1. **Theoretical Framework**
   1. **Introduction**

Geeks vs. Bugs is an android logical video game that aims to aid learners of basic computer programming to grasp its fundamental concepts. The proponents’ aim is to develop an environment that would use entertainment as a major tool for learning.

This chapter includes theories that are used as the reference of the study. Tools such as database management, game engines and etc. that were used to develop the game will also be enumerated and explained in the latter part of the chapter.

* 1. **Psychology of education**
     1. **Problem-based learning**

Problem-based learning (PBL) is a method of learning and teaching, which allows students to focus on how and what they will learn. An unfamiliar problem, situation or task is presented to the students (by the lecturer or tutor) and students are required to determine for themselves how they will go about solving the problem.

PBL is a student-centered approach to learning that encourages students to be self-directed, interdependent and independent as they attempt to solve the set problem.

This study applies the PBL principle of teaching through providing a virtual world to players. In these virtual worlds, the player will encounter problems that would require them to apply basic programming concepts. This method will allow the players to integrate what they learned with a situational real world situation.

* + 1. **Interest and Effort in Education**

Interest and effort in education is a study conducted by an American philosopher and psychologist–John Dewey–that became responsible of most of our educational advancement. This study was conducted to prove that improved learning experience could be acquired when the interest of learners are being considered. At the same time, learners should also be given an opportunity to exert their effort through problem-based learning. Many universities, teachers and professors later inherited this educational philosophy.

As an educational virtual game, Geeks VS Bugs inherits the method of capturing the interest of learners and at the same time requiring their effort in order for them to learn what was being instructed in the game. As surveys portray, that playing virtual games has been a huge interest of the majority of our generation’s teens, the game will be used to capture the attention of young learners. And also, as the book of Dewey stated, this interest must be used to stimulate the learner’s will to provide effort, which in the game, will be the challenges and goals. Awards/medals will also be given as an incentive to boost the confidence of the players who give enough effort to meet the game’s requirement

* + 1. **Age Learning Brackets**

The learning capacity and style of a single person has never been constant for the rest of his/her life. According to Age-Specific Learning Characteristics of Utah Medical Education, there are at least 7 learning age brackets.

These are the following:

|  |  |
| --- | --- |
| **Age-Specific Learning Capacity** | |
| **Group** | **Age bracket**  **(Years)** |
| Infancy–Toddler | 0-3 |
| Preschooler | 3-6 |
| School-Aged Childhood | 7-11 |
| Adolescence | 12-18 |
| Young Adult | 18-40 |
| Middle-aged Adulthood | 40-65 |
| Older Adulthood | 65 and older |

Geeks VS Bugs is a game designed for the purpose of captivating the interest of adolescents and early young adult, which is roughly around 18-22 years old. According to Age–Specific Learning Age Characteristics, adolescence is the time of one’s life when he/she develops and enhances abilities to abstract and hypothetical reasoning, reasoning based on logic and scientific reasoning and intense personal preoccupation while early young adulthood is the time when we develop a desire to experience and learn new things.

* 1. **Database**

A database is a collection of information that is organized so that it can easily be accessed, managed, and updated. In one view, databases can be classified according to types of content: bibliographic, full-text, numeric, images and etc.

Database will be used as a container of the data that is being saved by the user as well as the high scores and awards.

* + 1. **Database Normalization**

Data normalization is a process in which data attributes within a data model are organized to increase the cohesion of entity types. In other words, the goal of data normalization is to reduce and even eliminate data redundancy, an important consideration for application developers because it is incredibly difficult to stores objects in a relational database that maintains the same information in several places.

The database will be designed in normalized form to reduce redundancy of data while keeping its integrity. This form of database will also help the game to more efficient in terms of memory usage.

* 1. **Game Software Methods and Theories**
     1. **Artificial Intelligence**

According to the father of Artificial Intelligence John McCarthy, it is “The science and engineering of making intelligent machines, especially intelligent computer programs”.

Artificial Intelligence is a way of making a computer, a computer-controlled robot, or software think intelligently, in the similar manner the intelligent humans think. AI is accomplished by studying how human brain thinks, and how humans learn, decide, and work while trying to solve a problem, and then using the outcomes of this study as a basis of developing intelligent software and systems.

Artificial intelligence could be experienced in the game through stage 4. It will be applied to the bugs in the last stage in a way that they will be fighting with the gamer. It will decide when to attack and when to flee.

* + 1. **Augmented Reality**

Augmented reality is a live direct or indirect view of a physical, real-world environment whose elements are augmented (or supplemented) by computer-generated sensory input such as sound, video, graphics or GPS data. It is related to a more general concept called mediated reality, which a view of reality is modified (possibly even diminished rather than augmented) by a computer. As a result, the technology functions by enhancing one’s current perception of reality. By contrast, virtual reality replaces the real world with a simulated one.

This technology will be applied in the stage 4 of the game. It will be introduce to the game along with the scene where the Nanobot fights against with each other.

* 1. **Shortest Path Analysis**

Shortest path analysis is a type of algorithm that searches the minimum sum of the weights of its constituent edges. It seeks to output the best path, in terms of time and effort, to be taken from one point to another.

The game applies this algorithm through dynamical computing the minimum distance and effort for the Nanobot to complete the requirements in a single level. It is useful for the game because it provides the absolute standard of scoring for each level.

* 1. **Summary**

This chapter contains the theories and previous researches that this study would be referring to. This chapter discusses different tools that were used to complete every module. It was also discussed how each and every theories, in this chapter, were applied in the game and why they are necessary.