The Implementation of Android-Based Gamification to Design an Interactive Quiz Educational Game for Support Learning Activities

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Abstract

Today's gadget technology has developed rapidly and has many features, along with the expansion of the internet network. In Indonesia alone, according to a survey from APJII, as much as more than 50% of the population has smartphone gadgets for daily use, and as much as more than 75% are dominated by children aged 12 years and over. However, only a few use smartphones for learning, which will affect smartphone users in terms of changing attitudes, behaviors, and motivation for learning. For this reason, the authors designed a quiz educational game application for learning, especially learning English, that utilizes gamification to increase children's motivation to learn while playing so they don't feel bored. The system was created using the GDLC development method with the Unity 3D Engine software, and for the Gamification system, using the Shephertz App42 API. Alpha testing shows that the functions in the game run well, and the gamification function works well and according to its function. The BETA test shows that the students taught by the author can improve their understanding of the English subject matter through the educational games made.

Keywords: Technology, Smartphone, Learn, Games, Gamification.

1. Introduction

Education is one of the things that is needed by every element of society because, by participating in education through learning and studying, it will form an intelligent and dignified individual in society in the future. Seeking knowledge does not always have to be from children alone; adults can still seek knowledge, although not as much as they get at school, either through interaction with the community, the work environment, or self-study. One of the subjects that is often studied is language. By studying linguistics, we can interact with other people or foreigners. English is an international language that is widely used today, especially in terms of daily communication around the world and with other countries [1]. Gadget device technology has also developed along with the times, along with the expansion and development of internet network technology. Gadget devices that are utilized by individuals nowadays have diverse purposes; some employ them for professional intentions, workplace tasks, recreational media, educational media, or mere correspondence. The most commonly encountered gadgets in individuals' lives are mobile phones. Nearly everyone possesses a mobile phone, from white-collar workers, entrepreneurs, adolescents, youngsters, and senior citizens. Mobile phones themselves have progressed significantly up until this point since they possess greater significance than notebooks and desktop computers. Apart from being effortless to transport everywhere, contemporary mobile phones have a range of characteristics that can facilitate numerous undertakings and offer convenient internet connectivity [2].

summary of statistical data on smartphone users in Indonesia in 2017, collected by the Association of Indonesian Internet Service Providers (APJII). These statistics cover every region in all of Indonesia, where as many as 50.08% use a smartphone. statistical data of internet users both from smartphones and other devices based on age category, the result of which is that 75.50% are users from the age category 13–18 years or teenagers, while the types of services frequently accessed by smartphone users in Indonesia are dominated by the use of social media, while for education or articles it only reaches 55.30%. For the whole world, recorded in 2016, smartphone users in the world reached 2.1 billion and will continue to grow to an estimated 5 billion users in 2019. From 2016 to early 2018, it was recorded that 36% of the world's population already used smartphones, both in the upper and middle classes. From the description above, it can be seen that the use of smartphones for educational or learning activities has been widely used; it's just that their use is still not optimal compared to the use of other features such as chatting, social media, and others. To obtain system requirements data, the researcher conducted interviews with several teachers at the case study tutoring center [3].

From the results of the interviews, it was shown that the informants needed an application that had features in gamification to help students understand English material and answer questions correctly. In this thesis, an English quiz application is designed that has a gamification feature. The Leaderboard feature ensures that students have a competitive atmosphere in the educational setting, the reward feature ensures that students are acknowledged for their achievements, and the book material is utilized to generate quiz questions that allow students to comprehend and absorb the material from the book. By incorporating gamification into educational games, students are able to engage in enjoyable learning experiences and by utilizing augmented reality, students are able to enhance their learning by utilizing smartphone technology [4]. There has been extensive research conducted on these two technologies as well as the implementation of gamification, as demonstrated in previous studies. These studies have identified the advantage of having limitless game scenarios, while acknowledging that the rules of gamification may still need improvement in order to be more captivating and innovative. In other studies, it has advantages in delivering material in the form of visualization and audio, while the drawback is that there is no feature to update material questions. The last one is that the fruit recognition application has been effective in conveying the information; it's just that the small fruit database and the less responsive AR feature are the drawbacks of the application [5].

Video games are frequently criticized for exerting a negative influence on children. However, games actually have positive functions and advantages for children, including helping them become familiar with computer technology, teaching them to follow instructions and rules, honing their problem-solving and logical thinking skills, developing their motor skills and spatial awareness, fostering communication between children and their parents when playing together, and providing entertainment. In fact, playing games can even serve as a therapeutic tool for certain patients. Education is a process undertaken by individuals to discover their identity, achieved through observation and learning, which then translates into actions and behaviors. Education is not much different from learning, which is a concept developed within the realm of behaviorism in psychology. The term "education" is often interpreted differently from "learning," although they essentially mean the same thing [6]. This term is commonly used in an educational context, indicating that it encompasses more than just acquiring knowledge. Educational games are games specifically designed to teach people about a particular subject, expand their understanding, reinforce their development, help them grasp historical or cultural events, or assist them in acquiring skills through play. Within a game, there are various elements that contribute to its overall experience, such as the game type, characters, background, sound effects, and movements [10]. If these elements are not managed effectively, a game can become dull and less engaging. Games are played on computer devices that are specifically created and designed to serve as mediums for teaching, incorporating various multimedia elements such as sound, text, images, videos, and animations. The content of these games focuses on specific subjects, aiming to broaden concepts, facilitate understanding, and enhance the delivery of instructional material during the teaching and learning process [7].

Nick Pelling was the individual who initially coined the term gamification in 2002 during a presentation at the TED (Technology, Entertainment, Design) event. Gamification is an educational approach that incorporates elements found in games or video games in order to motivate students during the learning process and enhance their enjoyment and engagement [8]. Additionally, this technique can be utilized to capture students' interests and inspire them to continue learning. Gamification leverages game mechanics to provide practical solutions by cultivating the engagement of specific groups [9]. The objective of gamification is to amplify the innate human desire to socialize, compete, achieve, learn, master, gain status, and self-express. By harnessing this inherent desire, the gamification strategy employs rewards for players upon completion of assigned tasks or compels players to compete against one another [11]. The rewards bestowed may take the form of points, badges, levels, progress bars, virtual objects, or the public display of player achievements to other participants. Rankings or leaderboards can be implemented to foster a sense of competition among players.

2. Research Methods

The collection of data used in this study was divided into three categories: literature, observation, and interviews. In developing this system, the GDLC (Game Development Life Cycle) system development approach was utilized. There are six phases utilized in the GDLC development approach: inception, pre-production, production, testing, beta, and launch. During the inception phase, the author will establish the requirements to be used, starting with the research site and tools that will be utilized in creating games, such as software manufacturers, supporting software, game art assets, and hardware supporting the process of creating and testing games. In the pre-production phase, the writer conducted the initial work on the game and revised the game's initial design. In the production phase, the writer begins working on the core part of creating a game. The game that has been created will enter the Alpha testing phase. During this phase, the author will test all functions and aspects of the game. The author will test this game with the game's internal team and the author himself. The developed apps or games will be provided to third-party testers or external testers. Testers will evaluate the final results of the spelling of games made before they are officially launched, starting from quality, ease of access, level of difficulty of the game, finding bugs, and

so on. The testers for this Beta phase are students and teachers. During this final phase, games that have been tested by internal parties and beta testers will be officially released after the necessary repairs have been completed.

3. Results and Discussion

At this initial stage, the writer will prepare the prerequisites that will be utilized, beginning with the research location and tools that will be employed in creating games, such as software developers, supporting software, game art assets, and hardware that supports the game creation and testing process. In this study, the author conducted on-site observations. This research focuses on the section of English instruction. The subsequent observation carried out by the author is to compare the pros and cons of similar games that are already accessible on the Play Store. The intended game category is the game mode that will be presented to youngsters. The game that will be developed will have a quiz category, which will enable children to learn and play simultaneously by completing questions or challenges provided in the game. The storyboard design aims to illustrate comprehensive guidelines concerning the application and will exhibit the appearance of the application in the future. The storyboard design will also indicate which multimedia components are utilized in each scene. When the user launches the game, the first thing that will be displayed is the starting page, which includes the choices to play or exit the game. Players who select the play option will proceed to the main menu, which consists of the play game, help menu, settings menu, trophy room, and exit menu. On the Play Game menu, players will be directed directly to the Game Modes page, which contains available game modes. After selecting a game mode, the user will enter the level selection page before playing the game. After the user plays the game, if you win, it will continue to the win page and send the score to the leaderboard. Users can then choose to go to the next level or to the main menu page. On the main menu page, the user can then check the prize in the trophy room; if the achievement is open, the user can take the prize listed in the achievement to be taken through the teaching teacher. The help page contains help for playing the game, while the settings page contains settings for resetting data in the game, starting from the highest score, the level reached, and the trophy or achievement that has been achieved. The game mechanism in this application is that players are obligated to discover and scan Enhanced Reality markers in the book; inside the marker is a virtual button that guides the player to the game level page or game mode selection page. Next, the player will choose an accessible level and will promptly enter the game page according to the chosen level. Players will be confronted with inquiries and answers in the game; they only have to select the accurate answer before the time runs out and proceed to the subsequent question. If the question is answered incorrectly, it will continue to the following question as well as the timeout condition. The game concludes when the questions have been answered by the players, and it will exhibit the total points earned by the players. At this pre-production stage, the authors implement Gamification in the shape of challenges to the game so that users refine their ability to think quickly and be responsive in answering, as well as their knowledge of the inquiries displayed in the game.

During this phase of production, the author will begin working on the primary component of the game that will be created. The process begins by gathering the necessary resources for the game, programming and constructing it, and incorporating the ranking system into the game. The collection of game assets is accomplished by obtaining them from different origins on the internet or by the author personally. Once the augmented reality sequence is completed, the next step is to generate the game menu scene and the actual game. This initial scene consists of two scenes, namely login and main menu. In the login scene, there are several menus, such as login, offline mode, and quit. For the main menu scene, there are menus such as start AR, trophies, help, and quit. In the select scene, there are two scenes, namely game modes and level select. In game modes, there is a menu of available game mode options. This scene game mode can only be accessed if the user cannot find the AR marker. Scene level select displays the number of levels contained in each game mode. This scene can be accessed via game modes or virtual buttons in ar. There are two game scenes, namely a quiz game and a picture game, and 1 scene called game over. In the quiz game scene, the user will be faced with a question and four answers, while in the picture game, the user will be faced with a picture question and three answers. The last scene is the game over scene, where the user can see the final score obtained and also the highest score in that level.

At this production stage, game applications that have been built will be integrated with the Leaderboard Shephertz App42 Cloud API. Previously, it was suggested to register or create an account first at http://api.shephertz.com/. Or you can log in using a Google or GitHub account. We will download the App42 Plugin SDK, which is on the download tab of the official website, and then extract the file. Create a Plugins folder in Unity Assets, and copy or move the.dll files into the plugins folder. The next stage is the API Key and Secret Key connection. On the App42 dashboard, select the Apps section, select Create App, and enter the application name and description. After the App is made, select settings and copy the API Key and Secret Key. For the placement of the paste key, the author places it in the Leaderboard script. The String API Key function is for the in-game leaderboard connection ID to the leaderboard database on App42 Shephertz. The secret key is for connection to leaderboards in the database. Same as an API Key, except that the secret key is used to enter a certain leaderboard database name. For Leaderboard connections, on the dashboard, select the gaming tab, then in the games section, select Add Game, and enter the name and description of the game. At this stage, the author creates two different game categories so

that they have their respective leaderboards. Public void Set Username functions to save the user's name data that is inputted after the game ends. Submit Score functions to send and store user name data that is inputted along with the scores achieved into the game database listed in (game name) on App 42 Shephertz. Update Rankings will display the name and score achieved on the game leaderboard. The data pulled from the database will be sorted from largest to smallest. After the game is made on the dashboard, the leaderboard connection is made by writing the script. After the game is complete, enter the import stage for Android in the form of an application. First, access the File, choose Build Settings, choose Android, and then choose Switch Platform. Following that, choose Player Settings. Fill in the application information as desired before checking the Vuforia Augmented Reality section in XR Settings so that the game can run AR. Next, go to Other Settings and set the Minimum API Level and Target API Level according to the Android SDK in our Unity.

In this preliminary test phase, the writer will assess the game that has undergone two previous test phases before progressing to the Beta testing phase. Specifically, in this official assessment, the writer will evaluate the sections pertaining to the user-friendly game login process, user-friendliness, and comprehensiveness of the game's features. Additionally, the functionality of the augmented reality aspect will be examined in relation to the brightness level and distance of the camera from the designated object. Refinement testing, in this test, the writer will test the parts related to the fun aspects, challenges, leaderboards, and quality of the game. In this Alpha test, the authors tested aspects of the functions in the game, starting with the button functions, augmented reality markers, virtual button functions, and gamification functions contained in the game. In this test, we also tested the light intensity and the distance of the camera to the marker. In the score function, players will get a score according to the bonus score stated in the question. If the player fails to answer correctly, the score does not increase and continues to the next question. The timer or timer function will limit the player's time to one question; when the time is up, proceed to the next question. The life span or life function will decrease if the player answers the question incorrectly. When lives run out, the game ends by displaying the Game Over page. A high score is the highest score achieved by a player in the game. High scores will be saved in the game. Scores obtained by players can be submitted to the Leaderboard at the end of the scene by entering the player's name. The leaderboard will also display scores from other players and sort them from highest to lowest. To reach a higher level, players are required to complete the first level without running out of lives. When you have reached these conditions, the next level is open. The Achievement function is in the form of a trophy that players can get every time they complete two levels. For each achievement or trophy, there is a reward or prize in it that can be redeemed through the teaching teacher or the cashier at the teaching place.

In the trial phase, the author will evaluate each feature in the game and the overall quality of the game with external individuals or end users. Users or end users can offer an evaluation of the overall outcomes of the games that are created, starting from button features, connections, and image excellence. At this phase, it will also be tested on learners to determine how much they can enhance their comprehension of the material taught in Beginner Book 2. After completing the initial testing stage, the author will conduct further testing involving end users to observe the success rate of function and user satisfaction in utilizing this game application as an additional supporting medium in learning. This test was conducted by interviewing teachers and learners who were taught by the author themself. During testing, both teachers and learners will be given the chance to try the application on the device provided by the author while providing responses along with an evaluation of the game application being tested. At this first stage, the author will provide a simulated game application to be tested by the teacher, as well as suggestions for improvement and an evaluation of the overall functioning and learning materials in it. For evaluation, the author set the minimum score at seven. Next, the author tested the application on the guidance learners taught by the author. The author allows learners to review or re-read the material in Beginner Study Book 2. After that, the author will provide this quiz game application to assess learners' comprehension of the material in Beginner Book 2. The values obtained from the number of questions answered by students to achieve victory. With a maximum error of 3 times out of 10 questions, answering 7 questions alone cannot win, and it requires students to repeat to get a total of 8 questions answered or make 2 mistakes to qualify. From all the test data above, it can be concluded that every student who plays for the first time already understands each function of the game application made, and with the gamification function, students can repeat the game to get better results accompanied by an understanding of the material being taught. The leaderboard function also makes students compete with each other in terms of total game scores, while the achievement and reward functions will make students feel happy because they get prizes according to what they complete at each level of the game.

During the phase of creating educational game applications, the creators utilize the Game Development Life Cycle (GDLC) development approach, which comprises of six phases: inception, pre-production, creation, experimentation, Beta, and launch. The primary phase is inception, where the creator will gather the requirements for designing and creating games, beginning with exploring sources, tools that will be employed during game development, and hardware that will aid in the creation and testing of games. Next is the pre-production stage, where at this stage the writer will define the type of game to be made and make an initial design of the game. The game development plan is made using a storyboard; the contents of the storyboard contain the design of each scene

(view) of the game in the form of a UI prototype and an explanation of the function of each button in that scene. The game system flow is made using a flowchart. At this stage, the gameplay mechanics and challenges of the game are also explained. Next is the production stage, where the writer begins to collect materials for games such as text fonts, images for questions, 3D models, AR markers, and leaderboard integration. Text fonts, images, and 3D model materials are all obtained through internet media to support the game system that will be made. At this stage, it is also explained about integration into the leaderboard, integration of augmented reality, installation of markers and virtual buttons, and export packages. In the fourth stage, namely testing in the form of an Alpha test, the writer will test each function of the button contained in each scene and also test the success of augmented reality tracking markers and virtual button functions. The fifth stage is Beta, namely testing involving end users or game application users. At this stage, the user will provide feedback about game quality, information clarity, button functions, aspects of challenge and fun in the game, and an overall assessment. The sixth and final stage is release. At this stage, the author releases game applications to tutors to use as additional learning media.

4. Conclusion

Based on the conducted research, it can be concluded that the initial AR game application developed has the potential to enhance students' English language comprehension and learning. The integration of gamification elements such as leaderboards, achievements, and rewards create a competitive learning environment and offers incentives that can be earned at different levels, thereby motivating students to progress further. The results of BETA testing conducted with end-users indicate that the system is suitable and its features are functioning properly. The tests conducted to fulfill the research objectives have resulted in the creation of games that aid students in improving their English language comprehension. Initially, only two out of six students were able to solve more than seven questions. However, with the inclusion of gamification and repetition features, five out of six students were able to solve more than seven questions with some additional practice, resulting in an overall comprehension rate of 71%. From the perspective of the teaching instructor, the games provide an opportunity to review and reinforce the material covered in the lessons. To find out the level of understanding of students, the teacher can see the progress of the total score that students get via the leaderboard on the App42 Shepherz API. The author realizes that there are still many deficiencies in the game system created; therefore, he suggests developing this game application with additional features, namely: Adding material from other Beginner book levels added a score sharing feature. Added the feature of displaying the list of answered and unanswered questions contained in the game. Added player experience features (XP and Player Level).

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