Game Based Learning: Crafting Interactive Educational Experience

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Abstract— **This research paper explores the potential of game development as a tool for e-learning. With the growing demand for online education, the use of games as an educational medium has gained significant attention. The study investigates the impact of game-based learning on student engagement, motivation, and knowledge retention. The paper also delves into the various game development techniques and tools that can be used to create effective e-learning games. The research methodology includes a literature review, case studies, and a survey of educators and students to gather their insights and opinions on the subject. The findings suggest that game development has the potential to enhance the learning experience, making it more engaging and enjoyable for students. The research also highlights the importance of integrating educational content seamlessly into games to achieve optimal results. Overall, this study provides valuable insights into the application of game development in e-learning and its potential to revolutionize the way we learn.**

Keywords— **Game Development, e-Learning, Education, Game-based Learning, Unity Engine.**

I. INTRODUCTION

Video games have been a part of the lives of many people since its beginning. Where they began only as a source of entertainment, the past few years have shown a significant growth in the use of video games for the various other purposes as well. Video games have shown promising results in grabbing the attention of children. They get deeply indulged in the stories and the game mechanics trying to learn all the different move-sets the game has to offer. Based on this factor alone it can be implied that

learning can be made more interesting and spark interest in a child's life.

Traditional methods of teaching although still in use at a huge scale is beginning to show only little benefits in the students' educational advancements [1]. Metaphorically speaking, the bookish study methods simply put the students in a box with a limited amount of resources and make them "make the best out of it" only providing some actual benefits in the name of practical sessions. Integrating education with internet not only means providing the contents of the book and lectures online which, in the current scenario, seems to be the way everyone thinks and implements.

Games to help study mathematics, to recreate various scientific experiments, to help improve critical thinking and develop a problem solving attitude are being developed and they show massive boost in children's cognitive skills. However, the success of game-based learning depends on the effective integration of educational content into the game. Creating games that are both entertaining and educational requires a unique set of skills and knowledge, including an understanding of learning theories, instructional design, game mechanics, and programming.

This research paper aims to showcase the development of one such video game that promotes learning in kids and toddlers. Using the Unity game engine, an amalgamation of various 3D and 2D games was developed that encourage the growth of children's minds as well as provide them with a fun experience. It not only focuses on improvement of cognitive skills in children but does it while covering their school syllabus.

II. LITERATURE REVIEW

An old study, much before the internet became mainstream and only a little while after video games were starting to be recognized by everyone, suggested the use of a four step process to develop an educational video game. Initiation, Design, Construction and Use being the keywords. It suggested the use of games from game shows running at that time on the television like jeopardy or wheel of fortune, basically games based on quizzes and mathematics, can be used to spark an interest in the younger generation. Games based of cards were also used [2].

An empirical research with the motive to study the impact of role-playing and strategy game on students' problem solving skills showed commendable response against the students who were not a part of the study [3].

A study about some high schools using video games to teach the students much less entertaining and engaging subjects like history was done in a small town of the Midwestern United States. The teacher made a game about World War II which was played by the students for a few days. The results shows a drastic shift of the class to a student-centered environment for learning rather than the regular teaching method [4].

In Chile, to test the impact of gaming on learning, a set of students were chosen to play video games to see its impact on their learning of Mathematics and English. The test happened for a period of 3 months and the students from the set along with others who weren't a part of the test were made to give an assessment. The results showed students who were a part of the test showed a great deal of up-gradation in their will to learn and scored better in the assessments [5].

In much more recent times, some educational technology companies (Byju's) and a few DTH service providers (Tata Play) have started using video games to promote learning in students. These games don't necessarily provide a wide variety of mechanics in-built in them but are still really beneficial for kids in teaching them basic

mathematics and spellings and toddlers in teaching them about colors, shapes etc.

III. METHODOLOGY

Using the Unity Engine, the main architecture and theme of the game was decided. Once the themes of the different games were set up multiple projects were created separately with the intention of merging them once complete.

Since this game involves six separate games, six projects were created with one additional project that will be used to merge all of them together.

The six projects are sub divided into two age groups: Toddlers and Pre-teens

The Pre-teens Games include:

1. Quiz Corner: A Quiz game based on their school's curriculum. It follows the general quiz mechanics complete with 4 options, a timer and a final score. Children receive stars based on their performance.
2. Math Mayhem: A 2D platforming game that teaches children about even, odd and prime numbers and their division. It is inspired from the classic Super Mario Bros. game with our player having the ability to damage enemies based on the numbers they are assigned with(even , odd or prime). You reach the next level on reaching the door at the end of the level.
3. Puzzleodgy: A 3D platforming game that is based on giving information about the events, symbols, sports, public figures etc. that a child may observe in its daily life. Inspired by the mechanics of one of the games from Takeshi's Castle, its levels get more and more challenging as the game progresses.

4. WORDS: Another 3D platforming game to teach children about words. They are shown a set of jumbled letters at the beginning of a phase and are required to form the correct word by jumping on the blocks given. Correct pattern leads to the beginning of the next phase whereas wrong block leads to the restart of the level.

The Toddlers Games include:

1. Guess The Sound: A quiz-like game for children to get them to know about the various sounds that they might hear in their daily lives. This is sub-divided in four sections separate for birds, animals, insects, and daily life objects.
2. Know The Word: This game teaches children about the pronunciation of different things that they see in their daily lives. It's also divided into multiple section for animals, fruits and vegetables.

Creating a unity project involves 5 major steps before its deployment:

1. Choosing the game concept
2. Designing the environment
3. Setting the mechanics
4. Adding sound and music
5. Testing and Debugging

After the concepts for all the various games were finalized (mentioned above), it was time for step 2, i.e. designing the environment. This is the part from where the actual work in the unity engine began. As the game primarily focused on children, the environment had to cater to them. The colors, the art, and the characters all was specifically designed to be cheerful, easy on the eye and cute.

The next step involved designing the setting and creating the mechanics for every individual games.

Pre-teens Section:

1. Quiz corner: In terms of the setting, this game was the most basic. It simply has questions according to the subjects chosen by the user, popping up with four options below it. A circular timer along with a progress bar are also displayed on the screen. On selecting the correct answer, a greeting screen is displayed, whereas if the wrong option is selected, the correct answer is displayed. When the game ends, your final score along with the grade and some stars are displayed for a user.

2. Math Mayhem: This is the most vibrant game of the lot. A small owl protagonist with the ability to shoot stones and evil flower enemies stopping the hero, making its health deplete by throwing cacti and spikes. Platforming across a challenging area with the fear of falling off of it, the protagonist needs to reach to the end of the level and through the door present there. The game screen UI contains the player health, amount of lives and score. The enemy has a health bar along with a number popping up at its head according to with the user judges the kind of rock to throw and destroy it. Touching the spikes that lie on the way too much or touching the enemies a lot results in your loss.

3. Puzzleodgy: This game is collectively based on events, symbols, arts etc. the 3D platforming. The game has a ball rolling and tumbling across the level. It has and image being displayed at the top of a structure with four doors that have options written on them. The ball (player) must choose the correct option and they maneuver through a maze-like level to complete it.

4. WORDS: The game has a character, who is a boy in a funky outfit, running across the map in space. It shows tiles scattered around the space with letters on them. Jump on them and form English words to complete the level. Choosing the wrong tile makes the character fall into the void. The entire theme is of space with the environment being starry black.

Toddlers Section:

1. Guess The Sound: This game follows the jungle and household theme. Sounds from the jungle or things common in any household are played and the toddler guesses who that sound belongs to. It has a similar UI to the quiz corner game with only the background and subjects to be different.

2. Know the Word: This game is a simple dictation game. Following the jungle and farm theme. It has animals or veggies and fruits simply popping up in the screen and a voice narrating what the image is of.

Once the mechanics of each game was programmed according to the setting. The sound and lighting was added.

The adding of sounds follows a basic set of steps in game development using the unity engine i.e. to select and object, add an audio object to it, download the audio you require to play, and set that audio file to the object. If an audio is to be played at a specific point of time, some extra programming is required. This was used in the quiz corner game as it allowed playing of a sound when you choose an option or to play a cheerful or sad sound, if the option you select is correct or wrong respectively.

Similarly, it was used in adding BGM to the math mayhem game. Also playing sounds when you jump or pelt stones at the enemies. Failing a level also played a sad audio.

Puzzleodgy and WORDS had less sound elements. The only ones being a cheer when you finish a level.

Know the word and Guess the Sound had heavy audio elements. Playing a new sound on each question and for every image being displayed on the screen.

After this stage the game was ready for deployment and for the general public to play. But before this the game was tested for bugs and any unnecessary mechanics that it may have. Few of the games had gaps around the corners, making the character fall through them even if it would appear that they are standing on the ground. This was a minor bug and was fixed simply by adjusting the position of the blocks. A few games showcased unwanted audio and lighting effects. Fixing the sound was a little challenging and required a lot of tinkering in the floating point values to have it play at the exact moment. Lighting effects were fixed on their own after the final build of the game was made. Websites like itch.io is a good space to deploy your game, before the actual deployment, for the general public to play and review the things that must be changed in order to make it more enjoyable and less frustrating. After acting upon the reviews of the games and making the final set of changes. The game is now ready for actual deployment.
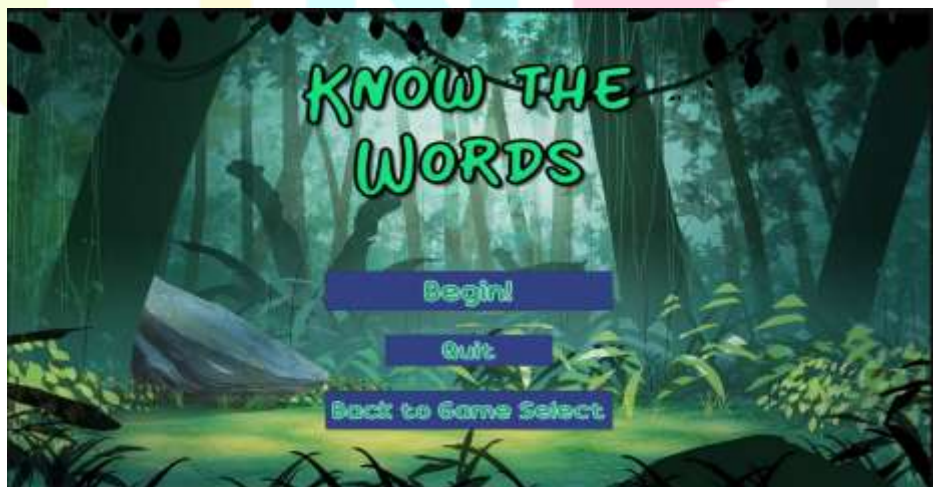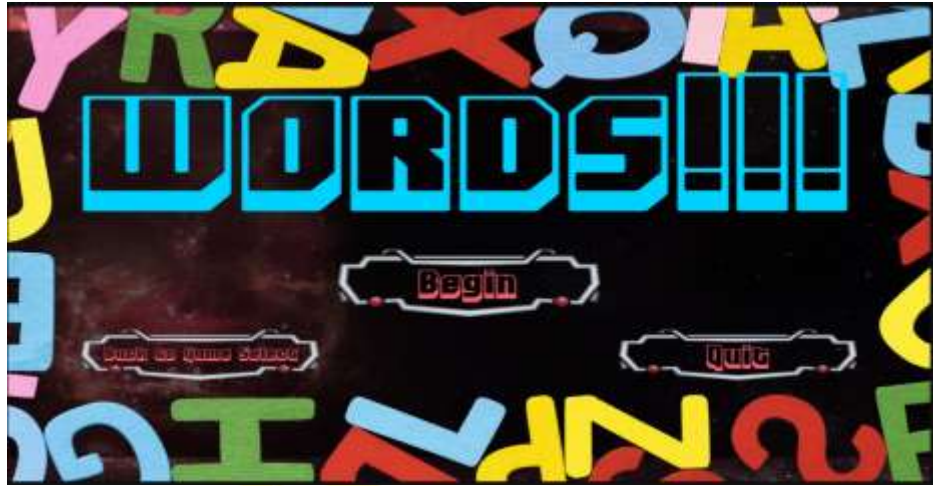
There are many websites that allow the deployment of games, however steam and epic games store are the most user friendly options. Although steam does charge you a fee for the deployment of the game, it has a bigger and more diverse set of users, making your game reach every corner of the world.

IV. Layout of Designed Form
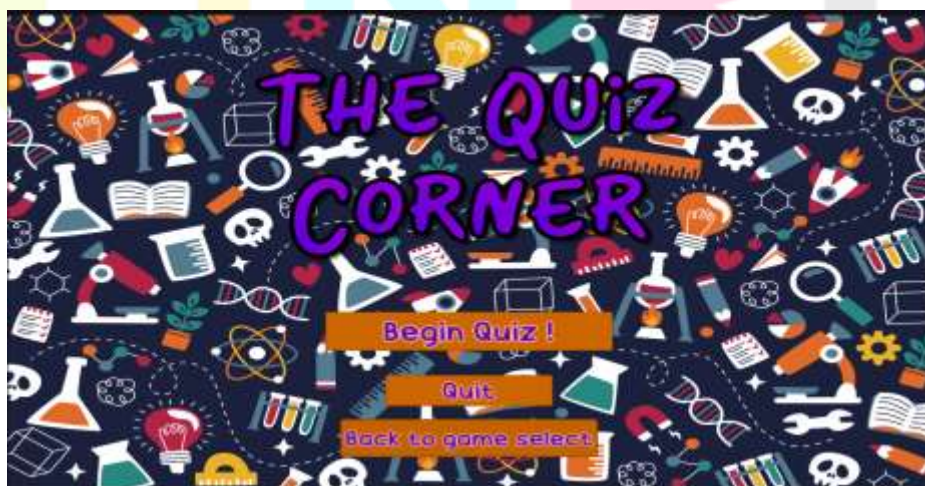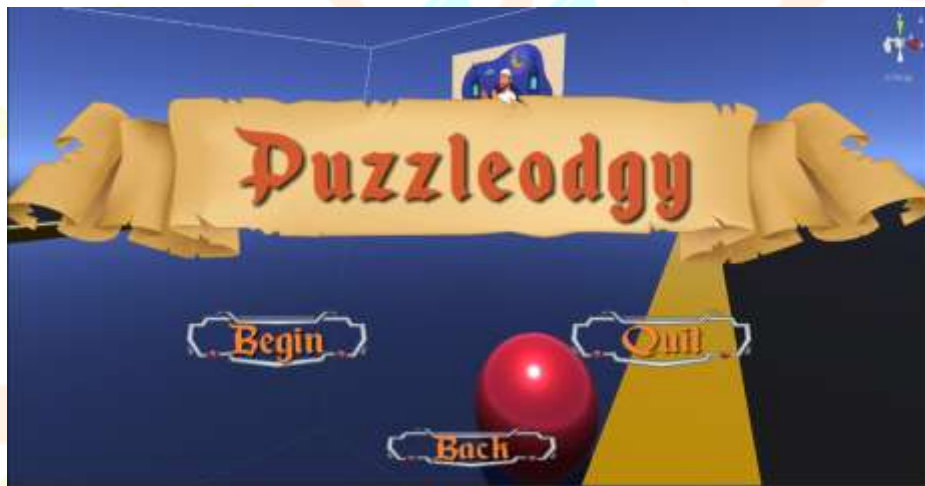
V. CONCLUSION

The process of game development requires deep knowledge of the psychology of the user as well as a vibrant and colorful brain to design a game that attracts an audience. From a thing as minute as how a block is placed in an environment to the entire storyline of the game, build a video-game is a challenging task and further to create something that not only promises a fun time but also provides a learning outcome makes it even tougher.

There are thousands of games present in the web, hundreds of which are actually engaging and fun to play, out of those only a few remain which are solely targeted for children and actually provide a learning outcome. There is no denial in the fact that E-learning is the future and the modern means of education will take over the more traditional methods of teaching, however gamifying the learning experience will only benefit the children, by increasing their cognitive skills and doing so while providing them a fun time.

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