

The Effectiveness of the Augmented Reality-Based Learning Media Application on Student's Interests and Learning Outcomes of Science Subject at Elementary Schools

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ABSTRACT

This study aims to determine the effectiveness of the application of Augmented Reality-based learning media on students' interests and learning outcomes in elementary schools in Palembang. The research was conducted utilizing a Quasi-Experimental design with Nonequivalent Control Group Design. This study's population comprised fifth-grade students of elementary schools in Palembang, sampling through a stratified random technique of 157 students. Data collection techniques used include documentation, observation, and tests. Based on the study results, the data showed that the application of the Augmented Reality-based learning media of science subject in Elementary Schools was more effective in increasing interest and learning outcomes compared to one without using Augmented Reality-based learning media.

Keywords: *Learning Media, Augmented Reality, Interest and Learning Outcomes.*

1. INTRODUCTION

Indonesia's learning process needs to require more attention to low learning participation and the quality of learning outcomes. The 2018 PISA evaluation test results showed that Indonesian students' performance was low (PISA, 2018). The data also showed that the cognitive ability of Indonesian students was deficient compared to other countries. Based on preliminary observations of research conducted at Elementary Schools in Palembang, several problems existed in learning, including low interest in learning, which resulted in less optimal learning outcomes.

Based on this phenomenon, measures to improve student engagement and motivation should be considered, promoting learning process practices to achieve quality learning outcomes. Achieving quality learning results is affected by several variables, including learning processes, instructors, students, climate, and learning resources. Hamalik (2006:32) notes that students, learning strategies and learning materials affect learning interest. Thus, teachers play an integral role in student learning activities; teachers must

plan a proper learning process to achieve learning goals optimally. Suhana (2014:3) supports it, explaining that teachers must always have the best learning environment to achieve optimal learning goals.

One element the teacher must improve in improving the learning process is learning media. Learning media is a particular method teachers use to help students understand the content. Suyono and Nurohman (2014: 74) suggest learning media to promote learning and enhance learning outcomes. To improve student engagement and learning outcomes, teachers' dedication to use and grow attractive media is important. In recent years, numerous technology applications have built learning media to optimize the learning process (Jonson et al., 2014). Elango's (2015) study concluded promising results in incorporating Virtual Reality in studying mathematics. Chiang, Yang, & Hwang (2015) suggest increased awareness of science learning by students using Augmented Reality-based media. Research by Sungkur, Panchoo, and Bhoyroo (2016:123-146) showed that Augmented Reality technology was proven to help grasp complex concepts that average students found hard to understand. Further,

Yoon's research (2017: 156-168) found that students could explain how Augmented Reality helped them understand phenomena. Students commented on visualizing scientific data. Kucuk, Zilmas & Goltas's (2015) research shows promising results in Virtual Reality for language learning.

Augmented Reality technology allows teachers to create a more attractive learning process. This technology enables combining a three-dimensional (3D) object into a real environment using a smartphone (Fouht, 2011). The advantage of using Augmented Reality is its attractive visual appearance as it can display 3D objects that appear to exist in real life. Hence, the learning process using Augmented Reality-based media is feasible to improve learning outcomes. In this study, particularly, researchers examined AR-based media's effectiveness on students' interest and learning outcomes of science subjects in elementary schools.

2. METHOD

2.1. Types of research

This study employed a Quasi Experiment method. The research design used is a nonequivalent control group design with the following scheme:

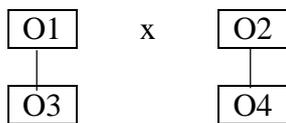


Figure 1. The experimental design with a control group (nonequivalent control group design)

Information:

O1: Experimental group pretest

O3: Control group pretest

X: Treatment

O2: Experimental group posttest

O4: Control group posttest

Figures show how Augmented Reality-based learning was compared to a control group. The experimental group was given the treatment of Augmented reality, and the control group was not. If the performance score of O2 is higher than O4, then the application of augmented reality is declared more effective. The learning design carried out on the two research subjects consisting of the experimental group and the control group is presented in the following table:

Table 1. Learning Design

Group	Class	Treatment
Experiment	X1	Learning using Augmented Reality-

		based media
Control	X2	Learning without using Augmented Reality-based media

2.2. Research Subjects and Data

The subjects in this study comprised fifth-grade students of Elementary Schools in Palembang. Sampling was done using a stratified random sampling technique, in which the sample was categorized into high, medium, and low-level schools consisting of 157 students. The research data were obtained utilizing a questionnaire to determine students' interest in learning and a written test to find students' learning outcomes. The instrument used had been validated through internal validity, content validity, and construct validity. Content validity was obtained from experts and construct validity from field trial results.

The trial results were analyzed using Spearman rho for data on learning interest and the difficulty test level and the discrimination power test for each question for the learning outcome test. The instrument's reliability in this study was obtained from Cronbach's alpha testing on interest and learning outcomes data. Students' interest and learning outcomes data were analyzed through descriptive analysis and hypothesis testing consisting of the Manova test and t-test.

3. RESULTS AND DISCUSSION

The study started by conducting a pre-test before applying the treatment to assess students' initial conditions relevant to their desires and learning outcomes. To determine the equivalence of the selected sample, the pre-test outcome data was taken into account. The study was continued after the pre-test by offering care to the experimental group by using Augmented Reality-based media to perform learning science, while the learning process in the control group did not use Augmented Reality-based media. The post-test was performed in each group after the procedure was completed. The post-test was performed in experimental and control groups to assess the increase in each student's interest and learning results.

Descriptive and inferential interpretation of the study data was analyzed. To determine the classification and categories of students' interests and to learning outcomes in a science subject, descriptive analysis was performed. In comparison, the inferential analysis was conducted through the Manova test and t-test to assess the efficacy of Augmented Reality-based learning media implementation in increasing the interest of students and learning outcomes in a science subject. Based on the data collected, the findings revealed variations in students' interests in studying science before and after

treatment. This difference was illustrated by the mean score before care of student learning interest in the experimental community, which was 53,13, and increased to 72,47. The control group, meanwhile, began at 55,50 and increased to 62,93. The efficacy of Augmented Reality-based learning media in increasing the interests of students in learning science can be seen from the rise in the scores of students in the experimental group, which was more significant compared to the scores of students in the control group. The comparison of the achievement of the mean score of students' interests in the experimental group and the control group is shown in Table 2.

Table 2. Mean Score of Students' Learning Interest Improvement

Information	Before	After	Improvement
Experiment	53,13	72,47	19,34
Control	55,50	62,93	7,43

Students' learning interests are classified into five categories; Very Good, Good, Enough, Poor, and Very Less (Widoyoko, 2009: 238). Classifications of students' learning interests before the learning treatment are presented in Table 3, and the classifications of learning interest after treatment are available in Table 4.

Table 3. Students' Learning Interests before Treatment

Category	Score Range	Group			
		Experiment		Control	
		F	%	F	%
Very Poor	17 – 30,5	0	0	1	1,27
Poor	30,6– 44,1	11	14,10	9	11,39
Enough	44,2– 57,7	33	42,31	29	36,71
Good	57,8– 71,3	34	43,59	40	50,63
Very Good	71,4 – 85	0	0,00	0	0,00

Table 4. Students' Learning Interests after Treatment

Category	Score Range	Group			
		Experiment		Control	
		F	%	F	%
Very Poor	17 – 30,5	0	0	0	0,00
Poor	30,6 – 44,1	0	0	0	0,00
Enough	44,2 – 57,7	0	0	17	21,52
Good	57,8 – 71,3	49	62,82	53	67,09
Very Good	71,4 – 85	29	37,18	9	11,39

The data above implies that the increase in students' learning interests in the experimental group was higher than the increase in learning interest in the control group. Based on the effectiveness criteria applied in this study, the score for the implementation of Augmented Reality learning media for science subject was in a suitable category, meaning that the use of Augmented Reality-based learning media in science subject has higher effectiveness in the learning process than one without Augmented Reality-based learning media.

The experimental group's mean score was 42.23, while the control group was 45.1. Both groups were considered to have an equal interest in learning science subjects. After learning was carried out in both groups, the researchers remeasured the student learning outcomes. The experimental group students' improvement score was 43.1, while the control group's improvement scored was 33.75. The improvement of learning outcomes is described in Table 5.

Table 5. Mean Score of Learning Outcomes Improvement

Information	Pretest	Posttest	Improvement
Experiment	42.23	84.64	42.41
Control	45.1	64.59	19.49

Based on calculations using Manova, the Sig. (p) 0.000 <0.05, meaning that the implementation of Augmented Reality-based learning media was effective in increasing fifth-grade elementary school students' interests and learning outcomes in a science subject. Separate testing was carried out with the t-test, resulting in the Sig. (p) in the further testing of students' learning interest score improvement in the experimental group and the control group, which was 0.001 <0.05, it denoted a difference in the increase in learning interest in the experimental and control groups. Furthermore, in further testing, the increase in student learning outcomes in the experimental and control groups was 0.014 <0.05, implying a difference in the experimental group's learning outcomes and the control group. Thus, Augmented Reality-based learning media effectively increased students' interests and learning outcomes of fifth-grade elementary school students in science subjects.

After the treatment of the experimental and control groups was conducted, it was found that results exhibited differences in students' learning outcomes in science subjects before and after learning. The difference was shown by the mean score of the science learning outcomes; 82.32 in the experimental group and 60.05 in the control group. Based on these data, it can be concluded that the implementation of Augmented Reality-based learning media is effective in improving students' learning outcomes.

4. CONCLUSIONS

The following findings are derived based on the discussion of the study results: (1) the introduction of Augmented Reality-based media in science learning in fifth-grade elementary school students improved the learning interests of students. The improvement in the mean score in the interests of the students in the experimental group was shown, which was 5.58 points higher than the mean score in the control group. The sig value obtained in hypothesis testing was 0.001 <0.05,

indicating that the hypothesis "there is a gap in the enhancement between the learning interests of students in science subjects using Augmented Reality-based learning media and students without using Augmented Reality-based learning media for fifth-grade elementary students in science subjects."

Pennsylvania, Philadelphia, PA, USA. *Educational Technology & Society*, 20 (1), 156– 168

REFERENCES

- [1] Chiang, T. H. C., Yang, S. J. H., & Hwang, G. J. (2014). Students' online interactive patterns in augmented reality-based inquiry activities. *Journal Computers & Education*, 78, 97-108.
- [2] Elango, P. (2013). *Sistem Pemulihan Lembaran Kerja Bagi Nombor Negatif Berasaskan Realiti Luasan (AR2WN2)*. (Phd), Universiti Kebangsaan Malaysia, Bangi.
- [3] Furht, B., 2011. *Handbook of Augmented Reality*, Departement of Computer and Electrical Engineering and Computer Science. Florida. Florida Atlantic University.
- [4] Hamalik, Oemar. 2006. *Proses Belajar Mengajar*. Jakarta: PT. Bumi Aksara.
- [5] Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2014). *Horizon report 2014 - Higher education edition*. Austin, TX: The New Media Consortium.
- [6] Kucuk, S., Yilmaz, R. M., & Goktas, Y. (2014). Augmented Reality for Learning English: Achievement, Attitude, and Cognitive Load Levels of Students. *Journal Egitim Ve Bilim-Education and Science*, 39 (176).
- [7] OECD (2018). *Programme for International Student Assessment (PISA)*. Diakses dari <http://www.oecd.org/pisa/PISA-2018-Indonesia.pdf> pada tanggal 17 Juli 2020.
- [8] Suhana, C. 2014. *Konsep Strategi pembelajaran*. Bandung: PT Refika Aditama.
- [9] Suyono dan Nurohman,S. 2014. *Pengembangan Modul Elektronik Berbasis Web Sebagai Media Pembelajaran Fisika*. *Jurnal Kependidikan*, 44 (1), 73 - 82.
- [10] Sugiyono. (2015). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- [11] Sungkur, R. K., Panchoo, A., and Bhoyroo, N. K., 2016. *Augmented Reality, the future of contextual mobile learning*. University of Mauritius, Réduit, Mauritius.
- [12] Widoyoko, E.P. (2009). *Evaluasi Program Pembelajaran, Panduan Praktis bagi Pendidik dan Calon Pendidik*. Yogyakarta. Pustaka Pelajar
- [13] Yoon, Susan. 2017. *How Augmented Reality Enables Conceptual Understanding of Challenging Science Content*. The Education University of