Available online at http://www.iorajournal.org/index.php/ijgor/index

International Journal of Global Operations Research

e-ISSN: 2722-1016
p-ISSN: 2723-1739

Vol. 3, No. 2, pp. 64-73, 2022

Endless Run Based Medicinal Plant Educational Game Development

M Sofwan Yazir[1*], Eneng Tita Tosida [2], Lita Karlitasari[3]

[1,2,3] *Computer Science Study Program, FMIPA, Pakuan University, Bogor, Indonesia*

**Corresponding author email: msofwanyazir@gmail.com*

Abstract

Medicinal plants are very beneficial for health. Medicinal plants can be used as an alternative to cheap and efficient medicine, but not everyone knows what plants can be used as medicine and how to process them. Students are expected to be more familiar with the types of medicinal plants, both local and scientific names, uses, parts used, processing methods, and rules for use. To be able to introduce medicinal plants more interactively, then one solution that can be applied is through application-based games. Educational games are expected to stimulate students to be more active in studying medicinal plants. The game technique used is endless run. Game "Endless Run" is categorized as an action game, has a linear design without ending, without stopping and no stages or changing levels. "Endless Run" is a game where the main character in the game continues to run the game that will not stop. The results of the usability trials shown to teachers, lecturers and students showed good respondents so that people who want to learn the introduction of medicinal plants can obtain information and benefits so that they can increase students' learning desires and the application is easy to operate and the survey results from the percentage (effect 80 %, control 90%, efficiency 70%, helpfulness 80%, learnability 90%). The Endless Run-Based Medicinal Plant Educational Game Development Application can be used by students, college students, millennials and the general public. By utilizing the Unity 3D application, this software includes a game engine capable of handling three-dimensional graphics. This application will run on the Android 8.0 (Oreo) mobile platform with an application capacity of 33.37MB.

Keywords: Unity 3D, Endless run, Medicinal plants

1. Introduction

In today's modern era, technological developments are unavoidable. The development of technology has entered all areas of life, including the field of education. These developments have affected the content of the material and the learning process in teaching and learning activities. Medicinal plants are very beneficial for health. Medicinal plants can be used as an alternative to cheap and efficient treatment. In addition, medicinal plants are also relatively safer because they are natural. Maybe all of them are familiar with the various properties of medicinal plants, but not all know what plants can be used as medicine and how to process them (Zuhud, 2004).

In the Integrated Thematic Book of 2013 Curriculum for Grade IV Elementary School, which studies Theme 3 on Caring for Living Creatures: Sub Theme 3 on Let's Love the Environment: Lesson 3 on Love for the Environment by Caring for Plants and Animals, students are introduced to the use of vacant land in the school yard or house which is a way of reforestation as a form of environmental care behavior. There are also plants that are very useful for planting, namely medicinal plants that can reforest the land. For that previously students are expected to be more familiar with the types of medicinal plants, both local and scientific names, uses, parts used, processing methods, and rules for use. However, so far students are more familiar with medicinal plants just by reading books or what the teacher explains through face-to-face learning, so that not all students look enthusiastic about getting to know these medicinal plants, especially teachers who only explain modestly through pictures and writing (Ministry of Education and Culture of the Republic of Indonesia, 2014). To be able to introduce medicinal plants more interactively, then one solution that can be applied is through application-based games. Educational games are expected to stimulate students to be more active in studying medicinal plants. The game technique used is endless run. The development of this game application is based on the increasing popularity of the game and to provide an interesting game experience, can be played to fill spare time and train the reflexes of the players by interacting with interactive buttons to move up and down through obstacles in the game and make a substitute media learning from the form of a book into a play application so that elementary school students can play and learn about medicinal plants.

In previous research, an endless runner game with the theme of fighting in the city of Rengat Riau has been created (Ridho, 2018). Subsequent development research resulted in a video game entitled k-jump (Adiwikarta and Dirgantara, 2017). Then based on previous research on the design and manufacture of the Android-based endless running game "RUNNER" using unity (Hakim and Alfatta, 2016).

This study resulted in an educational game introducing green plants for elementary schools (Sakti, 2018). And the last research is the application of endless runner game to introduce Pontianak city tourism (Apriyandi et al., 2019).

One of the technologies that can be utilized is the Unity 3D application, which is a game engine used to form games and their objects, Unity does not limit the applications that must be made without having to pay a license fee or royalty to Unity. And this software includes a game engine capable of handling three-dimensional graphics (Irmanto, 2018).

Starting from these problems, it is necessary to build an educational application of traditional medicinal plants based on Endless Running. In this application, there are interesting games and various kinds of information on traditional medicinal plants in Indonesia. Not only in the form of 3D forms of medicinal plants, this application will also be equipped with interesting and interactive content. This study aims to create a means of information on educational games in designing and building a medicinal plant using Game engine unity.

2. Materials and Methods

In this study the method used is GDLC (Game Development Life Cycle), where this method has 6 stages, namely the initiation phase or concept creation, pre-production, production, testing, beta and release. An illustration of this method can be seen in Figure 1.

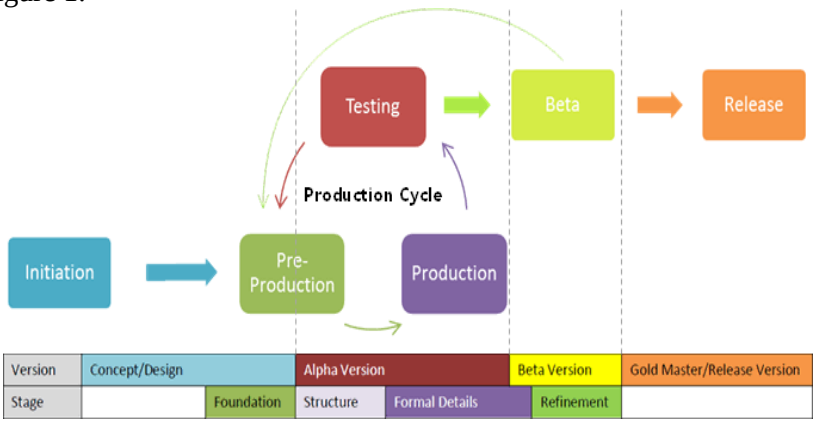


Figure 1. Game Development Life Cycle Diagram

Initiation stage is the initial process in the form of making a rough concept of the game, starting from determining what kind of game will be made, starting from the identification of trending, topics, and target users of the game to be made. The output of the initiation stage is a very simple game concept and game description.

The Pre-Production stage is the beginning of the production cycle that includes game design. It is a vital stage before the production process begins, the game production plan and game design will be carried out. This stage includes game design, namely the refinement of the game concept and its documentation (Game Design Document) and prototyping (prototyping of games).

The Production stage is the core process that revolves around asset creation, source code generation, and integration of the two elements. Related prototypes in this phase are formal detailing and refinement. This stage includes asset creation, programming and integration between assets and source code.

The testing stage is also known as the trial stage, the trial stage itself is the stage where the application that has been made is used for the first time after the application is built, to find out the shortcomings, advantages, or compatibility with the design that has been made. The trials carried out consisted of: Structural testing, namely the stage of the process of checking whether the application that was built was in accordance with the design made in the design process. Functional testing is the stage of the process of checking whether each button in this application is in accordance with its function or not. And the Validation Test, which is the stage of checking the information data displayed by the system according to its truth with what is in the book used.

Release stage is a game that has been completed and passed the beta testing stage, indicating the game is ready to be released to the public. Release is the stage where the final build process of the official game is released.

The tools used in this research include pentab, laptop, handphone and mouse. Meanwhile, the materials used in this research are Unity as Engine, Blender, Adobe Photoshop CS5, and Microsoft Visual Studio.

3. Results and Discussion

The concept of the game to be built is in the form of an analysis of what the game will be like, initiation will produce a game concept and a simple description of the game. At initiation, it will describe the game scenario, characters, in-game story, target players, platform used and game engine. An overview of the various ways of studying the system can be seen in Figure 2.

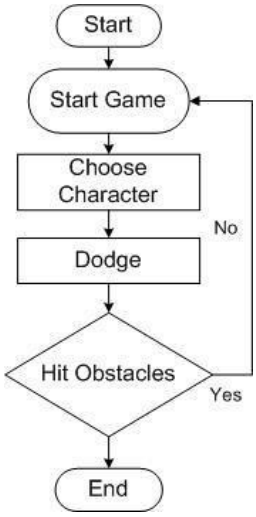


Figure 1. Game Play

Game "Endless Run" is categorized as an action game, has a linear design without ending, without stopping and no stages or changing levels. In making an application for developing an endless run-based medicinal plant educational game for this android-based information media, starting from analyzing. Then proceed with designing the application interface design. The next stage is the implementation of the interface that has been designed into the form of a system. For further testing of the application to find out whether the application has errors or errors. The results of the application's User Interface can be seen in Table 1.

Table 1. User Interface Results

Page	User Interface	Description
App Icon		The application icon page is the display of the medicinal plant game application that has been installed on the android device.
Main Course		On the main menu page there are five navigation buttons that can be selected, the Main button is a navigation button to go to the game start page, the Instructions button is a navigation button to go to the page explaining how to use the game, and the About button is a navigation button to see a description of the application. Score button is to see the highest score in this game Exit button to exit the application.

Play		When entering the main menu, there will be a player choice, namely there are two farmer characters including a male farmer and a female farmer.
Play		On the start page of the game there will be a farmer who runs looking for medicinal plants and has to solve obstacles in the form of turns of rocks and trees.
Play		After running and there are medicinal plants, farmers must harvest the medicinal plants in order to find out the information.
Play		This page displays the information obtained after harvesting the medicinal plant.
Play		When farmers fail to complete obstacles or hit trees, rocks and farmer turns will be bitten by dogs and game over.
Instruction		On this page it is explained how to use this game application.

About		On this page there is an explanation of the application and the data sources that can be obtained in making this application.
Score		On this page displays info on the highest score in this game.

The development of this educational game uses the Game development life cycle (GDLC) method based on endless run. In this application there are several button options, namely instructions, about, score, start playing and exit. For about information, namely the name of the author and supervisor, the instructions page contains information about its use and the score page which displays the highest score and for the main button is directed to the character selection page consisting of 2 characters when you have selected it press start to go to this game page, after starting the character will run and must collect as many medicinal plants as possible to display information on this medicinal plant but must control the character so as not to collide with existing obstacles such as trees, rocks and turns. When the score has reached a multiple of a thousand the obstacles will be more difficult and more numerous, if the character collides with the obstacles, then the game is over and you have to start all over again. There are 10 types of medicinal plants contained in this game, from leaves and herbs taken from the 2013 Curriculum Integrated Thematic Book for grade IV Elementary School and the Herbal Medicine Book for Healthy Medicine.

Before this application was made, students and teachers had to fill out previous questionnaires in order to find out what the obstacles were when in learning activities, including the obstacles that students only knew about medicinal plants from reading books and what was explained by the teacher, so not all were enthusiastic about getting to know these medicinal plants, then one solution that can be applied is through application-based games. After making the application, testing is carried out by introducing the previous application and how to use it. This test involves teachers, lecturers and students, asked to fill out a questionnaire containing views or perspectives on the assessment of this application.

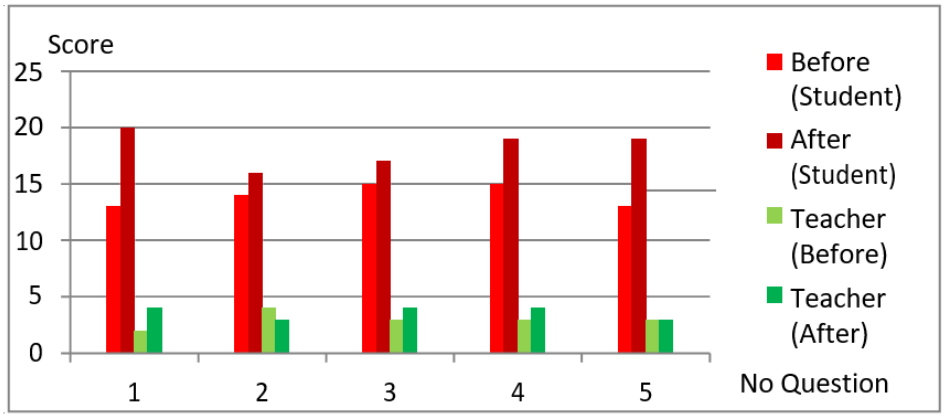


Figure 3. Graphics before and after application

The results of the questionnaire assessment show that this application is very helpful for student learning activities and can increase the desire to learn, because this application is easy to operate and very challenging to play. In delivering in class the teacher is easier to explain the material so that students are more interactive in the introduction of medicinal plants.

The next stage is to test this application system by running it on an Android Smartphone. This test is carried out to find out the shortcomings or weaknesses of the application, such as menus not running, buttons not working and so on. In testing the application there are several stages that will be carried out, namely:

This structural trial is a stage to check whether the application made is in accordance with the design that was previously made in the design stage.

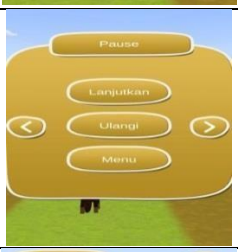
Table 2. Structural Test

No	Page View	Trial Status
1.	Page Loading Screen Page Menu	Appear, Fit
2.	Page *Main* Page *Pilih Karakter* Button Start Page Loading Screen Page Play Button Pause Page Pause	Appear, Fit
3.	Button About Page About	Appear, Fit
4.	Button Instruction Page Instruction	Appear, Fit
5.	Button Score Page Score	Appear, Fit
6.	Button Exit	Appear, Fit

This functional test is carried out to determine whether the system created is functioning properly. At this stage an experiment is conducted to determine whether the function of each button or menu on the page can function properly. Based on the trials that have been carried out, overall, the buttons or menus on each page can function and run as desired. These results can be seen in Table 3.

Table 3. Functional Trial

No	Name Scene	Appearance	Beginning	Results
1	Scene Splash Screen	Logo		
2	Main Page Scene	Play		
		Instruction		
		About		

		Score		
		Exit		
3	Scene Play	Start		
		Pause		
		Medicinal plants		
		Obstacle		

Validation test is the stage where the information data checks whether it is in accordance with the data that has been previously collected, in other words, validation is here to ensure whether the application made is in accordance with user expectations or not. Below is a test application testing.

Table 4. Validity Test Based on Slope

No	Trial Description	Trial Image	Test Results
1.	Medicinal Plant Display		Object detected

2.	Information display		Object successfully displays information

At this compatibility test stage, it is carried out using several types of smartphones as a comparison, this application can be used, in this case the object is tested based on RAM, processor.

Table 5. Compatibility Test

No	Mobile Phone Brands & Specifications	Application Performance	Test Results Image
1.	Specification: - Quad-core (2x2.15 GHz Kryo & 2x1.6 GHz Kryo) -Ram: 4 GB - OS: Android 8.0 (Oreo)	The performance of the application on this cellphone is smooth, the buttons can interact quickly, can start the game in about 3 seconds.	
2.	Specification: - Octa-core (4x2.3 GHz Mongoose M2 & 4x1.7 GHz Cortex-A53) - EMEA -Ram: 4 GB -OS: Android 9.0 (Pie)	The performance of the application on this cellphone is smooth, the buttons can interact quickly, can start the game in about 3 seconds.	
3.	Specification: - Octa-core (4x2.3 GHz Cortex-A73 & 4x1.7 GHz Cortex-A53) -Ram 4 GB -OS: Android 9.0 (Pie)	The performance of the application on this cellphone is smooth, the buttons can interact quickly, can start the game in about 3 seconds.	

This test has the first process, namely by introducing the application first and then continuing with training and how to use the game. The test results from prospective application users are asked to fill out a questionnaire containing the views or perspectives of the candidates. The test involves 4th grade students and teachers from the Tangkil State Elementary School consisting of 8 students, 1 teacher and 1 lecturer totaling 10 people. The percentage of survey results is shown in Table 6.

Table 6. Usability Trial

No	Question	Evaluation		Persentase
		Good	Not Good	
1	This application is presented attractively	8	2	80%
2	Appropriate use of background color and design (background)	8	2	80%

3	The accuracy of the selection of the type of writing	8	2	80%
4	The accuracy of the writing color selection	8	2	80%
5	Button color match	9	1	90%
6	Animation display compatibility	9	1	90%
7	Quality of study aid materials	7	3	70%
8	Ease of giving material	7	3	70%
9	The relationship of the image to the material	10	-	100%
10	Applications can help in student learning	8	2	80%
11	Giving feedback to students	7	3	70%
12	Clarity of instructions for using learning media	8	2	80%
13	Ease of operation of the application	10	-	100%
14	Overall convenience of using the app	8	2	80%

Evaluation:

1) Effect : (Question 1-8)

$$\text{Result} = \frac{80 + 80 + 80 + 80 + 90 + 90 + 70 + 70}{8} \times 100\% = 80\%$$

2) Control : (Question 9-10)

$$\text{Result} = \frac{100 + 80}{2} \times 100\% = 90\%$$

3) Efficiency : (Question 11)

Result = 70%

4) Helpfulness : (Question 12)

Result = 80%

5) Learnability : (Question 13-14)

$$\text{Result} = \frac{100 + 80}{2} \times 100\% = 90\%$$

From the results above, it can be concluded that the information media for simulating the human respiratory system is appropriate to be used to assist learning for students, college students and people who want to study it, because it can add interest and interest.

4. Conclussion

This endless runner-based medicinal plant educational game development application has been completed using Unity 3D, as an educational learning medium that can facilitate the introduction of medicinal plants, the method used is the GDLC (Game development life cycle) method based on endless run, making this educational game application android-based with a 3D display that can study medicinal plants easily and is easy to use.

In this game there is a choice of characters consisting of 2 characters when you have selected them press start to go to this game page, after starting the character will run and must collect as many medicinal plants as possible to display information on this medicinal plant but must control the character so that do not collide with existing obstacles such as trees, rocks and bends, there are 10 types of medicinal plants contained in this game taken from the Integrated Thematic Book of 2013 Curriculum for fourth grade elementary school and the Book of Herbal Medicine for Healthy Herbs.

This application has gone through the stages of the testing process including structural testing on each scene in the application created, functional tests carried out at the button stage in the application and validation trials carried out on application scenes that display objects and information that are in accordance with the data, that have been collected at the data collection stage, so that this application can be used by the user.

The results of the usability trials shown to teachers, lecturers and students showed good respondents so that people who want to learn the introduction of medicinal plants can obtain information and benefits so that they can increase students' learning desires and the application is easy to operate. Users can also easily access applications just by using an Android smartphone.

In addition to the benefits obtained by users, the authors also get great benefits. Making this application provides more knowledge for writers about android programming, and can understand about the development of android software on smartphones. The use of Unity makes it easy for writers.

The making of this endless runner-based medicinal plant educational game application is expected to be used and put to good use. In the development of this application, further development can still be done, such as adding levels in the game and adding more player characters or medicinal plants.

References

Zuhud, E. A. M. (2004). *Indonesian Tropical Forests as a Source of Diversity of Germplasm of Medicinal Plants*, pp. 1-15 Department of Forest Resources Conservation, Faculty of Forestry, Indonesian Tropical Nature Institute. Bogor: IPB.

Ministry of Education and Culture of the Republic of Indonesia. (2014). *Caring for Living Creatures, Theme 3 Thematic Books for Integrated Curriculum 2013*. Books for Class IV Elementary/MI Students. Jakarta: Ministry of Education and Culture.

Ridho, E. (2018). *Making Game of the Endless Runner Themed Battle in Renget City, Riau As an Effort To Improve Patriotic Spirit In Children Age 11-14 Years*. Computer Course Multimedia, STIKOM Surabaya.

Adiwikarta, R., and Dirgantara, H, B. (2017). Development of Endless Running Video Game Based Android Using Game Development Life Cycle Framework. *Journal of Science and Technology KALBI Scientia*, *4*(2), 142-148.

Hakim, R., and Alfatta, H. (2016). *Design and Development of Endless Running Game "Runner" Android Based Using Unity*. Information Systems, College of Informatics Management and Computer. Yogyakarta: AMIKOM.

Sakti, R. T. (2018). *Educational Game Introduction of Green Plants for Elementary Schools*. Department of Informatics, Muhammadiyah University of Surakarta. Surakarta: UMS.

Apriyandi, D., Anra, H., and Pratiwi, H. S. (2019). Application of Endless Runner Game to Introduce City Tourism Pontianak. *Journal of Information Systems and Technology*, *7*(3), 171-175.

Irmanto. (2018). *Development of 3D Unity-Based Learning Media for Android Platform On Class X Engineering Drawing Learning at Berbah National Vocational High School*. Department of Automotive Engineering, Yogyakarta State University. Yogyakarta: UNY.