Implementation Of The Multimedia Development Life Cycle (MDLC) In Solar System Application Design

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***Abstract**.*

Augmented Reality (AR) technology has had an impact on changes in the world of education, especially improving the quality of education which has positively influenced the learning and teaching process, with the use of tools in education it has proven effective in improving the learning and teaching environment in the classroom and even changing the way we view education. This research aims to design a solar system application as an alternative AR-based learning media by integrating 3D models, animation and video to improve the learning experience of students, especially students of SDN Larangan 5 Tangerang. This is based on the lack of student learning experience, especially regarding the solar system material which is still lacking and not yet varied because so far SDN Larangan 5 has not used technology, especially AR technology in the learning process and still uses book texts and videos. This research used the Multimedia Development Life Cycle (MDLC) method and usability testing was carried out using the System Usability Scale (SUS) method with a total of 33 respondents with a test result of 78 which indicates the level of user satisfaction with the solar system application that has been tested on the respondents.

***Keywords:** Augmented reality, Sytem Usability Scale (SUS) and Multimedia Development Life Cycle (MDLC) .*

I. INTRODUCTION

The use of digital technology is currently increasingly rampant, this can be seen from other levels that technology has also influenced human life, including in the field of education where technology has become a part of education so that it positively influences the learning and teaching process [1] [2] [3]. Technological advances have also become the attention of researchers to realize a technology-based educational process aimed at optimizing the teaching and learning process [4] [2]. This has also become a concern for researchers in its implementation in the educational process, where students have abandoned old learning methods by switching to digital-based learning [2].In education, learning by doing or what is known as learning by doing is very important to complete theoretical concepts and technical introductions to maximize learning outcomes. Still, many students have not been able to apply this knowledge practically even though they have a theoretical understanding of the basics due to a lack of motivation due to the absence of content with appropriate visualization that involves students in class [5]. The transition of students' way of learning from the old way of learning to the digital way through the use of computers and the internet has become part of recommendations for the use of digital media in the world of education [6]. Apart from that, traditional lecture-based education has limitations, namely the need for physical space and the physical presence of participants [7] and it has been proven that the use of tools in education can improve the classroom environment for learning and teaching and even change our perception of education.

[8].The success of this technology is largely determined by how well teachers understand the technology in meeting expectations, goals, and strategies in teaching [9] [10]. Augmented reality (AR) is a simulated 3-dimensional environment created using hardware and software, has interactive capabilities, provides authenticity to the user's experience, and has the potential to enhance education by providing accessible educational resources, interactive learning environments, and cost-effective training [11]. In addition, the AR system can increase the ability to adapt information beyond the range of human perception of nature and can improve human perception so that it is easy to understand the information through the realization of a three-dimensional world with AR technology [12] [13]. AR technology has brought many changes to the world of education, especially improving the overall quality of education which has

dramatically impacted current and future education [14].In this research, researchers integrated 3D models, animations, and videos into solar system applications as learning media using augmented reality (AR) technology.

Therefore, the research will implement AR applications in particular for Natural Sciences (IPA) subjects with discussions related to the solar system which aims to improve the learning experience of students, especially students at SDN Larangan 5 Tangerang, because so far SDN Larangan 5 has not used technology. augmented reality (AR) in the learning process and still uses textbooks and videos so that students' learning experiences, especially for solar system material, are still lacking and not yet varied.Based on the description of the background and problems explained above, the research aims to design a solar system application as an alternative learning media based on Augmented Reality (AR) to introduce knowledge about the solar system to students at SDN Larangan 5 so that it can produce a better learning experience. good and varied and increases students' knowledge about the solar system based on AR technology through simulations by viewing the solar system as it is in real life, but in virtual 3D form.The advantages of learning using AR are increasing learning achievement, increasing positive attitudes, and reducing cognitive load as a learning medium [15] [16]. The use of AR technology has become a platform that allows students to observe phenomena that may not have been experienced in real life and can adapt to each student's level of understanding [17].

II. METHODS

In this research, the method used to develop a solar system learning application based on Augmented Reality (AR) is the Multimedia Development Life Cycle (MDLC) as shown in the image below. MDLC is a systematic and structured method for developing multimedia, allowing for iteration or repetition at certain stages if necessary, thus allowing for refinement and improvement at each stage [18].

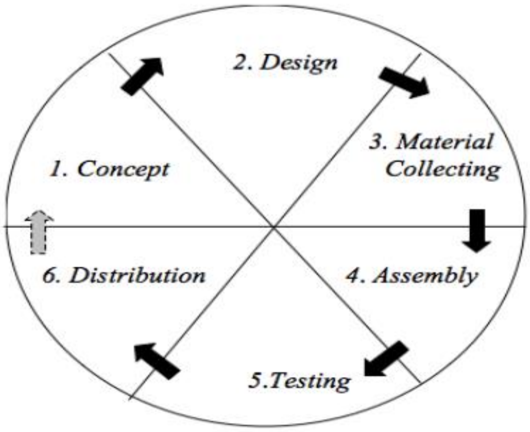


Fig 1. Multimedia Development Life Cycle (MDLC) Stages

Multimedia Development Life Cycle (MDLC) is a software development method specifically applied to multimedia projects proposed by Aria Luther in her book entitled "Authoring Interactive Multimedia" in 1994, (MDLC) is a method for developing multimedia applications that include 6 main stages [19]:

1. Concept

At this stage, the developer defines the project objectives, target users, type of application (presentation, interactive, etc.), general specifications, and development limitations. Concepts are finalized and analyzed to get a complete picture of the project.

2. Design

The stage where technical specifications for multimedia applications are prepared in detail such as storyboards, navigation structures, display sketches, making flowcharts. The design is created after the concept has been finalized in the previous stage and is carried out as follows in table 1:

Table 1. Storyboard Design Of The Solar System Module Application

Visual	Sketch	Audio
In the Opening Screen frame there is a Home Menu		Solar System Screen and Audio
The following is a Details Page which contains information about each planet and there is a back button to return to the initial menu		Solar System Screen and Audio
Detailed explanation of each planet		Solar System Screen and Audio
Following is the Page Quiz, if the answer is wrong then there is an indication that it is wrong and if it is correct there is an indication that it is correct and there is a back button to return to the initial menu		Solar System Screen and Audio
This is the display if the answer is wrong		Solar System Screen and Audio
This is the display if the answer is correct		Solar System Screen dan terdapat Audio
In this Quiz frame there is a calculation of how many wrong, how many correct and the total score and there is a back button to return to the initial menu		Solar System Screen and Audio

3. Material Collecting

The materials needed to create a multimedia application are collected at this stage, such as images, clip art, animation, video, audio, other multimedia elements according to the needs determined at the design stage.

The data required when designing a Solar System application at the Collecting stage includes:

a. Assets

b. Audio

A collection of assets in the form of 3D object models starting with supporting photos which are intended to provide backgrounds and interactive animations in the form of 3D object models as replicas to accompany the teaching materials needed to create Solar System module applications.To build a Solar System application starting from supporting images whose aim is to create animations and interactive backgrounds, an asset collection process is required in the form of 3D object models as replicas, then the application is also designed with a music feature as a background and button sounds when the pointer is above it.

4. Assembly (Manufacture)

The production stage is where all multimedia materials are integrated into a complete multimedia application according to the design that has been created. Application programming is also carried out at this stage. This editing stage was carried out in several steps by the researcher, namely determining the object with Unity Asset Store and Sketchfab.

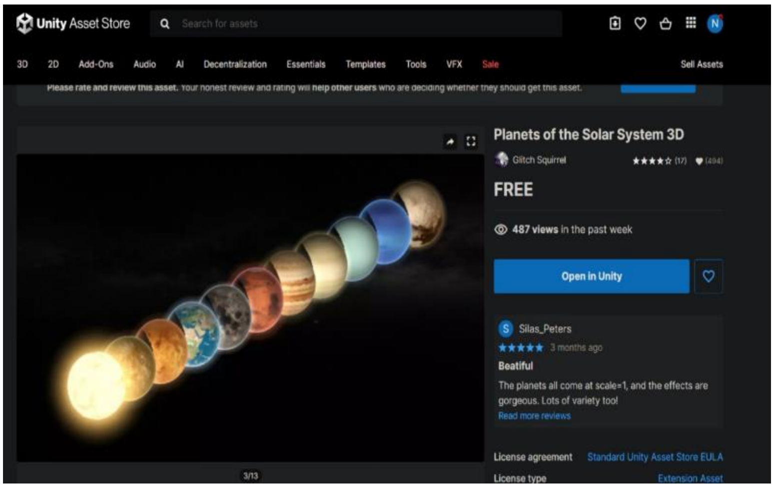


Fig 8. Creation of 3D Objects

At this stage, coding is also carried out which aims to ensure that the features or buttons on the solar system application can function properly, then add scripts for the command buttons, where each process creates its script code and adds new components, and then the Visual Studio program. code with the C# programming language can be run with Unity 2018 software as explained in the following image.

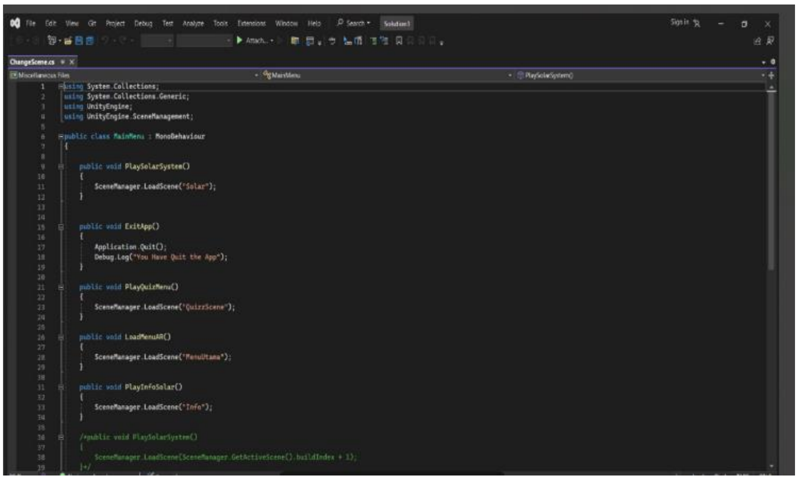
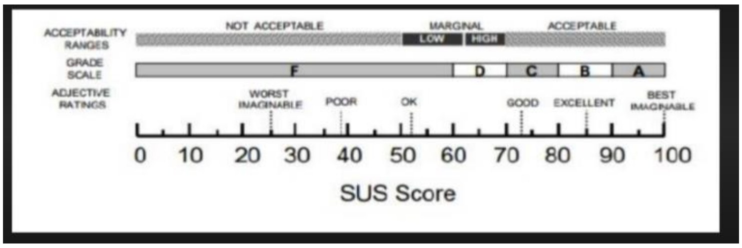


Fig 9. Application coding with C#

5. Testing

The multimedia application that has been built is tested modularly and in its entirety to ensure there are no errors or problems. Testing was carried out using the System Usability Scale (SUS) method.In 1986 the SUS method was developed by John Brooke, this method is one of the most usability testing tools and is an effective, popular, reliable and cheap usability scale measuring tool. This method is an approach that uses a questionnaire with ten questions and a five-point Likert scale as the answer. The Equation 1 formula is used to generate positive questions, while the Equation 2 formula is used to generate questions with negative meaning. Next, the number of positive and negative question answers produces the SUS score. after that multiply by 2.5. As can be seen in Figure 11 below, the system is said to be good if the SUS value is not less than 68, which is above average. [20]:



Figu 11. System Usability Score (SUS) score

6. Distribution

In the final stage, the multimedia application is stored on appropriate storage media such as CD, DVD, website/online, or installed on the targeted device such as a computer or smartphone. Distribution can also be accompanied by packaging to support product marketing.

III. RESULT AND DISCUSSION

The results of the application of Augmented Reality in Ban 5 Elementary School which aims to motivate students' interest in learning which has an impact on creating Solar System learning applications by utilizing the Multimedia Development Life Cycle (MDLC) Method. Next, the appearance of the application is to be observed through the results of application implementation. This allows users to experience and interact with the application as it was intended during its development.

Application Implementation

Objects developed include characters, An introduction to the solar system accompanied by a description of each planet in the solar system as well as a quiz feature accompanied by notification of the correct or incorrect answers and the score. Figure 10 illustrates the application display when marker scanning is performed.

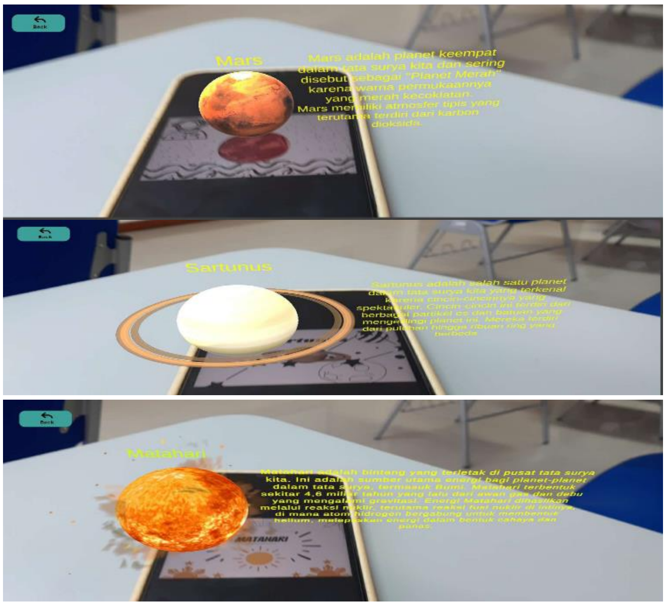


Fig 10. Solar System Application Display

System Usability Scale (SUS) Method Test Results

Testing results were carried out involving a group consisting of 12 teachers, 13 students and 8 parents with a total of 33 respondents. The usability testing results are summarized in Table II which contains the aspects assessed, the average score in percentages, and the corresponding interpretation.

Responden	Pertanyaan										Hasil Hitung
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	
1	4	4	4	4	4	3	4	4	3	4	95
2	4	2	4	2	4	2	4	2	2	2	70
3	3	3	3	3	2	3	2	3	3	3	70
4	4	2	4	2	4	3	4	2	4	2	78
5	3	3	3	3	3	3	3	3	3	3	75
6	3	3	3	3	4	4	4	3	4	3	85
7	3	3	3	3	3	3	3	3	2	3	73
8	4	3	4	3	4	2	4	3	2	3	80
9	3	3	3	3	4	2	4	3	3	3	78
10	2	2	2	2	2	3	2	2	2	2	53
11	3	3	3	3	3	2	3	3	3	3	73
12	3	3	3	3	3	2	3	3	3	3	73
13	4	4	4	4	4	4	4	4	3	4	98
14	3	3	3	3	4	3	4	3	3	3	80
15	3	3	3	3	3	3	3	3	3	3	75
16	4	4	4	4	3	4	3	4	3	4	93
17	3	3	3	3	4	3	4	3	3	3	80
18	4	3	4	3	4	4	4	3	3	3	88
19	2	2	2	2	3	3	3	2	3	2	60
20	4	3	4	3	3	3	3	3	3	3	80
21	4	4	4	4	3	4	3	4	3	4	78
22	3	3	3	3	4	3	4	3	3	3	77
23	4	3	4	3	4	4	4	3	3	3	77
24	4	2	4	2	4	3	4	2	4	2	77
25	3	3	3	3	3	3	3	3	3	3	77
26	3	3	3	3	4	4	4	3	4	3	78
27	3	3	3	3	3	3	3	3	2	3	77
28	3	3	3	3	3	2	3	3	3	3	77
29	4	4	4	4	4	4	4	4	3	4	77
30	4	4	4	4	4	3	4	4	3	4	77
31	4	2	4	2	4	2	4	2	2	2	79
32	3	3	3	3	2	3	2	3	3	3	79
33	3	3	3	3	4	4	4	3	4	3	79
SKOR HASIL HITUNG											78

The SUS test results above obtained a calculated score of 78 which illustrates that the test received the title "Good", thus indicating the level of user satisfaction with the solar system application that has been tested on respondents.

IV. CONCLUSION

Based on implementation and testing application of Augmented Reality to the Solar System application, several main conclusions that can be drawn, firstly, the implementation of the solar system application can function and run effectively and in harmony with aims to motivate students' learning by providing learning innovations based on Augmented Reality technology. The two application test results that were tested with the System Usability Scale (SUS) regarding the use of the features and quizzes contained in the application are suitable for use because the calculated score obtained is above the average, namely 78, but still needs to be improved for usability. so that it can be more easily accepted by users. Further research can add other features such as animation and can also be tested with other methods because the SUS method is not diagnostic.

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