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Educational Game Introducing Cells in Animals and Plants Based on Android Using the Linear Congruential Generator Algorithm

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Abstract

In the world of education, science lessons have been taught since elementary school. However, material related to the introduction of animal and plant cells is only given at the junior high school level. State Junior High School 2 Kanatang, East Sumba is one of the secondary schools that provides introductory material to animal and plant cells for class VIII students. In teaching and learning activities, the delivery of material by teachers still uses limited teaching materials, which results in students not understanding the material related to the introduction of animal cells and plant cells. This is proven based on data on student scores for learning material on animal cells and plant cells. Student scores are still below average. flat. For this reason, an educational game about the introduction of cells in animals and plants was created to help students learn science. The method used in this research is the Multimedia Development Life Cycle (MDLC) method. In making the application, the Linear Congruential Generator algorithm was applied to randomize the practice questions in the educational game application for introducing cells in animals and plants. The aim of this research is to produce an educational game for recognizing cells in animals and plants which is able to improve students' ability to remember the cells in animals and plants at SMP N 2 Kanatang, East Sumba. The tools used to build this application are Unity.

Keywords: *Educational Games, MDLC, Linear Congruential Generator (LCG), Unity, SMP N 2 Kanatang.*

1. Introduction

The rapid development of technology currently makes life easier in various ways, technological developments in the field of education have a very good influence on the progress of the world of education and also on teaching and learning activities at various levels, both primary, secondary and higher education. Technology in the field of education has given birth to various new learning media that apply technology, such as learning using information technology through multimedia-based electronic media which is useful in helping to foster interest in independent learning and is able to develop students' creativity and understanding in learning. State Junior High School 2 Kanatang, East Sumba is one of the secondary schools that has science (natural science) subjects. Natural Science (Science) subjects are one of the subjects that have an important role in teaching students about the universe. Law Number 20 of 2003 article 37 paragraph 1 explains that, "Natural Science is one of the mandatory subjects in primary and secondary education" [1]. Science learning is given to class VIII SMP students. One of the materials provided is about the introduction of cells in animals and plants. Animal cells are the general name for the eukaryotic cells that make up animal tissue. Animal cells differ from other eukaryotes, such as plant cells, in that animal cells do not have cell walls, and chloroplasts and animal cells have smaller, if not nonexistent, vacuoles. Because they do not have hard cell walls, animal cells vary in shape [2]. In teaching and learning activities, the delivery of material by teachers still uses limited teaching materials, which results in students not understanding the material related to the introduction of animal cells and plant cells. This is proven based on data on student scores for learning material on animal cells and plant cells. Student scores are still below average flat.

Based on these problems, in this research learning media will be created in the form of Android-based educational games to help teachers convey science learning to students and help make it easier for students to understand and remember material related to cells in animals and plants and can increase students' desire to learn science. In this context, educational games become a very interesting solution to facilitate more interactive and fun learning. By combining an interesting game concept with educational content, it is hoped that users' interest in learning can increase rapidly. Therefore, Android-based application development is the right choice to create an interesting and memorable learning experience. In developing this application, the Linear Congruential Generator algorithm was used to randomize quiz question numbers. Apart from that, there are also additional features such as quizzes that can test users' understanding and knowledge. An attractive and easy-to-understand display will increase user involvement in the learning process. Apart from that, this application is also compatible with various Android devices so that it can be accessed by users with various types of smartphones or tablets. Overall, the

development of an Android-based application with the Linear Congruential Generator algorithm is expected to provide an interesting, memorable and interactive learning experience for users [3].

The term learning media comes from the Latin word "medium" which means a message conveyed so that communication occurs between the giver and recipient, which refers to the role as an intermediary or introducer. Learning media is an important component in the learning process. The presence of learning media can help the interaction process between teachers and students to be more motivated to learn. Media is used as a means to transmit information that can influence students' thoughts, emotions, interests and motivation in the learning process, so that it can increase their enthusiasm for learning. Learning is the process of transferring knowledge and information from an expert to another person. The aim is to increase the recipient's knowledge and skills and requires interaction between teachers and students [4]. Unity is a game engine that has evolved into an IDE/rapid development tool. Game winds are a huge collection of code and are used to create functions for games, especially the game's physical laws, such as lighting rendering, basic camera functions, etc. Unity is also a cross-compatible Windows game that can be a bridge between the code that will be created and the device you want to install, form a game application, process all existing assets and change the format according to the needs of the distribution platform that will be used [5]. Unity is one of the most widely used wind games. Unity provides game development features on various platforms, namely Unity Web Windows, Mac, Android, iOS, Xbox, Playstation 3 and Wii. In Unity, various programming language options are provided for developing games, including JavaScript, C#, and BootScript. Unity supports 2D and 3D game creation [6]. C# is a programming language that implements the concept of object-oriented programming, or Object Oriented Programing (OOP). In object-oriented programming, the first thing to do is define a class that can represent objects. This class is used as a wrapper for the required variables (data) and operations (functions). Next, solve the case by forming an object from the class in question [7]. The MDLC method is suitable for system development in multimedia applications and the stages can be exchanged according to research needs.

The method used in developing this educational game uses MDLC. This method was chosen because educational games are part of interactive multimedia so MDLC is considered the most suitable for their development. The following is an explanation of the stages of the Multimedia Development Life Cycle (MDLC) development method: Concept: (Stage to determine the goals and who the users of the program are). The conceptualization stage (Concept) is the stage for determining the purpose and to whom the multimedia is intended (audience identification). Design: Design is the stage of making specifications including project architecture, style, appearance and material or material requirements for the program. Material Collecting: Material collection is the stage of collecting materials that suit the needs being carried out. Assembly: The assembly stage is the stage where all objects or multimedia materials are created. Testing: This stage is called the alpha testing stage where testing is carried out by the manufacturer. Distribution: At this stage the project will be stored on a storage medium [8]. Black box testing is testing software in terms of functional specifications without testing the design and program code to find out whether the functions, input and output of the software comply with the required specifications. So Black box testing is done by observing the output from various inputs. If the system output is in accordance with the design, then the system is declared good [9]. Black box testing is carried out to find out what errors there are in the game interface. Testing was carried out on several predefined features. Black box testing is carried out to observe the input and output results of the software without knowing the code structure of the software. Black box testing is carried out at the end of software development to find out whether the software can function properly [10].

2. Research Methodology

SMP N 2 Kanatang is a school that started teaching and learning educational activities in 2007, and the school is located on Jalan Waingapu-rambangaru, Kuta, Kec. Kanatang, Kab. East Sumba Province. East Nusa Tenggara. Currently SMP N 2 Kanatang has a total number of students, namely 331 people with 183 male students and 148 female students, for class VIII the number of students is 96 people, divided into 3 classes with each class having a total number of students. 32 people, and the number of teachers is 26 people. The reference book used for class VIII science lessons is an integrated thematic book for the 2013 curriculum. The results of the final assessment of the 2023 semester show that the scores of students who did not reach the KKM were 13 with an average score of 59 in animal cell and plant cell material with sub Cell Introduction theme. To answer these problems, in this research learning media will be created in the form of Android-based educational games to help teachers convey science learning to students and help make it easier for students to understand and remember material related to cells in animals and plants and can increase students' desire to learn IPA. This research uses the MDLC method with 4 stages as outlined in Figure 1: Data Analysis Stage: At this stage data analysis involves processing raw data that has been collected into information that can be used to answer research questions. Data collection was carried out by interviewing class VIII teacher Mince Noty S.Pd., at SMPN 2 Kanatang. The data obtained is the low value of the material on the introduction of animal cells and plant cells due to limited teaching materials which result in students not understanding the material related to the introduction of animal cells and plant cells. This is proven based on data on student scores for the learning material on animal cells and cells which are still below average. Design or Design Stage: This stage is the stage of designing a game application design that uses the Multimedia Development Life Cycle (MDLC) method and is in accordance with the learning objectives of the students, namely in the form of design and selecting what content will be included in the game application in the form of text , images, audio, and a combination of several media types. Stages of Making a Game Application: At this stage the researcher begins to make a game application based on the results of the design or design using the chosen method. Testing Stage: At this stage the researcher will carry out testing before and after receiving educational games to research subjects using pre-test and post-test.

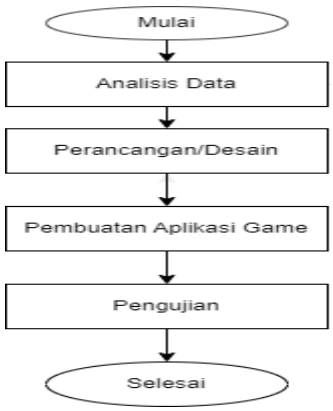

Fig. 1: Research Flow

At the design stage the researcher will create a game design. The design stage will also involve creating a storyboard that describes the workflow of the application. The menu contained in the first application is material, the material menu will contain 2 sub-materials about cells (animal cells and plant cells). In the material menu images and text will be displayed that describe animal and plant cells. The second menu contains a quiz on animal and plant cell material. In the quiz menu, the LCG algorithm will also be implemented to randomize the questions. The questions that will be displayed alone are 20 questions that have 4 answer options.

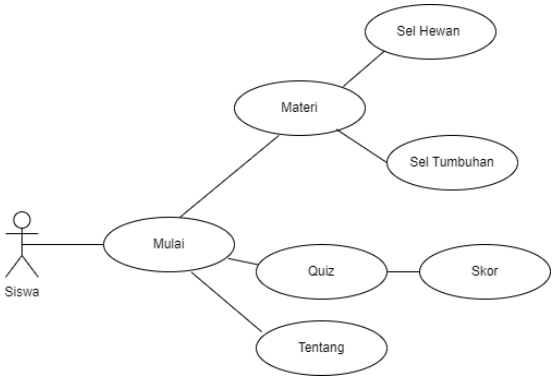

Fig. 2: Use Case

The main menu that the user will see when the user starts running the educational game application. On the main page there is the title of this educational game, namely Introduction to Cells in Animals and Plants and there is a material menu for studying, a games menu for practicing questions, a settings menu for making audio settings and an exit menu for exiting the game application. The material menu contains 2 sub-materials about cells, namely animal cells and plant cells, each sub-material will contain cell images and text to further clarify what objects will be described. Then there is a home button to return to the main menu. The quiz menu in the application will consist of 20 question banks with 4 answer options and when you have finished taking the quiz, the application will immediately display the final score. When the user starts taking the quiz, if the player answers the question correctly a happy sound will appear and the score will increase, but if the player answers the question incorrectly then a sad sound will appear but the score will not decrease or increase.

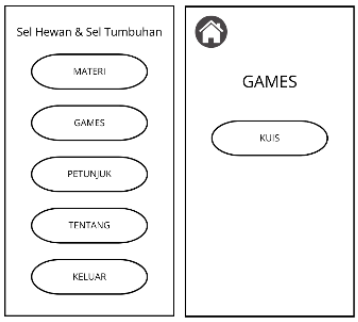

Fig. 3: Main course

3. Testing and Analysis

3.1. Implementation of an educational game application for the introduction of animal and plant cells

The results of the human anatomy application that have been designed will be implemented, the user interface for the animal cell and plant cell applications and the explanation can be seen in the following image.

1. Main Menu Page

The main menu is the display that will appear when the user opens the animal cell and plant cell application. On the main menu there are several menus which can be seen in the following image.

Fig. 4: Displays the main menu

The main menu has 4 buttons, and they have different functions, for example, if the material button is clicked it will display 2 sub-material buttons, the games button to display the quiz, the hint button to see game instructions, then on the settings button there is a function to adjust the background sound and sound effects. And the last one is the exit button which functions to exit the animal cell and plant cell applications.

2. Material menu display
The learning menu is a page that contains cell introduction material, this page is divided into 2 sub-materials, the first material contains animal cell material then the second material contains plant cell material, the material menu display can be seen in the following image.

Fig. 5: Displays the material menu

Figure 5 shows the material menu and the display of the existing material content. On the material content page there is a next button which functions to move to the next material, a back button which functions to return to the previous material and a home button to return to the main menu.

3. Games Menu Display
The games menu is the menu to start the quiz and will produce an output in the form of a final score.

Fig. 6: Games Menu Display

This display contains several buttons, for example, the home button for
return to the main menu and the sound effect button to turn the sound on and off when answering a question correctly or incorrectly.

3.2. Testing

The testing stage is the final stage in this research, there are three types of testing that will be carried out on animal cell and plant cell applications starting from testing application features and functions or black box testing, pre-test testing and post-test to determine the user's level of understanding after and after using the application.

3.2.1. Black Box Testing

The results of testing the human anatomy application using black box testing, show that all the features in the animal and plant cell application work as they should. The results of black box testing can be seen in the table 1 below.

Table 1: Black Box Testing Results

Testing Activities	Expected realization	Test result	Results
Main course	Testing material buttons	The sub-material display appears	[✓]Success
Sub-material menu	Testing sub-material buttons	The material view appears	[✓]Success
Next button	Clicking the next button	The next material display appears	[✓]Success
Back button	Clicking the back button	A display of the previous material appears	[✓]Success
Implementation of the LCG algorithm	Answer practice questions	The questions that appear will be randomized and will not come up first again on the next try	[✓]Success
Correct answer	Choose the correct answer	The score increases according to the question points, a pop up sound of right or wrong appears and will move on to the next question	[✓]Success
Wrong answer	Choose the wrong answer	The score does not increase or decrease, an incorrect pop up sound appears and it will proceed to the next question	[✓]Success
Score page	Have completed the quiz	The final score display appears	[✓]Success
Start again button	Choose to start retaking the quiz	The quiz menu display appears	[✓]Success
Menu about	Clicking the about button	A display appears regarding the application developer and the book sources used	[✓]Success
Home button	Clicking the home button	The display appears to the main menu	[✓]Success
Exit button	Clicking the exit button	Exit animal and plant cell applications	[✓]Success

Table 1 shows the results of black box testing. It can be seen in the table that testing of all features and functions in the application runs as expected. It can be concluded that the application of animal and plant cells is going well.

3.2.2. Pre-test dan Post-test

The testing method that will be carried out is testing on class VIII students of SMP N 2 Kanatang which consists of 3 classes, each class has 24 students by giving a pre-test and post-test. First, students will be given a pre-test to measure students' initial abilities before being given learning media, after that they will be given a post-test to see students' abilities after getting to know animal cells and plant cells through educational games. Pre-test and post-test testing is used to measure the comparison of student scores before and after using learning media.

4. Conclusions

The results of the analysis have been carried out through making animal and plant cell applications, several tests are used to help class VIII students at SMPN 2 Kanatang understand science lessons, especially animal and plant cell material. The average result of pre-test testing was 65 and post-test was 73.64 with the percentage increase in scores from a total of 24 students increasing by 76.2%, this figure shows that students' understanding of human anatomy material has increased well. Black box testing has also been done and all features plans have been carried out in accordance with their respective functions. The application of animal and plant cells certainly has several shortcomings, of course there needs to be further development so that the application becomes better.

References

[1] H. Pagarra dan N. A. Idrus, "Pengaruh Penggunaan Video Pembelajaran IPA Terhadap Minat Belajar Siswa Kelas III SD Inpres Lanraki 2 Kecamatan Tamalanrea Kota Makassar," *Publ. Pendidik.*, vol. 8, no. 1, hal. 30, 2018, doi: 10.26858/publikan.v8i1.4362.

[2] Yuli Lestari Rasyid, Brave A. Sugiarso, dan Arthur M. Rumangit, "Animasi Interaktif Pembelajaran Sel pada Hewan dan Tumbuhan," *J. Tek. Inform.*, vol. 16, no. 2, hal. 175–182, 2021.

[3] T. Marha, Y. S. Siregar, dan S. Sundari, "Implementasi Game Edukasi Lingkungan Dengan Algoritma Linear Congruential Generator Berbasis Android," *E-Link J. Tek. Elektro dan Inform.*, vol. 17, no. 2, hal. 8, 2022, doi: 10.30587/e-link.v17i2.4572.

[4] S. I. Prahesti dan S. Fauziah, "Penerapan Media Pembelajaran Interaktif Kearifan Lokal Kabupaten Semarang," *J. Obs. J. Pendidik. Anak Usia Dini*, vol. 6, no. 1, hal. 505–512, 2021, doi: 10.31004/obsesi.v6i1.879.

[5] A. R. Dewi, R. R. Isnanto, dan K. T. Martono, "Aplikasi Multimedia sebagai Media Pembelajaran Ilmu Pengetahuan Sosial Materi Budaya di

Indonesia menggunakan Unity Engine untuk Sekolah Dasar," *J. Teknol. dan Sist. Komput.*, vol. 3, no. 4, hal. 471, 2015, doi: 10.14710/jtsiskom.3.4.2015.471-480.

[6] R. Reno, "Pembuatan Game Balap Kelinci Dengan Unity Berbasis Android," *J. Ilm. Rekayasa dan Manaj. Sist. Inf.*, vol. 7, no. 1, hal. 19, 2021, doi: 10.24014/rmsi.v7i1.10531.

[7] B. Raharjo, "Dr. Budi Raharjo, S.Kom., M.Kom., MM.," hal. i–111, 2022.

[8] D. Septian, Y. Fatman, S. Nur, U. Islam, dan N. Bandung, "Implementasi Mdlc (Multimedia Development Life Cycle) Dalam Pembuatan Multimedia Pembelajaran Kitab Safinah Sunda," *J. Comput. Bisnis*, vol. 15, no. 1, hal. 15–24, 2021.

[9] I. Fahrozi, A. Fadly, H. Pratama, Y. Nuraeni, dan R. Pratama Juniar, "OKTAL : Jurnal Ilmu Komputer dan Science PENGUJIAN BLACK BOX TESTING PADA APLIKASI ACTION & STRATEGY BERBASIS ANDROID DENGAN TEKNOLOGI PHONEGAP," *J. Ilmu Komput. Dan Sci.*, vol. 2, no. 5, hal. 1347–1354, 2023, [Daring]. Tersedia pada: https://journal.mediapublikasi.id/index.php/oktal

[10] R. Parlika, T. A. Nisaa', S. M. Ningrum, dan B. A. Haque, "Studi Literatur Kekurangan Dan Kelebihan Pengujian Black Box," *Teknomatika*, vol. 10, no. 02, hal. 131–140, 2020.