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# Design and Construction of Augmented Reality Learning Media for Pet Recognition in English Using the MDLC Method

Hanifah Amaliya<sup>1</sup>, Sri Lestanti<sup>2</sup>, Filda Febrinita<sup>3</sup>

<sup>1,2,3</sup>Universitas Islam Balitar, Indonesia

E-mail: [hanifahamaliya16@gmail.com](mailto:hanifahamaliya16@gmail.com), [lestanti85@gmail.com](mailto:lestanti85@gmail.com), [febrinitafilda80@gmail.com](mailto:febrinitafilda80@gmail.com)

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## Abstract

Technological developments in the world of education encourage the application of interactive and innovative learning media, especially for elementary school students to more easily understand the material through visual approaches and games. One of the problems often faced in learning is the difficulty of students in understanding English, especially in recognizing and memorizing vocabulary. Based on this problem, this study aims to develop Augmented Reality (AR)-based learning media to introduce pet vocabulary in English to second-grade students of MI Islamiyah Slumbung. The development of this media uses the method *Multimedia Development Life Cycle* (MDLC) which consists of the following stages: *concept, design, material collecting, assembly, testing, Anddistribution*. Testing is carried out using the method *black box testing* to test the functionality of the AR learning media, and all showed a success rate of 100%. In addition, the testing *beta testing* Tests by IT experts, media experts, and English teachers showed that this media achieved an average feasibility score of 93.3%, falling into the "Very Feasible" category. Thus, this media has proven to be feasible and effective in improving students' English vocabulary comprehension through an interactive visual approach.

**Keywords:** *Learning Media, Augmented Reality, Pets, MDLC.*

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## INTRODUCTION

Educational technology is currently experiencing significant progress in various fields, including education. Signs of this progress are demonstrated by teachers' use of engaging and interactive learning media. This media is designed to support the learning process, especially for elementary school students. At an early age, children tend to more easily understand and absorb information through games and innovative and interactive learning media. (Husnia & Wibisono, 2023) However, innovative and interactive learning media must also pay attention to the use of language that is easy for students to understand.

Language plays a vital role in a child's intellectual, emotional, and social development. In the education system, language is one of the primary aspects studied because it is a means of communication for interacting with others. (Susanthi, 2020) English, as an international language, has become an essential part of the elementary school curriculum. However, for elementary school students, English is not the language they use in their daily lives. This is one of the main reasons they have difficulty understanding English lessons. (Ritonga et al., 2022) These difficulties include aspects such as reading vocabulary, memorizing, writing, and understanding the meaning of English vocabulary. (Rahmawati et al., 2024).

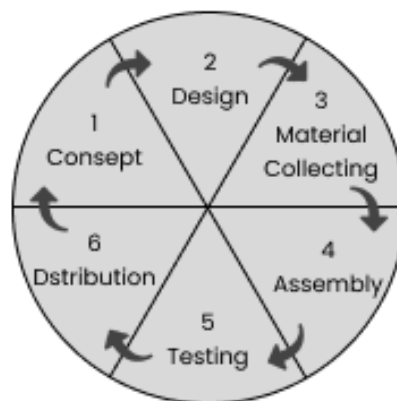
Students at MI Islamiyah Slumbung, located in Slumbung Village, Gandusari District, also experience difficulties in learning English vocabulary. English instruction at MI Islamiyah Slumbung still uses traditional methods such as textbooks, material explanations, and memorization. These methods tend to make students easily bored, resulting in a lack of student engagement. (Yanuar & Pius, 2023) Observations indicate that second-grade students require a more creative and interactive learning approach to increase their interest in learning, particularly in English. The use of technology and engaging learning media can be an effective solution to help students overcome this challenge. Technology enables the creation of interactive learning media that can motivate students while improving their understanding of English.

Augmented Reality (AR) technology is an innovative solution that brings digital objects into the real world through devices like smartphones. This technology can be used to provide more engaging and interactive learning materials. Using AR technology in learning helps students learn lessons that are difficult to grasp directly. By implementing AR in the learning process, students can experience a more realistic learning experience, thereby encouraging critical thinking in dealing with everyday problems and improving their understanding of the information presented.(Nistrina, 2021).

## METHODOLOGY

### System Development Methods

The development method used in this research is the Multimedia Development Life Cycle (MDLC). This method is suitable for developing products that combine elements of images, sound, animation, video, and others.



Picture 1. Method Stages *Multimedia Development Life Cycle*

The following are the stages of the Multimedia Development Life Cycle method in developing Augmented Reality learning media for pets:

1. *Concept*: At the concept stage, researchers need to determine the target users and the objectives of the application to be created.
2. *Design*: At this stage, researchers create interface designs, navigation structures, and materials that need to be used in designing multimedia applications according to needs.
3. *Material Collecting*: At the material collecting stage, researchers need to collect materials that are appropriate to the application, such as images, sound, and text.
4. *Assembly*: At this stage, the researcher combines all the previously collected materials into an application to form a complete multimedia product.
5. *Testing*: In the testing phase, researchers verify the application's functionality through a testing process. Testing is conducted by the testing team or users to obtain feedback.
6. *Distribution*: The distribution stage is the process of distributing the application that has been developed to target users.

The MDLC method has structured stages that allow developers to easily adapt to user needs. MDLC has an iterative cycle, where developers can return to previous stages to make improvements and refinements to achieve maximum results.(Nurul et al., 2024).

### Method of collecting data

#### 1. Interview

Interview techniques are used to obtain direct information from those involved in the learning process, such as teachers and students. The purpose of these interviews is to understand user needs and the obstacles they face in learning.

#### 2. Observation

Observation techniques were used to directly observe student interactions during English learning. Data collected through these observations included student behavior and levels of engagement during

the learning process. These observations were conducted to determine how the English learning process was currently being implemented.

### 3. Literature Study

A literature review was conducted by examining various sources, such as books, scientific articles, and journals relevant to the development of Augmented Reality (AR)-based learning media and the application of the Multimedia Development Life Cycle (MDLC) method. Researchers accessed scientific journals from trusted platforms such as Google Scholar and Garuda, which provide a variety of quality references. This study aims to strengthen the theoretical foundation, understand the latest trends in AR-based learning media development, and evaluate the advantages and disadvantages of similar approaches in previous research.

### 4. Questionnaire

A questionnaire was used to collect data from various validators, such as IT experts, media experts, and English teachers, as well as direct users, namely second-grade students of MI Islamiyah Slumbung. The collected data included their responses to the Augmented Reality learning media to be developed. The results of this questionnaire will be used to identify aspects that need improvement and to evaluate the extent to which this learning media can meet user needs.

## RESULTS AND DISCUSSION

This research resulted in an AR learning tool used to introduce pets in English. The AR feature allows users to view animal objects in 3D using markers (marker cards) recognized by the device's camera. The goal of developing this learning tool is to help students learn English animal names in an interactive and engaging way. The following are the steps in the Multimedia Development Life Cycle method used to develop this Augmented Reality learning tool for pets:

#### 1. Concept

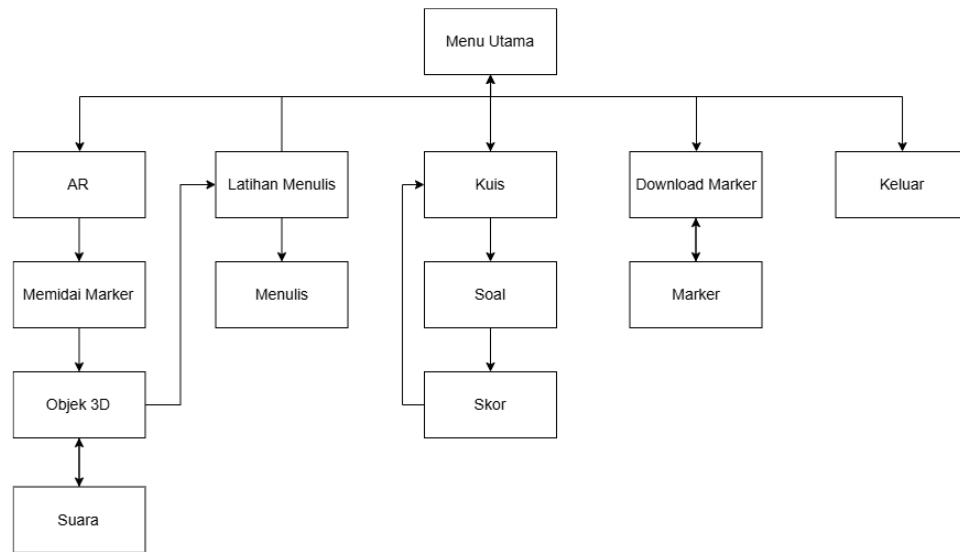
At this stage, the researcher determined the objectives, target users, and features of the AR learning media. The target users of this learning media were second-grade students at MI Islamiyah Slumbung, with the goal of introducing pets in English. To achieve this goal, the chosen features included Augmented Reality (AR) technology and handwriting methods to support students' multisensory learning.

#### 2. Design

This phase focuses on creating user interface (UI) designs and user flow. The design includes flowcharts, data flow diagrams, and wireframes to illustrate the relationships between features such as marker scanning, writing exercises, and quizzes. The designs were created using Figma for consistency and ease of implementation in Unity.

##### a. Navigation Structure

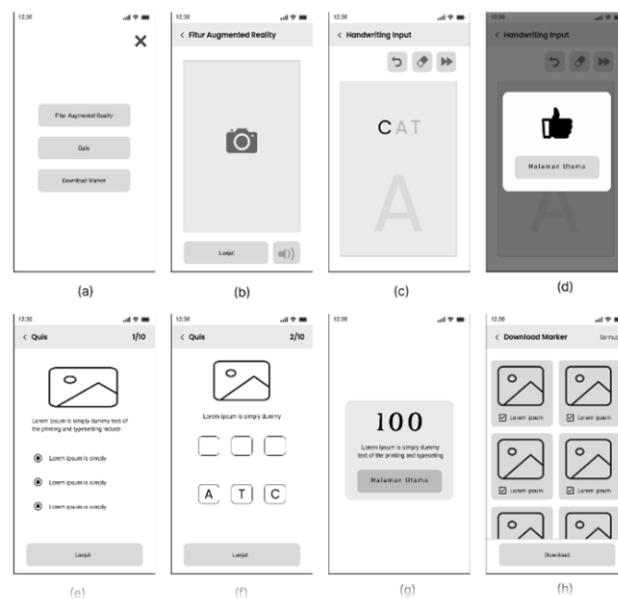
The navigation structure of the AR learning media consists of 4 main features as shown in the image below:



**Figure 2.** Navigation Structure

**b. Wireframe**

The following is a wireframe of the AR learning media display, where the author used Figma to create the wireframe.



**Figure 3.** DesignWireframe

**3. Material Collecting**

In the material collecting stage, researchers collected various materials needed to build Augmented Reality-based learning media. The materials collected included image markers that would be used as markers for the appearance of 3D objects, markers, UI, sound effects, and 3D objects. For 3D objects, researchers used external sources, namely Skechfab by importing them into Unity to make it easier for researchers to import and download 3D objects directly.

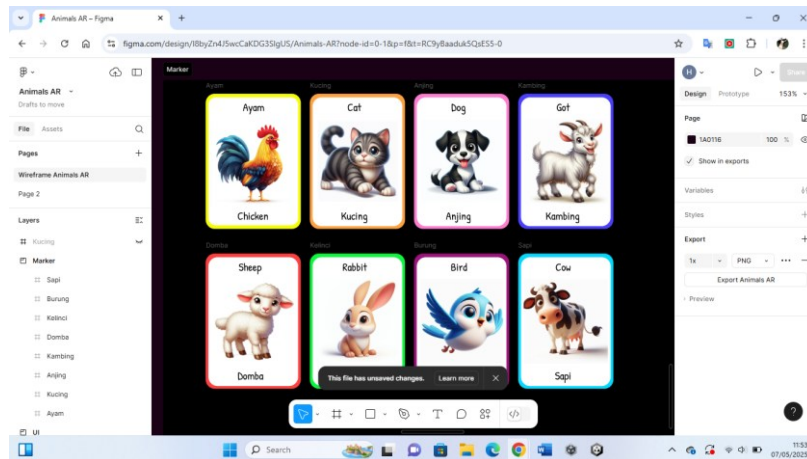


Figure 4. MakingMarker

#### 4. Assembly

At this stage, all the collected materials are integrated into the Unity platform. Key features include AR with Vuforia, a handwriting system using linerenderer, and a quiz system using JSON files to store quiz questions and scores. This learning media is then optimized to run smoothly on Android devices running version 8.0 (Oreo) and above.

##### a. Home Page

When the user enters the application, the application will display the main menu consisting of the AR start menu, quiz, download marker, and the close application button as shown in the image below.



Figure 5. Home Page

##### b. Marker Scan Page

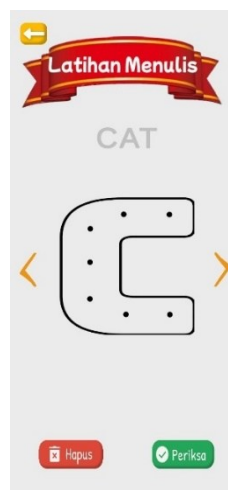
Selecting the AR start menu will display the rear camera. Pointing the camera at a marker will display a 3D object above it, as shown in the image below. When the 3D object appears, a sound button will appear. Clicking the sound button will play the English name of the animal corresponding to the marker.



**Figure 6.**Marker Scan Page

**c. Writing Practice Page**

Once the 3D object appears in the camera, there will be a "continue" button. Clicking this button will take you to a writing practice page, as shown in the image below. Users can write directly on the smartphone screen and also erase their notes.



**Figure 7.** Writing Practice Page

**d. Quiz Page**

On the main page, if a user selects the quiz menu, they will be directed to the quiz selection page, which allows them to choose a multiple-choice or word-composition quiz. Before working on a question, the user must enter their name, which will be used to store their quiz score.

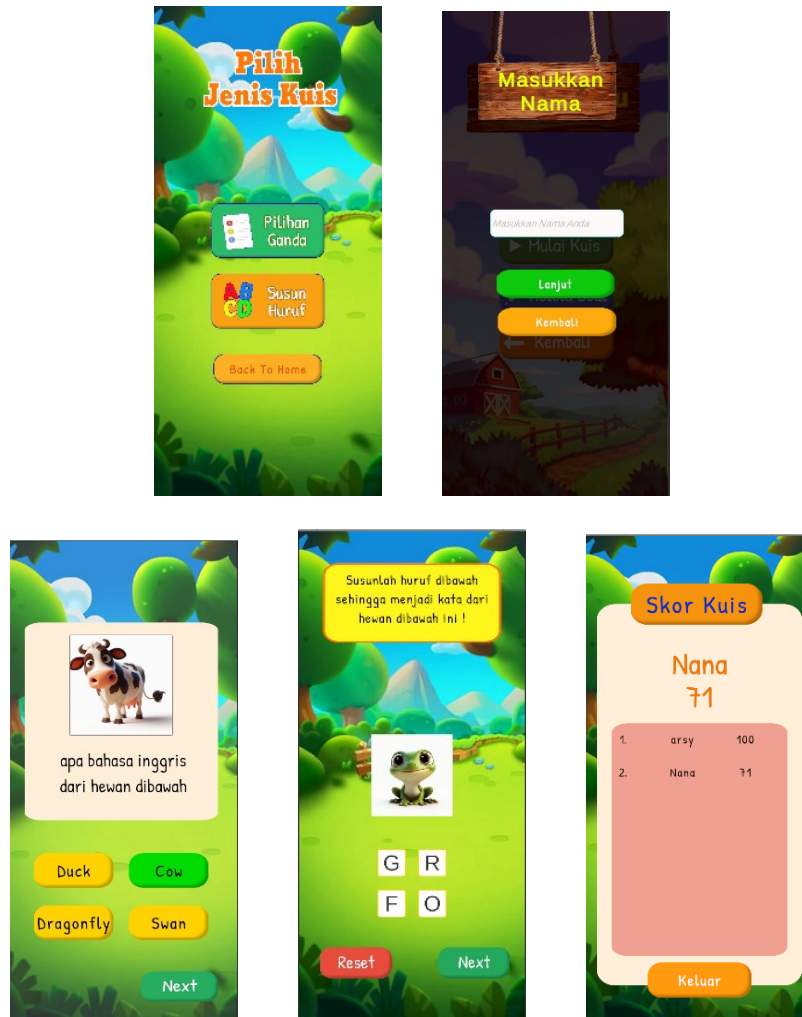


Figure 8. Quiz Page

e. **Marker Download Page**

On the main page, if the user selects the "Download Marker" menu, they will be directed to the marker download page, as shown in the image below. Users can download markers if they are lost or damaged. Users can select which markers to download by checking the image and clicking "Download." The marker image will then be saved to the user's smartphone gallery.



Figure 9. Page Download Marker

## 5. Testing

To test the functionality of the AR learning media, researchers used black box testing and beta testing methods to collect data on students' and experts' experiences with the AR learning media, which introduces pets in English. Researchers used questionnaires to collect data on the experiences of subject teachers, IT experts, media experts, and students.

### Black Box Testing

Blackbox testing is carried out to ensure that functions such as buttons, inputs and outputs available on AR learning media function as they should.

**Table1 Blackbox Test Results Table**

Main Components	Number of Tests	Results	Information
Menu Navigation	10	In accordance	All buttons work properly
AR 3D	5	In accordance	3D objects appear after the marker
Handwriting	9	In accordance	Point detection and reset are working normally.
Quizzes & CRUD Questions	17	In accordance	Questions are saved, displayed, and scored correctly.
Download Marker	6	In accordance	File saved
<b>Total (47 Tests)</b>	<b>47</b>	<b>100% Compliant</b>	<b>No system errors found</b>

The table above shows that 47 test scenarios yielded satisfactory results. The following is a calculation of the success rate of the blackbox tests performed:

$$\text{Persentasi Keberhasilan} = \left( \frac{\text{Jumlah Kasus Uji yang Sesuai}}{\text{Jumlah Seluruh Kasus Uji}} \right) \times 100\%$$

$$\text{Persentasi Keberhasilan} = \left( \frac{47}{47} \right) \times 100\% = 100\%$$

### Beta Testing

Beta testing was conducted to collect data related to user experience in using AR learning media. In beta testing, researchers involved students in completing a questionnaire regarding student responses to the media. Researchers also involved three validators, including an IT expert, a media expert, and an English teacher. The instrument used in beta testing was a questionnaire, which was used to obtain assessments from the validators. In the assessment, researchers used a Likert scale of 1-5 to provide an assessment in the form of a score. The following are the categories for each score given:

**Table2 Scoring Criteria Table**

Score	Criteria
5	Very good
4	Good
3	Pretty good
2	Not good
1	Not good

(Source: Siregar, 2013)

### 1. IT Expert

This questionnaire is used to evaluate the technical aspects of the AR learning media that has been developed, including aspects of system functionality, application stability, and overall technical performance.

**Table3IT Expert Validation Questionnaire Assessment Results Table**

No.	Statement	Score
1.	The application can run stably without any interruption on android devices.	4
2.	The marker detection process and the appearance of 3D objects run smoothly.	5
3.	The handwriting feature works as intended, including dot validation.	4
4.	The system provides a notification correctly if all points have not been passed.	4
5.	The marker download feature runs smoothly and is saved in the device gallery.	4
6.	The quiz feature runs without any technical glitches.	5
7.	Loading time between features is relatively fast and does not interfere with the user experience.	5
8.	The application does not crash or force close during use.	4
9.	The application file size is light enough for students to use.	4
10.	The media is technically suitable for use in learning	4
<b>Total Score</b>		<b>43</b>

$$\text{Persentasi Pencapaian} = \left( \frac{\text{Skor Total}}{\text{Skor Maksimum}} \right) \times 100\%$$

$$\text{Persentasi Pencapaian} = \left( \frac{43}{50} \right) \times 100\% = 86\%$$

Based on the results of the assessment questionnaire calculations from the IT experts above, the achievement percentage was 86% of the 10 scenario test statements.

## 2. Media Expert

This questionnaire is used to obtain an assessment of the visual design, interface appearance, and aesthetics from media experts of the AR learning media that has been developed.

**Table4Media Expert Validation Questionnaire Assessment Results**

No.	Statement	Score
1.	The overall interface is attractive and suitable for elementary school children.	5
2.	Color, font size, and visual design support student comfort in using the media.	4
3.	Navigation between features is easy for users to understand	5
4.	The layout of elements (icons, buttons, text, images) is neat and easy to recognize.	4
5.	The media provides clear visual feedback.	4
6.	The 3D animal objects displayed look clear and true to reality.	5
7.	Animations and scene/display transitions are quite smooth and not annoying.	5
8.	The handwriting feature is easy to use and suitable for elementary school students.	5
9.	The quiz feature design (multiple choice and word order) is attractive and suits children's style.	5
10.	This learning media has a level of interactivity according to the pet vocabulary material.	5
<b>Total Score</b>		<b>47</b>

$$\text{Persentasi Pencapaian} = \left( \frac{\text{Skor Total}}{\text{Skor Maksimum}} \right) \times 100\%$$

$$\text{Persentasi Pencapaian} = \left( \frac{47}{50} \right) \times 100\% = 94\%$$

Based on the results of the assessment questionnaire calculations from the media experts above, the achievement percentage was 94% of the 10 scenario test statements.

## 3. Teacher

This questionnaire was administered to English teachers at MI Islamiyah Slumbung to evaluate the use of AR learning media in supporting English vocabulary learning. The assessment covered aspects such as the achievement of learning objectives, the relevance of the material, and ease of use by students.

**Table 5 Teacher Validation Questionnaire Assessment Results**

No.	Statement	Score
1.	Pet vocabulary material presented according to the English curriculum	5
2.	Delivering material through 3D objects, writing, and quizzes helps students understand and memorize vocabulary.	5
3.	The language used in the instructions and content is appropriate to the abilities of 2nd grade elementary school students.	5
4.	The handwriting feature supports students in learning to write and remember vocabulary.	5
5.	Quiz questions (multiple choice and word order) according to the level of understanding of grade 2 students	5
6.	This media can increase students' interest in learning English.	5
7.	Illustrations and sound support understanding of the material	5
8.	This media is easy for teachers to use as a teaching aid in class	5
9.	Students have the potential to learn independently using this media.	5
10.	This media is suitable for use as additional learning media in schools	5
<b>Total Score</b>		<b>50</b>

$$\text{Persentase Pencapaian} = \left( \frac{\text{Skor Total}}{\text{Skor Maksimum}} \right) \times 100\%$$

$$\text{Persentase Pencapaian} = \left( \frac{50}{50} \right) \times 100\% = 100\%$$

Based on the results of the calculation of the assessment questionnaire from the English teacher above, the achievement percentage was 100% from 10 scenario test statements.

#### 4. Validator Average Rating

The scores given by each validator will be averaged and the percentage will be calculated, then converted to media suitability as follows.

**Table 6**  
Eligibility Criteria

No.	Score in percent %	Eligibility Category
1.	1 < 21%	Totally Unworthy
2.	21 – 40%	Not feasible
3.	41 – 60%	Quite Decent
4.	61 – 80%	Worthy
5.	81 – 100%	Very Worthy

Source : (Revelation, 2022)

$$\text{Average} = \frac{86\% + 94\% + 100\%}{3} = \frac{280}{3} = 93,3\%$$

The percentage of the average validator assessment obtained a result of 93.3%, where this value falls into the "Very Suitable" category for use in the learning process.

## 5. Student Response

This questionnaire was aimed at students to determine their responses, satisfaction levels, and impressions after using AR learning media. The data from this questionnaire was used to directly determine how the media was received by students. This instrument uses a scale of five emoticon images to facilitate student completion. The following are the scale criteria and assessment results for the questionnaire completed by students:

**Table7**  
**Scale Criteria Emoticons**

Emoticon Images	Category	Score
😊	Strongly agree	5
🙂	Agree	4
😐	Neutral	3
☹️	Disagree Less	2
😞	Don't agree	1

Table 8 displays the results of the student response questionnaire completed by 21 second-grade students. The data shows that the majority of students rated the learning media on a scale of 5 (Strongly Agree), with a total score of 126 for each of the eight statements. These results indicate that the majority of students responded very positively to the learning media.

**Table8** Student Response Questionnaire Assessment Results

No.	Statement	Emoticon Scale				
		😊	🙂	😐	☹️	😞
1.	I enjoy using this learning media	21	0	0	0	0
2.	This learning media is easy to use	15	5	0	0	1
3.	I can understand animal vocabulary better after using this media.	17	3	0	0	1
4.	I like the AR feature in this learning media	18	1	1	0	1
5.	The quiz feature on this media is fun and helps me learn.	18	3	0	0	0
6.	I would like to use this learning media another time.	12	5	3	0	1
7.	The visual and graphic displays in this learning media are attractive.	8	10	2	0	1
8.	The sound feature in this learning media helps me understand the material better.	17	3	0	0	1
<b>Score Results</b>		<b>126</b>	<b>30</b>	<b>6</b>	<b>0</b>	<b>6</b>

From the assessment results in Table 8, the total score was calculated by multiplying the number of responses by the appropriate scale weight. The results can be seen in Table 9, where the total score obtained was 774 out of a maximum score of 840.

**Table9**  
Calculation Table

Score	Score obtained	Total Score (Scale x Number)
5	126	630
4	30	120
3	6	18
2	0	0
1	6	6
Total Score		<b>774</b>
Maximum Score (respondent*score*number of statements)		<b>840</b>

$$\text{Persentasi Respon Siswa} = \left( \frac{\text{Skor Total}}{\text{Skor Maksimum}} \right) \times 100\%$$

$$\text{Persentasi Respon Siswa} = \left( \frac{774}{840} \right) \times 100\% = 92\%.$$

The percentage of student response questionnaires was 92%, this shows that student responses were very positive, which shows that this media was well received by students.

## 6. Distribution

At the distribution stage, the researcher submitted the AR learning media to the school, especially the English subject teacher for grade 2. The build file of the learning mediaThe files are stored digitally on a flash drive and then handed directly to the teacher. The teacher can then coordinate distribution of the media files to all students through their guardians. This distribution process aims to ensure that the learning media can be widely used by students in their learning activities and become part of a supporting tool for engaging and interactive English vocabulary learning.

## DISCUSSION

The result of this research is an Augmented Reality (AR)-based learning media that raises the topic of pet vocabulary in English. This media is specifically designed to help second-grade students of MI Islamiyah Slumbung in understanding and remembering English vocabulary through a visual and interactive approach. The main features in this media include marker-based 3D visualization of pet objects, handwriting practice using Line Renderer, and interactive quizzes in the form of multiple choices and word formation. The combination of these three features is expected to create a fun, contextual, and immersive learning experience for students.

Based on the results of blackbox testing conducted by researchers, all components in the media functioned properly as designed. The navigation button function, interaction with AR markers, writing exercises, and even the quiz system were tested through 47 test scenarios. All scenarios were successful with no bugs or system errors found, thus concluding that this media achieved a 100% functional success rate. These results align with research conducted by(Dwi Putra et al., 2023)with the title "Implementation of MDLC in Lampung Script Learning Using Augmented Reality Technology" which shows that the AR learning media tested using the blackbox testing method is declared suitable for use if all functions run as they should.

In addition to functional testing, the media was also evaluated for content and technical feasibility through beta testing involving three validators: an IT expert, a media expert, and an English teacher as the subject matter expert. The IT expert's validation results for system stability, performance, and response speed showed a feasibility score of 86%. The media expert's validation for visuals, layout, and readability showed a feasibility score of 94%. Meanwhile, the English teacher gave a perfect score of 100% in assessing the media's benefits in supporting the learning process. On average, the media achieved a feasibility score of 93.3%, which falls into the "Very Feasible" category.(Revelation, 2022).

Overall, the AR learning media developed is not only technically and visually feasible, but also proven effective in improving student learning outcomes. By combining AR technology, handwriting features, and interactive quizzes, this media is able to provide a more enjoyable learning experience, especially for early childhood students who require visual and kinesthetic stimuli in the learning process.

## CONCLUSION

From the results of the research that has been conducted, it was concluded that Augmented Reality-based learning media for introducing pet vocabulary in English was successfully built using the Multimedia Development Life Cycle (MDLC) method. The development was carried out through 6 stages, namely concept, design, material collecting, assembly, testing, and distribution. This media was built using the Unity game engine and the Vuforia system to recognize markers and display animal objects in 3D. Key features such as AR visualization, handwriting exercises, and interactive quizzes were successfully designed to support the learning of 2nd grade students of MI Islamiyah Slumbung. Media testing showed that all components functioned as expected with a functional success rate of 100% based

on 47 blackbox testing scenarios. Meanwhile, the results of beta testing from three validators (IT experts, media experts, and English teachers) obtained an average score of 93.3% which is included in the "Very Feasible" category.

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