Application of augmented reality technology in biological learning

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Abstract. The writing of this paper aims to introduce Augmented Reality technology to the world of education in schools in Indonesia precisely in Biology learning. Previously there have been several studies discussing the application of Augmented Reality technology to the world of learning but the object of research that was studied was too broad, while the research that the author did was more focused on learning biology. The research method used in this paper is a descriptive research method by giving questions in the form of questionnaires to 50 respondents. Augmented Reality technology in its application to Biology learning is expected to contribute innovation and add variations in existing learning media before, from the results of research conducted, it was found that Augmented Reality technology received many positive responses in its application to the world of education. Augmented Reality can be made using some software that is used such as 3D Blender, Unity and other supporting software. With the application of Augmented Reality technology in the world of education is expected to be able to add learning methods to be more interactive and interesting.

1. Introduction
Along with the development of the times until now, almost everything that happens now is based on technological progress. This field is a strong driver in the cycle of globalization. Likewise, with the world of education that is inseparable from the influence of technological developments [1], is human knowledge, equipment, work methods, processing systems, and devices used. This is shown by many ways used in the teaching and learning process [2], one of which uses technology that makes it easier for students to more easily understand the material provided by the teacher.

Over the past few years, AR applications have become portable and widely available on mobile devices. And start entering other aspects of our lives in a real and interesting way. Facilitating learning everywhere, AR will give students quick access to site-specific information collected and provided by various sources [3]. Augmented reality is technology that has the ability to project computer graphics into the real world [4]. Augmented reality is a technology that MIT recognized as one of the ten technologies that emerged in 2007 [5]. AR is different from Virtual Reality (VR) because in VR people are expected to experience a virtual environment that is computer-generated. In AR, the environment is real, but it is expanded with information and images from the system. In other words, AR bridges the gap between real and virtual in a subtle way [6].

The types and sources of data used in conducting research are using primary data and secondary data. Primary data is data obtained through filling in questionnaires, while secondary data obtained from
literature, books, or other documentation taken indirectly [7]. The method of data collection used is by conducting observations and interviews. Observation is a form of observation carried out systematically about an object by analyzing, while interviews are a form of direct communication to obtain information [8,9].

In its application in the field of biology later with this technology will realize objects that previously can only be seen through the media books and props such as organs and other objects into virtual forms that can be accessed through smartphone devices so that it will save time and money [10].

The purpose of this research is to make or create new learning methods that are more interactive and interesting to increase students’ interest in learning, this research is conducted by using quantitative research methods where the data obtained by conducting observations and interviews.

2. Method
This research was conducted in the city of Bandung in October. The sample we took was 50 students at SMAN 1 Bandung. The research method used is descriptive method with 50 sources. The types and sources of data used by the author in conducting research are using primary data and secondary data. Primary data is data obtained through filling out questionnaires given to respondents about the use of augmented reality technology in biology learning while secondary data is obtained from literature, books, or other documentation taken indirectly among them about the product being studied.

Data collection methods used are by conducting observations and interviews. Observation is a form of observation that is carried out systematically about an object by analyzing and recording carefully, while interviewing is a form of direct communication between two parties to get an information.

3. Results and discussion
Augmented Reality (AR) is known as an interactive technology that is able to project virtual objects into real objects in real time. The development of AR technology at this time has contributed a lot to various fields. In the field of education, AR can be used as a means of learning media, one of which is to facilitate students in getting information about objects such as organs and others. Users can visualize 3-dimensional objects, so that they can enhance the perception and interaction of users with the real world.

In this section some examples of AR-based applications will be explained using the Marker Based Tracking and Markless AR methods. One of them can be seen in the picture below which shows how AR projects objects in the form of body organs, cell forms and other organs in virtual 3D form.

The following is a description of how AR (augmented Reality) technology displays 2D objects into 3D by using a cellphone camera, for example can be seen in figure 1. The Human Brain forms contained in the book are displayed in the form of 3D objects.

![Figure 1. Human brain form.](image)
Not only small objects AR technology can also display 3D objects that are quite large in size as found in figure.2, we can see objects such as organs that are large enough to be displayed in 3D objects.

![Figure 2. Organs.](image)

The figure above describes the use of augmented reality in biology, one example of which is the discussion of parts of the human organ.

The results of the study that the authors collected by distributing questionnaires to 50 high school students with the following questions.

3.1. Do respondents know about this Augmented Reality technology?

**Table 1.** Table results of knowing whether or not respondents respond to augmented reality

| Response         | Total | Percentage |
|------------------|-------|------------|
| Know             | 30    | 60%        |
| Do Not Know      | 20    | 40%        |
| Total            | 50    | 100%       |

Table 1 describes the results of the questionnaire shared about whether or not the respondent knows about augmented reality technology, and gets the results that most respondents already know about augmented reality technology.

3.2. Are the respondents easy to understand the material delivered only through the media of books?

**Table 2.** The level of respondent's understanding of the material contained in the book.

| Response               | Total | Percentage |
|------------------------|-------|------------|
| Very Understand        | 5     | 10%        |
| Understand             | 30    | 60%        |
| Lack of Understanding  | 10    | 20%        |
| Do not Understand      | 5     | 10%        |
| Total                  | 50    | 100%       |

Table 2 explain the level of understanding of respondents to the learning material that is delivered through textbooks.
3.3. *Accompany if this Augmented Reality technology is applied in learning biology at school?*

**Table 3.** Agree whether or not respondents respond to the application of augmented reality at school.

| Response       | Total | Percentage |
|----------------|-------|------------|
| Strongly Agree | 35    | 70%        |
| Agree          | 10    | 20%        |
| Do not know    | 5     | 10%        |
| Disagree       | 0     | 0%         |
| Strongly Disagree | 0  | 0%         |
| Total          | 20    | 100%       |

From the questionnaire given about whether or not the respondent agrees if augmented reality is applied in the school the results show that the majority of respondents strongly agree with the delivery of AR in school, the results of the questionnaire can be seen in table 3.

4. **Conclusion**

Based on the results of research conducted by the author regarding the Application of Augmented Reality Technology in Biological Learning, it can be concluded that Augmented Reality technology in biology learners in schools gets many positive responses where this technology will bring more interesting and interactive learning methods for students. But there are some things that must be considered in the application of this technology, such as making an application that must be done by people who understand the field so that there is no misinformation and so on. This research still needs to be developed regarding the objects that are used not only include parts of the body's organs.

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