AN ADAPTIVE COMPUTER GAME

FOR PROGRAMMING LOGIC FORMULATION

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A Thesis Proposal

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by

DAVY JONES S. BOLIVAR

ALFONZ R. MONTELIBANO

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Adviser:

STEPHANIE POLINAR

**ABSTRACT**

As information technology is rapidly growing today in the 21st century, the industry is in need of more talented programmers and software engineers more than ever. Meanwhile, video gaming has become one of the most popular and engaging recreational activity in the world. It has a great effect on early adolescents where they tend to become easily immersed to a game, thus making it a good learning environment for introducing basic programming concepts.

This research proposes to develop a computer game software that will teach secondary level students from grade 7 and 8 the fundamentals of programming, as well as enhance their analytical and algorithmic thinking. This will prepare them with knowledge and skills necessary for taking up a programming related course in secondary school. This will also help increase the population of programmers in the I.T. industry by producing potential talented software developers. The computer game will teach students who have little to no idea what programming is, as well as aspiring programmers how to code and introduce them to basic programming concepts.

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**CHAPTER I**

# INTRODUCTION

## 1.1 Rationale of the Study

Information technology is progressing rapidly nowadays - many new technologies are made and introduced to the market every year. Because of this, the researchers believe it would be better to expose students to the inner workings of such technologies in such an early age to show them a glimpse of how such things are done as well as develop the way they solve analytical problems. And since most early adolescents are more inclined to computer games rather than anything related to schoolwork, the researchers choose to make an adaptive computer game software for teaching so the students would enjoy playing while learning programming at the same time.

As more technology and software are being introduced today, so is the demand for more I.T. related jobs. Recent statistics predict that over the next decade, there will be 1.4 million computer jobs and only 400,000 qualified computer science students (Bureau of Labor Statistics, 2013).This means there are 1 million computer jobs more than students by 2020. According to Zuckerberg (2013), “there just aren’t enough people who are trained and have these skills today.”

Programming is one of the most essential skills for an I.T. career. However, learning how to program can be difficult and intimidating. This study will respond to this problem by exposing students to programming and algorithmic thinking through a medium that most of them will find entertaining - computer games. A computer game can help provide a friendly and exciting learning environment. Besides, video gaming has become increasingly popular today. The study will develop a computer game software that introduces basic programming concepts to students so they will be equipped with algorithmic and analytical skills needed in taking up computer science and programming courses in secondary school. This will also help them become more interested in the field of programming and hopefully have them pursue a computer science or an I.T. related degree, ultimately solving the shortage of talented software engineers.

## 1.2 Statement of the Problem

**1.2.1 General Objective**

This study aims to develop an adaptive game software that will introduce students from grade 7 and 8 the basic concepts of programming and enhance their logical and algorithmic thinking.

**1.2.2 Specific Objectives**

The study aims to :

1. determine which basic programming concepts to teach students;
2. determine the game components;
3. design and develop game modules;
4. design the database; and
5. test and evaluate through game scores and written exam.

## 1.3 Significance of the Study

This study will use adaptive computer game software to teach students the basics of computer programming. This research will benefit the following:

**Students** This research will help students in learning basic programming and algorithm concepts through playing a computer game. The study specifically aims to teach grades 7 and 8 students so they will be better acquainted with programming before or while taking up a programming course. The computer game is especially designed to be interactive and fun which will help students become more interested in learning the concepts taught compared to when they are normally taught in classrooms.

**Academe** The study will benefit the academe by providing a new and exciting teaching tool. This method of teaching will make the class more interesting because most students are always interested to play computer games.

**Programming and Software Development Field** This research aims to make students interested in programming by introducing to them the beauty of programming and algorithms through a medium they find exciting and interesting (computer games). This will help motivate them into pursuing a computer science or an I.T. related course in the future. Thus, this study will help solve the job shortage in the computer science industry by producing a good amount of future programmers and software engineers.

## 1.4 Scope and Limitations

The study will develop adaptive game software that teaches students the basic programming concepts as well as improve their analytical and algorithmic skills. The computer game adjusts its degree of difficulty according to the player’s performance. The study aims students in grades 7 and 8 who have no prior knowledge to programming. The game software will not teach language specific syntax, but rather programming logic that can be applied to most programming languages. The software will be a desktop Java application that can be run on any computer with the Java virtual machine installed.

One of the limitations would be that some users might have different interests not related to programming. And there are different types of users playing the game and some of them have different ways of learning, rendering the game useless. Also, the game might not be useful to respondents who have adequate knowledge or experience to programming.

## 1.5 Definition of Terms

**Adaptive computer game** is a computer game that dynamically adjusts its degree of difficulty depending on the player’s performance.

**Computer programming** isthe process of designing, writing, testing, and maintaining the source code of computer programs.

**Algorithmic thinking** refers tothe ability to understand, execute, evaluate, and create algorithms.

**Basic Programming Concepts** refer tocontrol structures such as conditional branching, variables, loops, function, and etc.

**Game Components** make up the game logic such as game mechanics, game rules, and scoring system.

**1.6 Organization of Study** Chapter 1 of this research will present the introduction of the study which is composed of: the Rationale of the Study; the statement of the problem which consist of the general and specific objectives; the significance of the study; and the scope and limitations

Chapter 2 will discuss about the different researches and articles related to the study.

Chapter 3 will present the methods used in the study. It is composed of the following sections: Research environment, research respondents research instruments, and research procedures.

**CHAPTER II**

# REVIEW OF RELATED LITERATURE

Teaching programming through a visual programming software is popular for a lot of researchers recently. Programming plays a vital role today and in the future. If more people are able to program, the possibility of the future to be more technologically innovative would be higher. Using computer games as educational tools in the academia is also a common topic among researchers today, since video gaming is becoming a very popular trend especially among children.

**Visual Programming Environment and Computer games as Educational Tools**

Many recent studies encourage the idea of videogames and computer software as tools for learning programming. One well-known visual programming environment is Scratch, developed by Lifelong Kindergarten Group at Massachusetts Institute of Technology, with the key goal of “supporting self-directed learning through tinkering.” It lets users manipulate jigsaw-puzzle-shaped pieces instead of writing actual code which makes it easier for novice students to create dynamic programs. In a study Maloney conducted in 2010, he concluded that “the Scratch programming environment and language work together to create a system that is exceptionally quick to learn—users can be programming within ﬁfteen minutes—yet with enough depth and variety to keep users engaged for years.”

Microsoft Research Developers also developed a visual programming tool named Kodu, together with other projects such as Alice, Squeak, AgentSheets. These tools are used to teach creativity, problem solving, storytelling, and more importantly, programming through an enjoyable and easy-to-use programming environment.

A research from the IT-University of Copenhagen, entitled “Overview of Research on the Educational Use of Computer games”, talks about video gaming being a good tool for education depending on the subject’s preferences on how they would want to learn it(Egenfeldt-Nielsen, 2006). The study also summarized the benefits of the educational use of computer games according to many different researchers.

**Table 1. A summary of the different benefits of using video gaming as an educational tool according to researchers**

|  |  |  |
| --- | --- | --- |
| **Author(s)** | **Year** | **Results** |
| Levin | 1981 | Video games are motivating, engaging and ultimately successful in teaching Highschools students, from 1st year to 2nd year ,the planned math concepts. |
| White | 1984 | Playing the game improves students’ problem-solving ability related to physics in relation to how force influences motion. |
| McMullen | 1987 | Video games do not have any effect on the learning outcome, neither short-term nor long-term. However, students playing video games indicate that they believe they learn more. |
| Din Feng and Caleo | 2000 | Highschools students who play video games learn better compared to peers who do not use video games |
| Rosas et al. | 2003 | Video games increase motivation and there is a transfer of competence in technology from using the video game |
| Egenfeldt-Nielsen | 2005 | Students learn the same in History when using video games, but have better retention. |

Another article called “Introduce Programming to Kids With Games” conducted by Audrey Watters talks about the importance of letting high school students be more acquainted with computers. Watters states: “Giving students an introduction to programming helps peel back the layers of what happens inside computers and how computers communicate with one another online. Programming knowledge, even at a very basic level, makes technology seem less magical and more manageable. Programming also teaches other important skills, including math and logic.”

**Learning and Teaching Programming**

According to Ala-Mutka (2003), a common approach to teach programming is to first teach the basics of a programming language. The learning of basic programming concepts first should be emphasized as these would “form the basis for building more advanced skills.” Another similar study conducted by Carlisle et al (2005), where they developed a visual programming environment called RAPTOR, states that “when students are learning to develop and dealing with issues of syntax rather than solving the problem.” The research concluded that the visual nature of RAPTOR makes it “easier for students to follow the control flow in their programs, and solve problems more easily”, and that it “develops problem solving skills better than teaching programming in a more traditional, non-visual language.”

Another research by K. N. Whitley explains the way on how the presentation of the problem to the users varies. Whitley states “Researchers do know that problem-solving performance is affected by the way in which a problem is presented.”, and so “This partitioning of programming tasks comes easily, as it follows an accepted understanding of programming”.

This study will determine which basic programming concepts are best to introduce to students who have little to no experience in programming. The researchers will then develop a game software that will use these concepts to help students and novice programmers to become acquainted with basic programming concepts as well as enhance their analytical and algorithmic thinking. The game software will follow a “syntax-free” approach and will not focus on a particular programming language so that problem-solving skills will be emphasized. The main goal of the study is not to provide a visual environment to make programming easier, but rather to give students a good programming background necessary in taking up a programming related course. Additionally, the game can inspire students to consider entering the field of programming in the future by exposing them to the beauty of programming and algorithmic thinking.

**CHAPTER III**

# METHODOLOGY

## 3.1 Research Environment

The development of the game will be done in the researchers' homes and in University of San Carlos. The actual testing, evaluation and data collection will be done in a school computer laboratory.

## 3.2 Research Respondents

Students in grades 7 and 8 who have no prior knowledge to programming will be the respondents of the study. They will be divided into two groups: Group 1 will be asked to play the game, while group 2 will be the control group.

## 3.3 Research Instruments

A series of questions will be presented every after the player finishes a certain topic in the game. This will be used to evaluate how much they learned from that topic. Additionally, a written exam will also be given to the two groups of respondents after group 1 has completed playing the game. The written exam will determine whether the game has a significant effect on the players’ understanding to programming concepts as well as their algorithmic thinking. The exam will be made with the aid of the faculty from the computer department of University of San Carlos Technological Center.

An interest level measurement will also be embedded in the game. The data will be used to determine if the game has an effect in their interest to programming.

## 3.4 Research Procedure

**3.4.1 Data Gathering**

Data will be gathered through the players’ performance in the game and their written exam results. To determine if the game software has a significant effect on the players, their test result will be compared to the non-players’.

**3.4.2 Treatment of Data**

Statistical software like IBM SPSS Statistics and Microsoft Excel will be used to analyze the data. The results collected from the questionnaires will be displayed in tabular form and in graphs.

**3.5 Design and Implementation**

The researchers will use the Java programing language along with Java game development libraries such as Slick2D and LWJGL (Light Weight Java Game Library) to develop the game. Photoshop will also be used to create the game graphics such as character sprites, game world/levels and the user interface.

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# CURRICULUM VITAE

**CONTACT INFORMATION**

Name: Alfonz R. Montelibano

Address: 12 Don Cayetano Ludo St., New Frontier Court Subd, Iligan City, Philippines

Telephone: (063) 225 0318

Cell Phone: 09209645922

Email: m.alfonz@gmail.com

**PERSONAL INFORMATION**

Birthday: June 2, 1993

Religion: Roman Catholic

Civil Status: Single

**EDUCATION**

University of San Carlos - Bachelor of Science in Computer Science

Tertiary level (2010 – present)

MSU-IIT Integrated Developmental School

Secondary level (2006 – 2010)

La Salle Academy

Primary level (2000 – 2006)

**TECHNICAL SKILLS**

C, C#, Java

Web Application Development

Game Design, Game Development

**CURRICULUM VITAE**

**CONTACT INFORMATION**

Name: Davy Jones S. Bolivar

Address: #44 Daffodil St., Guadaville Homes, Guadalupe, Cebu City

Telephone:4127644

Cell Phone: 09164907270

Email: [davy.bolivar@gmail.com](mailto:davy.bolivar@gmail.com)

**PERSONAL INFORMATION**

Birthday: October 21, 1992

Religion: Roman Catholic

Civil Status: Single

**EDUCATION**

University of San Carlos

Bachelor of Science in Computer Science

Tertiary level (2010 – present)

St. Paul Learning Center (Beacon House)

Secondary level (2006 – 2010)

Sacred Heart School - Jesuits

Primary level (2000 – 2006)

**TECHNICAL SKILLS**

C#, Java

Game Design, Pixel Art, Game Development