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Implementation of Augmented Reality Snap That Animal Using MDLC Method as Learning Media

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ABSTRACT

This research introduces Snap That Animal, an augmented reality (AR) mobile application designed as an innovative educational tool for early childhood education. The study focuses on identifying challenges faced by teachers at Aisyiyah Bustanul Athfal Krajan Kindergarten when using traditional teaching methods to engage young learners. To address these challenges, the application was developed using the Multimedia Development Life Cycle (MDLC) method, incorporating the Vuforia SDK on the Android platform to create interactive 3D animal models activated by markers. This interactive approach aims to enhance student interest and learning outcomes by offering more engaging and accessible educational content. The app underwent thorough testing, including marker recognition under varying light intensities, tilt angles, and distances, as well as compatibility with different devices. Results demonstrated that the application performs efficiently in real-life educational settings. A quantitative descriptive approach was employed, with data collected through a questionnaire. The study population consisted of kindergarten teachers, and a total sample of nine teachers participated as respondents. The processed questionnaire results, evaluated using an assessment scale, revealed a feasibility rating of "very good," with a score of 93.56%. In conclusion, the findings suggest that AR applications like Snap That Animal significantly enhance student engagement and learning effectiveness in early childhood education.

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1. INTRODUCTION

Based on Indramawan et al. (2020), education is essential for human development. Education services are provided at school for the first time, and the learning process at school is usually almost the same. It means there is a teacher as a mentor, provider of teaching materials, explanatory tools, and demonstrations as part of the learning process[1]. Education is essential in improving the skills and quality of human life as a factor of national development. Education can be improved through formal education institutions, one of which is school[2]. Technological developments such as "augmented reality" can provide opportunities for teachers to innovate and develop learning methods that can be improved so that students can improve their concentration and overcome difficulties in learning[3]. However, this still does not solve the problems faced during learning. One of them is the problem faced at Aisyiyah Bustanul Athfal Krajan Kindergarten. Trying to teach a child early is the most complex challenge of all. The curiosity level of children at this age tends to be high, but because of this, it is difficult for them to settle on one topic. Their attention is more likely to turn to what they find interesting at the time. If the teacher forces them to focus on learning, their enthusiasm for learning will diminish. That is why finding techniques to make them more interested in what is being taught is essential for Aisyiyah Bustanul Athfal Krajan Kindergarten.

Augmented reality (AR) is a technology that can combine unreal or imaginary things into the real world and then show it in real-time in two or three dimensions[4], such as animal names that need to be visualized by the user. Therefore, augmented reality can make students more interested and motivated to learn without coercion. Augmented reality has several weaknesses, including the fact that the results sometimes do not look natural or have a limited viewing angle[5]. This means that the objects placed in the augmented reality technology will not be similar to the original object. However, the progress of augmented reality also has characteristics that do not match the original object. Therefore, the image quality obtained is still not optimal.

Recently, augmented reality has been widely used in various fields, such as medicine, entertainment, military, design, robotics, and others[6]. Augmented reality has also been implemented using several devices, one of which is the most widely used smartphone. In higher education, many have used augmented reality because it is easier to understand and looks more realistic, so many people can access it and use it in various fields, especially in education. With augmented reality, people can better understand the subject they are studying[7].

The use of augmented reality related to the education of kindergarten children is very suitable, considering the cognitive development of children, where children will be more interested in learning using actual forms because children will easily understand them. For learning in children that is easier to understand to be created, a learning model that looks real is needed. Therefore, implementing augmented reality as a learning medium

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is very suitable[8]. In this study, researchers will use animal material as the primary material for learning, considering that children need to learn about animal recognition. Researchers use the Android-based Vuforia image tracking method as a means of teaching and learning. This research uses Vuforia to support augmented reality that is applied/applied using an Android-based smartphone.

In a journal entitled Augmented Reality as a Medium for Learning Ancient Animals, it is mentioned that when children learn about ancient animals, they only learn about them through books; there are only pictures of fossilized forms of ancient animals that have been found[9]. Therefore, educators must be more creative and innovative in teaching so that students can be more interested and like the learning system that aims to support success. Learning media that align with the development of the times can make students more enthusiastic and interested in the learning process, thereby increasing their knowledge and improving their learning outcomes compared to before[10].

There is also a research journal entitled "Making Augmented Reality (AR) for Learning Cell Organelles in Plants and Animals" applied at SMA Negeri 1 Dlingo, with results showing that augmented reality (AR) technology can be appropriately implemented on smartphones as a marker[11]. Augmented Reality (AR) (Snap That Animal) is also to make it easier for teachers to monitor and evaluate student learning outcomes. Augmented reality technology can also make the learning environment more realistic and contextualized. It can make students see and interact with animals directly[12]. According to research conducted by Tafakkur et al. (2023), multimedia is one of the information technology products that has the advantage of stimulating the imagination and interest of its users. This is supported by multimedia, including images, audio, text, and animation[13]. These days, multimedia users continue to utilize the Internet, which facilitates the process of interaction anytime and anywhere, regardless of time and distance. Product and service providers often use multimedia content as a promotional tool. Product and service providers can introduce and promote their products to consumers through audio and video content. According to Wibowo et al. (2022), augmented reality is an application that can show two or three-dimensional objects by combining the real world with the virtual world and showing them simultaneously—utilization of augmented reality as an alternative learning tool on animal material[14]. According to Fitria et al. (2023), augmented reality is used as a means of learning that cannot be achieved directly, for example, by observing three-dimensional objects. We can only observe something without using a smartphone or laptop or doing it directly[15].

Suwito et al. (2023) stated that technology in education is developing very rapidly, especially in the learning process. In the past, learning was only done through books provided by the school and pictures drawn by the teacher. Therefore, book learning is considered less effective. Media-free learning moves from traditional to electronic media, such as educational videos[16]. Rosyid and Sitio (2022) suggest that this learning method does not cater to children's learning desires. Children want to learn to be exciting and

creative. In other words, you can learn while playing. Therefore, technology is needed to connect children's desires and learning[17]. According to Rachim et al. (2024), The development of digital technology brings changes to memorization-based education, which has only been centered on books. With this, learning for students becomes boring. Therefore, more modern education must be developed to support a dynamic and practical learning experience. The advancement of increasingly popular developments is augmented reality as a learning medium[18]. According to Robianto et al. (2022), augmented reality is a new technology field that allows users to interact with the natural environment using computer simulations[19].

2. RESEARCH METHOD

In this study, the authors used a quantitative descriptive approach that could direct this research to examine the problem in detail, thoroughly, and comprehensively. The qualitative approach using likert scale criteria interpretation scores[20]. The population of this study were kindergarten teachers and the sample in this study was a total sample, namely all teachers who taught in kindergarten. This method can also provide data about an observed behavior in written and descriptive words[21]. In this research, the Multimedia Development Life Cycle (MDLC) method is used; the MDLC method itself is the method most often used in designing an application. MDLC method in research is an approach to developing and applying multimedia materials in a study. MDLC method also includes a series of flows to control the multimedia development process related to the research objectives[22]. The learning process can use the MDLC method to make the learning system more attractive[23]. There are several stages of the method in multimedia development, one of which is the MDLC method, which has several stages: concept, design, material collection, assembly, testing, and distribution[24]. The method used in this research has a complete and complex process stage, and the development system has used an interactive multimedia system[25]. MDLC method is very suitable for designing and developing an application combining multimedia such as images, sounds, videos, animations, etc[26].

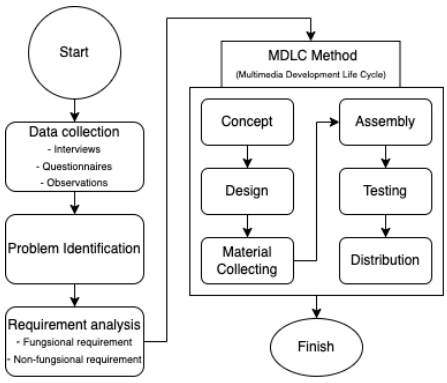

Figure 1. The method of research

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2.1. Data Collection

The research has collected data through various techniques, including questionnaires, interviews, and on-site observations of the research object. These methods are highly effective for data collection as they include important information during the information-gathering process.

2.1.1. Interview

In this study, the authors used the interview method at Aisiyah Bustanul Athfal Krajan Kindergarten. So that the results of the interview can be used to collect data about student's interest in learning with the results seen in table 1 below:

Table 1. Interview results

Question	Answer
Are there any problems at Aisiyah Bustanul Athfal Krajan Kindergarten in the learning process?	There are no significant problems, because the children taught are 4-5 years old.
Are there any constraints on the teacher in delivering the material in the lesson?	There are no obstacles, it's just that some teachers are not very creative in the way they deliver lessons to students so that many students become bored and then play alone.
How is the relationship between teachers and students at Aisiyah Bustanul Athfal Krajan Kindergarten?	Sometimes teachers are confused to teach or control children because of the monotonous subjects.
Is there any material that must be visualized for students to better understand the material?	Children prefer animals or plants to be visualized because they can usually only see them from books or videos.
Can an app for animal name recognition help teachers and interact?	Yes, because in addition to teachers being able to teach students, it can also hone students' cognition so that students are not bored with the same lessons.
What should be conveyed in the application, does it only show images, is it 3D, animated or does it include side and back views?	Anything, so that teachers can be more creative in delivering lessons and students are more interested in learning so that the relationship between teachers and students can increase.

2.1.2. Pre-questionnaire

The questionnaire stage is a data collection stage carried out using a list or list of questions that have been made through online forms or printed physical questionnaires. This questionnaire method is very helpful and more organized in collecting data. The pre-questionnaire was given to teachers containing a list of questions covering the learning process at Aisyiyah Bustanul Athfal Krajan Kindergarten with 7 open questions.

Table 2. Pre-questionnaire

No	Answer

1	Do students at Aisyiyah Bustanul Athfal Krajan Kindergarten get material about animal recognition?
2	So far, how do you introduce animals to students? Can you tell clearly and mention if there are any tools used?
3	Are the learning methods used effective, what are the reasons?
4	In learning animal recognition so far, have you used the IT approach? For example, using smartphones or other tools, what is the reason?
5	Are there any obstacles or problems in providing learning about animal breeding?
6	Do you use Android smartphones in your daily activities?
7	Does the Kindergarten operational curriculum need to use IT-based learning approaches?

2.1.3. Observation

Researchers make direct observations by coming to an object to see first the problems that are happening. In this case the researcher has made observations to Aisiyah Bustanul Athfal Krajan Kindergarten to see firsthand the teaching and learning process to students.

2.2. Problem Identification

In this phase, the author can determine a research title based on the results of problems found according to the results of interviews, questionnaires, and observations made at Aisyiyah Bustanul Athfal Krajan Kindergarten.

2.3. Requirement Analysis

The author needs to analyze the requirements to build the application during this phase. The two components of requirement analysis are functional needs and non-functional needs. Functional demands entail examining the issues present in the study item by offering certain features required in the application that must be created. Meanwhile, non-functional needs include analyzing applications developed/made so that they can run on devices with predetermined specifications.

2.3.1. Functional Requirement Analysis

This application is expected to be able to display a communication and interaction service on service on the object that has been designed, including scanning animal markers that have been made, displaying animals in 3D, and providing voice-over explanations about related animals.

2.3.2. Non-Functional Requirement Analysis

The non-functional requirements needed to run the AR filter in this study are devices with the following minimum specifications: an Android operating system (Oreo), 2 GB RAM, a processor that supports Open GL ES 3.0, and an 8 MP smartphone camera.

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2.4. Concept

The concept at the application design stage is to create a flowchart design, storyboard, and application mockup. The flow of an application aims to facilitate the process of making the application. After all the data has been collected, based on the results of the interviews obtained, it can be concluded that the challenges faced by schools include limited resources, limited space, lack of teacher training. According to Utomo et al (2023) limited resources mean that schools must increasingly support the needs of students, but the available funds are limited[27]. Furthermore, the author considers and decides to make an application that will be useful to facilitate the learning process of children and is preferred by kindergarten children. Where the application to be made shows an image of the animal in a more interesting form. This is expected to fulfill most of the aspects needed to increase learning interest in students at Aisiyah Bustanul Athfal Krajan Kindergarten. 1) Applications that will be made using multimarker-based augmented reality (AR) will be made. It is expected that students as if interacting with animals on a smartphone so that it can make students focus more on learning and make learning more fun. 2) There are only 2 tools needed to operationalize augmented reality (AR), namely a 21 x 15 cm book as a marker containing 12 animals and a smartphone owned by a teacher who has downloaded the Snap That Animal application.

2.5. Design

The following steps to creating this application are to create the design specification, which includes multiple designs for the application's appearance, structure, and material needs. To prevent disastrous decisions from being made later on, the design that will be made in the application needs to be fully stated.

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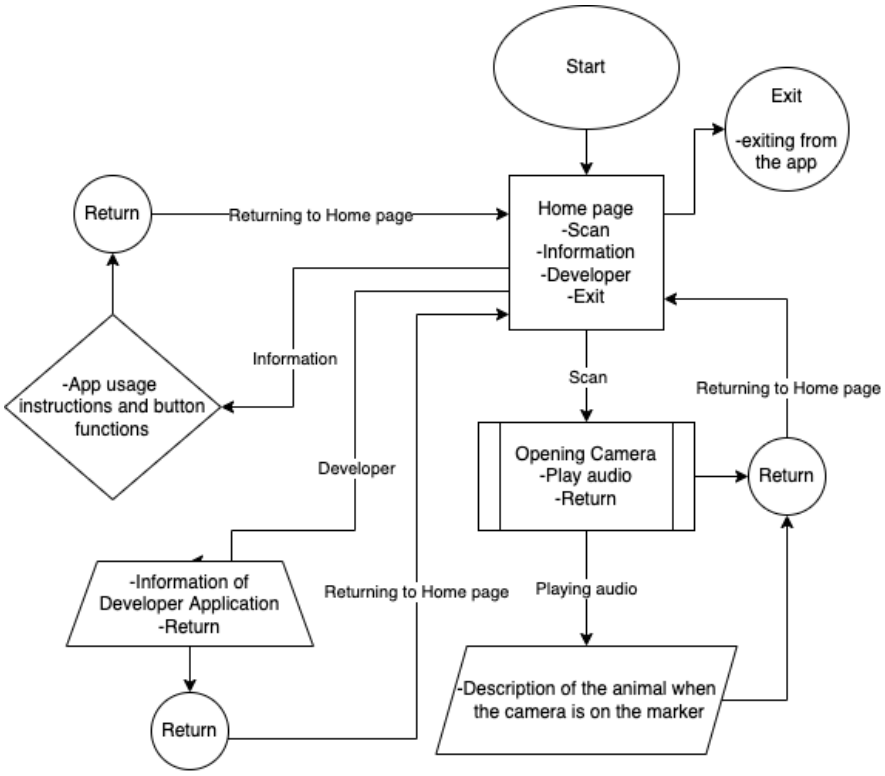

Figure 2. Flowchart Application

2.6. Material Collecting

In order to build the application, the author needs to collect assets after the design and concept have been made earlier. There are plenty of elements that can be used for this study as materials such as 3D objects, 2D objects, audio, etc. materials, can be made or found in specific ways; for example, the assets can be taken from Google and several platforms, or they can be made using software to build the materials itself. The author uses 3D objects in this research by taking assets from a Google platform. For audio, use a voice generator; for animal audio, take it from the YouTube platform.

Table 3. Assets which has been collected

Assets	Description
Sketchfab	Animal 3D assets - Tiger - Rhino - Elephant - Cow - Crocodile - Rabbit - Shark - Manta fish - Sea turtle - Goldfish

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	- Eagle - Butterfly
Youtube	Audio of the animals and sound effect above
Audio Generator	Audio for description of the animals above

2.7. Assembly

At this stage, all the materials that have been designed will be made into the Snap That Animal application according to the design stage that has been made before. To make sure everything is in order, organized, and structured. The researcher will make hardware and software specifications in designing the Snap That Animal application.

2.7.1. Hardware development tools

In making the Snap That Animal application, Personal Computer (PC) hardware is used with the specifications in the table 3 below.

Table 4. Specification of computer

Hardware	Description
Brand and model	Personal Computer (PCS)
Processor	Ryzen 5 3.6 Ghz
RAM	32 GB
Internal Memory	2 Terra Byte
Graphic card	NVIDIA GeForce GTX 1660 Super
Operation System	Windows 10

The hardware used by researchers to test each application is a smartphone Xiaomi Redmi Note 10S, with the following specifications in the table 4 below:

Table 5. Specification smartphone tester

Hardware	Description
Brand and model	Xiaomi Redmi Note 10S
RAM	6 GB
Internal Memory	128 GB
Battery Capacity	5000 mAh
Operation System	Android 11

2.7.2. Software development tools

The development of the Snap That Animal app requires much software. Because it needs to save the previously constructed animal markers in the Vuforia database. The following are a few of the software programs the researchers used to create this application:

Table 6. Specification Software

Software	Description
Sketchfab	A platform website that provides 3D assets.

Vuforia SDK	The software used to store the library asset into a database and to store animal markers to be used as a marker for a 3D object.
Unity	The software used to create the Snap That Animal application.
Canva	Website used for making 2D design of animal images used as markers and descriptions of animals.
Figma	Website used to make mockup design of the Snap That Animal application.
Draw.io	Website used to create a flow of this research and make it as a flowchart to design.
QR Code Generator	Website used to create 2D markers so that applications can be downloaded using Google Drive.
Google Drive	The website used to store assets and access the Snap That Animal application using a QR Code Generator.
Visual Studio code	Application to create a coding flow in applications that are integrated to Unity

2.7.3. Application assembly

Creating an AR homepage or front page in the Unity application.

Figure 3. Homepage application

In Figure 3 above, a homepage is created with a button feature at the bottom of the layer using Unity application. Another materials also being imported into the Unity application such as animal 3D, marker, audio, 2D description.

Combination of hyperlinks with homepage.

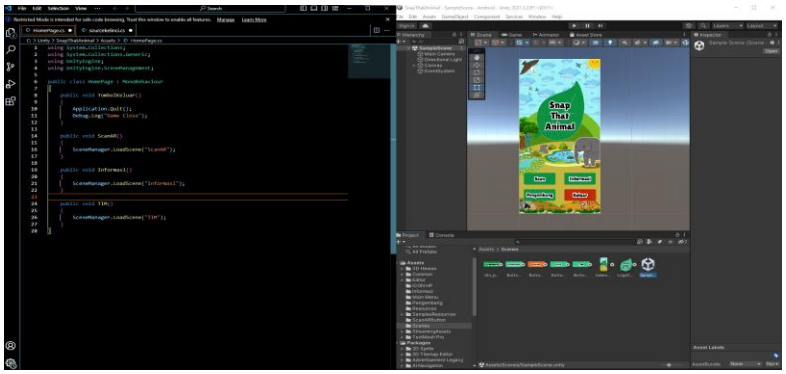

Figure 4. Integrating homepage with Hyperlink .

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In Figure 4 above, the hyperlink is combined with the homepage so that the button can be pressed and enter the next page and can be connected between other pages using Visual Studio code with C# code.

Putting 3D AR model into the canvas.

Figure 5. putting 3D animal into markers

In Figure 5 above, 3D animal models are made, including sound of the animal, voice over, 2D description as well as markers obtained from the Vuforia database and to combine all the material together so that they can be scanned using a smartphone.

2.8. Testing

The last step in building this application based on the MDLC method is to test the application. In this process, a bug or error will be found when the testing process is carried out. Plenty of software will be used in processing, including software provided according to the non-functional requirements above. When a bug or error has been found, it will return to the manufacturing stage process to be fixed. System testing in this application involves several stages: testing on different devices, black box testing, marker testing, light intensity testing, angle testing, distance testing, and content validation.

2.9. Distribution

At this stage, researchers will provide augmented reality (AR) applications equipped with books and user manuals that have been printed and given to the object of this research. Furthermore, whether this application is suitable for use or not will be assessed from the object. When it agrees, the object will provide an approval letter to accept the application developed appropriately.

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3. RESULTS AND DISCUSSION

3.1. System Analysis Design

3.1.1. Application Usage Guide

The first stage in using the Snap That Animal application is scanning the QR code printed on the back of the book. Next, the QR code will direct the user to Google Drive to download the Snap That Animal application.

Figure 6. QR Code access to install the Application

3.1.2. Application Homepage View

Four features on the Application's homepage are designed during the mockup design stage: scan, information, developer, and exit. They provided options to access the information section of the Application, related application developers, and exit the application program.

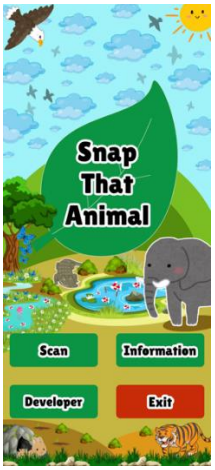

Figure 7. Homepage display Application

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3.1.3. Information page of the Application

On the Information page of the Application, there are instructions for using the Application and one return button feature. It provides information about the four button features in the Snap That Animal application, as well as how to use this application.

Figure 8. Information page display

3.1.4. Developer page of the Application

On the Developer page of the Application, there is a profile of the developer of the Application along with a button feature to return to the homepage menu.

Figure 9. Developer page display

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3.1.5. Application Scan View

The smartphone can access the camera feature on the Scan application page, as shown below. Then, a one-button feature allows you to return to the homepage menu.

Figure 10. Scan display

3.1.6. Scan view when scanning a marker in the Application

In this section, when the camera detects the animal marker that has been made, the 2D and 3D objects will appear; when the play button is pressed, it will bring up the audio sound of the animal along with a description of the animal.

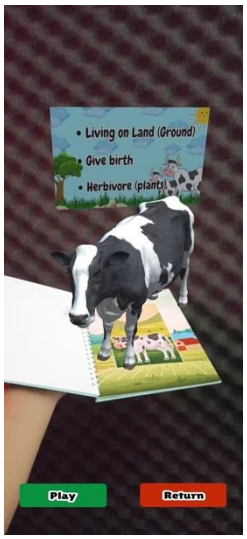

Figure 11. Display when scanning an animal marker

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3.2. System Testing

Testing is the last stage in the application development process; in this process, a bug or error will be found when the testing process is carried out. Plenty of software will be used in processing, including software provided according to the non-functional requirements above. When a bug or error is found, it will return to the manufacturing stage to be fixed[28]. This application's system testing consists of multiple phases, including testing on various devices, content validation, angle, distance, light intensity, black box, and marker testing.

3.2.1. Testing on Different Devices

This testing phase aims to test the functionality of the Snap That Animal application on several different smartphone devices and find out whether this Application can work well or not[29].

The test of this Application uses the following devices.

Table 7. Test result from several smartphones

Features tested	Samsung galaxy A33 5G	Infinix Note 30 Pro	Poco F3	Xiaomi Redmi Note 12	Realme Narzo 20	iPhone 11
Homepage	Success	Success	Success	Success	Success	Unsuccessful
Information page	Success	Success	Success	Success	Success	Unsuccessful
Developer page	Success	Success	Success	Success	Success	Unsuccessful
Scan page	Success	Success	Success	Success	Success	Unsuccessful
Animal marker	Success	Success	Success	Success	Success	Unsuccessful
Exit	Success	Success	Success	Success	Success	Unsuccessful

The results obtained when testing from Android and IOS smartphone devices on the Snap That Animal application obtained great results, and all features in the Snap That Animal application ran properly on the Android version. Starting from the homepage, information, developer, and scan to exit the Application. In the other hand, this application doesn't support on IOS devices such as iPhone.

3.2.2. Black Box Testing

Behavioral testing is another name for black box testing. Where the tester is unaware of the internal workings of the program being tested[4]. There are several types of black box testing, including boundary value analysis, partitioning, effect-causing graphs, etc[30]. In testing the Snap That Animal application, a black box test is carried out with the type of limit value analysis; this is done following the test scenario that has been prepared.

Table 8. Result of black box testing with different devices

Test Component	Test procedure	What to expect	Conclusion
Scene Homepage	- Klick button Information - Klick button Developer - Klick button Scan - Klick button Exit	- Display information about what the buttons do, and how to use the app. - Display information about the developer of this application. - Display camera access on the smartphone device. - Exit the app.	Success
Scene Information page	- Klick button Information - Klick button Return	- Display information about what the buttons in this application do, and how to use this application. - Return to homepage.	Success
Scene Developer page	- Klick button Developer - Klick button Return	- Display information from the developer of the Snap That Animal app. - Return to homepage	Success
Scene Scan	- Klick button Scan - Klick button Play - Klick button Return	- Open the camera feature in the app - Display 3D objects and 2 D descriptions of animals. - Play audio animal sounds and descriptions of animals - Return to homepage	Success
Scene Exit	-Klick button Exit	- Exit the application	Success

The result of the black box showed that all the pages that have been tested are successfully tested. All the expectation have been met and there is no bugs that can be found in the application based on the black box testing.

3.2.3. Marker Testing

Several testing techniques are used in this testing step, including measuring the light intensity, tilt angle, and distance between the camera and the marker's gadget[31]. This marker testing will evaluate the marker's ability to recognize and display 2D and 3D items. In addition, this test also aims to determine how bright or dark the light intensity is so that the camera can detect the marker on the smartphone device. The distance that can be scanned by a smartphone device and the angle of inclination to see the effectiveness of the marker can be seen or detected by the camera on a smartphone device.

3.2.3.1. Testing Light Intensity on the Marker

In the article of Tengku Wook et al., it is said that light intensity can be tested with two conditions: when the lights are on and when not. Markers close to the lighting source

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will get a higher brightness value than markers far from the source[32]. Both the indoor and outdoor light intensities were used in this test. The objective is to evaluate the camera's performance in scanning markers in various lighting scenarios. Both the indoor and outdoor light intensities were used in this test. The objective is to evaluate how well the camera scans animal identifiers in various lighting scenarios.

Table 9. Testing based on the brightness intensity of the animal marker

Light	Test result	Conclusion
100 %	The outdoor light is captured quite well, however when its too bright, the camera inconsistently recognizes the marker, therefore, the 3D model looks inconsistent	Success
75 %	The indoor light is captured very well.	Success
50 %	The light is captured less effectively, objects take view seconds to appear.	Success
25 %	The intensity of the light is low, therefore the 3D model looks inconsistent.	Success
0 %	No light is entering	Unsuccessful

Table 11 above explains how to measure the brightness intensity to scan animal markers. The test results indicate that the camera can scan animal markers from 100% lighting intensity to 50% lighting intensity. However, the camera cannot scan animal markings at 25% lighting intensity to 0% lighting intensity.

3.2.3.2. Tilt Angle Testing on the Marker

The tilt angle test determines how well the device can scan markers from different angles. The marker and the AR camera are placed 20 centimeters apart. After that, the smartphone's rotation angle is 0 to 90 degrees[32].

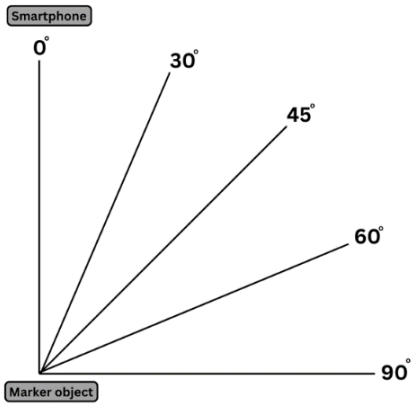

Figure 12. Standard tilt angle measurement.

In Figure 9 above, a standard measure of slope in scanning animal markers is carried out. An explanation of the slope test results is in Table 12 below.

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Table 10. Testing based on the tilt angle of the animal marker

Angle	Description
0 degree	Success
30 degree	Success
45 degree	Success
60 degree	Success
90 degree	Unsuccessful

As shown in the table 12 above, the marker has been tested from the tilt angle of the smartphone itself. From the angle 0 until 60 degrees smartphone can easily detect marker so that AR animal can project. But when the camera is being tilted 90 degree or standing upright vertically while the book is flat, the camera can no longer detect AR markers so it cannot project AR animals.

3.2.3.3. Distance Testing on the Marker

Distance testing is carried out for the AR camera to determine how far it can scan markers[28]. This test aims to evaluate the efficacy of animal markers in the Snap That Animal application at distances between 10 and 100 cm.

Table 11. Testing based on the distance to the animal marker

Distance	Description	Conclutions
10 cm	The camera cannot detects the marker	Unsuccessful
20 cm	The camera is able to detects marker	Success
30 cm	The camera detects well, allowing for easy detection of marker	Success
40 cm	The camera can easily detect both 3D and 2D of the marker	Success
50 cm	The camera can easily detect both 3D and 2D of the marker	Success
60 cm	The camera can easily detect both 3D and 2D of the marker	Success
70 cm	The camera can easily detect both 3D and 2D of the marker	Success
80 cm	The camera can easily detect the marker	Success
90 cm	The camera is able to detects marker	Success
100 cm	The camera cannot detects the marker	Unsuccessful

As shown in Table 13 above, the test results indicate that the camera cannot scan the animal marker at a distance of 10 cm, which is the typical measurement of the distance to scan animal markers. However, the camera can scan the animal marking between 20 and 90 cm away; beyond 100 cm, the camera cannot scan the animal marker.

3.2.4. Content Validation Testing

At this point, the study aims to evaluate the developed Snap That Animal application. Nine instructors from Aisyiyah Bustanul Athfal Krajan kindergarten conducted validation testing for the Snap That Animal application. Five categories make up the grading scale: (1) Very terrible, (2) terrible, (3) Neutral, (4) Good, and (5) Very good. This procedure entails reviewing and assessing the application regarding the material's depth

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and the appropriateness of the 3D objects it presents. Interval value analysis can calculate the following feasibility percentages: 0 - 20% very bad, 21 - 40% not good, 41 - 60% neutral, 61 - 80% good, and 81 - 100% very good[22].

Table 12. Content Validation testing

Indicators	Animal	Assessment Scale					Total
		1	2	3	4	5	
Depth of Material & Suitability of 3D and 2D objects	Tiger	0	0	0	3	6	9
	Rhino	0	0	0	0	9	9
	Cow	0	0	0	0	9	9
	Elephant	0	0	0	0	9	9
	Crocodile	0	0	0	1	8	9
	Rabbit	0	0	2	4	3	9
	Shark	0	0	0	3	6	9
	Manta fish	0	0	0	1	8	9
	Sea turtle	0	0	0	0	9	9
	Goldfish	0	0	0	1	8	9
	Eagle	0	0	0	2	7	9
	Butterfly	0	0	0	0	9	9
	Summary	0	0	2	15	91	108
	Percentage	$\frac{0}{108} x\ 100\%$	$\frac{0}{108} x\ 100\%$	$\frac{2}{108} x\ 100\%$	$\frac{15}{108} x\ 100\%$	$\frac{91}{108} x\ 100\%$	$\frac{108}{108} x\ 100\%$
		0 %	0 %	1,85 %	13,8 %	84,2 %	100 %

Based on table 14 shows that 12 animal markers were evaluated by nine respondents who are kindergarten teachers. Based on the evaluation results, 84,2% of teachers gave the depth of the content and the appropriateness of the 3D and 2D items a "very good" rating. Based on the findings of the validation testing, it is possible to deduce from the evaluation results that the Snap That Animal application has successfully provided high-quality information.

3.2.5. Results

3.2.5.1 Pre-questionnaire results

Before the questionnaire assessment was given, a pre-questionnaire assessment was conducted to respondents (9 teachers) at Aisyiyah Bustanul Athfal Krajan Kindergarten in table 2 above. With the results of 9 teachers stating that kindergarten students have been given material about animal recognition and the methods used have not been effective because so far they are still using conventional learning methods (with books and telling in front of the class). This shows that the learning method still does not use the IT approach. The obstacles faced in the learning process so far are the lack of learning media (books), and

children are sometimes less focused and less interested, and 9 teachers already use smartphones for daily life. And all respondents (9 teachers) stated the need to use a learning approach with an IT-based system.

3.2.5.2 Questionnaire results

At this stage, a questionnaire was given to 9 teachers of Aisyiyah Bustanul Athfal Krajan Kindergarten. The rating scale consists of five categories, strongly disagree (1), disagree (2), neutral (3), agree (4), strongly agree (5). This process is carried out to determine the suitability of the Snap That Animal application in increasing student interest in learning. the results of content validation testing can be seen in table 20 below[33]

Table 13. Questionnaire results

No	Questions	Respondent results				
	Design Application	**1**	**2**	**3**	**4**	**5**
1	The app has an intuitive and easy-to-understand design	0	0	0	2	7
2	Animal visualization using easy-to-understand multimarker method	0	0	0	4	5
3	The material on animal recognition is well presented	0	0	0	3	6
4	The instructions for using the AR camera are well explained	0	0	0	3	6
5	Information about the app developer is easily accessible and informative	0	0	0	4	5
	Application features	0	0	0		
1	All features in the application are tested and function as expected	0	0	0	2	7
2	The multimarker method is effective in various light conditions, and angles and distances.	0	0	0	4	5
3	This app has good information in terms of material.	0	0	0	4	5
4	3D and 2D objects are appropriate to the learning material and provide a more interesting learning experience	0	0	0	2	7
5	Animal audio in the app can be heard well	0	0	0	3	6
	General	0	0	0		
1	I think I will use this app again	0	0	0	4	5
2	I find this app fun to use	0	0	0	4	5
3	I find this app easy to use	0	0	0	4	5
4	I do not need help from other people or technicians in using this application	0	0	0	2	7
5	I feel that the features of this system are working properly	0	0	0	3	6
6	I feel pretty consistent on this app	0	0	0	0	9
7	I feel others will understand how to use this app quickly	0	0	0	5	4
8	I feel this app is suitable for children's learning	0	0	0	1	8
9	I feel no obstacles / smooth in using this application	0	0	0	2	7
19	I find this app quick to understand.	0	0	0	2	7

3.2.5.3 Assessment scale

In this questionnaire, a scoring weight of five categories is used, Strongly disagree (1), Disagree (2), Neutral (3), Agree (4), Strongly agree (5). Each of these weights will be translated into a score for each question. The following is the conversion of scoring weights to numbers for each question in the questionnaire.

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Table 14. Assessment scale

Category	Statement	Value
SD	Strongly Disagree	1
D	Disagree	2
N	Neutral	3
A	Agree	4
SA	Strongly Agree	5

By using the assessment weights contained in Table 13, the questions on the questionnaire will be assessed and can produce scores in the form of numbers in accordance with the assessment weights chosen by respondents.

3.2.5.4 Interval value

The interval value is used to determine the percentage of feasibility of the learning media and students' interest in learning. This percentage is shown in Table 14.

Table 15. Interval value

Interval Level	Value
0 – 20 %	Very Bad
21 – 40 %	Bad
41 – 60 %	Neutral
61 – 80 %	Good
81 – 100 %	Very Good

Based on Table 14 above, it can be seen that we can assess the feasibility level of learning media and student interest in learning based on the percentage obtained.

3.2.5.5 Questionnaire score results

To be able to get the value of the questionnaire in table 14, the following percentage formula can be used[10].

$$P = \frac{f}{N} \times 100\ \%$$

Description
P : Percentage value
f : frequency of value scores that appear
N : total number of activities 100% = fixed number.

$$\text{Percentage value} = \frac{\sum score\ obtained}{\sum score\ maximum} \times 100\%$$

That The percentage formula is used in the answers to the questionnaire that has been given. Each answer that has been given can be processed using the percentage formula,

where the number of scores obtained is divided by the maximum number of scores, then the result is multiplied by 100% to produce a final score.

The following is the value of the questionnaire results that have been processed with the percentage value shown in table 15.

Table 16. Final Score

No	SD	D	N	A	SA	Total
Design Application						
1	0 (x1)	0 (x2)	0 (x3)	2 (x4)	7 (x5)	43
2	0 (x1)	0 (x2)	0 (x3)	4 (x4)	5 (x5)	41
3	0 (x1)	0 (x2)	0 (x3)	3 (x4)	6 (x5)	42
4	0 (x1)	0 (x2)	0 (x3)	3 (x4)	6 (x5)	42
5	0 (x1)	0 (x2)	0 (x3)	4 (x4)	5 (x5)	41
Application features						
1	0 (x1)	0 (x2)	0 (x3)	2 (x4)	7 (x5)	43
2	0 (x1)	0 (x2)	0 (x3)	4 (x4)	5 (x5)	41
3	0 (x1)	0 (x2)	0 (x3)	4 (x4)	5 (x5)	41
4	0 (x1)	0 (x2)	0 (x3)	2 (x4)	7 (x5)	43
5	0 (x1)	0 (x2)	0 (x3)	3 (x4)	6 (x5)	42
General						
1	0 (x1)	0 (x2)	0 (x3)	4 (x4)	5 (x5)	41
2	0 (x1)	0 (x2)	0 (x3)	4 (x4)	5 (x5)	41
3	0 (x1)	0 (x2)	0 (x3)	4 (x4)	5 (x5)	41
4	0 (x1)	0 (x2)	0 (x3)	2 (x4)	7 (x5)	43
5	0 (x1)	0 (x2)	0 (x3)	3 (x4)	6 (x5)	42
6	0 (x1)	0 (x2)	0 (x3)	0 (x4)	9 (x5)	45
7	0 (x1)	0 (x2)	0 (x3)	5 (x4)	4 (x5)	40
8	0 (x1)	0 (x2)	0 (x3)	1 (x4)	8 (x5)	44
9	0 (x1)	0 (x2)	0 (x3)	2 (x4)	7 (x5)	43
10	0 (x1)	0 (x2)	0 (x3)	2 (x4)	7 (x5)	43
Total	0	0	0	232	610	842
Total maximum score	Obtained from 9 teachers x 20 questions x max score (5)					900
Percentage result	$\frac{842}{900}$ x 100%					**93.56%**

The explanation of table 15 above states that the results of the questionnaire that have been processed with the assessment weight indicate that the feasibility level of this application is classified in the "Very Good" category by getting a percentage value of 93.56% consisting of 9 teachers as respondents. So that the Snap That Animal application gets a strong positive response from users, so that this application is successful as a means of learning media and can help teachers to increase student interest in learning.

4. CONCLUSION

According to the study, the Snap That Animal application has been effectively integrated with several programs, including Canva, Figma, Sketchfab, Unity, Vuforia, and

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QR code Generator. This is achieved through the multimarker method, which displays 2D and 3D objects that can represent animals along with audio and descriptions of the animals based on the markers that have been made. After testing various smartphone devices, this application can run smoothly and efficiently on several Android devices. However, compatibility issues are found on some versions of Android devices, and they cannot be used on iOS device systems. Marker testing involves three stages: lighting, angle, and distance. However, in dark lighting conditions, the animal marker cannot be detected by the AR camera, so the 3D animation of the animal cannot be displayed. The AR camera can then scan the animal marking during testing at an angle between 0 and 60 degrees. However, the AR camera cannot detect the animal marker at a 90-degree angle, which prevents the animal's 3D animation from being displayed. When testing the distance on the AR camera with the marker 10 cm away, The AR camera is unable to scan the animal marker; nevertheless, it can scan the animal marking at a distance of 20 to 90 cm and a distance of 100 cm AR camera again cannot scan the animal AR which causes the 3D animation of the animal cannot be scanned. Kindergarten teachers at Aisyiyah Bustanul Athfal Krajan benefit from the Snap That Animal application as it helps to increase students' enthusiasm for learning. According to the answers provided to the instructors in the questionnaire, the Snap That Animal app scored 93.56% (very good), indicating that it is an enjoyable, user-friendly, and appropriate tool for children's learning. As a result, this research can enhance student learning and make the process of teaching and learning about animal recognition more engaging for students—recommendations for additional studies to create apps that work on all Android and iOS tablets and smartphones.

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