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DESIGN OF AUGMENTED REALITY-BASED INTERACTIVE LEARNING MEDIA TO RECOGNIZE ENDEMIC ANIMALS IN EARLY CHILDHOOD

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ABSTRACT

Education is currently experiencing a significant influence from the rapid development of technology. This encourages the world of education to continue to adapt, both in teaching methods and learning media. This adaptation is important so that learning remains relevant, interesting and effective for students, especially at the early childhood education level. This research aims to design learning media to introduce endemic animals in Indonesia by utilizing AR technology. This research uses the Design and Development (D&D) method, with the main focus being the process of creating or developing AR-based learning media carried out through the stages in the ADDIE model. The results showed that AR-based interactive learning media that had been designed, made and carried out validation tests. The validation results showed that the material expert gave a score of 30 with a good assessment category, while the media expert gave a score of 25 with the same assessment category. From these results, it is concluded that this media is declared feasible to use to introduce Indonesian endemic animals to early childhood. The implication of this research is that AR-based learning media can be an effective solution to introduce animals in a more real way, where the visual approach used is able to attract students' interest and increase their understanding, especially in recognizing local animals.

***Keywords**: Augmented Reality, Early Childhood, Interactive Learning Media, Recognize Endemic Animals*

INTRODUCTION

In essence, ECE is education organized with the aim of facilitating the growth and development of children as a whole or emphasizing on the development of all aspects of the child's personality (Kangas et al., 2021). In general, the goal of ECE is to develop various potentials of children from an early age as preparation for life and can adapt to their environment (National Department of Education, 2007).

To achieve this goal, in its implementation, it is necessary to apply the principles as stated by the center the curriculum includes orientation to children's needs, learning trough play, a conducive environment, using integrated learning, developing various life skills, using various educational media and learning resources and being implemented gradually and repeatedly.

The above objectives need to be interpreted and implemented properly by educators. This is so that educators can make a real contribution in building civilization through education (Mufidah & Kuswanto, 2020). In realizing these goals, educators must be adaptive in improving the quality of learning that is relevant to the needs and challenges of this century. This means that educators need to design innovative learning by integrating technology according to the characteristics of students.

In today's digital era, early childhood grows in an environment that is closely related to technology, but this is not in line with the learning media used in ECE which is still dominated by conventional methods that do not stimulate children's interest in playing and learning activities. The urgency of developing learning media that is innovative and in accordance with the characteristics of early childhood learning is becoming increasingly important, especially with the existence of Augmented Reality (AR) technology that is able to present a more real, interactive and joyful learning experience. AR is an application that combines the real world with the virtual world in two and three dimensional forms that are projected in a real environment at the same time (Iffah et al., 2024; Muntahanah et al., 2017). Now AR is familiar in the children, because there are many in the market that use AT technology, such as AR in animal recognition cards, and even cartoon character cards. Like research of Pramono & Setiawan (2019) which uses AR in the field of education wih the title "Utilizing Augmented Reality as Learning Media for The Introduction of Fruits", the result is that the application developed is very effective as a medium for the introduction of fruits because with using the concept of combining the real world, real pictures on cards and virtual, application can stimulate imagination and curiosity in children and learning motivation is growing.

As for other research related to endemic animals, namely research conducted by Raharjo et al., (2020) regarding the implementation of Augmented Reality for the introduction of endemic Indonesian animals based on Android, which combines information on species and animal habitats with interactive educational applications based on android. Several studies have investigated the utilization of augmented reality (AR) technology as an interactive learning medium for early childhood. Waro & Ikrimach (2024) designed AR media for the introduction of ancient animals, and the orientation of their research was to make an application of how the system works in outline. In addition, research by Suharyanto (2021) shows that the use of AR in early childhood education can increase children's involvement in the learning process. However, most of these studies focus more on media development in terms of visual aspects, systems, and general animal recognition, without emphasizing the integration of educational content about Indonesian endemic animals which has essential value in raising students' awareness and character.

The research gap identified is the lack of AR-based interactive learning media specifically designed to introduce Indonesian endemic animals to early childhood. In addition, early introduction to endemic animals can foster ecological awareness and love for the diversity of local animals. Based on the conditions, this research aims to design AR-based learning media along with guidebooks that are specifically intended for early childhood in recognizing endemic animals in Indonesia, different from previous research which is generally aimed at designing from the visual aspect or application system and has not led to specific local content such as endemic animals in Indonesia.

With this approach, this research is expected to contribute to the development of learning media that is not only visually appealing, but also educative and contextual according to the needs of children.

METHODOLOGY

The research design that will be used in this research is based on development research (Design Based Research), which is a strategy to develop a particular product. Richey & Klein (2014) define this research method as a systematic study in designing, developing and evaluating with the aim of providing an empirical basis for producing products and tools for learning and non-learning or engedering new or enrichment models that govern change. In this study, researchers used the D&D model to create or build a learning product/media. This research is focused on the design and development stages, which include needs analysis to the validation process of the products that have been developed. The research design used by researchers is the ADDIE model. The ADDIE model is a systematic learning design model to assist in designing and developing learning media/programs effectively (Komariah et al., 2024; Tegeh et al., 2014).

The research procedure starts from the analysis stage regarding the need for variations in learning media and analyzing the coverage of teaching materials that suit the needs of early childhood. Then the design stage is carried out by determining the target users of learning media, formulating the objectives of making learning media, analyzing the standards for achieving aspects of child development, determining the endemic animals that will be displayed in the application, determining the application in making AR-based learning media. At the development stage, researchers have designed AR-based learning media, but it still cannot be applied to students, because it requires validation by expert judgment. In this case, researchers have selected two expert (learning media and material experts) to assess the feasibility of the learning media that has been made.

Validity is the score given by the validator to Augmented Reality-digital based learning media in terms of design, technical and content/material aspects with a score of, 1-4; 1 Very Poor, 2 Less, 3 Good, 4 Very Good. The ideal score in the assessment conducted by learning media experts is 32. The score is obtained from three aspects of the assessment. The first aspect is the suitability of 3D objects in the application, and the second aspect is the suitability of the media with its utilization, each of which consists of three statements. And the third aspect is the suitability of book design which consists of two statements. As for the material expert, the ideal score is 40, which is obtained from three aspects. First, the suitability aspect of the material which consists of five statements. Second, the aspect of the accuracy of the concept of science process skills which consists of two statements. The last aspect is the clarity of the material in helping teachers and students consisting of three statements. To find out the results of the assessment from the experts, the researcher has explained in the results section.

RESULTS

The creation of Augmented Reality-based interactive media is based on the problems found in the early childhood education environment. Researchers conducted an analysis based on the needs of children during learning through observation activities. In this activity, researchers analyzed the learning process, especially on the theme of animal recognition. Then the researchers analyzed the active participation of children while learning and the variety of learning media used.

Empirical facts, it was found that learning about the introduction of endemic animals was carried out through pictures and media in the form of videos, so that information was obtained by children related to animal names and animal habitats. From the results of the analysis obtained, it shows that the learning process still does not involve students in finding their own understanding. As well as the lack of variations in learning media contribute to low student learning activities, so that learning becomes less effective in training thinking skills and encouraging active participation of children. Referring to the results of this analysis, researchers began to design learning media that were expected to be an alternative solution to learning problems that occur in early childhood education. The first stage in this design, researchers determine the targets and objectives of creating media. The following can be seen through table 1.

Table 1
Targets and Objectives of AR-based Interactive Media

Targets	Early childhood 4-6 years old who are studying the topic of material about the introduction of endemic animals.
Objectives	Develop children's cognitive aspects such as critical thinking skills and active participation in obtaining a complete understanding of Indonesian endemic animals through the use of AR-based interactive media.
Course Content	The materials included in this AR-based interactive media are selected according to the stages in the science learning process for early childhood, namely observing, classifying, and communicating. These activities are also aligned with the early childhood learning outcomes stated in Regulation of the Minister of Education and Culture (Permendikbud) No. 137 of 2014. The content in this AR-based interactive media was selected according to the stages in the science learning process for early childhood, namely the process of observing, classifying, and communicating. These activities are also adjusted to the early childhood achievements in ministry of education and culture regulation number 137 of 2014.

Storyboard

Furthermore, researchers make storyboards in designing AR-based interactive media, this can help clarify the concept of making this media. In making AR-based media there are two products, namely applications and guidebooks. Making storyboards can be seen through figures 1-10.

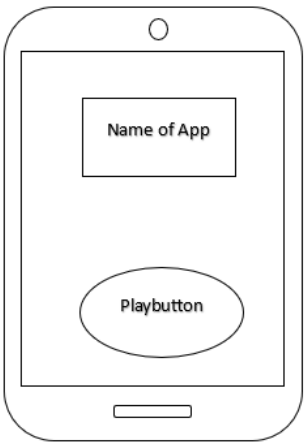

Figure 1. First view of the application

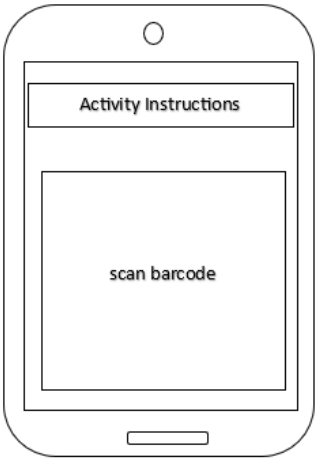

Figure 2. Next view of the application

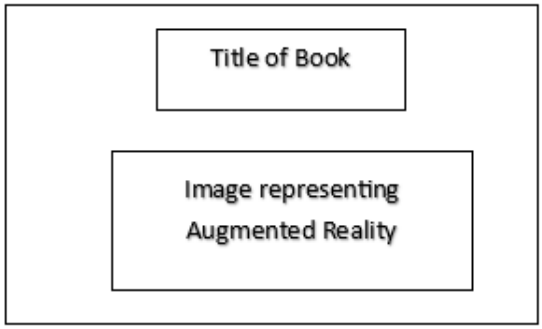

Figure 3. Cover Book

Figure 4. Fisrt Page

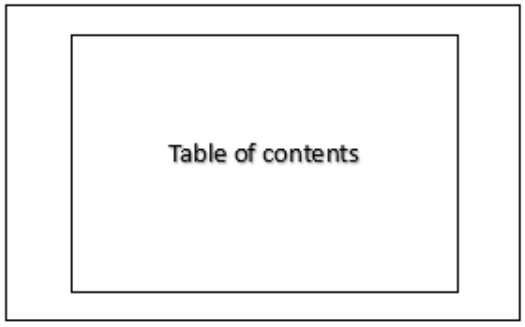

Figure 5. Second Page

Figure 6. Expected achievements page in using the book

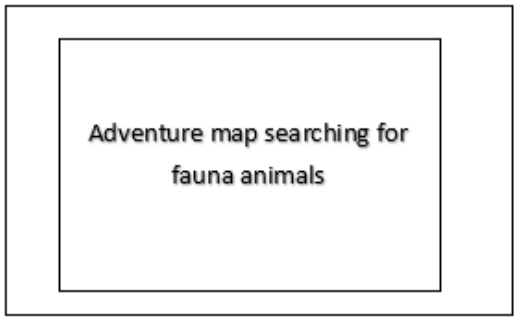

Figure 7. Activity page to be performed

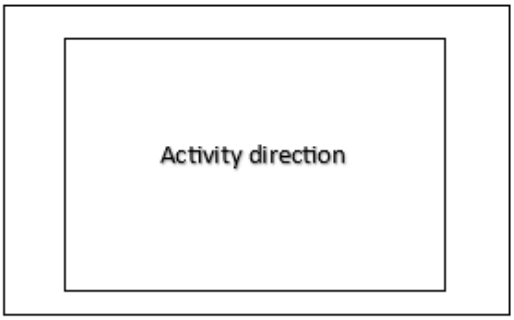

Figure 8. Name of activity direction page

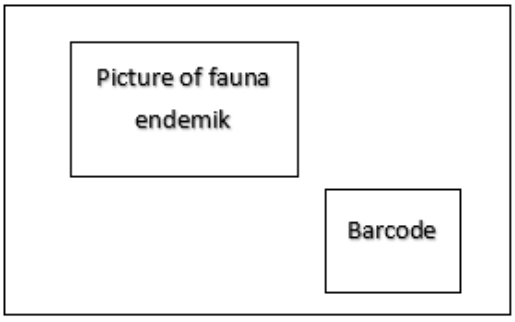

Figure 9. Activities carried out in conjunction with AR-based applications

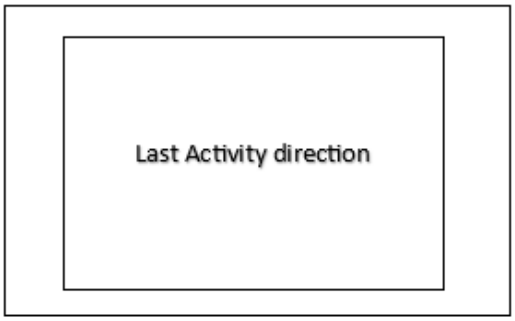

Figure 10. Closing Activity

Create Product

In the early stages, researchers made 3D objects in the form of AR, these 3D objects are endemic animals. In the process of making Augmented Reality, License Key and Database are needed to upload markers to the website. Both components can be created on the Vuforia website. After that, select the first marker, copy the available License Key, then paste it into the project that is being developed in Unity.

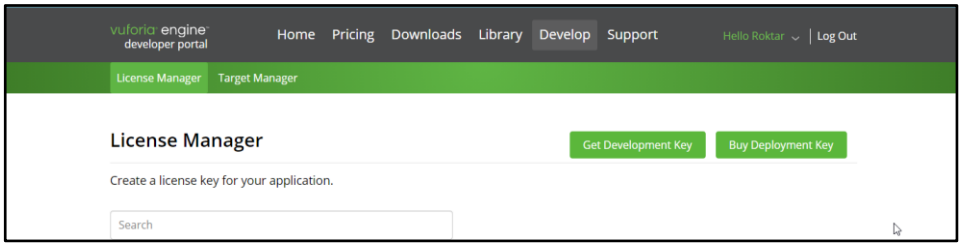

Figure 11. Website Vuforia

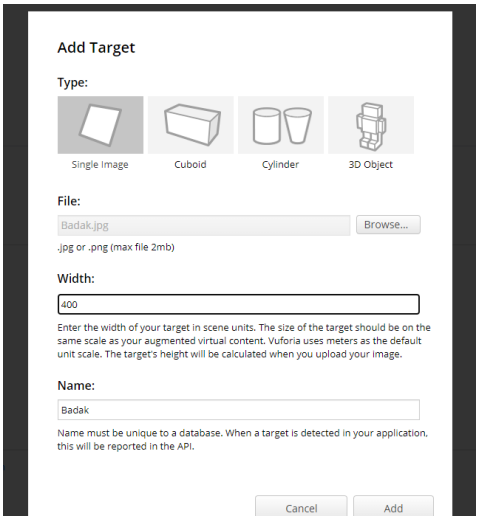

Figure 12. Picture of Marker

After that, create markers in the same database as needed, markers can be downloaded and saved in unity. The marker that has been downloaded is then imported into unity. Next, select the target image section that has been entered when selecting the AR camera in the game object menu. In the inspector section and automatically there will be a Marker database and Image target in the form of an image that is used as a target in the database.

Import the 3D object in unity 3D and adjust its position so that it is above the marker. After that do the same thing starting from pairing the marker and 3d object above the marker.

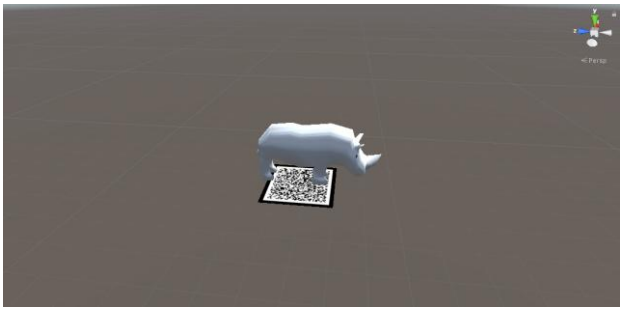

Figure 13. Picture of Objek 3D

To change the marker, you can change it in the target image section. After that, enter the texture on each 3D object. To create a texture, select assets in the menu section, then create material. Then click on the material that has been obtained, and switch to the inspector section. Then select the texture section to add the texture. Texture has been imported along with the imported 3D object. Select the texture according to the 3D object. After that, click on the 3D object material to be added, then switch to the inspector. Select the materials menu section then change all the textures to the textures that have been created, then click apply.

Figure 14. Picture of Objek 3D with texture

The next stage is designing the guidebook, researchers use the Photoshop version cc 2019 application. At this stage, the layout of text, images, and QR Barcode for each page in the book is adjusted to the development of science process skills.

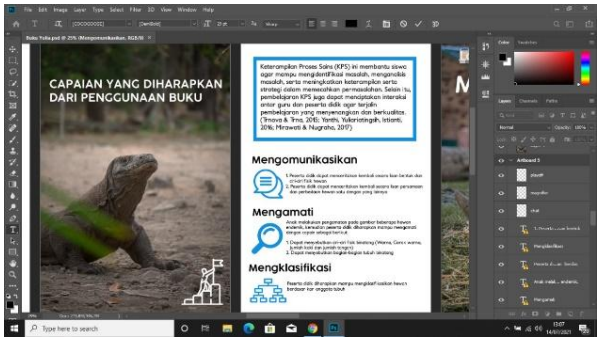

Figure 15. Examples of font use

In making the cover there are examples of endemic animal images when used. It is intended as one example of Augmented Reality contained in the book. The image is taken by screenshooting the camera when scanning the QR Barcode on the tiger animal, then inserted into the cover design.

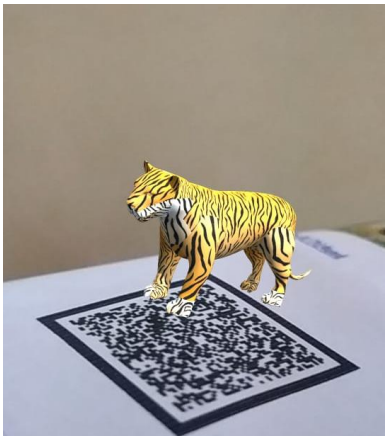

Figure 16. Screenshoot AR

Figure 17. Cover Book

Layout of images and QR Barcodes on several pages of the book that are adapted to the development of science process skills. The images of endemic animals used came from the unsplash.com website. Researchers look for images in accordance with predetermined endemic animals. After that, QR Barcodes were added to some animals in the observing activities.

Figure 18. contents of the book

Product Feasibility Test

Feasibility Test of Augmented Reality-based interactive media is tested by two experts, namely material experts and media experts. Both experts are lecturers at one of the campuses in Indonesia, namely the University of Education Indonesia. Material experts are lecturers of natural science courses and media experts are lecturers of multimedia education courses. The following feasibility test results from each expert on Augmented Reality-based interactive media can be seen in tables 2 and 3.

Table 2
Media Expert Validation Results

Number	Aspect	Ideal Score	Score acquisition	Percentage
1	Appropriateness of 3D Objects in the Application	12	9	75%
2	Appropriateness of Book Design	8	7	87, 5%
3	Appropriateness of Media with its Utilization	12	9	75%
Total		32	25	78%

Based on the validation results from the media expert, it shows that this AR media gets a score of 32 or a percentage assessment of 78%, this shows that this media fulfils the validation criteria. From the results of this assessment, this interactive media is included in the "Good" category from the aspects of appropriateness of 3D objects in the application, appropriateness of book design, and appropriateness of media with its utilization.

Table 3
Material Expert Validation Results

Number	Aspect	Ideal Score	Score acquisition	Percentage
1	Appropriateness of material	20	15	75%
2	Accuracy of science process skill concepts	8	6	75%
3	Clarity of material in helping teachers and students	12	9	75%
Total		40	30	75%

Based on the validation results from material experts, it shows that this AR media gets a score of 30 or a percentage assessment of 75%, this indicates that this media fulfils the validation criteria. From the results of this assessment, this interactive media is included in the "Good" category from the aspects of appropriateness of material, accuracy of science process skill concepts, clarity of material in helping teachers and students. The assessment from the two experts above shows that this AR media can be implemented as an effective learning media to introduce endemic animals to early childhood.

DISCUSSION

Learning media is one of the important principles in implementing the learning process to achieve the intended goals. The use of media needs to be optimized to improve the quality of the learning process (Tafonao, 2018). Therefore, an educator needs to improve the quality of learning by making an innovation, both in terms of methods and development of learning media. This is an effort to solve the problems that occur in the learning process.

Based on the above statement, in this context researchers are trying to make an innovation in the form of developing learning media that aims to introduce endemic animals to early childhood. The learning media designed is based on Augmented Reality. Researchers chose AR because so that children can witness the representation of animals in three-dimensional form or as if real. AR technology itself is a combination of the real world and the virtual world that is displayed simultaneously in two or three dimensions (Iffah et al., 2024; Muntahanah et al., 2017).

Furthermore, the use of this learning media also aims to be an alternative learning media that can be used by teachers in developing aspects of child development. So before this media can be used by students, first this media is assessed by material experts and media experts. Media assessment uses a validation questionnaire to determine the feasibility of using the media related to the depth of material and media feasibility. Based on the results of the study, it shows that AR-based learning media in the introduction of endemic animals is feasible to use in developing aspects of early childhood development, so it is proven that the use of AR-based learning media is feasible for group B kindergarten children aged 4-6 years.

Recent studies have shown that the integration of AR technology in interactive learning media can increase early childhood understanding and interest in recognizing endemic animals. Suharyanto (2021) showed that the use of AR in the introduction of endemic animals in early childhood can increase children's interest and understanding of the material. Similarly, research by Padwika et al., (2023) developed AR-based flashcards to introduce wild animals to early childhood, which showed that this media was effective in improving children's early reading skills. Pradana et al., (2024) developed AR-based learning media to introduce the distribution of endemic animals in various countries, which showed that this media can help children understand the concepts of geography and biodiversity more interactively. In addition, some research results show that the use of AR in introducing animals in early childhood can increase children's interest and understanding of learning materials (Kmurawak & Setyaningsih, 2020; Yilmaz & Gözüm, 2023).

Overall, these studies show that the use of AR in interactive learning media can increase early childhood understanding and interest in recognizing endemic animals. In contrast to previous studies that only focus on visual design aspects, this study also considers the effectiveness of using AR technology. This is reflected in the preparation of a guidebook for using AR made by researchers, to assist educators in guiding and facilitating children during the learning process. This effort is made so that the presence of educators is not replaced by technology, but becomes stronger with its presence (Nugraha et al., 2023; Toyama, 2011).

Although technology-based learning media such as AR offer interactive and engaging learning experiences, the role of educators cannot be replaced. In the context of early childhood education, educators play an important role in building emotional relationships that support holistic learning. Therefore, the integration of technology in learning must be balanced with the active role of educators so that the goal of educators is to bring learners to reach maturity intellectually and socially (Abdullahi & Adebayo, 2019; Atabey, 2024).

CONCLUSION

This research shows that the augmented reality-based interactive learning media that has been designed and validated is feasible with a good category in introducing Indonesian endemic animals to early childhood. Through the visual and interactive approach offered in this media, it can foster children's interest and active participation in learning, especially their understanding of local animals. This media can also be one of the variations of learning media that is innovative and in accordance with the characteristics of early childhood development. Thus, the use of augmented reality-based learning media in pre-school children is a variety of media that can support a joyful and meaningful learning process.

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