

Making Learning Fun: Educational Concepts & Logics through Game

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Abstract- Children are torches that light our future; however, children do not know what is best for them. Children often waste their time procrastinating from studying or doing their homework. That time could be spent on developing their knowledge and for learning new skills. Education is not agile, it follows strict rules and doesn't allow kids to be creative, thus, it puts walls between kids and their education, in which, kids lose interest and stop improving themselves. With these walls, kids refer to non-educational entertainment, such as, cartoons that do not provide moral lessons, any kind of knowledge, or develop their skills. An educational video game is a simple trick to get kids to be interested in education, the video game will teach them math and logic concepts. Such as addition, subtraction, division, multiplication ...etc. Video games in general also develop amazing skills, such as, hand-eye coordination and improve concentration by giving kids real-time challenges that require fast reactions.

Keywords- Education, Logic, Game, Concepts, Unity Engine, Learning

I. INTRODUCTION

These days' kids have been using tablets and smart phones at an early age and they are firmly attached to them. Due to the lack of supervision of adults, they are using it to play aimless games that don't have any educational purpose, which could cause lassitude towered learning. As a solution developers started to make Game-based learning (GBL) games. Which it can be defined as "Game-based learning broadly refers to the use of video games to support teaching and learning" [1]. Which can attract kids to play them and at the same time teach them and concurrently makes them have a good time. Studies found out that Game-based learning is shown to be more positive than the usual methods [2] [3].

Schools and the educational system usually follow the same method of teaching, which is Teacher-Centered Approach (TCA), in this method, the teacher is the authority-figure that takes charge of the class; students are in a passive state to accept the knowledge being fed to them [4]. In some schools, new methods of teaching have been introduced to change the way that used to in learning and encourage the kids to become more active in the class such as Student-Centered Approach (SCA). This method involves students more than TCA, SCA offers is that the students discover things by themselves instead of being fed by the teachers [5]. Cooperative Learning (CL) this method emphasizes teamwork instead of doing all the work by oneself or being fed by the teacher.

Our educational game is designed and developed to be used by children of 5 years and older divided into three different difficulty levels such as, Level 1, the easiest choice, preferable for the youngest age bracket, which will have simple shapes (E.g. fruits) and will perform simple logic based concepts appropriate for their age (arranging colors or sizes... etc.). Level 2, which will introduce, addition and subtraction to the kids, and lastly, Level 3, which is going to introduce multiplication and division for the kids, it will also introduce number sequences. Our aim consists of making children calculate mathematical concepts that were mentioned earlier faster than they usually do, and improve a child's critical thinking by solving simple logical concepts.

A. Literature Review:

There are many video games that provide or enhance knowledge, such as, 01 Words 4 Pictures (1W4P), 1W4P is a video game on mobile devices that shows 4 images that hint towards something, then, and the players should analyze the pictures and type the appropriate word [6]. Secondly, Chess, it is a tabletop board game, where two players sit in front of each other and have their pieces, which are divided into multiple shapes, each shape has its unique sets of movement. Thirdly, Minecraft, it is a video game on mobile devices and home consoles, in which a player controls a character and they have to collect resources and build houses, castles, or bridges. Minecraft has a special edition, called Minecraft Education Edition (MEE) this special edition was developed by the same team but for a different purpose. It was built to be used inside a classroom. It adds basic features on the original, such as, providing supervision by their teacher, play with other classmates and chalkboards [7]. Lastly, Grand Theft Auto (GTA) GTA is a series of video games, which is developed for an older audience; it has brutal violence, car theft, drug use... etc. GTA provides negative learning if kids can get their hands on it [8].

Educational Method	Creativity	Knowledge	Engagement	Interest
TCA	No	Knowledge depends on which course	Depends on the teacher	Depends on the teacher
SCA	No	Knowledge depends on which course	Depends on the course	Depends on the student
CL	Yes	Students usually slack off and let one do all the work	Depends on the group	Interesting
GBL	Yes	Varies with each game	Immersive	Interesting
1W4P	No	Introduces and refines people's vocabulary	Immersive	Depends on the vocabulary
MEE	Yes	Greatly refines creativity, basic physics lessons by trial and teamwork	Immersive for children	Interesting
GTA	No	Violence, sexual crimes and breaking the law	Addictive	Depends on the person
MLF	Yes	simple logic based concepts and mathematical concepts	Immersive	Interesting

Table 1. Comparison between Education Methods

II. GAME AND LEARNING

One of the hardest things is how to understand what kids like, since parents care about children, and they cannot force children to do anything. Also, some parents don't know how to persuade their kids towards doing something fruitful, or some parents cannot make enough time to spend their time with their kids due to their jobs which took a major share of their daily time; their kids usually waste their time for playing games that are not mostly useless for them.

The biggest issue is that children get bored too easily and look for other entertaining options or games. Also, kids nowadays are hard to please with all other entertainment outlets. Moreover, it is a challenging issue to keep the kid's interest in

any single video game. Kids normally seek more after each game they play, they look for challenges so they do not get bored, they also, look for a way to compete with their friends, several games have a high scoring system, which lets kids compare their scores with their friends' scores, which in turn keeps them interested in a game.

III. EDUCATIONAL GAME DESIGN AND STEPS

The following section discusses the flowchart and sequence diagram of MLF in details in flowchart form, it shows how the game works in detailed order from start to finish in all phases:

A. Flowcharts:

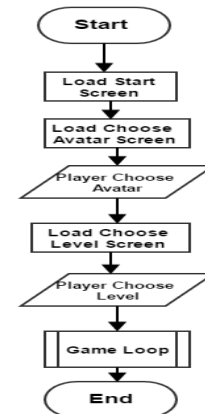


Figure 1. Primary Flowchart

Figure 1 shows the flowchart of the main game, it first loads the title screen which shows the game's logo, a simple nice-looking picture that shows a hint of the game's world, and a message that says, "Touch the screen to continue.". When the user touches the screen it will take them to the avatar selection screen, which will allow the user to choose an avatar they like, and after that it will go to the levels selection screen, which will have three options, Level 1, the easiest mode, Level 2, moderate mode and Level 3, the most challenging one.

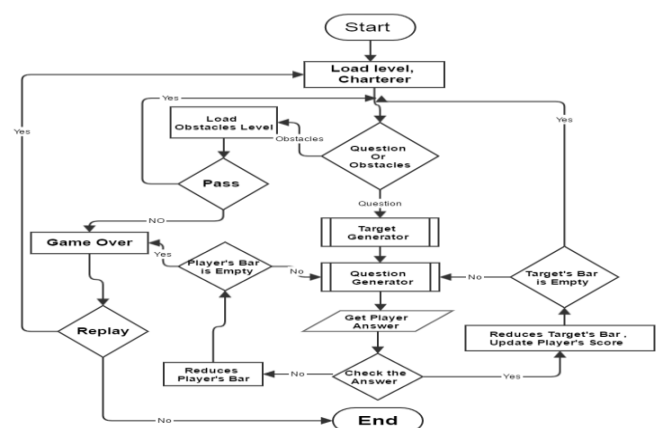


Figure 2. Game Loop Flowchart

The game loop that was shown in **Figure 2**, which is a sub-process of the main game process that runs continuously during the running time until the player decides to exit the game. Game loop will be initialized as a part of the main game.

The first thing the game loop does is loading the game environment. Then it will load the Avatars that the kid chooses from and initialize the player bar. At this point the game should start by randomly decide rather it will load an obstacles level or a question level. The aim of the obstacles level to successfully avoid obstacles. Failing on that level will terminate the game and ask the kid if he/she want to replay the game again. Finishing that level successfully will raise the kid scores. On question level Game Loop, will run a sub-process called Target Generator that is responsible for loading targets. After the target has been loaded the Game loop start a cycle of questions that the kid has to answer them as quickly as can to gain scores the questions are randomly generated by a sub-process called Question Generator. Question Generator will return a question and an answer which Game loop going to compare it with the kid answer. A correct answer will reduce the target bar and raise the score of the player. When the target bar is empty Game loop will run Target Generator to load a new target. A false answer will reduce the player bar until it has run out. Empty player bar terminates the game and asks the kid if he/she want to replay the game again. By end of every cycle, the Game loop will update the High Score List.

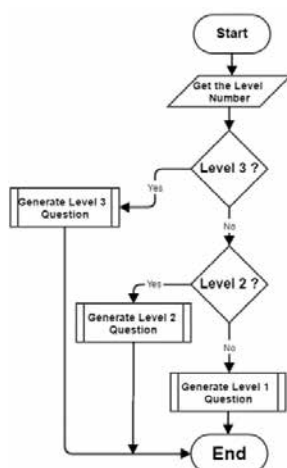


Figure3. Question Generator Flowchart

Figure 3, shows the sub-process that begins by taking the level number which was chosen after the game was loaded. It will first see if the user chose Level 3, Level 2 or Level 1 and will generate the question appropriately. The Generate Level 3 Question sub-process will be ran if the user chose Level 3 when he/she started the game. The Generate Level 2 Question sub-process will run if the user chose Level 2 when he/she started the game and the Generate Level 1 Question sub-process will run if the user chose Level 1 when he/she started the game.

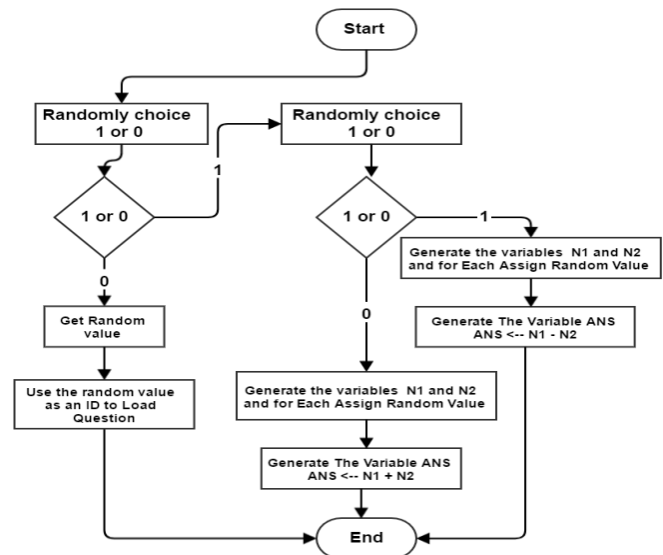


Figure4. Level 2 Question Generator Flowchart

Figure 4 shows the sub-process that will randomly determine the questions for Level 2. It will first randomly choose between 0 or 1, if it's 0 it will generate a Logic question, if it's 1, it will then randomly choose 1 or 0, if it's 0 an addition question will be generated by making two variables, and a third variable to hold the answer. If it's 1, a subtraction question will be generated by making two variables, and a third variable to hold the answer. The question and the answer will be returned to the main game loop to show the question and its answer.

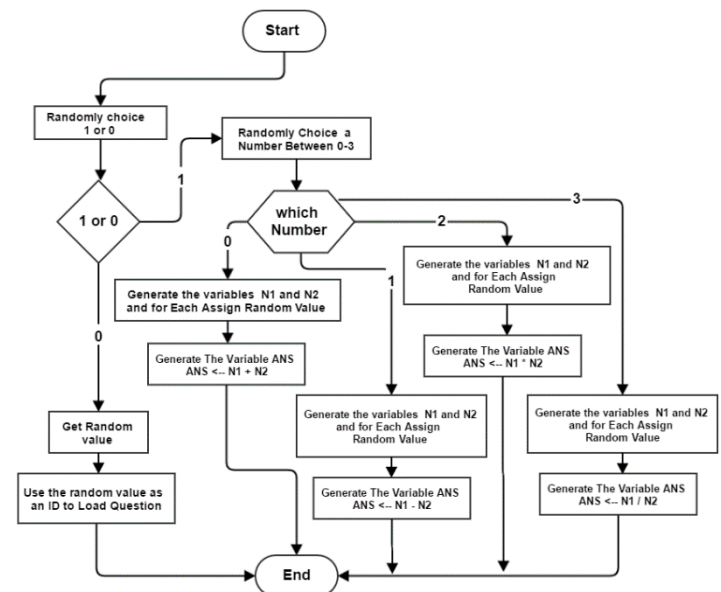


Figure5. Level 3 Question Generator Flowchart

As shown in **Figure 5**, the sub-process that will randomly determine the questions for Level 3. It will first randomly choose between 0 or 1, if it's 0 it will generate a Logic question, if it's 1, it will then randomly choose 0, 1, 2 or 3, if it's 0 an

addition question will be generated by making two variables, and a third variable to hold the answer. If it's 1, a subtraction question will be generated by making two variables, and a third variable to hold the answer. If it's 2, a multiplication question will be generated by making two variables, and a third variable to hold the answer. If it's 3, a division question will be generated by making two variables, and a third variable to hold the answer. The question and the answer will be returned to the main game loop to show the question and its answer.

B. Sequence Diagrams:

This section contains the UML Sequence diagram, which will show the interaction between the player, the game, and the game with its different Sub-processes while the game is running.

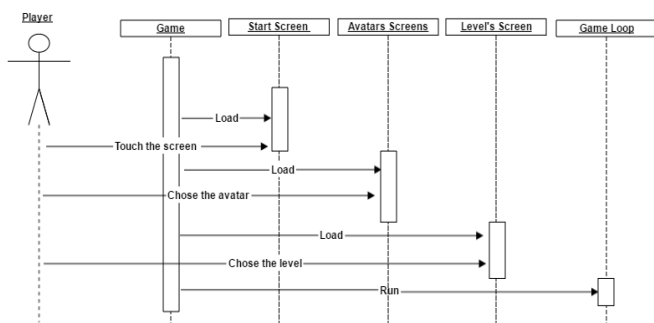


Figure6. Main Game Sequence Diagram

The initialization on the game is shown in **Figure 6**, which that starts by the game loading the Start Screen and wait until the player interacts with it by touching anywhere on the screen that means the player is ready to play. After that, the game loads the Avatar Screen which will show the player different avatars that the player must choose one out of them. Next, the game will load Levels Screen, which shows three difficulty levels, and the player has to choose one of these three difficulty levels. Then, the game calls the Game Loop sub-process, which will operate continuously until the player's health bar reaches zero (empty).

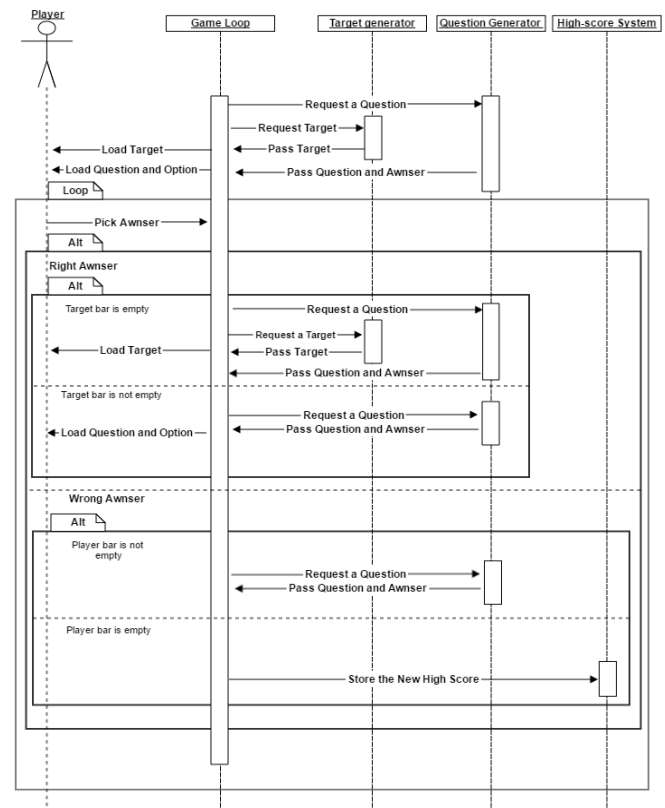


Figure7. Game Loop Sequence Diagram

When the Game Loop starts running (as shown in **Figure 7**), it will send requests to the Question Generator and to the Target Generator. Target Generator will respond by passing the suitable target for player's current score. While on the other hand, Question Generator responds by passing a randomly generated question with its answer. After getting both responses, Game Loop will load the target with its target bar. After that, it will load the question alongside with its corresponding options with the correct answer amongst the options. The player must figure which one is the right one and pick by touching it. Touching the correct answer will make the Game loop do one of these conditions if the target bar is empty then the Game loop will send requests to Question Generator and Target Generator for a new question and new target otherwise it will only send a request for a new question. However, when the player touch incorrect answer Game loop will send a request for a new question when the player bars is not empty else it will update the High-score System.

C. State Diagram:

This section contains the state diagram, which will describe the behavior of the system.

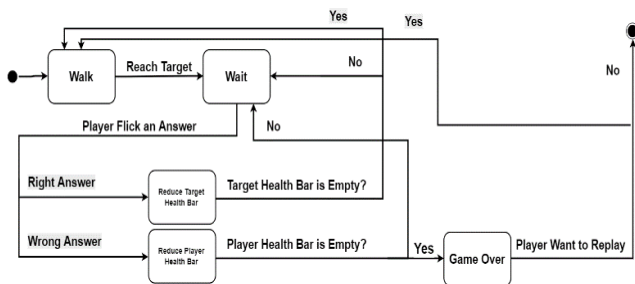


Figure8.State Diagram

Figure 8 shows the behavior of the system while in different situations, such as, "Walk," then it goes to the "Wait" state if the player Reaches a Target as shown in the transition.

IV. Educational Game Interfaces

This game is targeted towards kids, with an aim to further their education during their free time, which is basically, by introducing simple mathematical problems into video games which a lot of kids enjoy spending their time doing:

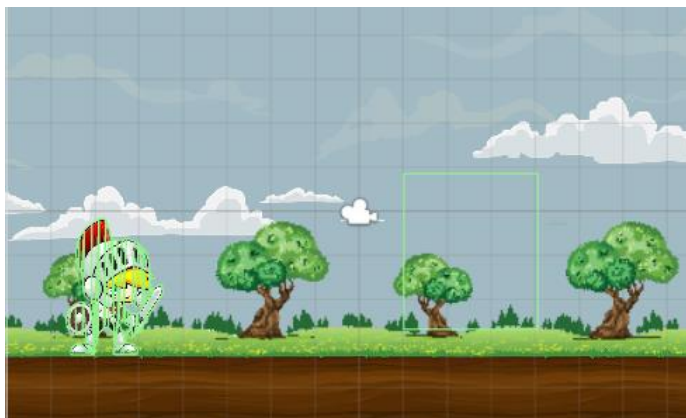


Figure9. Environment of the game with a character

Figure 9, shows the environment [9] with a character (a 2D sprite, which will be referred to as "Knight" [10] from here on) implemented in it, this is one of the characters that we are implementing with the rest of the characters will be implemented later, by the end of the implementation phase. Moreover, Figure 9, also shows the character's collision system, the green lines on the character are what gives the sprite a physical body on the engine of the game.



Figure10. GUI of the game including the Target

Figure 10, shows the GUI of the game, as can be seen on the figure, the hearts on the top right are the player's "health points," while the hearts above the target are the target's [11] "health points." The question showed in the top middle of the screen is the question that is randomly generated by the engine, while the numbers in front of the character represent the options that the player can choose from. The text on the bottom of the screen is the scoring system. If the player successfully answers the question, a single point will be added to the player's score. If the player successfully defeated the target by removing all the hearts above the target the player will get an additional 10 points, which makes the player feel more accomplished, in comparison, if the player didn't get the additional 10 points, it will make the winless fun.

V. CONCLUSION

Outside schools, kids nowadays spend most of their time in non-educational activities that may have a negative impact on them. This research presented game-based learning environments to teach basic computational skills. This paper shows what we have implemented game-based learning for kids based on their free time. This approach is very popular with the emerging of smartphones and smart gadgets era.

VI. FUTURE WORK

As this research is at its completion stage and it will require more time to be tested for real analysis at user end after a great use of it. We aim to discuss MLF impact on school going kid in second phase to know the real impact on learning through MLF game.

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