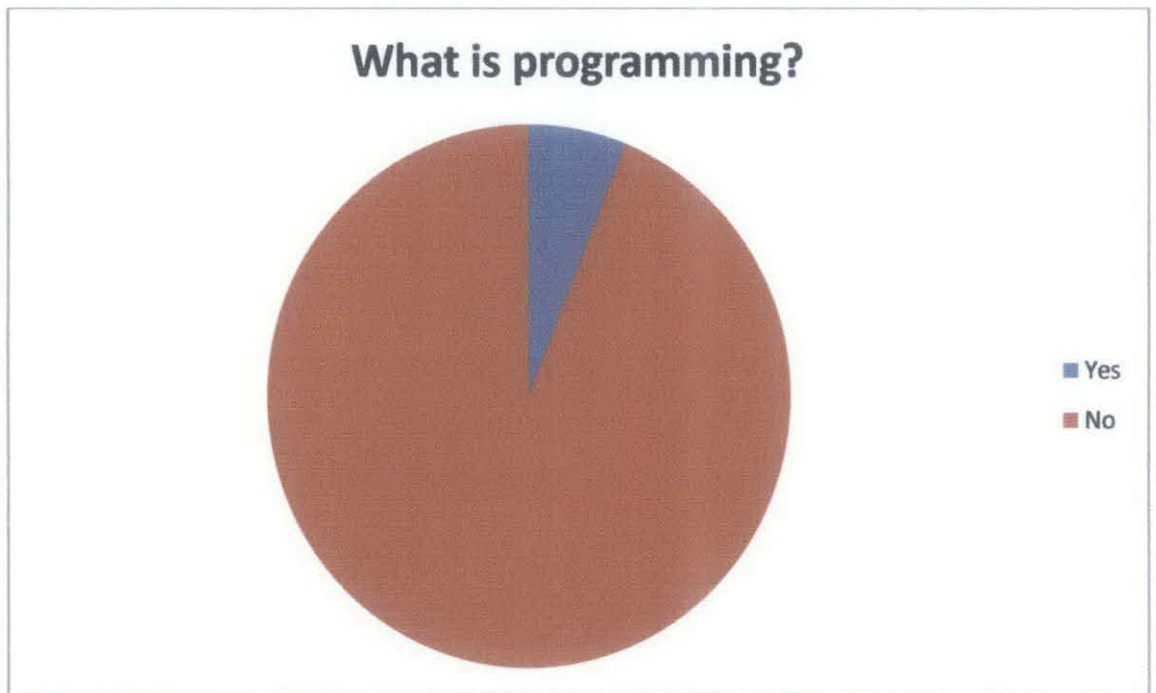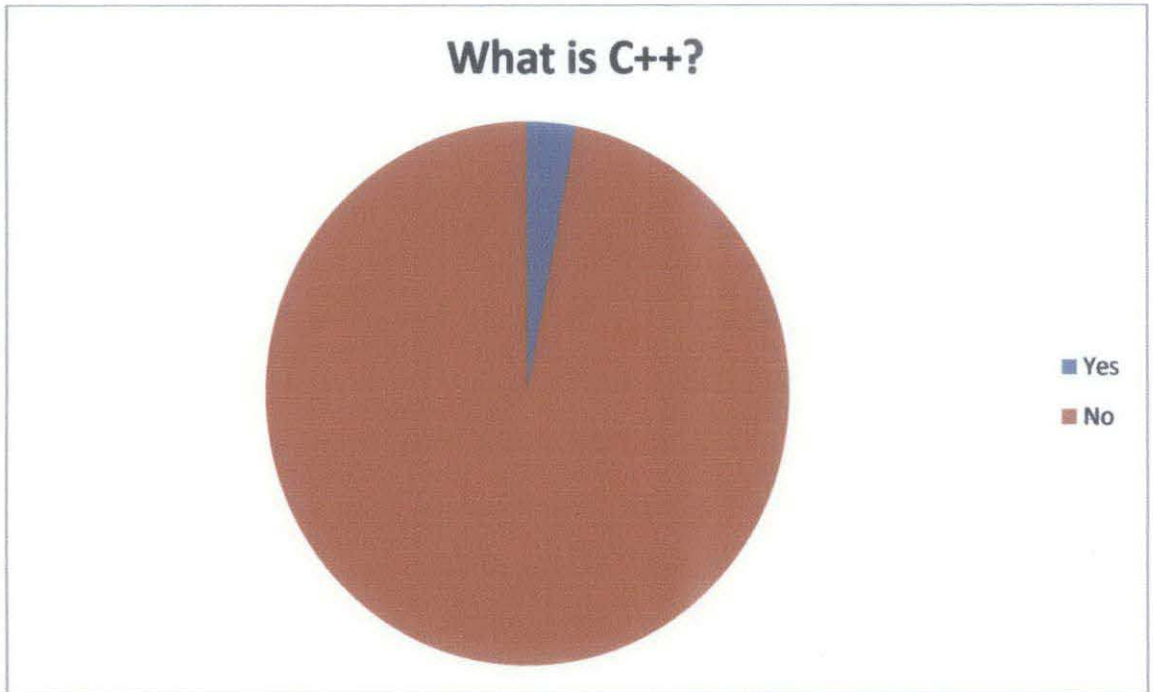**Figure 2:** *Pie Chart of Survey Question 3.*

From the figure above, it shows that almost 97 percent of student did not know about C++ language and only 3 percent knows about C++ and that is likely through their siblings that have taken the subject.

1.7.3 What course in higher education level that you want to pursue?
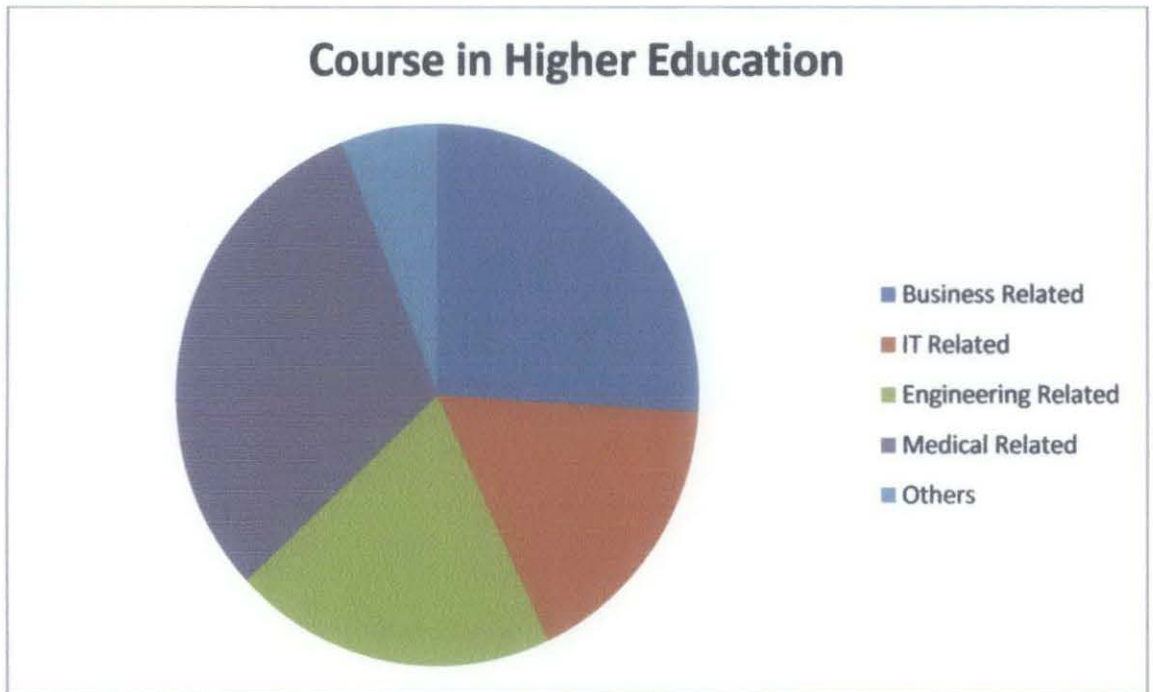
Figure 3: Pie Chart of Survey Question 4.

The figure above shows that 26 percent of student wants to pursue in Business related, 17 percent in IT related, 20 percent interested in Engineering related courses, 31 percent interested in pursuing Medical related courses and 6 percent in other related courses in higher education level.

1.7.4 Do you interested to learn programming language?

Figure 4: Pie Chart of Survey Question 5.

The interest of the student to learn programming language is 50 percent each as shown in the figure above.

1.7.5 Do you want to learn programming before entering higher education? level?

Figure 5: Pie Chart of Survey Question 6.

Almost 80 percent of the student wants to learn programming language before they enter higher education level.

CHAPTER 2
LITERATURE REVIEW

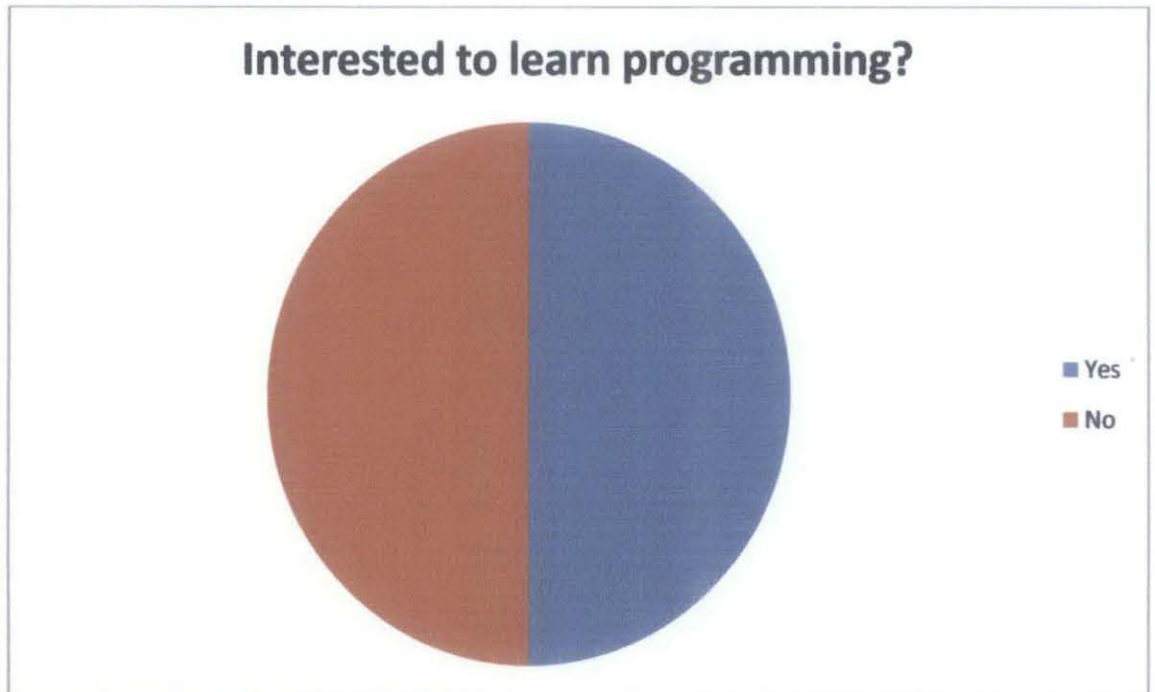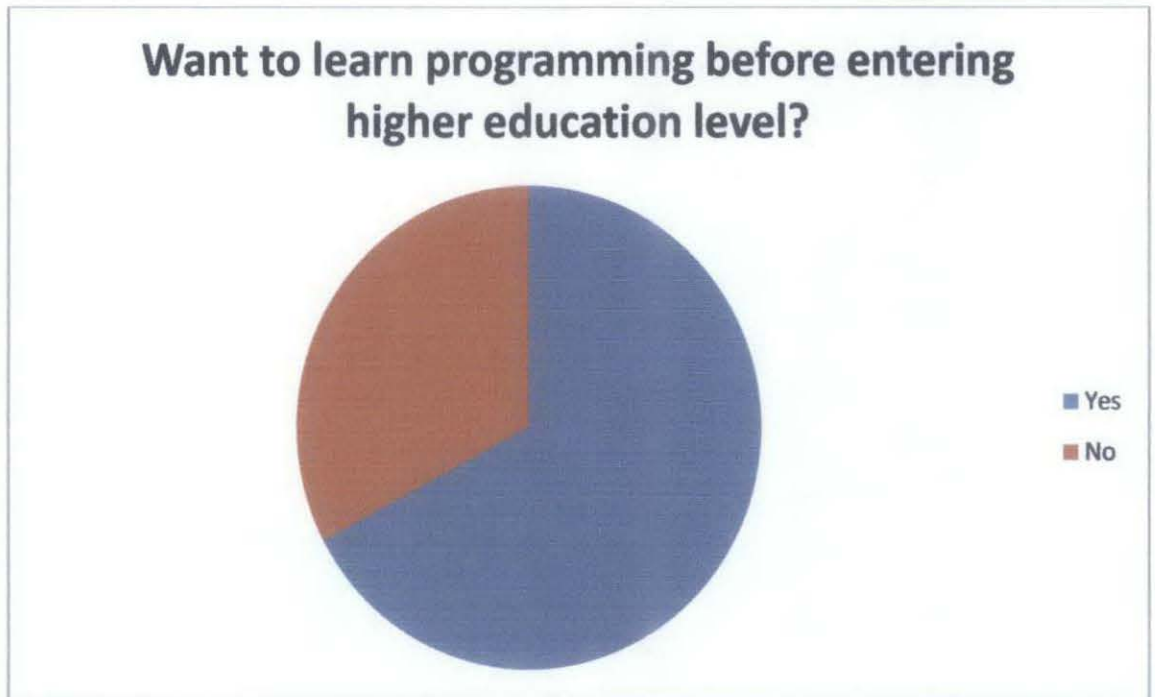Education is an act or process of imparting or acquiring general knowledge, developing the powers of reasoning and judgment, and generally preparing oneself or others intellectually for mature life [2]. Wikipedia also stated that education is derived from a Latin word, *educare* which mean "bring out potential" and *ducere*, "to lead" [10]. To put it in a simpler word, education is an act or experienced which will affect the mind, the character and the physical ability of an individual. It is a process of transmitting or transferring knowledge from one generation to another. Thus, in every country on Earth have education. Each and every one of them has their own set of education that can be followed by.

The education in our country is all handled by the Ministry of Education (MOE). From kindergarten until the Doctorate of Philosophy (PhD) level, as long as the education is based in Malaysia, it will be handled by MOE. But there is also Ministry of Higher Education (MOHE) which handled mainly the IPTA's and IPTS's all around Malaysia. It will focus on the higher learning only [3] [4]. So, all the subjects taken by students in all levels are determined and set by these ministries. And in higher level of education such as diploma and degree, programming language such as C language and C++ language are compulsory to be taken by the students especially those who are taking Computer Science and Engineering courses.

As shown on the title of the topic, my focus is on lower-secondary school students, to teach and have them learn C++ programming language before they even enter the IPTA's. Why? They need to learn it because C++ language is a very difficult subject, and this is from the respond that I get from friends and colleagues of mine. C++ is a subject that must be taken by all engineering student, and also computer science courses.

By learning it early, it will be easier to be used in the higher learning level. C++ programming language has exists from long before (1980s) [5] and considered as the intermediate-level language as it comprises a combination of both high-level and low-level language features [6]. It is one of the most popular programming languages as it has influenced many other popular programming languages such as C# and Java.

Based on Teaching Objects-first In Introductory Computer Science, there are 3 most common ways that has been used to teach programming language to students. They are imperative-first, functional-first and object-first [9]. According to this paper, imperative-first and functional-first will give the students an introduction to programming and started with simple code and gradually more complex programming projects. This is the gentle approach that will give the students the time to assimilate the understanding of how the programming codes works. But the object-first is bolder, it ask the students to jump straight into complex programming without a basic introduction [9]. This way, the students will understand the programming better as a whole rather than bit by bit.

There is one time long ago that computer games is considered as distraction and not worthy to be compared with doing homework or playing outside [8]. But now, computer game has been involved in teaching children in their lives. Computer games such as "Typer Shark" that teach children how to type fast and correct or even flash games over the internet like the "Bubble Shooter" that teach these children on coordination and accuracy. So, a computer game is an alternative that any parents have to teach their children something in lives.

When we are a baby, where we still unable to walk, talk and only know how to cry, our learning curve is very individual. We learns based on what we see and listen. We see our parents walking to us, we try to walk too. We listen to our parent conversation and we try to talk too. As we grow, our learning capacity increase and we start interacting with

the environment, generalizing on the interaction of that basis and then start interacting with other individuals [11].

2.1 Microsoft Visual Basic Express 2008

Microsoft first release it Visual Studio Express on 2005, which can ran on Window 2000 SP4. Due to its popular demand since their original release, Microsoft has stated that the edition will remain free-of-charge. In 2008, it releases an upgrade version of Visual Basic Express which is called Visual Basic Express 2008 [13].

Visual Basic Express 2008 allows its users to provide streamlined, easy-to-use and easy-to-learn integrated development environments (IDE) for users other than professionals software developers such as students or hobbyist [13].

2.2 Advantages of using Microsoft Visual Basic Express 2008

- This software has been taught in UTP.
- This software has the capability to change interface according to developer desire.
- Form can be created from the developer's computer.
- The developer has experienced in using the software to create form with workflow.

CHAPTER 3

METHODOLOGY

3.1   Research Methodology

The project has adopts the prototyping system development life cycle. The prototyping approach allows repetition of analyzing, designing and implementation before the real implementation occurs. This helps to speed up the development of the projects without leaving any small details behind as if any problem arises, it will be solved immediately. This method also could align the development of the proposed optimization technique with academic standards.

Key Milestone

- Data Gathering
- Analyze Requirement
- Design Architecture & System
- Develop Prototype
- Prototype Testing

Prototyping Methodology
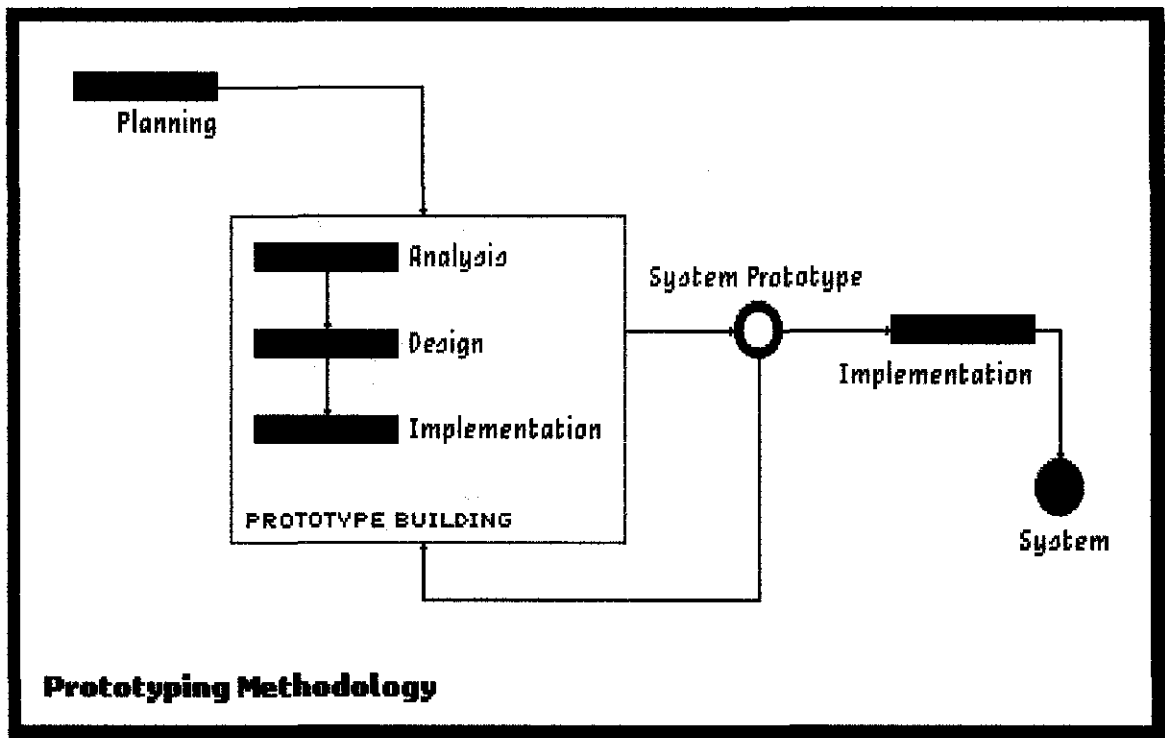
Using prototyping method, there are some important areas that will be covered by the author. The planning phase, the prototype building phase and the implementation phase. This is the important phases before the projects can be considered as complete system.

3.2   Project Activities

In this section, the author will explain how the project activities will be carried out as the author start to work on with the project. By referring to the methodology that has been chosen, the author will explain on how the project is carried out.

3.2.1   Planning

In the early stage of this project, the developer needs to plan ahead the path that will be taken by the projects. The developer has conducts a survey, meet with experienced personnel regarding the project that he will do. As the purpose of this stage is to investigate the current situation regarding the project's feasibilities

3.2.2   Prototype Building

This stage will be analyzing the survey that has been conduct, investigate how the project can be done, investigate the current situation of the project and also for the collection of system requirements.

The result from the analysis, a draft of the initial design was made to have an overall view of the system and this will be taken to the implement stage.

Then, the initial design is implement to the platform that already been decided from the planning stage to see the initial result of the design. This stage allow developer to check whether the platform is suitable (able to meet project's system requirement) for the project.

3.2.3   System Prototype

This stage is where the system is ready to be released and try out to the targeted users, it can be called as Beta-testing.

3.3 Tools

In creating and completing this project, the author has recognized some tools that required in assisting the author. The author will explain each of the tools required as to give understanding why those tools are required.

3.3.1 Hardware

Hardware is one of the most important things in starting and completing this project. As this is a development project, it requires the most important hardware which is a computer or a laptop. As for this project, the author requires only one computer or laptop to create and develop the project.

3.3.2 Notepad

This is the basic tools that needed by the author to complete this project. Even though it is just a notepad, the author writes down the entire things that cross in mind in the notepad. Every simple to the complicated things as noted in the notepad. This step is important because the author working alone and all the things that is not being write down maybe will slip away from mind and it is a waste.

3.3.3 Software

This is the tool which cannot be forgotten nor missed. To accomplish this project, the author has chosen Microsoft Visual Basic Express 2008 as the platform to create the interactive learning platform

3.4 Findings of Research Methodology

After doing some research on the engine that can be used to create my project, I was introduced by my colleague to many other options like OpenGL, Flash and Game Maker 8 that I can use to start my project. Thus, I need to do more analysis on the game engine so that my project can be fully utilized. And I also want the engine to be user-friendly to beginners.

For the content of my project, I will limit the content of C++ language as below:
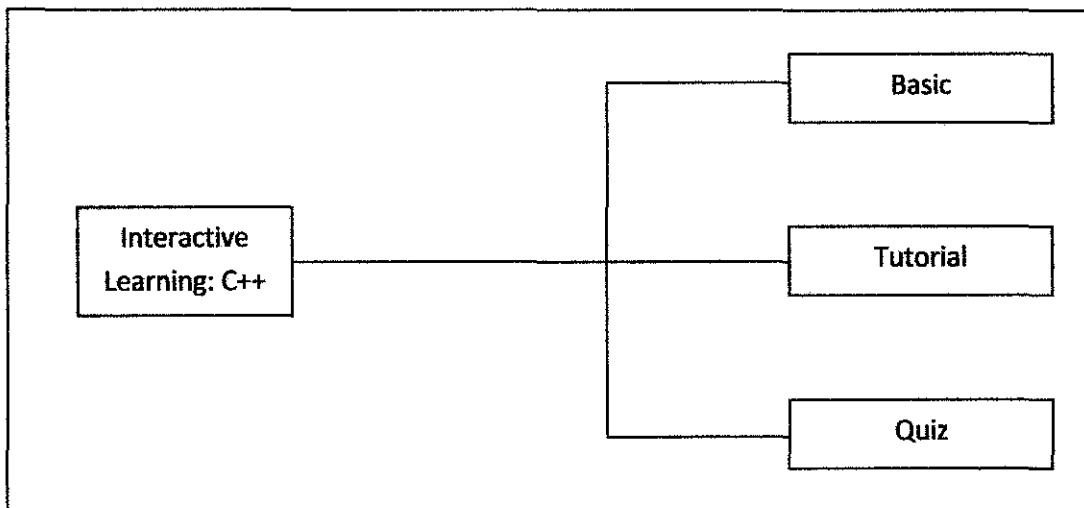
1. Basic elements of C++

   1.1 #include <iostream>/<string>(and other basic)

   1.2 Const

   1.3 System("pause"); return 0;

2. Input and Output in C++

   2.1 cin

   2.2 cout

3. Expression and mathematical logarithm

   3.1 <>

   3.2 >=

   3.3 <=

   3.4 And other relation

4. Control structure in C++

   4.1 If...Else

   4.2 Switch...Case

CHAPTER 4

RESULT AND DISCUSSION

4.1   Software Architecture

The software architecture is basically divided from one part into three which is the Basic, Tutorial and Quiz.

```
┌──────────────────────────────────────────────────────────────┐
│                                           ┌──────────────┐    │
│                                    ┌──────│    Basic      │    │
│                                    │      └──────────────┘    │
│   ┌──────────────┐                 │                          │
│   │  Interactive  │                │      ┌──────────────┐    │
│   │  Learning: C++│────────────────┼──────│   Tutorial    │    │
│   └──────────────┘                 │      └──────────────┘    │
│                                    │                          │
│                                    │      ┌──────────────┐    │
│                                    └──────│     Quiz      │    │
│                                           └──────────────┘    │
└──────────────────────────────────────────────────────────────┘
```

The project will guide the users from Basic part until the Quiz part. The interface will likely be the guidance for the users to finish through the project. Basic, Tutorial and Quiz are all info-quiz type of interactive learning which the users will have to experienced and adjust according to their style to benefit from it.
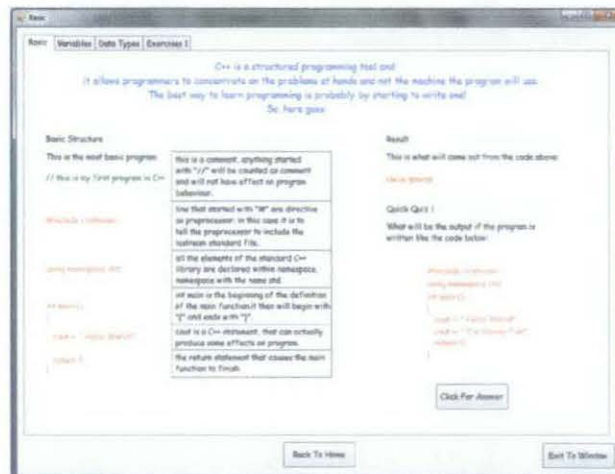
4.2   Prototype and Screenshots

The first time the user use this project, they will come to the interface shown below.

There are 4 buttons, 3 will leads to the C++ interactive program while one is to exit the program.

In the next part, Basic, the developer straight away started the learning by introducing the basic of C++.

All three parts of the program, Basic, Tutorial and Quiz are having the same template as the base design. And the way the C++ is being presented to the user is also the same, giving the info, and there will be a simple quiz and at the end of the part, there will be a quiz.

All the quizzes and questions ask in the program is a must, because it will help the student to constantly remember the previous part.
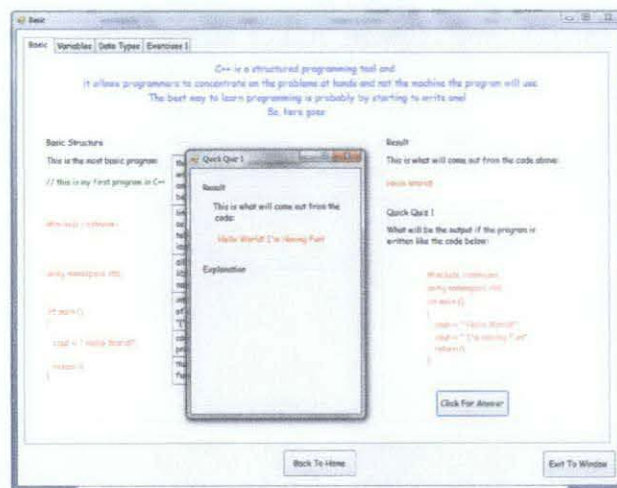
CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

This project highlights the use of interactive learning in education systems in the country. The design and development of a new genre of application through interactive learning is vital as C++ is a vital subject in every university in Malaysia. The main contribution of this project is the preparing the secondary school students about what they will learn in university which is very different compared to what they are learning right now.

5.1 Recommendation for Future Expansion

This project can be expanding further. If there are people who interested in continuing this project, I am recommending adding more advance content like encapsulation and other more complex topic of C++ language. Maybe a database can be used in the project to store some data of the users and also if possible, the project is an online based so that the user may change opinion and interacts with other users.

Plus, the design interface may need to be more matures as it will target a more matured audiences.

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APPENDIX 1: SHORT TERM GANTT CHART

Training Activities	Week Number													
	1 (24/1)	2 (31/1)	3 (7/2)	4 (14/2)	5 (21/2)	6 (28/2)	7 (7/3)	8 (14/3)	9 (21/3)	10 (28/3)	11 (4/4)	12 (12/4)	13 (18/4)	14 (25/4)
Proposal	■													
Approved Proposal			■											
Extended Proposal						■								
Visit to PPPMSB and other plant														
Proposal Defense & Progress Evaluation									■					
Interim Report											■			
Technical Report													■	
Study Week														

☐	In Progress
■	Submission Date

APPENDIX 2: LONG TERM GANTT CHART

Training Activities	Week Number														
	1 (24/1)	2 (31/1)	3 (7/2)	4 (14/2)	5 (21/2)	6 (28/2)	7 (7/3)	8 (14/3)	9 (21/3)	10 (28/3)	11 (4/4)	12 (12/4)	13 (18/4)	14 (25/4)	15 (2/5)
Proposal	■														
Approved Proposal			■												
Extended Proposal						■									
Proposal Defense & Progress Evaluation									■						
Interim Report											■				
Technical Report													■		
Study Week															
Final Exam (Jan 11)															

Training Activities	Week Number															
	16 (9/5)	17 (16/5)	18 (23/5)	19 (30/5)	20 (6/6)	21 (13/6)	22 (20/6)	23 (27/6)	24 (4/7)	25 (11/7)	26 (18/7)	27 (25/7)	28 (1/8)	29 (8/8)	30 (15/8)	31 (22/8)
Final Exam (Jan 11)																
Semester Break																
Start of May '11 Semester																
Project Work Continue																
Start Developing the System (Planning)																
Progress Report 1					■											
Project Work Continue																
Continue Developing the System (Analysis & Design)																
Progress Report 2										■						
Seminar																
Project Work Continue																
Continue developing the system (Design & Implementation)																
Testing the System and Receive Feedback																
Poster Exhibition												■				
Submission of Dissertation (soft copy)														■		

Oral Presentation												
Submission of Dissertation (hard bound)												

☐ In Progress ■ Submission Date