Developing Augmented Reality Application on Living Komodo Dragon for Elementary School Students during the New Normal of COVID-19 Pandemic

by Hadi Sutopo

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Abstract— The COVID-19 pandemic has brought much challenge and disruption to the lives of students in elementary through high schools, their families, and their communities. Most students cannot attend schools due to the increased spread of COVID-19, and they learn online from home. This paper aims to develop an augmented reality learning model that delivers information on Komodo dragons that can be accessed using smartphones. The developing augmented reality application uses the Augmented Reality Development Method. It can be that the augmented reality learning model would be easier, more fun, and interesting for students in conducting online learning the New Normal of COVID-19 Pandemic. This research is still ongoing in the Testing phase and the research findings show that the learning model is feasible to be implemented.

1 Introduction

The COVID-19 pandemic has brought life disruption across the globe to people of all ages. This disruption has impacted all of the lives of individuals including education. The experience of education is a core life component for people from the ages of kindergarten to the late teens for those who are in college. These contexts of life have moved into a new normal for survival through the pandemic and perhaps laid the foundation for a more permanent new normal. [1]

As COVID-19 is still a global pandemic experience with an unknown ending date, the published literature is still limited on the impact of the experience and lessons to be learned – this is still a work in progress. Szente argued that a disaster category that included a health crisis, which could embrace the current COVID-19 pandemic [2]. There is much literature on disaster experience and impact with the education that can support to study of the impact of COVID-19 on the person in the experience of education and the business of education. The guidance can provide information to teachers and students both in the development of prevention of negative impacts as well as implementation and sustainability in coping and developing during a disaster or pandemic. Insights can also be gained on planning future interventions to help students and schools survive and thrive in a pandemic that does not necessarily end.

Education has developed in the use of learning modalities during the COVID-19 pandemic, where online learning alternatives are implemented in schools from kindergarten to university. Brass and Lynch said that the use of online learning had been developed even before the Covid-19 pandemic. This online learning offers

students the opportunity to progress individually through a competency-based curriculum that is aligned with educational standards [3]. The important challenge and problem of online learning is the using online learning technology for teachers and students.

Hung, et al. [4] said that the role of educational leadership in managing a new normal of learning during the COVID-19 pandemic. The pandemic had generated a great opportunity in the midst of the pandemic, particularly in the learning system. The barriers to successful progression were identified that needed management in a new normal – infrastructure to promote equality in learning space such as accessibility of internet of student communities and homes; appropriate content of digital learning; and development and encouragement of educational environmental systems that are proper.

The development of education and information technology has changed the way we live today, including the learning method. Augmented reality (AR) is a display in an application that, directly or indirectly, shows the real-world physical environment that is added with input from computer processing results such as 3D models, video, sound, graphics, or GPS data.. Augmented reality enables digital information to be superimposed and integrated into the physical environment. Many people now at home during a global pandemic, AR is a tool that can help to transform the immediate surroundings into learning, work, and entertainment spaces. [5]

When information technology is used to support students with new teaching methods, it can enhance the meaning of content to be understood. Students can find information, use augmented reality applications as well as 3D models to convey what they have learned. The development of mobile devices is good in implemented on online learning [6]. Mobile devices such as smartphones are used increasingly by people everywhere including schools and homes, which makes educational information can be delivered increasingly.

This study describes developing augmented reality applications, that contain about Komodo dragons, what they look like, where they live, and what they eat. Students are worth learning the unique animal in the world. Komodo island one of the New 7 Wonders of Nature, that designated as one of the wonder of the world by the New7Wonders organization [7]. The other six wonders are Halong Bay in Vietnam, Amazon in Latin America, Jeju Island in South Korea, Table Mountain in South Africa, Iguazu Falls in Latin America, and Puerto Princea Underground River in Philippines. Indonesia's Komodo National Park was declared to protect the Komodo dragon in 1980.

This research aims to build an augmented reality application that can be accessed by students at home using their smartphones. The advantages of the application are very interesting for children, support the learning material, and enhance the online learning during the COVID-19 pandemic.
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1.1 Komodo Dragon

Komodos are hard to find in the world only in Komodo National Park which is located in the Lesser Sunda Islands of Komodo, Gili Montang, Rinca, and Gili Dasami. In the island of Flores, the big lizards live freely. The habitat of the lizard as Komodo

can live in tropical dry forest and savanna. Komodo lives in very heat around 95 degrees Fahrenheit with 70 percent humidity in the islands. [8]

According to National Geographic, as carnivores, Komodo dragons eat meat while hunting, such as large buffaloes, deer, carcasses, pigs, and even humans. They have unique ways to kill prey. First, they appear and kill their prey with their large legs. Then they used their sharp and jagged teeth - like sharks - to tear their prey to death. If the prey escapes, it will die within 24 hours of blood poisoning because Komodo's saliva contains 50 strains of bacteria. [9]

The Komodo Lizard that lives in Komodo National Park is, Varanus komodoensis. The big lizards do not live in the world anymore, especially for their implication of evolution. The big lizards are known as 'Komodo Dragons', due to the gigantic appearance with aggressive behavior. The lizards can to an almost length of 3 meters. The park where Komodo dragons live provides many species such as the fowl, rat, and deer. Komodo dragon is one of the world heritage that was legacy from the past, and live today, and should live in the future. [10]

The special species that lives now as the Komodo dragon is worth to be known by people in the world. Hence, the home of the gigantic lizard in Komodo Island is one of the most popular places to be visited by domestic and international tourists. Elliott [6] stated that tourism can be realized in many objects, depending on the basis of the study, such as economics, sociology, education, psychology, or geography. It can also be viewed as pleasurable and profitable, or as a troublesome nuisance. United Nations Statistical Commission, following the advice of the World Tourism Organizations (WTO) stated that the term 'tourism', 'visitor', and 'tourist' generally used in tourism statistics [11].

1.2 Augmented Reality

Augmented Reality (AR) system combines the virtual world and real-world objects. The virtual objects seem to display in the same location as the real-world objects [12]. AR is not restricted only to the sense of sight, but it can be combined with all senses, that people can hear, touch and smell [13]. This differs from Virtual Reality (VR) where the users control completely the application in the AR application, while the users only watch the content in VR.

The current state of AR applications in education. A considerable amount of literature has been published in AR's application in educational contexts for a wide variety of learning domains. However, the state of current research on AR for education is still in its infancy [14]. According to Cheng & Tsai [15]the research in this field should continue and should be addressed to discover the affordances and characteristics of AR in education that differentiate this technology from others. Deepening this analysis will allow for discovering the unique value of the environment of learning based on augmented reality. The potential of augmented reality application in educational is just now being explored. Dunleavy, Dede, & Mitchell [16] point out that "we are only beginning to understand effective instructional designs for this emerging technology."

1.3 Learning Media

Education uses media as an important part of the infrastructure. Lee states that there are three forms of application based on multimedia: computer-based learning, broadcast-based learning, and mobile-based learning [17]. The use of media such as mobile devices and television depends on the need of learners and the impact of the multimedia program. It was found that learning design for radio, computer, mobile devices, and television is different. In avoiding any complex problem and giving a chance for teacher's creativity, the designing and programming of learning are of significant importance. Widyasari et al. [17] stated that learning using mobile devices can improve the learning motivation of students. Her research about learning that used QR-code to link and access a math game is very interesting for children. Children can play the game at a flexible time and place. This model of learning has motivated children in math learning. Another research was done by Widjaya and Sutopo who gave an experience that multimedia learning with interactivity make students enjoy it. The learning model is a multimedia application that uses interactivity to continue with the other item or subject [18]. Multimedia applications is called mobile multimedia if it can be accessed on mobile devices [19].

2 Method

The research is conducted in elementary schools in Manado from March 2020 to November 2020. The object of research is augmented reality application on Komodo Dragons that can be accessed using smartphone.

2.1 Research Method

This study uses the Augmented Reality Development Method [20] divided into six phases, see Fig. 1. which consists of ten following stages: (1) Assignment, (2) Analysis, (3) Creation, (4) Testing, (5) Implementation, and (6) Operation. These include (1) *Assignment*. The assignment stage is the foundation of augmented development, so it should be done perfectly. The researchers have to create an idea of the whole concept of the augmented reality application, including the requirements of the development; (2) *Analysis*. The analysis stage starts with the rough design. This stage should be done to meet the requirement of assets the tasks that are decided, the code, and the story that generates the virtual reality. This stage is the guidance for working in the next stage; (3) *Creation*. The creation stage is a stage that the developer team collects, and create some assets. During the creation stage, using augmented reality development tools, engines, and platforms. All of the assets are used in developing the augmented reality application; (4) *Testing*. The testing stage is the phase that whole assets, codes, and interactivity are tested. The tests focus on errors and make the solution of the code exceptions, and also the overall of the virtual environment. The team developer should test every building of the application immediately. The virtual environment and interactivity are also tested by the users; (5) *Implementation*. After the testing stage, the product will be checked in the next stage according to the testing. (6) *Operation*. The

operation stage is the stage that the developer has to monitor the implemented virtual environment and to gain bug for further revisions. The developer team and the customers should gain the experience applied from the augmented reality application. In this stage, the assets should be known whether they can be used in other projects. The developer team watches users' actions in order to check whether there are bugs or problems that users have.
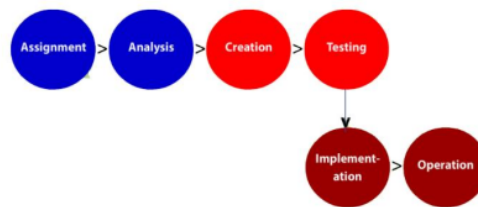

Fig. 1. Augmented Reality Development Method [20]

2.2   Data Analysis

The object of the research was augmented reality application, and the research was conducted in an elementary school in Manado. Respondents consisted of students and teachers. The data was collected and analyzed using mix method, quantitative and qualitative approach [21]. Analyzing and data processing carried out with six stages including assignment, analysis, creation, testing, implementation, and operation [20].

3   Results and Discussion

3.1   Assignment

The goal of this phase is to get information that students and teachers need to develop augmented reality application. The research phase was conducted on a small scale at an elementary school in Manado, Indonesia. Data was collected from interviews and questionnaires with details: (1) Questionnaires with open questions were used to find useful information to support the theory, information needed for system development, information about what kind of system to be developed that met their needs; and (2) interviews with open questions were used, then the respondent gave an answer that was not restricted from a general point of view. In addition, extensive interviews were conducted to obtain data on the product and learning process. Table 1 shows the list of

questions and answers that was used for the teachers, and Table 2 [14] shows the list of questions and answers that was used for the students.

Table 1. Questionnaires and answers of teachers

No	Questionnaires	Answers
1	It is worth digital learning resources as an effective risk mitigation solution for managing children's learning during the COVID-19 pandemic.	It is worth
2	What kind of applications do you use to support learning?	• Multimedia presentation • Video conference • Massage using smartphone
3	Learning technology is growing now with many kinds of tools. How about using augmented reality to support your teaching.	Strongly agree and agree.
4	It is worth the augmented reality application as a learning resource for students' cognitive development.	Strongly agree and agree.
5	It is worth building children's learning motivation stability through digital learning sources.	Strongly agree and agree.
6	It is feasible that the augmented reality application is able to develop indicators of recognizing activity patterns and realizing the importance of time for students.	Agree
7	Is interesting the content of cognitive development learning using augmented reality?	Augmented reality can enhance learning especially for disability students
8	What is your most used electronic device?	I use my phone more than using PC / laptop
9	Which social media platform do you use most often. Do rank from used most (number 1) to use least (number 6). For example, if "Facebook" is the one you use most often, type 1 next to "Facebook".	WhatsApp

No	Questionnaires	Answers
10	Where do you acquire most learning information from (choose one that you source the most)?	• Via mobile devise/gadget: accessing a link that is SHARED by friends on social media (example: through Whatsapp, Telegram, Instagram, etc.) • Via mobile device/gadget: INDIVIDUAL RESEARCH example "Google Search, with the absence of any attached links".
11	Which internet platform do you count on when trying to get information on learning?	• Mobile applications (Smartphone.) • Official websites (from Ministry Education). • E-books

Table 2. Questionnaires and answers of students

No	Questionnaires	Answers
1	How do you find some learning resource.	• YouTube • Game • Searching on Google
2	During the COVID-19 pandemic most of the learning were conducted online. Can you receive the information clearly?	The information from teachers is hard be understood clearly at once.
3	Learning technology is growing now with many kinds of tools. Do you know the augmented reality application.	Just a little
4	How did you know the augmented reality application	From internet

5	How about using augmented reality to support your teaching.	It will be interesting
6	It is interesting to access an augmented reality application containing a 3D model?	Strongly agree
7	The augmented reality app is interesting for getting to know animals, plants, and more?	Agree
8	Are you familiar with Komodo Dragon in Indonesia as a world wonder?	Just a little
9	What is your most used electronic device?	I use my phone more than using PC / laptop
10	Which social media platform do you use most often. Do rank from used most (number 1) to use least (number 6). For example, if "Facebook" is the one you use most often, type 1 next to "Facebook".	WhatsApp
11	Which internet platform do you count on when trying to get information on learning?	• Mobile applications (Smartphone.) • Official websites (from Ministry Education). • Ebooks

Data were analyzed using descriptive-analytical methods and interpreted narratively based on the results of the study. Multi-step analysis and data processing involves collecting data, preparing data for analysis, reading carefully, developing code, presenting data, and analyzing data [22]. Based on research findings after discussions with students and teachers, augmented reality application were described in Table 1 and Table 2, the augmented reality should be developed.

3.2 Analysis

The analysis stage starts with the rough design. This stage was done based on the findings of the preliminary survey using questionnaires and can be described in Table 3.

Table 3. Concept of Komodo Dragon application

Object	Description
User	Elementary school students and teachers

Module	Module: - Text - Images - 3D model
Marker	Markerless

3.3 Creation

The developer team collects, and create some assets and objects. There were many assets that can be found in the marketplace, and the researchers bought 3D assets of Komodo Dragon and download free assets of the environment and images.

After getting the assets, they were used to develop the augmented application. Many popular software development tools are available to be bundled as Unity, Vuforia Engine, and Android studio. Unity Editor is a popular and useful creation platform for creating powerful augmented reality experiences for handhelds and digital glasses. Visit https://unity.com to download and set up Unity. The Vuforia Engine is easily added to any project, and a prime example of Vuforia is available on the Unity Asset Store to help you get started. [23]

The Vuforia prime example provides comprehensive Unity knowledge demonstrating how to create AR applications for everyday objects and environments using Vuforia targets and trackers. Vuforia Engine supports the following versions of the operating system, tools, and tools for developing applications with the Vuforia Engine platform is a software development kit (SDK) for creating Augmented Reality applications. Developers can easily add advanced computer vision functionality to any application, enabling it to recognize images and objects and interact with real-world spaces. [24]

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development.[8] It is available for download based on operating systems or as a subscription-based service in 2020.[9][10] It is a replacement for the Eclipse Android Development Tools (E-ADT) as the primary IDE for native Android application development. [25]

Some augmented reality platforms are also available that users can develop augmented reality application without experience in an algorithm, programming, and developing the mobile application. Hence, the researchers develop augmented reality using one of the platforms named Assemblr Studio. Table 4 show the objects for developing augmented reality application.

**Table 4.** Object fpr creating Komodo Dragon application

Object	Name	Description

	Komodo Dragon	Bought from skechfab, https://sketchfab.com
	Tree	Available at Assemblr Studio
	Grass	Available at Assemblr Studio
	Grass	Available at Assemblr Studio

After collecting the object, an augmented reality application was build using Assemblr Studio as can be seen in Fig. 2. Fig.3 shows a preview the augmented reality with text that informs about Komodo Dragon.
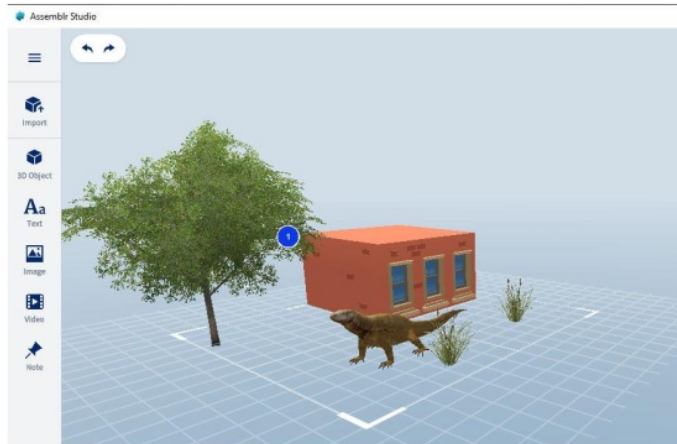
Fig. 2. Work area of Assemblr Studio
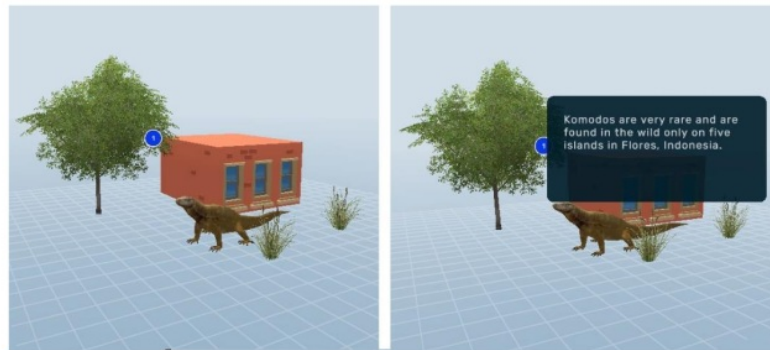
Fig. 3. Preview of augmented reality in Assemblr Studio

3.6 Testing

After the development of augmented reality application using Assemblr Studio, students can access on their smartphone through the Assemblr apps. So they should install the application on their smartphones. Students open Asemblr on their smartphones and then search for the Komodo creation. Fig. 4 shows the Komodo augmented reality on smartphone.
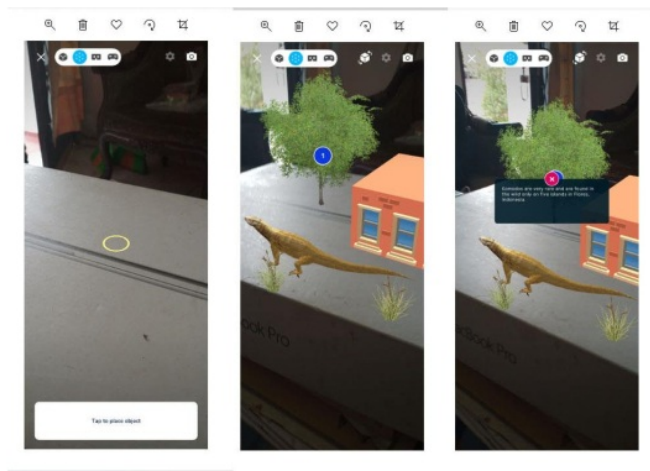

Fig. 4. Accessing augmented reality using smartphone

4. Limitation of Research

Limitations of research in prototype development, especially development of augmented reality application include three things: (1) The research and development that consists of 6 phases was not fully implemented. The 5th phase Testing was conducted in a small scale; (2) The 5th phase Operation will be conducted after the large scale of testing and implemented in most of the elementary school in Manado, Indonesia.

5. Conclusion

Based on the objectives and results of this study, the following can be concluded: (1) Preliminary research and information collecting in which students take information needs for augmented reality application. The initial investigation information serves as

a guide for developing for augmented reality application. (2) Development of for augmented reality application using the Augmented Reality Development Method; and (3) for augmented reality application is very useful to help teachers since it can be used for independent learning and is motivated children to learn in COVID-19 pandemic. Most of them said that they thought that teachers were capable of using AR applications and were willing to implement this technology in their teaching [26].

For future work, the augmented reality application must be continued in the operation phase. In addition, the augmented reality application must be able to run on any platform, mobile device product, and mobile device resolution.

6. Acknowledgement

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