

ENHANCING EARLY CHILDHOOD LEARNING EXPERIENCE WITH AUGMENTED REALITY MODELING OF ANIMALS AND DEEP LEARNING

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Abstract: *The pandemic condition greatly influences the educational sector where the learning process must be carried out online which causes the learning experience of children to become less. Education in early childhood is developed to provide meaningful and enjoyable real experiences for children. AR technology is a new digital innovation where many experiences can be obtained without bringing the actual conditions. The objectives of this study are to Analyze the needs for technology-based learning models at the early childhood education level in Indonesia; and Develop mobile-based AR technology using deep learning to improve early childhood learning performance in the present time. The research began with a needs analysis, followed by the development of AR products, then limited trials were conducted and trials on respondents, namely early childhood. The results of the research show that the deep learning-based AR technology developed has a positive effect on improving early childhood learning performance in mastering animal introduction materials. This study has implications for the learning process and in the long run provides benefits to the wealth of applied educational technology science.*

Keywords: *Augmented Reality; Deep Learning; Animal Modeling; Early Childhood*

Abstrak: Kondisi pandemi sangat mempengaruhi dunia pendidikan dimana proses pembelajaran harus dilakukan secara online yang menyebabkan pengalaman belajar anak menjadi kurang. Pendidikan pada anak usia dini dikembangkan untuk memberikan pengalaman nyata yang bermakna dan menyenangkan bagi anak. Teknologi AR merupakan sebuah inovasi digital baru dimana banyak pengalaman bisa didapatkan tanpa membawa kondisi sebenarnya. Tujuan penelitian ini adalah menganalisis kebutuhan model pembelajaran berbasis teknologi pada jenjang pendidikan anak usia dini di Indonesia; dan Mengembangkan teknologi AR berbasis seluler menggunakan pembelajaran mendalam untuk meningkatkan kinerja pembelajaran anak usia dini di masa sekarang. Penelitian diawali dengan analisis kebutuhan, dilanjutkan dengan pengembangan produk AR, kemudian dilakukan uji coba terbatas dan uji coba pada responden yaitu anak usia dini. Hasil penelitian menunjukkan bahwa teknologi AR berbasis deep learning yang dikembangkan memberikan pengaruh positif terhadap peningkatan performa belajar anak usia dini dalam penguasaan materi pengenalan hewan. Penelitian ini berimplikasi pada proses pembelajaran dan dalam jangka panjang memberikan manfaat terhadap kekayaan ilmu teknologi pendidikan terapan.



Kata Kunci: Augmented Reality; Pembelajaran Mendalam; Pemodelan Hewan; Anak usia dini

INTRODUCTION

Pandemic conditions are very troubling for people around the world, because various activities cannot run smoothly. A lot of negative impacts are experienced, especially for the education sector. All activities are limited to prevent the spread of the Corona virus, including educational activities. The government finally made a policy to carry out the distance teaching and learning process, namely via online (in the network) (Estacio & Raga Jr, 2017). This causes a lack of learning experience (Shirley, 2001) for students in educational activities. However, online learning makes us aware of the tremendous potential of the internet (Baek et al., 2022) that has not been fully utilized in various fields, including education. Without time and space limit, educational activities can be done anytime and anywhere. Moreover, in an era where there is no certainty when this pandemic will end, online learning is an absolute necessity that must be fulfilled by all Indonesian people.

It is necessary to develop AR-based applications (Avilés-Cruz & Villegas-Cortez, 2019) using deep learning (Yang et al., 2021) for early childhood (Singer-Brodowski, Brock, Etzkorn, & Otte, 2019) taking into account the main reason that the use of mobile devices has been widely used at all school levels. AR is suitable for young students to practice interactivity and activity. With interactive visuals (Brennan & Monroy-hernández, 2010), students will absorb the material more easily. Even though students are not interacting with the teacher in class, AR can help them do their homework and assignments more optimally.

The learning process in early childhood education has reached a very high level of innovation. For example, the use of gadgets today is an achievement of the digital learning process that has spread throughout Indonesia. The use of gadgets (Avilés-Cruz & Villegas-Cortez, 2019) in learning provides opportunities for children to be able to self-actualize with positive freedom and makes it easy for children to gain a variety of knowledge about anything (Moore, 2009). AR technology is a new innovation in the digital field (Martin & Grudziecki, 2006), many experiences can be obtained without bringing original conditions. Through AR, all materials can be presented in real time and brought into the room without the need for special space. An interactive augmented reality can help young children understand information at their comfort level and for a long time. In addition, augmented reality also has advantages in developing children's motor skills (Morton et al., 2016). This is because in AR various forms of digital content such as audio, music, video, 3D images (Neves et al., 2020) and pictures are combined to create a learning experience for children.

Deep learning in a learning process is conditioned by a person's gesture and feedback when knowing a material that is learned. Deep learning (Moore, 2009) is characterized by students' willingness to explore a material and motivation from within themselves. The application of deep learning has advantages where students are easier to achieve and have

better emotional wellbeing (Contract, Not, Signed, & Bda, 2009). Deep learning is characterized by students having the intention to learn in order to understand the learning material, find meaning and understand the ideas in it. The use of deep learning will lead to an active and meaningful learning process for students.

AR in early childhood education is very appropriate, because many things can be revealed by bringing direct experience through the process of self-learning. Utilization of educational media using Augmented Reality (Mullen, 2011) can stimulate the mindset of students in thinking critically about problems and events that exist in everyday life. Utilization of educational media (Moore, 2009) with augmented reality can directly provide learning wherever and whenever students want to carry out the learning process. Early childhood characteristics that like to play, have high imagination, and have high curiosity can be facilitated by the use of AR. This is because AR is designed with technology that is able to combine two-dimensional or three-dimensional virtual objects into a real environment (Powers & Barnes, 2001) and then display them or project them in real time.

This research aims to Analyze the needs of technological learning models at the early childhood level in Indonesia; and Develop mobile-based AR technology using deep learning to improve early childhood learning performance in the present.

METHOD

This research uses the research and development method (Gall, Gall, & Borg, 2003) and also adopts steps that have been carried out by other studies, namely starting with literature studies, planning, development, preliminary design, limited trials, revisions, and finally wide-scale trials, and final products (Riwanto & Budiarti, 2020). The data obtained from this research is data from expert validation, the data is in the form of forms filled in by media experts, material experts and linguists. Meanwhile, questionnaires and feedback were obtained from data distributed to teachers and students through documentation during the trial and on the experimental sat to determine the effect of this media.

In the initial literature study step, it was found that AR in early childhood education can foster a variety of positive gestures that can foster good independent learning patterns. This research design begins with an analysis of basic competencies in early childhood education, then the basic competencies are developed into a product development step. The development process carried out refers to the adopted development steps from Borg and Gaal, and this step begins with the conversion of the interface display sketch into an AR prototype that can be read by a computer application. The finished prototype is then validated by experts using an open form validation process. During this validation process, limited trials were also taken to teachers and students to find out feedback from all of them. The entire process of taking instrument data from various sources of experts and teachers is then used as an interpretation of data feasibility. The data analysis process in this study uses qualitative and based on questionnaire data.

RESULTS

This research begins with a needs analysis of learning models using technology at the early childhood education level in Indonesia. The needs analysis was carried out with literature studies and interviews with early childhood educators. The results of the literature study show that AR can be used as a medium in the independent learning process and can provide real experience for students. The results of interviews with early childhood teachers show that the early childhood learning process is directed at providing rich experiences for children. A fun learning process is needed so that children feel comfortable and motivated to learn. Real experiences that can be presented at school are limited, where teachers have difficulty in delivering abstract material. On the other hand, limited space and time also make it difficult for teachers to provide real experiences for early childhood students. So that teachers need learning tools and strategies that can overcome the problems faced. The use of AR in the learning process can be used as a means of providing real experiences for students because AR technology is able to present real objects in digital form. So that the learning process can be done anywhere and anytime, without being adrift in space and time. Abstract concepts that are difficult for early childhood to understand, can be clearly visualized so that it will be easy to understand.

This research also develops AR technology using deep learning to improve early childhood learning performance. After analyzing the needs of AR technology in learning at an early age level, the AR product development planning process is carried out. This technology design is designed using an open planning system, meaning that this system is designed through FGDs between researchers and classroom teachers. This FGD aims to reveal the specific needs of learning materials in the classroom. While the design process begins with making an application flowchart as follows:

FLOWCHART APLIKASI DENGAN VR

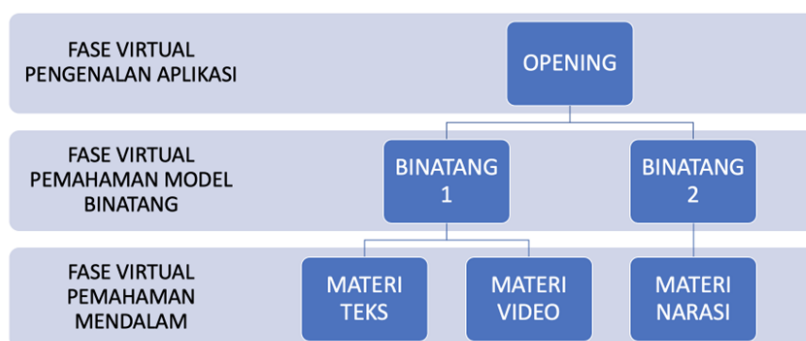


Figure 1. Flowchart

Referring to Figure 1, an application was developed with 3-phase virtualization. In-depth explanations of the material objects are explained through videos, texts and narratives that are prepared comprehensively in the application.

After the planning process was completed, the development process was continued. The development process with sketches is done virtually in the application coding process in Unity Developer. Several times the prototype was designed so that it could find the most appropriate gesture for early childhood.



Figure 2. Development process with unity

Figure 2 is the development process through unity, with various virtual project asset creation. Unity is an application that can be used to develop various 3-dimensional modeling for object learning needs. The next step is preliminary design. The front end design of the application requires various considerations, such as design considerations, coloring, and even the virtual surrounding environment.

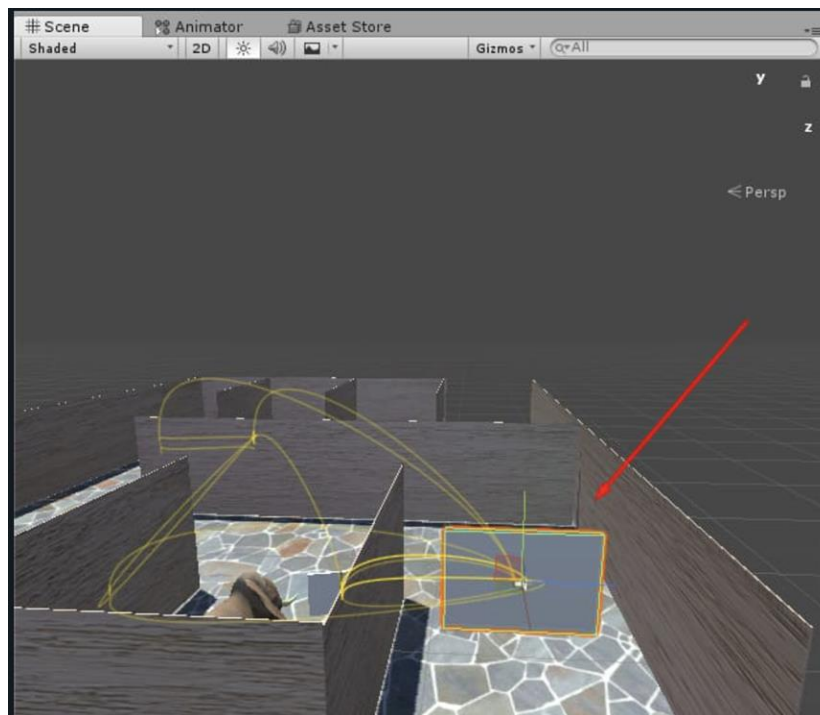


Figure 3. Design process as required

Figure 3 is the process of designing according to the needs, so that in the sketch drawing some layout adjustments are made. The next step is to conduct a limited trial of the developed product. This trial is conducted to evaluate the prototype so that it is better prepared to be presented in real classroom learning experiments. experiments that will be carried out in pre-schools allow students to play an active role in using the device and application, so it is necessary to consider factors that could potentially endanger students.



Figure 4. Limited trial

The limited test process as shown in Figure 4 was tested on 1 person with consideration of usability. This consideration was also chosen in the limited test respondents were students to provide objective input on the application that would be used in the experiment later.

The next step was product revision. The first revision was carried out as input from pre-school teachers because they saw several shortcomings such as:

Table 1. Application Improvement Notes

no	shortage	Description
1	The virtual reality view port is still too high, so the trial requires the person wearing the device to look up.	revised by replacing the virtual environment landscape
2	animal models need to be narrated or videoed	given a narrated video
3	the view port runs too fast, which prevents a good look at the animal model.	coding improvements made

After making improvements based on the notes in table 1, the product was ready to be tested on a wide scale, namely on children after early childhood.

The wide-scale trial was conducted at PAUD Al Mahira Semarang. Students tried the AR application developed with the help of teachers and researchers. The trial was conducted to find out whether the AR application using deep learning and animal modeling developed was suitable for use. In addition, to find out whether the AR technology developed can improve children's understanding of several types of animals and their characteristics.



Figure 5. Wide scale trial

DISCUSSION

The theory expressed by Gecu-Parmaksiz & Delialioğlu (2020) states that the use of AR in early childhood learning activities has a positive effect in developing their skills. The findings in the field show the same conditions as the theory where Augmented Reality (AR) technology can be used as a medium in the early childhood learning process at PAUD Al Mahira Semarang. The development of augmented reality for the learning process begins with a needs analysis to determine the material needs and competencies of students (Yousef, 2021). The process was also carried out in this study where AR product development planning was carried out with an open planning system involving FGDs between researchers and classroom teachers to reveal the specific needs of learning materials in the classroom. The use of the unity application can produce 3D objects needed in Augmented Reality (Lai et al., 2019). Conditions in the field in the process of developing AR applications for early childhood learning are carried out using Unity, in order to develop various 3-dimensional modeling for object learning needs.

The product development process must pay attention to the color and shape of 3D objects to make them look real (Hung et al., 2017). The next step is preliminary design, where in this process the design, coloring, and virtual surroundings that fit the needs are considered. The stages in AR development include a prototype testing process to evaluate the product before it is applied in the learning process (Yousef, 2021). The theory is in line with the field conditions where a limited trial of the product is conducted to evaluate the prototype and prepare for learning experiments in real

classrooms. After revising the product based on feedback from teachers and limited test respondents, the product was ready to be tested on a wide scale at PAUD Al Mahira Semarang. The implementation of AR products developed by participants is needed to find out whether AR products are easy to use and have an impact on the learning process (Rojas-Sola & Aguilera-García, 2018).

The conditions in the field have reflected this theory where a wide-scale trial was conducted to find out whether the AR application developed using deep learning and animal modeling is feasible to use and can improve children's understanding of various types of animals and their characteristics. The theory put forward by Yilmaz et al., (2017) The use of AR in the early childhood education environment has an impact on the development of children's competencies. This is in accordance with the field findings, namely the results of a wide-scale trial conducted at PAUD Al Mahira Semarang show that the AR application developed can be used to increase children's understanding of various types of animals and their characteristics. This can be seen in the response of students who enjoy and like using AR applications in the learning process in class. Augmented Reality technology in this research can give an impression to children in their learning experience. This is in line with previous research where hologram technology can provide new experiences or impressions for Arabic language subjects in elementary schools (Ismail et al, 2021).

CONCLUSION

AR technology is needed in the learning process in early childhood. So that AR product development using deep learning for early childhood is carried out. AR learning media development is carried out based on the Borg and Gaal model adoption research flow chart which includes several steps, namely literature study, planning, development, preliminary design, limited trial, revision, wide-scale trial. The process of developing ar-based learning media involves various parties and procedures. including literature studies conducted to analyze the needs of technology learning models at the early childhood level. Furthermore, the planning process is carried out with the initial process of conducting FGDs between researchers and class teachers, then making AR media flowcharts. The next step is the development process which is carried out virtually in the application coding process in Unity Developer. Then proceed with the preliminary design to adjust the appearance of the application according to the needs. The next step is limited testing with 1 participant with usability considerations. After testing, improvements were made according to the notes on the limited trial. The last step is to be tested widely to early childhood.

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