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The Impact of Augmented Reality on Increasing Students' Cognitive Abilities in History Learning

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ABSTRAK

Rendahnya kemampuan kognitif siswa dalam memahami konsep sejarah yang kompleks masih menjadi tantangan dalam pembelajaran di sekolah. Pemahaman siswa sering kali terbatas pada hafalan fakta tanpa mampu menganalisis hubungan antara peristiwa sejarah. Kondisi ini menuntut adanya inovasi dalam media pembelajaran yang mampu meningkatkan pemahaman siswa secara lebih mendalam. Penelitian ini bertujuan untuk mengevaluasi efektivitas penggunaan teknologi Augmented Reality (AR) dalam meningkatkan kemampuan kognitif siswa pada pembelajaran sejarah. Penelitian ini menggunakan desain eksperimen dengan pendekatan kelompok kontrol yang tidak setara. Pengumpulan data dilakukan melalui tes awal dan tes pasca untuk mengukur peningkatan kemampuan kognitif siswa. Subjek penelitian terdiri atas dua kelompok, yaitu kelas eksperimen yang menggunakan media AR dan kelas kontrol yang menggunakan metode pembelajaran konvensional. Analisis data dilakukan dengan membandingkan skor rata-rata tes awal dan tes pasca pada kedua kelompok serta menghitung persentase peningkatan hasil belajar siswa. Hasil penelitian menunjukkan bahwa kelas eksperimen yang menggunakan teknologi AR mencapai skor rata-rata tes pasca sebesar 73,50, sedangkan kelas kontrol mencapai skor rata-rata tes pasca sebesar 65,40. Meskipun kedua kelompok mengalami peningkatan dari tes awal itu tes pasca, kelas eksperimen menunjukkan peningkatan yang lebih besar dibandingkan dengan kelas kontrol. Namun, hasil belajar siswa di kelas eksperimen tidak secara signifikan melampaui kelas kontrol. Simpulan dari penelitian ini menunjukkan bahwa teknologi AR dapat meningkatkan kemampuan kognitif siswa dalam pembelajaran sejarah dengan memberikan pengalaman belajar yang lebih interaktif dan visual.

ABSTRACT

Students' low cognitive abilities in understanding complex historical concepts is still a challenge in learning at school. Students' understanding is often limited to memorizing facts without being able to analyze the relationship between historical events. This condition demands innovation in learning media that is able to increase students' understanding in more depth. This research aims to evaluate the effectiveness of using Augmented Reality (AR) technology in improving students' cognitive abilities in history learning. This research uses an experimental design approach unequal control group. Data collection is carried out through initial test And post test to measure the increase in students' cognitive abilities. The research subjects consisted of two groups, namely the experimental class which used AR media and the control class which used conventional learning methods. Data analysis was carried out by comparing average scores initial test And post test in both groups and calculate the percentage increase in student learning outcomes. The research results show that the experimental class using AR technology achieved an average score post test amounted to 73.50, while the control class achieved an average score post test amounting to 65.40. Although both groups experienced an increase in initial test That post test, the experimental class showed greater improvement compared to the control class. However, student learning outcomes in the experimental class did not significantly exceed the control class. The conclusion of this research shows that AR technology can improve students' cognitive abilities in history learning by providing a more interactive and visual learning experience.

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1. INTRODUCTION

Learning resources are anything that can be used to support the teaching and learning process. In a learning context, sources can be primary sources, such as historical documents, artifacts, or direct interviews, or secondary sources, such as textbooks, articles, and research documentation (Putri et al., 2022; Sopacua et al., 2019). These resources help students understand the material in depth by presenting relevant authentic facts. In learning history, sources also involve visual, oral and written elements that enable students to analyze past events critically and objectively. Learning media are tools or means used to convey information from these sources more effectively and interestingly (An, 2019; Apuke, 2020). Visual media such as pictures and maps, audio-visual media such as documentary films, and interactive digital media such as virtual reality and simulations are examples of learning media. Teachers can improve the learning process by bridging the gap between complex material and student understanding through the use of appropriate media (Sesmiyanti et al., 2020; Volioti et al., 2019). A more contextual and in-depth learning experience can be achieved by combining relevant learning media and authentic sources. The study of history is associated with the systematic investigation of natural phenomena. Consequently, the acquisition of historical knowledge is not simply the mastery of a collection of facts, concepts, or principles; rather it is a learning process that emerges from the discovery process. 3 From the definition above, it is clear that the acquisition of historical knowledge is not just a product, but also a process. The history learning process prioritizes providing direct experience to foster exploration competence and scientific understanding of the natural environment. The aim of history education is to investigate and investigate, thereby enabling students to develop a deeper understanding of nature (Thukral et al., 2019; Yeo, 2023).

Basically learning is a communication process between teachers and students. A good communication process involves students to participate in the learning process. So learning is not only focused on the teacher delivering the material, but there is a two-way interaction between students and teachers . This is expected to make students play an active role during learning, so that students are more interested in paying attention to the material being taught. The communication process that occurs does not always run smoothly, even if the communication process is not good it can give rise to misunderstandings or misconceptions (Gunawan et al., 2020; Suhaimi et al., 2018). To achieve an efficient communication process, tools are needed that can provide learning alternatives for students to understand the concepts that have been taught. Learning media is one of the instruments that can be used in the learning process (Ibharim et al., 2020; Ogah, 2020). Learning media has a variety of practical benefits, such as the ability to improve and streamline learning processes and outcomes by clarifying the presentation of messages or information. Second, learning media has the potential to increase and focus students' attention, thereby facilitating the development of learning motivation, more direct interaction between students and their environment, and students' ability to learn independently according to their interests. Third, learning media has the potential to transcend the boundaries of space, time and the senses. Fourth, learning media can facilitate direct interaction with teachers, society and the environment, as well as provide students with shared experiences about events in their environment (Ali, 2023; Busch, 2024).

Visual media is one type of media that can be used as a learning instrument. Visual media is a form of communication related to visual perception. Visual communication symbols are used to convey the intended message. Various learning media have emerged that utilize information and communication technology (ICT) along with advances in science and technology. After conducting research, it was discovered that students' understanding of history in class was still relatively low. Furthermore, the Information Systems Department conducted research which revealed that the scores of students who studied with the help of technology were greater than students who studied without the help of technology in the classroom (Gudoniene & Rutkauskiene, 2024; Paquot & Plonsky, 2021).Augmented reality (AR) is an example of visual media that has implemented information and communication technology systems. Augmented reality is an alternative medium that can function as a suitable visual medium for students (Phungsuk et al., 2024; Renalia & Suprapta, 2020).. This system is different from virtual reality (VR), which is an entirely virtual environment. Augmented reality is a technology that integrates two-dimensional and/or three-dimensional virtual objects into an original three-dimensional environment, and then projects these virtual objects in real time. Augmented reality is a technological advancement in the field of computer graphics (Mangkhang, 2020; Meekaew & Ketpichainarong, 2020).

By using this technology, the dissemination of information will become more interesting and interactive. The novelty in this research lies in the specific exploration of the impact of Augmented Reality (AR) on increasing students' cognitive abilities in history learning, which was still limited in previous research. Different from previous studies which emphasized more on aspects of student motivation and involvement, this research focuses on how AR can influence critical thinking processes, problem solving, and students' memory in understanding historical events. In addition, this research adopts an experiment-based approach with a more comprehensive cognitive evaluation method, thereby providing stronger

empirical evidence regarding the effectiveness of AR in improving historical understanding. Another novelty is the integration of AR with interactive elements that allow students to participate directly in historical simulations, thus providing a more immersive learning experience. Thus, this research not only enriches the study of the use of technology in education, but also provides new insights into how AR can be optimized to improve students' cognitive thinking abilities in more depth.

The aim of this research is to analyze the impact of using Augmented Reality (AR) on improving students' cognitive abilities in learning history. Specifically, this research aims to measure the extent to which AR technology can improve students' conceptual understanding, memory and critical thinking skills in studying historical events. In addition, this research also aims to evaluate the effectiveness of AR compared to conventional learning methods in increasing student engagement and motivation. Thus, it is hoped that the results of this research can provide recommendations for educators, educational technology developers, and policy makers in integrating AR as an innovative and effective learning strategy in formal education environments.

2. METHOD

The methodology used in this investigation was quasi-experimental. The quasi-experimental method is a research method that includes a control group, but is unable to fully control external variables that influence the experiment (Anis et al., 2019; Jiang, 2020). The class chosen as the research subject has challenges to manage in relation to other variables not assessed in the research. Therefore, this methodology was applied. In this investigation, a nonequivalent control group design was applied. This design was applied to two different groups: the experimental group and the control group, which were not randomly selected. The two groups were selected based on certain criteria to ensure that they were relatively homogeneous ((Azhar et al., 2024; Luepsen, 2020). Before being given treatment, a pretest was carried out on both groups to determine the extent of students' basic abilities in the concepts concerned, especially media and history learning. In addition, the two groups received different treatment. The experimental group received learning treatment that utilized augmented reality, while the control group received conventional learning treatment. Both groups will be given a posttest to find out the extent of student learning outcomes in historical learning sources and media after giving treatment. The research design is summarized as follows (An, 2019; Gudoniene & Rutkauskiene, 2024).

Research Design

Group	Pretest	Treatment	Posts
Test	O1	CAR	O2
Control	O1	XK	O2

Information: XE = Treatment used in the experimental group augmented reality; XK = Conventional learning treatment in the control group; O1 = Pretest initial test before treatment; O2 = Posts final test after treatment

There are two research variables in this study, namely the independent variable and the dependent variable. The dependent variable (Y) in this research is student learning outcomes in History Learning Resources and Media, while the independent variable (X) is augmented reality learning media. The search targets all students taking part in the history education program in the odd semester 2024/2025. A total of 26 students from all history education disciplines at Tadulako University constitute the accessible population. As a control class and experimental class, this research used a sample of 13 students. The history education study program has a total of 26 students, resulting in a saturated sample for this research. The data acquisition methods used in this research were test and non-test. Multiple choice objective tests in the cognitive domain are carried out to evaluate student learning outcomes.

The test instrument consists of five answer choices. To find out students' views regarding augmented reality in historical sources and media, a questionnaire or attitude scale is used as a non-test instrument. In this investigation, students responded to statements with the answer choices Strongly Disagree (STS), Disagree (TS), Agree (S), and Strongly Agree (SS) using a Likert scale questionnaire. The Pearson point biserial correlation technique is one method for evaluating the validity of test elements. The KR-20 formula is used to evaluate the reliability of an instrument (Bahri et al., 2019; Novak, 2024). Analysis prerequisite tests and hypothesis testing are two stages in data analysis testing. The homogeneity test and normality test are prerequisite tests for test data analysis. Procedures applied during data analysis. The purpose of this normality test is to ensure whether the sample studied represents a normally distributed population. The chi-square test was used in this investigation to determine normality. Fisher's test will be used to evaluate the impact of augmented reality learning media on student learning outcomes in this research. The t-test is the hypothesis test used in this investigation. Test formula (Novak, 2024).

3. RESULT AND DISCUSSION

Result

The results obtained from the pretest by 13 students as the experimental class and 13 students as the control class for this research are presented in Figure 1.

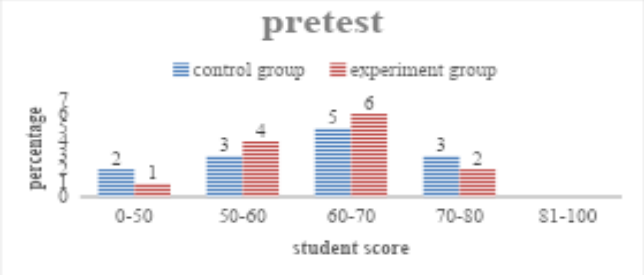

Figure 1. Frequency Diagram of Pretest Results for Experimental and Control Classes

The experimental class contained one student (7.8%) who scored in the lowest range (0-50), as shown in the diagram above. On the other hand, the control class had two students (15.5%). In addition, there were no students in the experimental and control sections who obtained scores in the highest range (81-100). Students in the experimental and control classes achieved the greatest scores in the range of 60-70 on the pretest. Four students (33.3%) in the experimental class and three students (30.3%) in the control class achieved scores between 50 and 60. Some data centralization and distribution values were determined from the pretest scores presented in Table 1.

Table 1. Measures of Centralization and Data Distribution of Pretest Results for Experimental Class and Control Class

No.	Data Centralization and Distribution	Pretest	
		Experimental Class	Control Class
1	Lowest Value	0.00	0.00
2	The highest score	80.00	80.00
3	Rate-rate	60.38	58.85
4	median	62.00	62.50
5	Mode	62.83	64.50
6	Standard Deviation	12.66	16.6

The results obtained in the posttest by pretest by 13 students as the experimental class and 13 students as the control class in this research are presented in Figure 2.

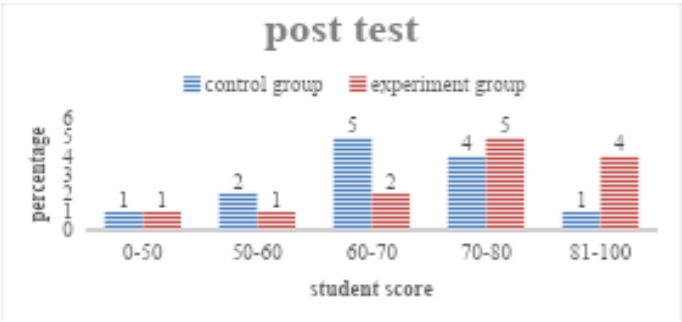

Figure 2. Frequency Diagram of Posttest Results for Experimental and Control Classes

The posttest scores in the experimental class were predominantly in the high range, different from the pretest results. Meanwhile, control class students showed a greater tendency to achieve grades in the low range. In the experimental class there were no students who got scores in the lowest range (0-50), as shown in the diagram above. On the other hand, the control class had one student (7.8%). In the experimental class, there were 4 students (30.7%) who got a score in the highest range for the posttest results, while in the control class only 1 student (7.8%) got a score in the same range. Four students (30.7%) in the experimental class achieved the highest score in the range 81-100 on the posttest results. One student

(7.8%) in the control group achieved the highest score in the range 81-100. Several data centralization and distribution values are determined from the posttest values presented in Table 2.

Table 2. Measures of Centralization and Distribution of Posttest Data from the Experimental Class and Control Class

No.	Data Centralization and Distribution	Posts	
		Experimental Class	Control Class
1	Lowest Value	0.00	0.00
2	The highest score	100.00	100.00
3	Rate-rate	73.50	65.40
4	median	75.50	66.50
5	Mode	77.50	67.00
6	Standard Deviation	18.91	15.4

Based on the results of the pretest and posttest calculations for the experimental class and control class, totaling 26 students, the recapitulation in Table 3 is obtained as follows:

Table 3. Recapitulation of Pretest and Posttest Data for Experimental and Control Classes

No	Data Centralization and Distribution	Post test		Pretest	
		Experimental class	Control class	Experimental class	Control class
1	Lowest Value	0.00	0.00	0.00	0.00
2	The highest score	100.00	100.00	80.00	80.00
3	Rate-rate	73.50	65.40	60.38	58.85
4	median	75.50	66.50	62.00	62.50
5	Mode	77.50	67.00	62.83.	64.50
6	Standard Deviation	18.91	15.4	12.66	16.6

Before conducting research in the experimental and control classes, a pretest was first carried out to determine the students' initial abilities. It can be seen from Table 3 above that the average (mean) score of the experimental class during the pretest was 60.38, while the average (mean) score of the control class was 58.85. This shows that the experimental and control classes have almost the same initial abilities before being given treatment. After implementing augmented reality-based learning media in the experimental class and conventional learning in the control class, a posttest was carried out to assess students' abilities after being given treatment. Based on the posttest results, both the experimental class and the control class experienced an increase. However, the experimental group experienced greater improvement than the control class. The average score in the experimental and control classes shows an increase in scores. The experimental class experienced an increase in the average value (mean) of 73.50 percent, while the control class experienced an increase in the average value (mean) of 66.50 percent.

The normal gain (N-Gain) test is used to demonstrate students' increased understanding or mastery of concepts following their education. The average N-Gain values for the experimental and control classes are presented in Table 4.

Table 4. N-Gain Test Results for Experimental Class and Control Class

N - Profit	Experiment	Control
Rate-rate	0.49	0.17
Category	At the moment	Low

This shows that the treatment in the experimental group was more effective in improving learning outcomes.

Table 5. Normality Test

Statistics	Pretest		Post test	
	Class Test	Class Control	Class Test	Class Control
X2count value	2.13	2.77	4.15	3.51
X2table value	5.99	5.99	5.99	5.99

Statistics	Pretest		Post test	
	Class Test	Class Control	Class Test	Class Control
Decision	Usually Distributed	Usually Distributed	Usually Distributed	Usually Distributed

In the table above you can see the values X2 counts all data is smaller than the X2 table, so it is stated that the pretest and posttest data for the experimental and control classes are normally distributed.

Table 6. Homogeneity Test Calculation Results

Statistics	Pretest		Posts	
	Experimental Class	Control Class	Experimental Class	Control Class
Variance Value	73.08	108.89	257.69	109.78
calculated F value	1.36		1.23	
F table values	1.76			
Decision	Both data are homogeneous		Both data are homogeneous	

Table 7. Displays the Results of Hypothesis Test Calculations

Statistics	Pretest	Posts
Count	2.27	4.86
Table	1.77	
Decision	Ha rejected	Ha accepted

The null hypothesis (Ho) is accepted, and the alternative hypothesis (Ha) is rejected, as evidenced by the table above which shows that t-the calculated value on the pretest results is less than t-table value. This means that there is no real difference between the pretest results of the experimental class and the control class. Posttest hypothesis testing shows that the scores of the two groups after receiving different treatment produce a t-count value exceeded t-table values that conflict with the results of the pretest hypothesis test. As a result, the null hypothesis (Ho) was rejected and the alternative hypothesis (Ha) was accepted (Thukral et al., 2023). Ha's acceptance hypothesis test resulted in the conclusion that the use of augmented reality learning media had an impact on student learning outcomes in the field of history. The average learning outcomes of students in the experimental class are also higher than students in the control class, this further supports this.

Table 8. Questionnaire Results for Using Augmented Reality Learning Media

Questionnaire Indicators	Experimental Class	
	Percentage	Conclusion
Use of augmented learning reality media in courses	90%	Good
Historical explanation	84%	Good
Animated display	89%	Good
Application of augmented reality	90%	Good
Average	88%	Good

This shows that the use of augmented reality learning media can facilitate students' understanding of the material and encourage them to interact with historical learning sources and media.

Discussion

The pretest value between the experimental class and the control class has a t-count value that is smaller than the t-table value, namely 1.77<2.00 as indicated by the results of the hypothesis test. This shows that augmented reality learning media does not have an impact on student learning outcomes in the context of historical learning sources and media. This is because the pretest results between the experimental class and the control class were not significantly different because the two classes were not given average treatment during the pretest. The control class obtained an average score of 58.85, while the experimental class obtained an average score of 60.38. This shows that the control class obtained a higher average than the experimental class during the pretest. The average score of both classes increased after the experimental class was treated with augmented reality learning media and the control class was treated with conventional learning. The posttest value between the experimental class and the control class has a t-count value that is higher than the t-table value, namely 4.86 > 2.00 as indicated by the results of the hypothesis test. This shows that augmented reality learning media has an impact on student learning

outcomes in the field of history. Students in the experimental class obtained a higher average posttest score than students in the control class, this was also confirmed by the average posttest results.

The control class obtained an average score of 65.40, while the experimental class obtained an average score of 73.50. The experimental class and control class both experienced an increase from pretest to posttest when viewed based on the percentage of cognitive level. The experimental class showed a greater increase in learning outcomes compared to the control class; However, the experimental class did not outperform the control class. This happened because the implementation capacity of the experimental class was greater than the control class at the time of the pretest. As a result, the experimental class experienced a smaller increase than the control class. These results are in line with research results (Busch, 2024; Thukral et al., 2019), which state that "The effect of applying augmented reality-based media as a learning medium in the classroom in terms of increasing student learning outcomes, there is a significant difference before and after treatment".

Learning using augmented reality learning media can improve learning outcomes more significantly than conventional learning, this is reinforced by the results of the normal gain (N-gain) test for the experimental class which is higher than the control class. In the experimental class the N-gain value was 0.49 indicating the high category and the control class was 0.17 in the medium category. This shows that the increase in learning outcomes in the experimental class which carries out learning using augmented reality learning media is higher than the increase in student learning outcomes in the control class which carries out conventional learning. In addition, learning history using augmented reality (AR) provides an interactive and immersive experience for students. With AR technology, students can relive historical events, such as watching 3D visual reconstructions of historic battles or exploring archaeological sites that are difficult to physically reach. For example, through the AR application, they can see a virtual model of Borobudur Temple in detail, including complex relief ornaments, while also getting interactive information about the history of its construction (Gunawan et al., 2020; Meekaew & Ketpichainarong, 2020). This approach not only increases understanding of the material, but also builds students' emotional involvement and curiosity, so that history learning becomes more relevant and meaningful. This can make it easier for students to recognize and remember new information related to historical learning sources and media. This is supported by the results of the questionnaire on the animation display indicator which obtained a percentage of 89% (good). This is also supported by the results of validation by media experts on indicators which state that the visual design is in accordance with material needs and supports teaching materials in the very good category. Apart from that, the results of material expert validation on indicators state that 3D animation in augmented reality can visualize historical learning sources and media in the very good category. Learning history using augmented reality (AR) can significantly improve students' cognitive abilities, such as understanding, analysis and memory of material. AR technology allows students to learn more interactively and visually, making it easier for them to understand abstract or complex concepts. For example, students can use the AR application to view interactive animations about the Proclamation of Indonesian Independence, where they can watch virtual scenes of important figures such as Soekarno and Hatta reading the text of the proclamation. With this experience, students not only understand events chronologically but can also analyze the historical context more deeply, which ultimately improves their memory and ability to think critically about historical material.

This is supported by the results of a student questionnaire, namely 90.00% of students gave a positive response that the application of historical learning sources and media and their characteristics is more enjoyable and easier to understand if delivered using augmented reality media. In line with (Apuke, 2020; Suhaimi et al., 2018). who stated that "80% of students stated that Android-based AR learning media was very good at helping students understand respiratory organs and increasing students' interest in learning." With augmented reality learning media, students only get direct experience in learning related to wave material through wave visualization, but mathematical equations in the material are not included in the media (An, 2019; Suhaimi et al., 2018). This makes students only focus on their ability to remember and understand the description of wave material. This is one of the shortcomings of augmented reality learning media.

Augmented Reality (AR) is an innovative technology that is effective in supporting history learning in higher education. By combining digital elements with the real world, AR allows students to explore historical events, artifacts or places in depth. Students don't just read text or see static images, but can watch three-dimensional representations of historical relics, such as temples, ancient buildings, or war scenes, directly through AR devices (Busch, 2024; Putri et al., 2022). This technology increases understanding because students can interact with learning material visually and practically, so that historical material which is usually abstract becomes more concrete and easier to understand. The effectiveness of AR also lies in its ability to increase student motivation and engagement. By providing a more interesting and interactive learning experience, AR encourages students to more actively explore historical material. Additionally, AR enables the integration of visual elements with narrative or additional information in real

time, helping students connect historical facts to a broader context. Thus, the use of AR in history lectures not only enriches the learning experience, but also develops students' analytical and critical abilities towards historical events. This makes AR a relevant learning medium in the digital era (Suhaimi et al., 2018; Yeo, 2023).

Of the several advantages stated above, there are several disadvantages of augmented reality learning media. First, the 3D animation model cannot display images that can penetrate the marker, so the animation created can only be seen on the top side of the marker. Second, the mathematical equations contained in the material have not been included in the augmented reality learning media, so students focus on visualizing wave phenomena only. Third, using your hand when holding the marker makes the animation display shaky and unstable, or even causes errors that cause the image not to appear on the webcam. Therefore, a supporting tool is needed to position the marker, so that the animation displayed does not shake or is as stable as when held by hand (Ibharim et al., 2020; Paquot & Plonsky, 2021). Based on the discussion above, it shows that overall learning using augmented reality learning media can improve students' history learning outcomes, especially in historical learning sources and media. This is also supported by the average questionnaire that received a positive response from students, namely 88% (good).

The implications of research regarding the impact of Augmented Reality (AR) on increasing students' cognitive abilities in learning history can make a significant contribution to the world of education. The results of this research can encourage educators to adopt AR technology as an innovative learning medium, in order to increase students' absorption of historical material which is often considered abstract and less interesting. In addition, this research can be a basis for educational technology developers to create AR applications that are more interactive and in line with the curriculum. From a policy perspective, these findings can encourage educational institutions and governments to consider integrating AR technology in formal learning systems as part of a strategy to improve the quality of education. Furthermore, this research also opens up opportunities for further research that explores the effectiveness of AR in improving other cognitive aspects as well as its impact on various subjects other than history.

Limitations in this study include limited sample coverage, so the results may not be generalizable to a wider population. In addition, this research only focuses on history learning, so the impact of AR on other subjects has not been explored further. Another limiting factor is the availability of technological devices and infrastructure in schools, which can affect the effectiveness of AR implementation in the learning process. Therefore, further research is recommended involving a larger and more diverse sample to obtain more comprehensive results. In addition, future studies can explore the application of AR in various subjects and develop AR-based learning methods that are more adaptive and suit students' needs. The government and educational institutions are also advised to provide infrastructure support and training for teachers so that AR technology can be implemented optimally in the learning process.

4. CONCLUSION

Augmented reality learning media has an impact on student learning outcomes in the fields of media and history. This can be seen from the t-value which exceeds the t-table value. Apart from that, the average learning outcomes of students who use augmented reality learning media are superior to students who do not use augmented reality learning media. Students in the experimental group also demonstrated superior learning outcomes at almost all cognitive levels assessed. 2. Based on the results of the questionnaire, the response to the learning experience using augmented reality learning media was good. In history lectures, the use of augmented reality (AR) has a quite large positive influence, especially in developing a more interesting, immersive and interactive learning experience. AR facilitates understanding and retention of complex material by providing students with three-dimensional visualizations of historical events, locations, or artifacts. Additionally, this technology fosters critical and analytical thinking skills, motivates students to conduct in-depth investigations, and increases their engagement with the material.

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