

Integrating Computer Game-Based Learning into Educational System

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Abstract: The attention to computer game-based learning has grown as research continues to demonstrate its effectiveness for education. Games have been proven to be an effective tool in amplifying regular or traditional teaching methods. However, prior to the development of such educational game, in order to be effective, it is essential that such teaching skills are addressed first and implemented into the game design process. Educational games cannot be designed and developed by instructional designers alone, or just by a game developer. It requires both the instructional designer and game developer to be equally involved during the design stage. This paper presents a logical summary of the phases involved in the Instructional Design Process and Tasks, and the Game Design Process of a game. This paper also includes a short overview of the Game Concept and Design Document and discussed how it can be adapted for an educational system. Teachers know little about game development, and the game developers know little about the science of teaching and learning. So a proper communication should be made between the two in order to create a content which plays very well and interests students but also at the same time teaches them concepts in a way that the teachers want to.

Keywords: Motion Gaming , Leap Motion , Unity 3D, hand detection, sensors, infrared.

I. INTRODUCTION

In recent years, the internet, smart phones and games have become detachable elements of our lives. Easy access to the internet through stationary or portable devices - is now playing an important part in making young people addicted to downloadable applications and games. Hence, this interest in gaming can be utilized by introducing the game based learning modules. Using emerging technology like unity engine and leap motion, this paper introduces an e-Learning game: "DUMP THE ANSWER" by using unity, an engine that can be used to develop e-learning games. the game also uses a device which senses hand motion called "leap motion" we have demonstrated the benefits of applying MOTION DETECTION technology of developing game-based application, which can be used as game-based learning tool.

II. INSTRUCTIONAL DESIGN PROCESS

Instructional design process include designing the learning concept. Questions like what will be learned should be answered in a detailed manner in this phase. In the following game i.e "DUMP THE ANSWER" we are focusing on basic mathematics, color recognition and shape recognition since the game is dedicated towards learning for kids. The mathematics part will involve solving problems of addition, multiplication and subtraction where multiple options will be given and only one right answer must be selected and similarly for shape and color recognition part. Instructional design process thus deals with what problems are created and solved while playing a game. This phase can be said to be focused on science of learning. The game will be in the incremental learning format. Which means all the levels will not be of the same difficulty, but there will be a step by step increase in difficulty as the player progresses.

The aim of the game is to take children from the most basic of mathematical operations, colors, shapes and take them to high difficulties so that the concepts are very well cleared to the kids or students and they can get the best possible results.

III. GAME DESIGN PROCESS

Game design process involves figuring out how the game is supposed to work, that is, the genre of game, the mechanics used in the game, the game engine, the various components that make up the game, etc. this phase involves creating the structure of the game so that later the learning process can be incorporated in the game being developed. We are using the Unity 3d Engine ,which is an open source and free application to everyone around the world, to create our game .The unity Engine will be responsible for the level designing of the game along with the codes or scripts which define the rules of the game. The game we are developing uses a device that detects hand motion. This device can be used to interact with in-game objects. "DUMP THE ANSWER" involves basically multiple interactive objects like balls, boxes etc as shown in the fig. 1 and a giant bin, the game mechanics is such that using the hand motion detector a projection of our hand is created on the screen guided by which we can pickup the balls, boxes or any other object and dump them in the bucket.

A. Working:

The game works on the basis of two C# scripts that play a very important role in the working of the game. The first script which is the "Grabbing Hand" script is basically a set of lines of code which detects pinches of the index and thumb finger and grabs the rigid-body which is closest to

the projected hand 3d model. The second script is the “Grabbable Object” script. Only the 3d models which have the Grabbable Object script attached to it can be grabbed. As it would be very uncomfortable to the player if the objects that have no reason to be a selected answer get picked up.

The Grabbing Hand Script is set up to activate the pinch state when the distance between the thumb tip and index finger is very less. When pinch state is activated it will find if there is any rigid body close to the hand. If a rigid body is found which also has the Grabbable Object Script attached to it, then that object will be grabbed and it will hover with the hand as the hand moves in space. Similarly when the distance from thumb tip and other finger is increased beyond a threshold value, the pinch state is deactivated and the object on hold is released.

Many other Scripts are also used in the game which are used for variety of functions like : The “Score Tracker “ Script is used to increase the value of score when an answer is Dumped in the bin. It also keeps track of which answer will reward you with more points and which ones with less points.

In order to detect if the Right answer is Dumped in the bin, we use a Trigger Event. The Trigger Event is activated when an object collides with it in 3d Space. The trigger Event is setup to detect which object enters the bin. So when the answer is dumped by the player, the trigger event detects the collision and finds the name of the object. If the name of the object matches with the correct answer, The Score Tracker Script is notified of this and Score Tracker then distributes the points.

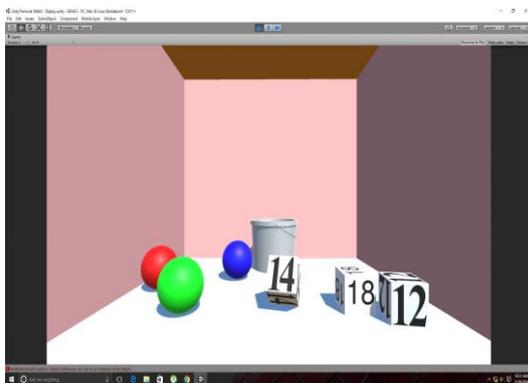


Fig. 1. Example Scene of the game showing objects that can be interacted with.

IV. GAME CONCEPT

The game is basically divided into 3 parts each part deals with a different part of learning process for kids i.e it involves learning about colors, maths and shapes. The goal of the game is to grab the right object and dump it into the bin for eg. drop black color ball in the bucket as shown in the fig. 2.

Similarly for Maths, a question or problem is asked to solve and the answers in the form of multiple choices are given. The player is required to grab the correct option and

Dump it in the Bin. When the correct option is dumped, points are awarded and score increases as shown in Fig 3. The same goes for the “Shapes” levels. A certain shape will be asked to be Dumped. The player must pick up the correct answer from available choices and Dump it. As the player completes levels, the difficulty increases along with the number of available choices. For eg, if previously there were 3 choices , now there will be 5 and the question or problem asked will also be much difficult.

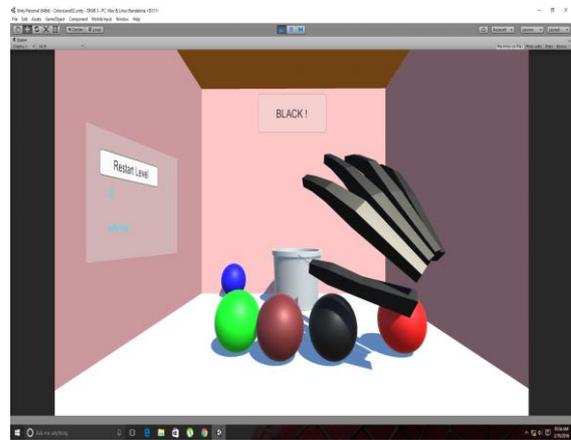


Fig. 1. Example of a Colour-Based Level

The example level of maths problem is given to calculate the answer for $5 \times 6 = ?$ as shown in the fig. 3

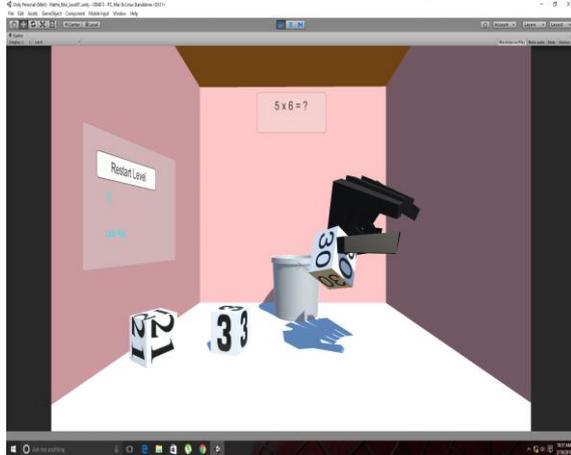


Fig. 3. Example of a Maths-Based Level

V. HOW IT CAN BE ADAPTED TO THE EDUCATIONAL SYSTEM

This game concept can be integrated in schools, Educational Games for Children helping in their cognitive development as well as creating a fun learning environment.

Creating interactive environments where hand gestures and hand motion can be used to interact with objects within the environment.

Reducing the need to have physical equipments to teach the children by having these equipments in the game (a simulated environment) this games can also be implemented in places like summer camps so that children can learn while being entertained.

VI. CONCLUSION

These kind of game applications can greatly improve students learning interests. In the future this system of gamification of learning can be used to deal with other aspects of learning like a virtual chemistry lab or physics lab can be created to play/learn with different tools virtually. Any virtual musical instrument like drums, piano can be created and virtually endless possibilities can be made available by this system.

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