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**IMPLEMENTATION OF AUGMENTED REALITY LEARNING MEDIA ON GEOGRAPHY SYMPTOMS TO IMPROVE GEOGRAPHY IN STUDENT SOCIAL SCIENCES**Ajat Sudrajat<sup>1</sup>, Ojat Darajat<sup>2</sup>, Sri Sumiyati<sup>3</sup>, Ary Purwantiningsih<sup>4</sup>, Lisa Dwi Ningtyas<sup>5</sup><sup>1,2,3,4</sup>Faculty of Teacher Training and Education, Open University, Jakarta, *Indonesia*<sup>5</sup>Faculty of Psychology, Pancasila University, Jakarta, *Indonesia*

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**ABSTRACT**

Geography symptoms are one of the materials in lectures intended for elementary school teacher education students at the Open University. Not infrequently, students feel difficulty in understanding the lesson. To increase students' understanding of geographical phenomena, augmented reality learning media was developed to improve student learning outcomes in this material. This research is research on the development of instructional media with the help of experimental research to see the effectiveness of its application. The sample was 90 elementary school teacher education students at the Open University. The results show that augmented reality is proven effective in increasing student learning outcomes in geographic phenomena in social studies. It is recommended that lecturers who teach material on geographic phenomena use this augmented reality learning media to support learning.

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## **PRELIMINARY**

In order to improve the quality of education in Indonesia, improve the quality of the learning materials used. The quality of teaching materials today centers more on technological developments (Gluchmanova, 2019; Jakicic et al., 2016; Wang et al., 2020). In the era of technology 4.0, technology development is high-speed. This has resulted in the world of education being forced to keep up with these very fast technological developments (Adedokun-Shittu et al., 2020; Kumar et al., 2020; Wasko, 2013) (Adedokun-Shittu et al., 2020; Kumar et al., 2020; Wasko, 2013).

One of the best impacts of technological developments that are felt in the world of education is that learning can reach the farthest and even unlimited areas. Open University students are students who are spread all over Indonesia. Even in its learning system, the Open University always wants to provide the best and most equitable learning for its students, even though they live in Indonesia's foremost, backward, and farthest areas. This is also a challenge that the Open University must face in its learning system. In the learning system, there are learning materials that are used by lecturers for students.

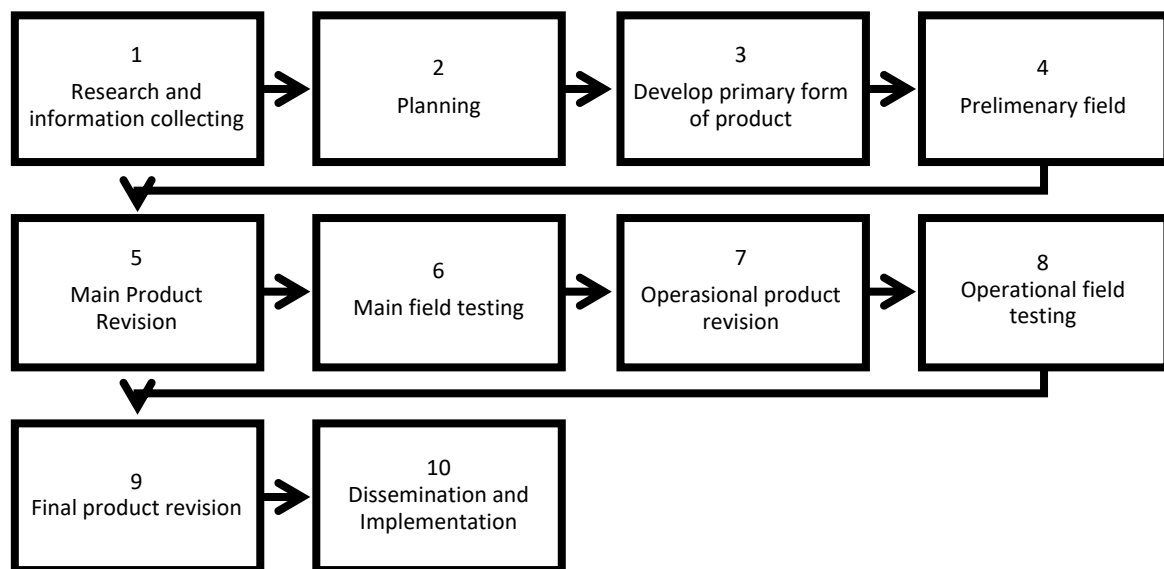
Learning materials that can be used evenly and simultaneously function for students in various regions to take advantage of technology. Meanwhile, some material may be challenging to understand if you only read the text related to an image or a process. Material related to a process and a process requires technology to convey it properly to students, especially students who are likely to struggle with signals. These namely students live in the 3T area. One of the technologies that can be used is augmented reality. According to Bower et al. (2014), augmented reality is a teaching material most appropriate for explaining processes. Of course, this is the basis for this research in choosing suitable teaching materials to explain the process of geographical phenomena such as tsunamis, earthquakes, and volcanic eruptions.

The following are some previous studies that used augmented reality to improve student and student learning outcomes. Namely, research conducted by Syawaludin & Rintayati (2012) uses augmented reality to improve student science learning. Furthermore, research conducted by Shelton & Hedley (2002) used augmented reality to explain the process of the sun and the earth to students. Based on some of these studies, no research has been using augmented reality to improve the student learning process about geographical phenomena such as tsunamis, earthquakes, and volcanic eruptions. The objectives of this research were (1) to develop augmented reality media on geographic phenomena in increasing understanding of geography in Social Sciences and environmental preservation (pro-environmental behavior) of Open

University students; (2) to test the effectiveness of augmented reality media on geographic phenomena in increasing understanding of geography in social studies and environmental preservation (pro-environmental behavior) of Open University students. Therefore, research is needed regarding the development of augmented reality learning media regarding geographic phenomena such as tsunamis, earthquakes, and volcanic eruptions for Open University students.

## RESEARCH METHODS

This research is research on the development of instructional media, and experimental research was carried out to see the developed learning media's success and effectiveness in improving student learning outcomes. The development of learning media in this study used the methods and steps of R&D from Borg & Gall (1983) in Aka (2019) with the steps described in Figure 1 below:



**Figure 1.** R&D procedures (Borg & Gall, 1987) in (Aka, 2019)

Furthermore, to prove the effectiveness of valid products, experimental research was carried out using a quasi-experimental design with the matching-only pretest-posttest, which was carried out for one semester. The use of pretest is carried out at the beginning of the semester before lectures are carried out, and the posttest is carried out when it is carried out after completing lectures. The pretest and posttest were carried out in both groups, namely the experimental group and the control group. It is just that the treatment was given only to the experimental group. This research was conducted at the Teaching and Education Faculty of the

Open University, which was conducted for one semester, namely from September to December 2022. The research design used in this study was a Quasi-experimental design with the matching-only pretest-posttest with the experimental design as follows:

Control Group Design				
Treatment group	M	O	X	O
Control group	M	O	C	O

**Figure 2.** Research Experiment Design

For data collection, it was started the first time by dividing into two groups of students based on male and female gender and group placement based on the order of the total grade point average taken from 4 classes (each in 1 group containing 45 students) students of elementary school teacher education study programs at the University Open. The instrument used to measure student learning outcomes is a tool for knowledge about student geography symptoms in social studies courses. The data that has been obtained is analyzed using the t-test and followed by calculating the N-Gain. Before the t-test, the data is assumed to come from a normally distributed population, and the homogeneity test is carried out using the F test.

## RESEARCH RESULTS AND DISCUSSION

The results of developing learning media are producing an augmented reality learning media product that can be downloaded and used in the following steps:

Step 1: Scan the following barcode to download the augmented reality application in this study:



**Figure 3.** App install barcodes

After the application is installed, when this application is clicked, the following display will appear:



**Figure 4.** The initial view of AR Geography

Then after clicking the arrow, the following screen will appear:



**Figure 5.** AR Geography Menu display

Then, when you want to see the augmented reality, click "AR Camera" then bring the camera closer to one of the following barcodes:



**Figure 6.** Tsunami, Earthquake, and Volcano AR Barcodes

For example, closer to the "Tsunami," then the display will appear as follows:





**Figure 7.** AR Geography on Tsunamis

Next, the following is the display when scanning the barcode “Earthquake”:



**Figure 8.** AR Geography on Earthquakes

Next, the following is the display when scanning the barcode “Volcano”:



**Figure 9.** AR Geography on Volcanic Eruptions

The three augmented reality can be enlarged, reduced, and can move. In addition to displaying augmented reality, this application also displays material regarding tsunamis, earthquakes, and volcanoes as follows:



Figure 10. Tsunami material regarding the definition of a tsunami



Figure 11. Tsunami material on Tsunami Mitigation



Figure 12. Tsunami Material on Tsunami Characteristics



Figure 13. Tsunami Material on the History of Tsunamis

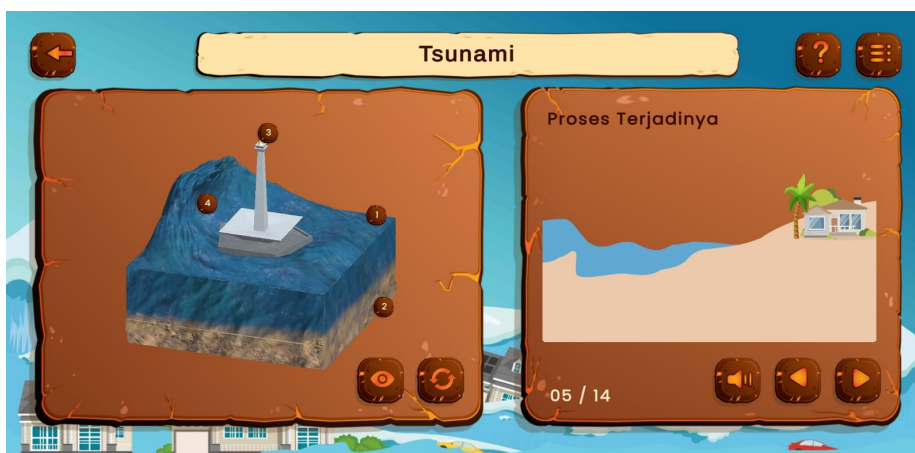


Figure 14. Tsunami Material on the Process of Tsunami Occurrence



Figure 15. Earthquake material regarding the definition of an earthquake





Figure 16. Earthquake Material Regarding Earthquake Characteristics



Figure 17. Earthquake Material on the History of Earthquakes



Figure 18. Earthquake Material on Pre-Earthquake Mitigation



Figure 19. Earthquake Material regarding the Process of Earthquake Occurrence



Figure 20. Volcanic Eruption regarding the Characteristics of Volcanic Eruptions



Figure 21. Volcanic Eruption Regarding Volcano Eruption Mitigation Strategy



Figure 22. Volcanic Eruption Regarding the Characteristics of an Erupting Volcano Strategy



Figure 23. Volcanic Eruptions Regarding the Process of Volcanic Eruptions



Figure 24. Volcanic Eruptions regarding the History of Volcanic Eruptions

The data is assumed to come from populations with normal distribution; a homogeneity test is carried out to see whether the data from the two groups have the same data variance. After testing homogeneity using the F test, the results show that  $F_{cal} = 0.975$ ; this indicates



that  $F_{0.975(44,44)} \leq F_{cal} \leq F_{0.025(44,44)}$ , so the variance of the data from the two groups is the same. From this, the t-test can be continued.

After analyzing the t-test, the results were obtained  $t_{cal} = 1.463$ , which means that  $t_{cal} > t_{table(0.1;44)}$ , so that the average learning outcomes of students who use augmented reality learning media are more significant than the average learning outcomes of students who are not given augmented reality learning media in studying geographic phenomena. Furthermore, the N-Gain calculation was carried out, and the result of the interpretation of the effectiveness of N-Gain was 76.36. This means that the interpretation of the effectiveness of  $N-Gain > 76$  indicates that augmented reality learning media is effectively used to increase student social studies learning outcomes on geographic phenomena (Hake, 1999). These results are by Azuma's (1997) research which defines augmented reality as a combination of natural and virtual objects in a real environment, running interactively in real-time, and there is integration between objects in three dimensions, namely virtual objects integrated into the real world. Merging real and virtual objects is possible with appropriate display technologies, interactivity is possible through specific input devices, and good integration requires effective tracking.

Augmented reality or augmented reality is a technology that can add virtual objects to the projection of a natural environment (Wu et al., 2013). In contrast to virtual reality, which completely replaces the natural environment, augmented reality only adds virtual objects to the natural environment (Huang et al., 2019), Sounds simple enough. However, augmented reality is more than just adding virtual objects to a natural environment.

Augmented reality is a technology that combines virtual objects (both 2-dimensional and 3-dimensional) and natural objects into a real 3-dimensional environment, then projects these virtual objects in real-time to be integrated and run interactively in the real-world (Lee, 2012). This is what underlies why augmented reality learning media can effectively improve student learning outcomes, this time in the subject of geographic phenomena.

## **CONCLUSION**

Understanding of material symptoms of geography in students can be increased by adding augmented reality to learning activities. Based on this research, augmented reality has proven effective and helpful in improving student learning outcomes regarding geographical phenomena. This is because augmented reality can combine virtual objects into real ones in the form of 3 dimensions so that students can easily understand them. It is recommended that



lecturers who teach material on geographic phenomena use this augmented reality learning media as a learning support to increase students' understanding of geographic phenomena.

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