



# Wild Animals Flashcard-Based AR as an Early Reading Game for Young Children

**Dian Ramadhani Padwika<sup>1</sup>, Sri Sumarni<sup>1</sup>✉, Windi Dwi Andika<sup>1</sup>, Zahra Alwi<sup>2</sup>, Muhammad Arry Erpapalemlah<sup>3</sup>**

Pendidikan Guru Pendidikan Anak Usia Dini, Universitas Sriwijaya, Indonesia<sup>(1)</sup>

Pendidikan Bahasa Indonesia, Universitas Sriwijaya, Indonesia<sup>(2)</sup>

Teknik Informatika, Universitas Sriwijaya, Indonesia<sup>(3)</sup>

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## Abstract

Wild animal material has been introduced by teachers and parents only in the traditional. Early reading can be challenging since it might be difficult to recognize new words. Technology has been used to this issue in the form of flashcard with augmented reality (AR). This study aims to develop a flashcard material for wild animals based on augmented reality for children aged (5-6) years in Kayu Agung which has been tested for validity and practicality. The research method used in this research was Research & Development (R&D) research. The research procedure was Rowntree and formative evaluation Tessmer. The formative evaluation stage of Tessmer consisted of self-evaluation, expert review, one-to-one evaluation, and small group evaluation. The results showed the wild animals flashcard-based AR was developed had met the valid and practical criteria and was suitable to children aged (5-6) as an early reading game years in Kayu Agung.

**Keywords:** *augmented reality; early reading; wild animals flashcard;*

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✉ Corresponding author : Sri Sumarni

Email Address : [sri\\_sumarni@fkip.unsri.ac.id](mailto:sri_sumarni@fkip.unsri.ac.id) (Palembang, Indonesia)

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## Introduction

Early childhood is a nation's asset that needs to be considered both for its growth and development. According to Piaget, at the age of 4-6 years, children begin to be able to use symbols to represent the environment around them cognitively, such as numbers and symbols that can be replaced with objects, activities and events (Rukmini, 2021). In addition, early childhood prefers fun activities such as small experiments, games, playing and running around. This makes children learn a lot from experience. According to Hurlock, early childhood only has a fairly short concentration of about 10-15 minutes (Zaini & Dewi, 2017).

One example of learning that requires fun and enjoyable ways so that children can interpret and understand it more is science learning. According to Eshach & Fried, science learning must be taught from an early age through play to develop children's logical thinking skills so that children will continue to be encouraged to observe as well. Thinking scientific concepts in life must also be in accordance with the stage of cognitive development of early childhood (Poppyariyana & Munajat, 2020).

One of the developments that need to be stimulated in children is language development. Based on the Minister of Education and Culture Regulation Number 137 of 2014, the aspects of development that must be used as learning in PAUD are religious and moral, cognitive, physical-motor, social-emotional, art and language aspects. Language is a form of communication, be it spoken, written or gestures based on a system of symbols (Lina & Suryana, 2018). Language has an important role in everyday life. Language development includes reading ability. According to Bromley in Yafie et al., (2020) states that there are four kinds of language forms, namely listening, speaking, reading, and writing.

The initial reading process becomes an important factor at an early age, especially in the application of learning in PAUD. This is because the emphasis on success in the development of children's reading makes aspects of child development, especially the development of language literacy, an important factor that must always be a major aspect of the learning process in PAUD. Even so, children's reading skills often experience problems, especially in verbal language skills and recognizing letters and words.

The results of the earlier research conducted by Danaei et al., (2020) indicate that using a book with AR content has a positive impact on those who read books that start with the first page. Story book of AR influence at the beginning of the reading session. The study in question provides evidence that a book on children's literature can increase understanding of children's literature. The reason why children understand stories in books about AR more is because of the animation stories. Visualizing and describing in detail a story will enhance visual comprehension and help people build better relationships. Some researchers have noted that cognitive decline occurs when a large number of texts are supplemented by multimedia content, which increases reader comprehension of the text (Kao et al., 2019).

The problem is the teachers do not understand and are creative in choosing learning media that will be used to stimulate early childhood reading skills. Learning is still done by spelling and giving examples using the blackboard. So far, teachers and parents have introduced wild animal material only in the traditional way through pictures, books, and children's magazines. In general, this can cause children to get bored quickly and focus less on the material. Teachers usually use media that are still traditional in introducing learning materials such as wild animal material. So that it makes children quickly bored and less focused, this has less impact on stimulating early childhood reading skills.

However, in reality, several observations were obtained from the two kindergartens in Kayuagung, such as Al-Azhar OKI and Sekolahalam Kindergarten, the learning media used in the learning process to introduce wild animal material is still in the traditional way, such as books, pictures. and blackboards that make children quickly get bored in listening to the material and also make children's attitudes more passive because they are less interesting. The limited media owned by schools and the lack of teacher innovation, especially in terms of technology to make learning media attractive to children, requires visualization for material in learning for children, especially at an early age.

Even though getting to know these wild animals is one of the early childhood science learning in the curriculum in accordance with Permendikbud Number 146 of 2014. Science learning is appropriate to the stage of child development, as well as quality science experience can help and is important for children to understand the world, organize and gather information, test and apply ideas and impart and develop positive attitudes about science (Arum Sekar Sari, 2021). Therefore, researchers are interested in the material about knowing wild animals in this study.

In Indonesia currently, Augmented Reality is a technology that is quite popular. This helps early childhood in recognizing fast learning content both in understanding the material and adding various experiences for children to touch virtual objects in the real world. According to Oranç & Küntay (2019), it is known that the relationship between the real world that children enter and also the virtual world that they see on the screen can raise various questions about the role of reality in the acquisition of children's knowledge so that children

can translate knowledge from different contexts into the real world. The research that has been conducted by Rasslenda-Rass produces a level of interest and motivation in children in using Augmented Reality compared to conventional learning in this research produces an Augmented Reality flashcard that has been designed for iOS applications. Flashcards based on Augmented Reality certainly involve a simulation and also interaction in animal recognition using various virtual 3D (Deshmukh et al., 2018).

According to Maryanto & Wulanata (2018) states that flashcard is a card that contains writing or images and relates to a concept. Meanwhile, Dina stated that flashcards are learning media in the form of picture cards whose size is 25 x 30 cm. The images on flashcards can be in the form of photos which are then pasted on the card sheet (Sary, 2022). In addition, Miles & Ehri (2017) argue that "flashcards are commonly used to teach children to read words by sight. Usually each word is printed in isolation on a card". From some of the explanations of the expert opinions stated earlier, it can be concluded that flashcard media is media in the form of cards that are commonly used for children in small-sized learning containing images, symbols, or text and have a conceptual relationship with each other and images.

According to Stefani & Samsiyah (2021) stated the advantages of flashcard include, namely, that it is easy to carry anywhere because of their small size, practical and instant because it is not as complicated as other learning media such as using electricity and so on. Flashcard usually presents only important messages. Next is interesting and also fun for children both because of the colourful shapes and pictures. Apart from the advantages, flashcards only focus on emphasizing the sense of sight. Then the size of the flashcard is very small when used in large groups. Besides that, usually, the pictures on flashcards only emphasize one message. Flashcards focus on object points so that usually the learning delivered contains only one message (Ilmaya, 2019).

According to Nazilah & Setiawati (2021) augmented reality (AR) is a term for an area that mixes the real world and the virtual world made by a PC so that the boundaries between the two become very thin. In the book entitled "Augmented reality a particular guide", defining that augmented reality is a natural way to explore various 3D objects and also data, augmented reality is also a concept that combines visual reality with world reality (Alfian et al., 2021). According to Rianto et al., (2021) augmented reality is a technology that can incorporate a two-dimensional virtual object into real-time. Some of the definitions of Augmented reality (AR) above, it can be concluded that augmented reality is a term for an environment that can combine the real world with virtual r virtual. Then, created with the help of a computer system so that the distance or boundary between the two is very thin.

There are several advantages and disadvantages of augmented reality. The advantage is that it is more interactive, its use is more effective, and it can be implemented widely in various media. For example, as an application in a smartphone, game console, product package and even print media such as books, magazines and newspapers. The modelling is simple, cost-effective to manufacture, and easy to operate. As for the drawbacks namely, if there is a change in viewing angle, it will be easily sensitive, the creators of augmented reality are still very few, and require a lot of memory usage for the equipment used (Hakim, 2018).

Previous research conducted by Chen & Chan (2019) one of the studies that have successfully demonstrated the use of augmented reality flashcards in Early Childhood learning. The results of his research show that augmented reality and flashcards significantly through the t-test and the level of influence measured actually can improve vocabulary learning and children enjoy learning augmented reality. Then, the results of research conducted by Utami & Andika (2021) show that flashcards based on augmented reality can be used practically and also effective in PAUD learning material to introduce marine animals. Apart from that, flashcard technology augmented reality has never been developed or used in the learning process or in children aged (5-6) years at Kayu Agung. In this study, researchers designed wild animals flashcard based on augmented reality as a game medium that can

stimulate interesting early childhood reading skills with a 3D object display that appears similar to the original shape of wild animals and so does their movement.

In accordance with education 4.0, teachers are expected to be more creative, collaborative, and think critically and communicate so that learning to introduce various wild animals, especially during the Covid-19 pandemic early childhood, can be the foundation for their success in making it easier for children to face education and the next life. and feasible to use in real. This study aims to produce wild animals flashcard-based AR as an early reading game for young children that can stimulate interesting early childhood reading skills that is valid and practical and suitable for use in introducing wild animal material to children aged (5-6) years at Kayu Agung.

## Methodology

The research methodology used in this research is research and development or what is known as Research and Development (R&D). The purpose of this research is to produce a product in the form of flashcard material for wild animals based on augmented reality that has validity and practicality. This study uses the Rowntree development model using the Tessmer evaluation stage. According to Aspriyani et al., (2018) the research and development model has several advantages including, namely, the implementation of activities for media design is entirely clear, then has a focus only on certain media production so that it is very easy to follow the steps, then the working method and also a simple model. The development research steps used are shown in Figure 1.

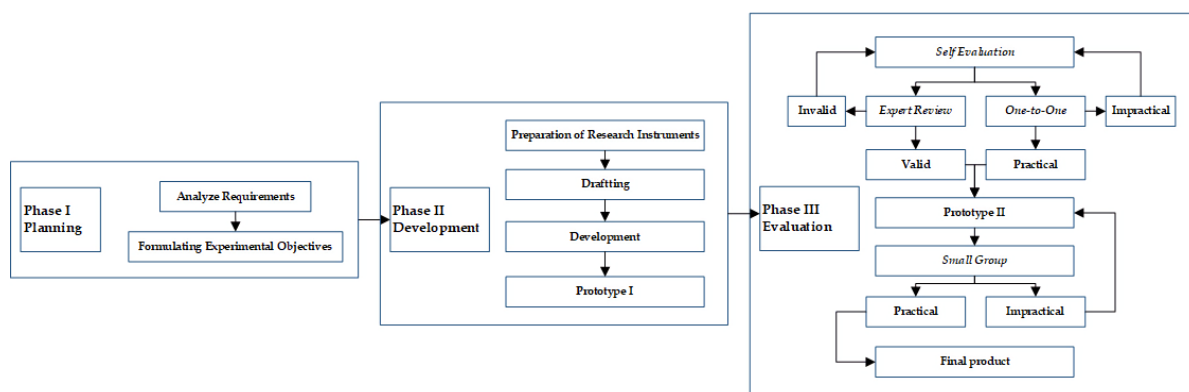


Figure 1. Chart of Development Research Steps

There are three stages, namely the planning stage, at this stage an analysis of children's needs is carried out and also the formulation of learning objectives. In the development stage, at this stage the development of a topic is carried out, and the drafting is also the production of a prototype so that it becomes an initial media product. Evaluation stage, at this stage an assessment is carried out to try out the prototype of a product that has been made and also make various improvements according to the suggestions that have been obtained.

This study uses the formative evaluation technique from Tessmer which of course has five stages, namely, 1) self-evaluation, 2) expert review, 3) one-to-one evaluation, 4) small group evaluation, and 5) field test. However, in this study, the researchers only reached the small group evaluation because this study was only focused on developing a product without seeing a potential effect on children. The expert test subjects used in this study involved two experts consisting of material experts and media experts. While the user trial subjects were children aged (5-6) years at the Kayu Agung Kindergarten, which consisted of a one-to-one evaluation phase involving three children and a small group evaluation involving nine children.

Data collection techniques were carried out using questionnaires and observations. Collecting data through a questionnaire has the aim of knowing the feasibility of the product being developed. Then, observations were made during the one-to-one, small-group stage. Has it been implemented properly according to the 2014 Minister of Education and Culture Regulation, namely the ability to recognize wild animals and the practicality of products when using flashcard material for wild animals based on augmented reality.

The research instrument used as a measuring tool for product assessment refers to the Standard Augmented Reality Teaching Platform (ARTP) which includes: 1. Ergonomic Quality, 2. Learning Quality, and 3. Hedonic Quality (Pribseanu, C., Balog, A., & Iordache, D, 2017, p. 482-495). While the material assessment aspect refers to the National Education Standards Agency (BSNP) which includes: 1. Adequacy of content, 2. Linguistics, 3. Presentation, 4. Graphic using a Likert rating scale by the validator. Meanwhile, the standards in the assessment were assessed or measured by teacher using a Likert scale with an assessment rubric on the child observation instrument, and validity and reliability trials were carried out on different respondents. Then it was declared valid and reliable.

The Data analysis technique used in this study is descriptive quantitative. This technique is used to analyze data by describing or describing the data that has been collected from the distribution of evaluation questionnaires from both median experts and material as they are without intending to make generally accepted conclusions or generalizations (Sugiyono, 2019:199). As for analyzing the data from the observation sheet, the researcher used the rating scale shown in table 1.

**Table 1. Category Level of Validity and Practicality**

Interval Score	Statement Value	Validity Category	Practicality Category
82-100	4	Very Vaid	Very Practical
63-81	3	Valid	Practical
44-62	2	Invalid	Impractical
25-43	1	Very Invalid	Very Impractical

## Results and Discussion

Reading in early childhood should emerge from the child and be adapted to the stage of development, namely with a fun learning process so that children perceive learning activities as playing. One aspect of language skills is reading. It is very important to develop early reading skills in children from an early age, especially ages 5-6.

According to Cochorane's research Ismaniar (2019) every child will experience these five levels of reading. a) Fantasy stage (magical stage), at this stage children learn to use books and begin to think that books are very important. Children read books, carry books with them, and often have books they like. b) The self-concept stage, the child sees himself as a reader, participates in reading activities, begins to appear in "pretend reading" activities, gives meaning to pictures or previous reading experiences, and uses the language of books, even though they doesn't match the book. c) Picture reading level (bridging reading stage), at this stage, children find pictures, as well as various writings or alphabets, express words that have meaning, and can repeat writing that has been read before. And the role of the teacher at this stage is to provide and teach learning innovations by giving children the opportunity to write reading results, as well as present poetry and song vocabulary.

d) Take-off stage, at this stage, children begin to use three sign/character systems, namely graphonic, semantic, and syntax. They start to get excited about reading, start to recognize letters from context, pay attention to the environment of printed letters and read anything around them, such as writing on packages, signs. e) Independent stage (independent stage), children can read books that are not known independently, construct meaning from letters and from previous experience and the author's cues. Children can make predictions about reading material. In the picture reading stage, children pay attention to visual signs such

as pictures but have not yet mastered symbols. Children read newspapers by looking at pictures, reading labels by paying attention to the goods and pictures.

The production of Wild Animals media material for wild animals based on augmented reality technology was carried out for approximately six months starting from the planning stage of the researcher analyzing the needs for development in children aged (5-6) years. The needs analysis activity was carried out in several kindergartens in Kayuagung such as Al-Azhar OKI and Sekolalaham Kindergarten. Flashcard media material for wild animals based on augmented reality to introduce wild stars to children aged (5-6) years makes it very easy and helps in learning who is at school. Observations were also carried out by finding out about any learning media that support learning about wild animals.

Furthermore, at the media development stage, the researcher determined the material based on the 2013 curriculum study, namely the theme of pets in the form of wild animals in science learning in accordance with Permendikbud Number 146 of 2014. Core Competencies, Basic Competencies and Indicators. Starting from Religious and Moral Values: being grateful for wild animals as God's creations. Physical Motor: The child's ability to follow the movements that appear from wild animals. Cognitive: the child's ability to recognize animal objects and the child's ability to say the names of animals in both Indonesian and English from the objects that appear. Language: the child's ability to carry out simple commands according to the rules and can retell simply. Sosem: child's interest and satisfaction with the appearance of existing objects and giving children the opportunity to try Art: Recognizing new game creations using simple technology

Some of the beasts chosen for the development of flashcards based on augmented reality are 1). Bull, 2). Rhino, 3). Eagle, 4). Tiger, 5). Shark, 6). Elephant, 7). Fox, 8). Wolf. With the aim of this learning media, it is necessary to pay attention to displaying objects in 3D as follows: 1). Users can easily mention and recognize the objects displayed. 2). Users can state the initials of the alphabet and the name of the object in Indonesian and English. 3). Users can easily mention the characteristics of the objects displayed. 4). Users can follow the movements displayed by 3D objects.

Then, followed by the design stage in media development, the researcher designed it twice, namely for flashcards applications Augmented reality. The flashcard was designed to be 9 x 12.5 cm via Canva. The flashcard is equipped with objects in the form of wild animals, names of wild animal objects with uppercase and lowercase letters also in 2 languages of wild animal names, namely Indonesian and English. Then, background the bright colour of the cover container flashcard designed is entitled Wild Animals (flashcard augmented realityapp) with bilingual descriptions and the number of cards is 8, wild animal material and for children aged (5-6) years. In addition, it has guidelines or a guide for adults or parents in accompanying children when playing flashcards using an application with a smartphone.

Furthermore, in the design of augmented reality, researchers use tools from several open sources namely Unity 2017.3.1.fl, to make the application framework. Then, other applications, such as tools from Vuforia, Unity 3D, Canva, and SDK. The parts that are designed are the main design of the AR application interface, the design appearance of the AR application, and the design of the 3D object layout of wild animals. The prototyping production process is divided into 3 namely, cover production, flashcard production and AR application production. In the production of the flashcard, covers are printed using artboard paper and a paper thickness of 230 gsm. Production Flashcard is printed with a printer with a maximum resolution of 570 dpl using laminated construction paper. At this stage, the researcher also prepared an instrument as an evaluation device. The results of this stage in development are called prototype I, which will then be evaluated. Shown in figure 2 is the design view from Canva and Unity.

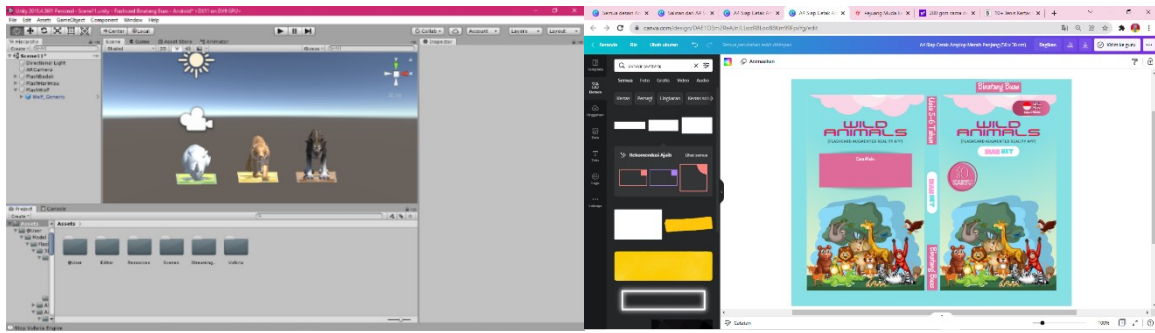


Figure 2. Cover Display Design in Canva and 3D Objects of Wild Animals in Unity

Media product flashcard-based augmented reality with the concept of product development is the introduction of wild animal material to children aged (5-6) years at Kayu Agung. In this media product, young children can see the appearance of 3D objects that appear similar to the original forms of wild animals on flashcards. This of course makes it easier for children to get to know various kinds of wild animals such as bulls, rhinos, eagles, tigers, sharks, elephants, foxes and wolves. The flashcard designs that have been designed in Figure 3 below are shown.



Figure 3. Design of flashcards Flashcard

Material media for wild animals based on augmented reality is produced by going through several stages according to the development model used to stage an expert review by 2 experts, namely material and media. In testing the validity of the material, the experts from the material assess with eight indicators from the aspects of content, presentation, language and graphics. From the validity assessment by material experts, a value of 89% is produced which is categorized as "Very Valid". So, it can be tried out because it is feasible by making revisions according to the suggestions given. As for some of the inputs along with suggestions that have been given by material experts, namely from 10 flashcards taken flashcards which correspond to the category of wild animals, which do not include spiders and dinosaurs.

Then, as for the results of media validity carried out by media experts with six indicators from three aspects, namely, ergonomic, learning, and hedonic, which is 92% which is categorized as "Very Valid". So that it can be tested because it is feasible by making revisions according to the suggestions given. As for some of the inputs and suggestions that have been

given by media experts, namely motion in animals, the guidelines are clarified both in software and hardware, and flashcards are laminated. From the results which are the assessments of the two validators, both media and material experts, the results show an average value of 91% which is categorized as "Very Valid". Shown in the following table of results 4 and 5.

**Table 4. Results of Analysis Checklist Material Validity**

Indicators	Categories	Number Statement	Description	Total Score
<b>Content</b>	Feasibility of material	4		88
	Goals and objectives	3	Very	
	Effectiveness in learning	1	Valid	
<b>Presentation</b>	Accuracy in the selection of colour, image and font	4		90
	Accuracy of images with children's knowledge and cognitive	3	Very	
	Material visualization		Valid	
<b>Language Graph</b>	Suitability of language with rules			88
	Conformity of elements of graphic unity	3	Very	
		8	Valid	
		3	Very Valid	
<b>Σ Score</b>		<b>103</b>		
<b>Mark (%)</b>		<b>89%</b>	<b>Very Valid</b>	

**Table 5. Results Checklist of Media Validity**

Indicators	Categories	Number Statement	Description	Total Score
<b>Ergonomic</b>	Learnability	1		7
	Easy of use	1	Very	
<b>Learning</b>	Efficiency	1	Valid	8
	Usefulness	1	Very	
<b>Hedonic</b>	Cognitive absorption	1	Valid	7
	Enjoyment	1	Very Valid	
<b>Σ Score</b>		<b>22</b>		
<b>Mark (%)</b>		<b>92%</b>	<b>Very Valid</b>	

After carrying out the expert review stage, the next step is the one-to-one evaluation of 3 children aged (5-6) years at Sekolahalam Kindergarten and OKI Al-Azhar Kindergarten. Then, from the test results data obtained is an average value of 85% which is categorized as "Very Practical". After the one-to-one evaluation which proved that the flashcard on wild animals based on augmented reality was very practical, it was continued to the small group evaluation. In the small group evaluation, it was tested on 9 children aged (5-6) in Sekolahalam Kindergarten and OKI Al-Azhar Kindergarten. Then from the data, the results obtained are an average value of 94% which is categorized as "Very Practical". Shown in the following tables 6 and 7.

Furthermore, from the two stages, namely, one-to-one evaluation and small group evaluation, an average score of 90% was obtained which proved that the development of flashcard-based wild animal augmented reality was in the "Very Practical" category. It can be seen from the reactions of the children when they did trials on the media, the children were very enthusiastic, curious and interested in the media with the 3D objects that appeared. They look happy and can recognize wild animals from their shapes, movements and even the names of wild animals in Indonesian and English. Shown in Figure 4.

**Table 6. Result of Observation *One-to-One Evaluation***

Name	Indicator							$\Sigma$ Score	
	Say the names of wild animals	Imitating the movements	Imitating the foreign language	Specify the features	Convenience for children	Focus	Meaningful	Fun	
	Score	Score	Score	Score	Score	Score	Score	Score	Score
MP	3	3	3	3	3	4	3	4	81
FS	3	3	3	4	3	4	3	4	84
MFP	4	4	4	3	3	4	3	4	91
<b>Total of Scores</b>								<b>256</b>	
<b>Average Amount</b>								<b>85%</b>	
<b>Category</b>								<b>Very Practical</b>	

**Table 7. Result of Observation *Small Group Evaluation***

Name	Indicator							$\Sigma$ Score	
	Say the names of wild animals	Imitating the movements	Imitating the foreign language	Specify the features	Convenience for children	Focus	Meaningful	Fun	
	Score	Score	Score	Score	Score	Score	Score	Score	Score
AW	4	3	4	4	4	4	4	4	97
JAS	4	4	3	4	4	4	4	4	97
AZY	3	4	4	4	4	3	3	3	88
MKA	4	3	4	3	4	4	4	4	94
RF	3	4	3	4	3	4	4	4	91
SMF	4	4	3	3	4	4	4	4	94
AKS	3	4	3	4	3	4	4	4	91
MSN	3	4	4	4	3	4	4	4	94
ANF	4	3	4	4	4	4	4	4	97
<b>Total of Scores</b>								<b>843</b>	
<b>Average Amount</b>								<b>94%</b>	
<b>Category</b>								<b>Very Practical</b>	



**Figure 4. The process of using the Animals Wild Application**

Based on the results of the data that has been obtained and analyzed previously, the flashcard technology-based augmented reality is successful in accordance with the results of observations of the ability of children aged (5-6) years to recognize wild animals, which have been categorized as valid and practical to use in introducing wild animal material to children.

Research and development in flashcard technology-based wild animal augmented reality is not perfect, here are some advantages and disadvantages of developing flashcard technology-based wild animal augmented reality. The advantages include, this learning media improving simple technological abilities, interest, focus, enthusiasm, and interesting attention for children aged (5-6) years in Kayu Agung which makes it easier for children to understand wild animals. In addition, the material that has been selected is in accordance with the needs of PAUD teachers. The 3D model used to introduce the beast material is a shape that already resembles the original form of the beast and so does its movement.

The use of augmented reality as game for early childhood produces a level of motivation and interest in learning of early reading when compared to conventional learning in introducing animals through 3D objects (Deshmukh et al., 2018). In addition, the main advantages of learning using augmented reality are motivation, learning progress, collaboration and interaction. Augmented reality is also very effective for better learning performance, motivation, positive attitudes toward learning and student engagement (Syafitri et al., 2017). Furthermore, the use of augmented reality in education can have many positive impacts, namely increasing the accessibility of educational content, collaborative learning, student control of educational content, attractiveness for multi-modal learning, active student involvement, and turning something abstract into concrete (A. Selviany, 2017).

Apart from these advantages, there are also several disadvantages of flashcard technology-based augmented reality, including that this media still does not have sound or no sound from each animal, however, there is only music at the beginning of the page when opening the application. Then, the material that is also introduced to early childhood is still limited to the introduction of wild animals and of course, the use of media still requires the help of adults or teachers.

## Conclusion

The novelty of this study is in the field of games to stimulate early reading for children, namely at the stage of reading pictures. In the multimedia environment lies in the use of AR flashcards with wild animal material as the subject. It's also one of the few studies in the field of AR that studies wild animal flashcards. Wild animals flashcard-based AR as an early reading game for young children is stated to be very valid and very practical and feasible to be used in learning. This is because it meets practicality and validity criteria in its use for children aged (5-6) years in Al-Azhar Kindergarten and Sekolah Alam Kindergarten in Kayu Agung.

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