Android Game-Based Learning Media Recognizes the Structure and Functions of Plant and Animal Parts for Elementary School

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Abstract - **Teaching and learning activities in Indonesia still employ the lecture method which is considered traditional, therefore it is necessary to refresh it by utilizing learning media in teaching and learning activities. One of the methods applied is using learning media based on android game in which it puts forward user experience to its user. With this interesting educational game, children will not realize that what they are doing includes learning and children will feel happy and want to learn. This application is intended for the android smartphone platform. This development method uses Research and Development (R&D) with an Analysis, Design, Development, Implementation, and Evaluation (ADDIE) development model. The results of the black box test from the research are that this android game-based learning media can run well.**

Keywords: Learning media, game, android

I. INTRODUCTION

At the elementary school education stage, children will tend to prefer playing rather than studying. Playing has many benefits in developing children's self-skills and intelligence to be better prepared for further education [1]. Education is a process of changing behavior, adding knowledge and life experience so that students become more mature in their thoughts and attitudes [2]. Recently, advances in technology are very rapid. This progress is not only enjoyed by adults, elementary school age children can also enjoy the results of technological developments [3]. Technology is very useful in the world of education. Searching for literacy to improve knowledge in learning can take advantage of technology [4]. However, there are negative impacts from this technology, such as children using activities that are less educational and unhealthy.

Educational game-based learning media is expected to make fourth grade elementary school students more interested to study. This learning method is much more interesting and newer for them. With this learning method, it is hoped that students can better understand and more easily remember the material being taught [5]. Smartphones is more widely used at this time for various reasons and is practical for everyday use. In addition, there are many features that we can develop in it in which we can make the application ourselves [6].

Previous study was conducted by [7] by developing educational game applications with the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) method as this research focuses on application development and direct testing to users. Aditama and Putri [8] have developed an Android-based science learning media design for 4th grade elementary school children. This learning media focuses on two testing methods, namely black box and User Acceptance Test (UAT). The application of game-based learning media [9-11] is also applied by [12] in the introduction of animal and plant games. This learning media requires the user to learn first then directed to play.

Looking at the need to use learning media for education and there has been a lot of progress in the field of educational games, the author aims to develop an educational game introducing plant and animal parts specifically for 4th grade elementary school children that can be operated with an Android smartphone. The benefits of learning media are needed so that learning activities become more interesting.

II. METHOD

This study was developed using the Research and Development (R&D) method with the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) development model [13]. The application of ADDIE model is based on the consideration of a method that is easy to understand and systematically developed. The stages of ADDIE method can be seen in Fig. 1.

A. Analyze

This stage is used to analyze the need to determine a solution that fits the existing conditions. There are two stages of this analysis, the first is a performance analysis and a needs analysis. The performance analysis stage is used to identify and classify problems related to learning media in schools. Needs analysis is used to determine interesting learning media.

B. Design

This stage is used to provide an overview of the product to be made using use case diagram, activity diagram, and wireframe design [14]. It aims to determine, organize, and construct the components of the final system solution so that it has a blueprint for building the system.

1) Use Case Diagram. Use case system can be described as Fig. 2 which its users can perform activities including: viewing material, playing, viewing information, setting and exiting the application.

2) Activity Diagram. It is a system in which the user starts an activity and selects a menu according to what activity will be carried out. Activity Diagram of this system can be described as Fig. 3.

3) Wireframe. It is an initial picture of a product. It is in sketch. It will make the explanation easier to others. It will also make a picture of the project being made easier as well.

C. Development

This stage develops learning media based on the previously made plans. The process of making applications uses Construct 2 [15] and Website 2 Apk Builder [16]. The applications employed to create buttons and other display designs use Adobe Illustration and Adobe Photoshop.

D. Implementation

This stage is used to find out whether or not all the features are running properly. The testing is conducted by using black box testing [17] and System Usability Scale (SUS) [18].

E. Evaluation

This stage is in the form of activities to conduct an assessment test of the product that has been created whether or not it has achieved the initial goal or the goal of creating the product [19].
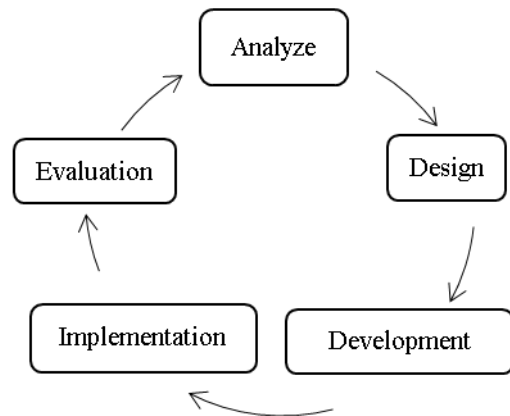

Fig. 1 Analyze, design, development, implementation, and evaluation (ADDIE)
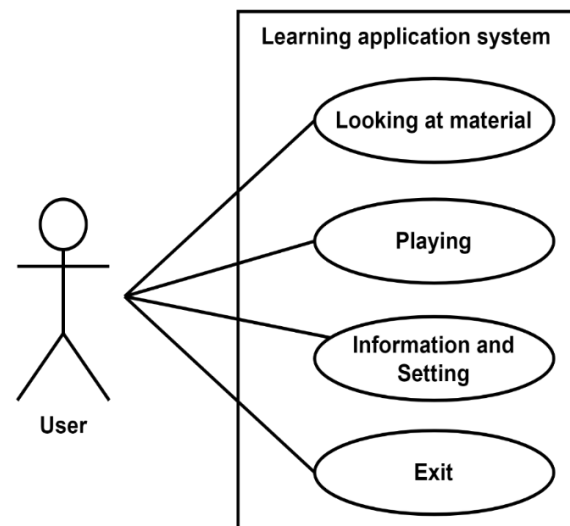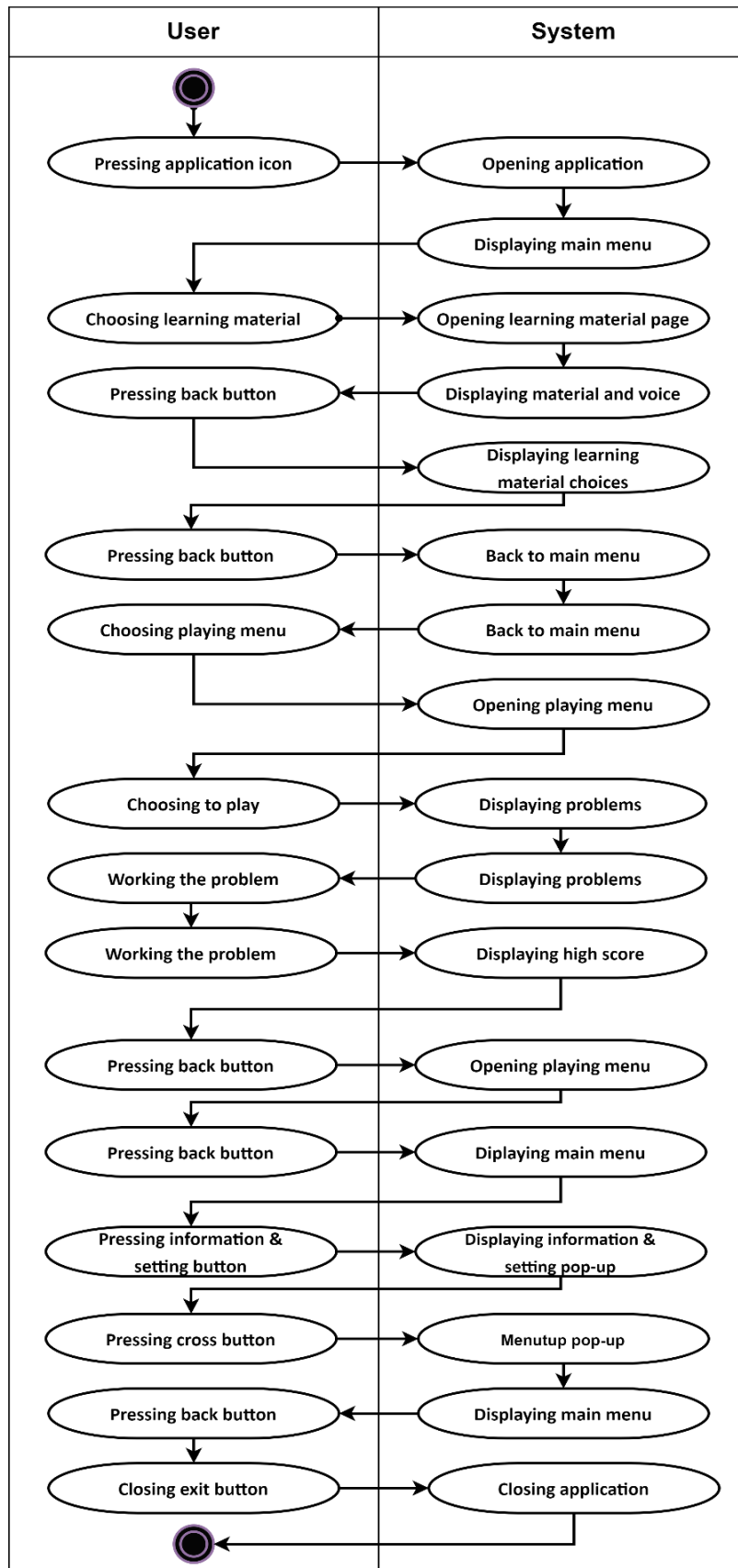

Fig. 2 Use case diagram

Fig. 3 Activity diagram

III. RESULT AND DISCUSSION

A. Result

The result of this study is a learning media application intended for the 4th grade elementary school children. The learning media aims to introduce the parts of plants and animals to increase students' knowledge and understanding in class. The following are the results of the study.

1) *The main menu.* It is the one that will display the main menu and will appear when users access the system. It can be seen in Fig. 4.

2) *The study page.* It is the one that will display a learning menu regarding the introduction of plant and animal parts. Fig. 5 shows the learning menu and Fig. 6 shows the learning option menu.

3) *The playing page.* It is the one that will display playing menu. It can be seen in Fig. 7.

4) *The score page.* This page will display the score obtained as having performed the game. It can be seen in Fig. 8.

5) *The information page.* This page used to see the information from media created.

6) *The profile page.* This page will display the profile of the learning media creator.

7) *The setting page.* This page will be used to turn the audio on or off.

8) *The KI&KD page.* This page will display core and basic competencies.
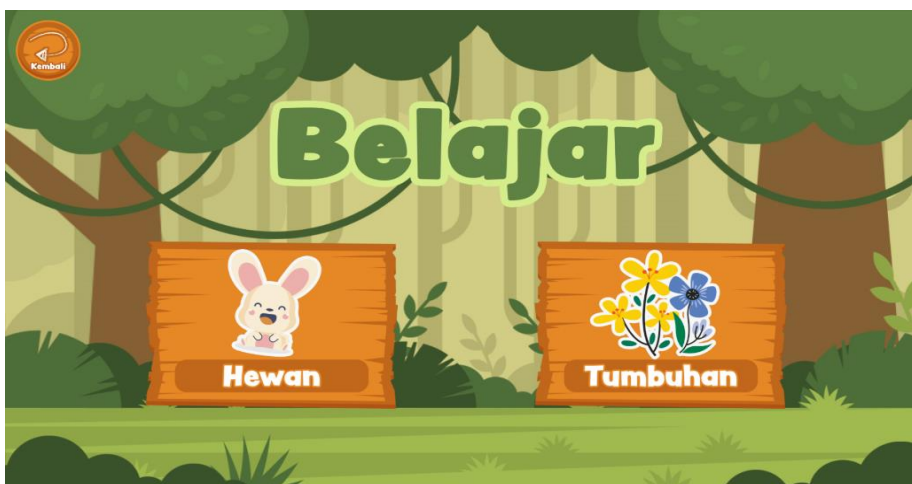

Fig. 4 Main menu display

Fig. 5 Learning menu display

Fig. 6 Learning material menu display

Fig. 7 Playing display

Fig. 8 High score display

B. Testing and Discussion

Software testing is an important part of application development. The goal is to be able to recognize errors or defects that exist in a software. This study uses two approaches, namely black box testing and SUS testing.

1) Black box testing. It is performed to test whether the existing features have run properly or not. Black-box testing includes test classes, test scenarios, expectations and the expected result in Table I.

2) System Usability Scale (SUS) Testing. This stage is carried out to evaluate the system using the System Usability Scale (SUS) test to find out how well the system is implemented. SUS test is in the form of questionnaire using a 5-point Likert scale. Respondents were asked to provide a system rating ranging from "Strongly disagree", "Disagree", Doubtful", "Agree", "Strongly agree" on ten question items. Each question item has a variable R1 to R10. The overall SUS score is obtained from the average individual SUS score, as in (1).

$$SUS = (((R1 - 1) + (5 - R2) + (R3 - 1) + (5 - R4) + (R5 - 1) + (5 - R6) + (R7 - 1) + (5 - R8) + (R9 - 1) + (5 - R10)) * 2.5) \qquad (1)$$

Where :

$R1$ to $R10$ is the answer score of each respondent

There are rules for 10 question questionnaires. For each question with an odd number, the answer from the respondent (respondent's score is reduced by 1). Each question with an even number, the respondent's answer (5 minus the respondent's score). The final result of adding up the total score per respondent then multiplied by 2.5. The following 10 questionnaire criterias were used in the calculation of SUS and the results are shown in Table II.

- According to me, I like this learning media and I will use it many times
- In my opinion, this learning media is too complicated to use
- I think this learning media is easy to use
- I need other people to assist me in operating this learning media
- I consider these parts of the learning media can be used well
- I think how to use this learning media is confusing
- In my opinion, other people will learn to use this learning media easily
- I consider this learning media difficult to operate
- I find that I can use this learning media

I need to study first to be able to operate this learning application.

3) Calculation result with SUS formula. In Table II, it was obtained the number of SUS scores and then the average value was calculated. The formula for calculating the average value can use (2).

$$average\ value = \frac{\sum x}{N} \qquad (2)$$

where :
x = Respondent's final result score
N = Number of respondent

TABEL I
BLACK BOX TESTING RESULT

Test Class	Test Scenario	Expectation	Test Result
Login	Pressing application icon	Displaying main menu page	*Valid*
Main Menu	Pressing learning button	Displaying learning page	*Valid*
	Pressing playing button	Displaying playing page	*Valid*
	Pressing information button	Displaying information	*Valid*
	Pressing KI&KD button	Displaying KI-KD	*Valid*
Learning Menu	Pressing animal study button	Displaying animal study menu	*Valid*
	Pressing plant study button	Displaying plant study menu	*Valid*
	Pressing learning material	Displaying learning material and material explanation dubbing	*Valid*
Playing Menu	Pressing correct answer	The correct sound rings and the score increases	*Valid*
	Pressing wrong answer	The incorrect sound rings and the answer returns to the original position	*Valid*
	Completing the game	Displaying high score page	*Valid*

TABEL II
SUS TESTING RESULT

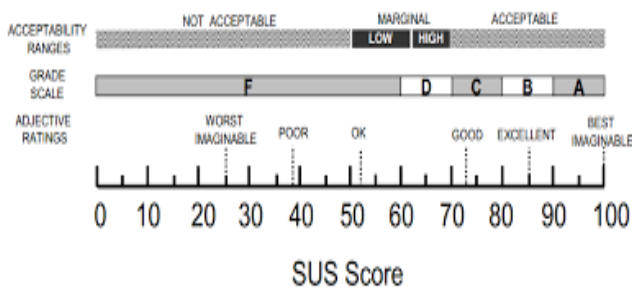| Respondent	Calculation Result Score										Total	Final Result (x)
	1	2	3	4	5	6	7	8	9	10		
1	4	1	4	3	3	4	4	3	3	2	31	77.5
2	4	4	4	3	3	3	4	4	4	2	35	87.5
3	3	4	4	4	3	3	3	3	2	3	32	80
4	4	3	4	4	3	4	3	3	3	2	33	82.5
5	3	3	4	3	3	4	4	3	4	2	33	82.5
6	4	4	4	3	3	3	4	4	4	2	35	87.5
7	4	1	4	3	3	4	4	3	3	2	31	77.5
8	3	3	4	3	4	4	4	3	3	2	33	82.5
9	4	4	4	3	2	3	4	4	4	2	34	85
10	4	3	4	4	4	4	4	3	3	3	36	90
Total SUS Score												832.5

Fig. 9 The range of SUS assessment

The calculation of the average value as in (2), and get a value of 83.25. This value is in the range of B (80-90). It can be seen in Fig. 9 which shows "excellent" results. Therefore, the application developed has met user expectations and is suitable for use.

IV. CONCLUSION

The product developed from this research is a learning media regarding the introduction of plant and animal parts based on android games. Based on the black box testing assessment that has been carried out this system can run well as it should and based on usability testing using the SUS system, an average value of 83.25 is obtained, which means this system is included in the "excellent" criteria.

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