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DEVELOPMENT OF AUGMENTED REALITY IN ISLAMIC RELIGIOUS EDUCATION LEARNING: CASE STUDY IN ISLAMIC BOARDING SCHOOL-BASED SCHOOLS

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ABSTRACT

This research aims to develop interactive learning media based on augmented reality to improve cognitive abilities in Islamic boarding school-based schools. This research and development type research uses the ADDIE development design through the analysis, design, development, implementation and evaluation stages. This research involved 94 students who collected data through tests, questionnaires and observations. Qualitative data was analyzed using the Miles and Huberman approach, while quantitative data was analyzed using the Paired Sample T-test. This study shows that the use of Augmented Reality learning media has a positive impact on students' cognitive abilities. The significant difference between the pretest and posttest scores, an average of -12.98, shows a significant increase after using this media. The standard deviation of 8.50539 indicates variation in improving results between students. However, with a 95% confidence interval, the difference between pretest and posttest scores was in the range -15.96 to -10.02, confirming a significant change. The results of the t-test hypothesis test ($t=8.905$, $df=33$) with a low p value (0.002) confirm that Augmented Reality media significantly increases student achievement in this trial. With these results, Islamic boarding school education policies can consider the integration of Augmented Reality as a learning medium that supports students' academic development more effectively.

Keywords: Augmented Reality, Islamic religious education Education, Native Generation, Pesantren.

INTRODUCTION

Islamic religious education learning in Islamic boarding school-based schools faces the challenge of uneven technological development (Dardiri Muhammad, 2020). Setiyawan's analysis shows that more than 74.3% of Islamic boarding schools in Indonesia still maintain traditional education patterns, in fact 64.8% of them rarely use the internet, and 35.2% do not use the internet at all (Ahmad Budi, 2012). In fact, many studies have proven the weaknesses of traditional learning, such as 1) one-way interaction. 2) Limited learning materials which lead to indoctrination (Amirrudin, Kamsin, 2005: 79). 3) Monotonous learning strategies, methods and techniques (Dian, 2016). This description of weaknesses provides the potential for failure to achieve learning objectives with greater scope (Wongsri, Prasart, 2010: 240). Nuraini stated that the anti-technology attitude towards Islamic boarding schools was due to the unavailability of supporting facilities, including the internet and digital-based learning media (Nuraini, 2020). This problem must be overcome by developing digital-based learning tools, such as Augmented Reality. Considering that Internet usage statistics in Asia reach 69% or around 2917 million of the world's total population (Yatan, 2018: 197), the development of AR-based educational transformation is something that must be implemented (Norabeerah, 2012). With many aspects of entertainment and novelty, AR has provided many benefits for education (Ronald, 1997: 355-385). However, this potential has not been widely exploited by Islamic boarding school educators who are identified with traditional learning patterns.

So far, many studies on augmented reality have been carried out in the realm of positivistic research. For example, Acesa Arrofa who measured the effect of using augmented reality media on the learning outcomes of elementary school students (Acesta, dkk, 2018: 346-352). The analysis shows similarities with Marsono's research that the use of augmented reality has a good impact on learning outcomes of Natural Sciences for elementary school students (Marsono, dkk, 2021: 3463-3469). Another research was also conducted by Dedy Atmaja who developed augmented reality for interactive learning (Dedy, 2017: 227-232). The results of his research are in line with Andis Indrawan's research which shows that the use of Augmented Reality development as an interactive learning medium can be developed through IoS and Android applications (Indrawan, dkk, 2021: 61-70). With a different approach, a post-positivistic study has also been conducted to examine the use of Augmented Reality in education. Shiddiq Sugiono for example, he succeeded in synthesizing challenges and obstacles that might be faced in using Augmented Reality (Shiddiq, 2021: 1-12). His findings are reinforced by Alalwan Nasser's research which states that the biggest challenge in using Augmented Reality is on the resource side of educators who do not have ideas for developing learning creativity (Nasser, 2020). These studies have provided many benefits for the development of educational technology. However, previous studies have not been able to apply the development of Augmented Reality for the study of Islamic religious education, especially in Islamic boarding schools which are identical with traditional education. In fact, this effort is very important to support the pesantren curriculum for the native generation so that it can adapt to the times (Krisdiyanto, Gatot, 2019: 11-21).

This research aims to develop Islamic Religious Education learning media based on Augmented Reality in Islamic boarding school-based schools. The research locus was carried out at Nahdhotul Ulama Junior High School, Bawang, Batang, Central Java. This location selection was based on the characteristics of Islamic boarding school-based schools located in semi-modern areas. We consider this condition important because the development of Augmented Reality applications requires Android assistance (Ronald, 2013: 41). School policies that allow students to bring smartphones under certain

conditions are a reasonable reason to carry out data mining. For this reason, this research focuses on two problems, 1) how to develop the application of Augmented Reality in religious knowledge for Islamic boarding school-based high school students. 2) what is the influence of the development of Augmented Reality applications on religious knowledge in Islamic boarding school-based high school students. This is based on the argument that the many aspects of entertainment and novelty in Augmented Reality applications have the potential to increase learning motivation which has an impact on achieving learning outcomes (Hsin-Kai, 2013: 41-49). However, the absence of a government policy regarding the use of Augmented Reality makes it still unfamiliar among Indonesian educators (Regie, 2020: 97). This opens up the possibility that there are certain factors that support the failure of media development. To answer these differences, this research is an important theme that must be carried out.

RESEARCH METHOD

Types and Research Approaches

This Research & Development (R&D) type study uses the ADDIE development design through the analysis, design, development, implementation and evaluation stages (Sri, 2012: 15). The product produced is in the form of learning media integrated with augmented reality applications in Islamic religious education learning subjects as a scientific branch of Islamic religious education as a mandatory curriculum in Indonesia. The theme tested in this research focuses on the material "Islamic religious education of marriage". The data presented has passed 1) the model development stage which consists of design validation, preliminary field testing, and field trials. 2) expert validation to obtain improvement. This study involved 4 experts who are experts in the media field, and material experts on the theme of marriage Islamic religious education. The field test in this study used the pre-experimental method with the pretest-posttest one group design (Thomas, 2016: 467).

Participant

Acting as a subject, this study involved students of Nahdhotul Ulama Junior High School Bawang Batang as a formal Islamic boarding school-based educational institution. The pre-field trial phase involved 30 students, while the playing field test involved 94 students with ages ranging from 17 years, the average of them was born in the 2005-2007 range so that they are classified as generation Z which is close to digital native (Sujana, Putu, 2021: 518). Selection of research subjects using purposive sampling. The reason for using this purposive sampling technique is because researchers do not generalize by sticking to certain considerations (Etikan, dkk, 2016: 1-4). The selected students are those who are in class XI in the second semester who receive Islamic religious education subjects as a branch of the development of Islamic Religion education.

Engineering and Data Collection

The data in this study were collected through tests, questionnaires and observations. The descriptive test aims to determine the effect of using Augmented Reality on students' religious abilities on the theme of marriage Islamic religious education. Aiken's V validity was used to measure validity with a 5% error rate of 0.78 (Dewar, dkk, 1980: 120). In the validity test that has been carried out, there are ten valid questions, while three of them are invalid. The next step is to test the reliability with Cronbach alpha, this analysis gets a value of 0.784. Referring to the r value with a 95% confidence level or 5% significance ($p = 0.05$) (James, 2002) with $0.784 > 0.4428$, these data indicate that the test

instrument developed can be said to be reliable.

The purpose of distributing the questionnaire was to find out student responses to the AR-based interactive multimedia prototype that we developed. This study analyzes the questionnaire on the aspects of learning materials, display application features, and programming related to the media (Elizabeth, 2005). In this study we used product moment correlation to test the validity of the questionnaire, while the significance level used was at 5%, $df = 8$, with a r_{table} value of 0.632 (Vogel, et al, 1993: 1745). All of the questionnaires tested have a value of $r > r_{table}$, so all questionnaires are classified as valid. In addition, this study also used Cronbach alpha to determine the level of reliability of the questionnaire. The level used is at an alpha value of 0.971 (James, 2002). The value of r at the 95% confidence level has a significance level of 5% ($\alpha = 0.05$) with a value of $df = 10 - 2 = 8$ is 0.4428. This data acquisition is representative enough that the questionnaire used can be said to be reliable.

Data Analysis

We have used Miles and Huberman's interactive data analysis model through the stages of data reduction, data display, and verification in this research (Ali., 2017: 1-14). After the data is collected, this research is continued with analysis. The entire research data was collected for selection so that the data presented really supports the conclusion stage (Huberman, 1994). In the main field test, data were analyzed using a paired sample t-test with a significance level of 5% (Ross, Amanda, 2017: 17-19). The analysis prerequisite test is important to ensure that each variable analyzed has a normal distribution, followed by the use of the Kolmogorov-Smirnov test as an attempt to measure normality. Tests were applied to students to obtain data on differences in Islamic religious education understanding ability scores before and after learning using Augmented Reality-based multimedia assistance (Berger, et al, 2014).

RESULT AND DISCUSSION

Prototype Development and Design Validation

After conducting an analysis of learning needs, the preparation of augmented reality (AR) product prototypes was followed by analyzing the curriculum through basic competency data which became the basis for developing learning materials. This is intended so that the developed media can help students effectively master the material "Islamic religious education of marriage" so that they can teach it properly. The scope of the material tested in this study is presented in Table 1 below.

Table 1: Competence and indicators of religious learning on marriage material

Indicator	Competency
1.5. Living the wisdom of Islamic provisions regarding marriage	1.5.1. Believing that there is wisdom from Islamic provisions regarding marriage 1.5.2. Spread the wisdom of Islamic provisions regarding marriage
2.1. Practicing obedience and responsibility as an implementation of understanding the provisions of marriage in Islamic law and legislation	2.1.1. Having noble character as an implementation of understanding the provisions of marriage in Islamic law and legislation 2.1.2. Be an example as an implementation of understanding the provisions of marriage in Islamic law and
3.5. Analyze the provisions of marriage in	

Islamic law and legislation	legislation
4.5. Presenting the results of an analysis of appropriate and inappropriate marriage practices in accordance with the provisions of Islamic law that occur in society	3.5.1. Organizing the provisions of marriage in Islamic law and legislation 3.5.2. Comparing the provisions of marriage in Islamic law and legislation 4.5.1. Selecting marriage practices that are appropriate and not in accordance with the provisions of Islamic law that occur in society 4.5.2. Enlighten marriage practices that are appropriate and not in accordance with the provisions of Islamic law that occur in society

The resulting product is an interactive multimedia based on augmented reality which can be used on both Android and iOS applications. The scanner system in the AR application is integrated with learning books that are attached to markers to be scanned with Augmented Reality. Augmented reality-based Islamic religious education learning media in Islamic religious education has the PAI logo as the parent of a family of Islamic religious education subjects.

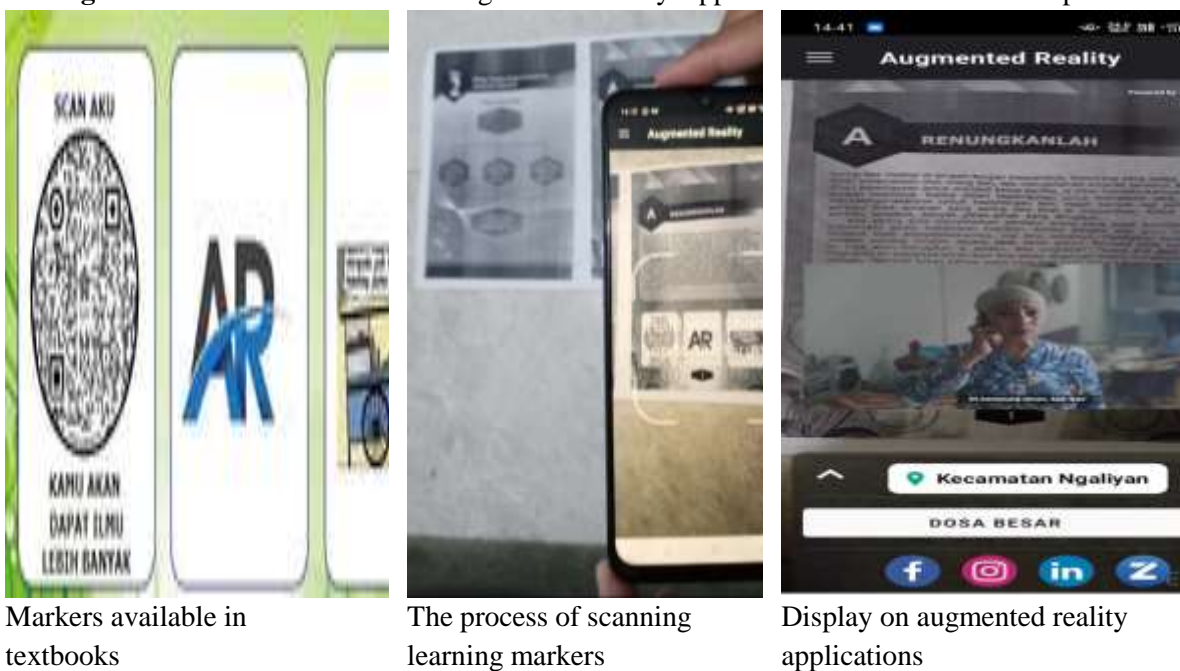


Figure 1: The logo of the augmented reality application product that has been developed

The developed multimedia has 3 main menus consisting of AR scan which includes quiz features, learning videos, additional material, and social media links. This application also provides a QR code scan if you need an object with the Quick Response series. Camera AR functions to display the desired 3D image. Its use is quite easy, students only need to point the camera at a two-dimensional image (marker) contained in the textbook, wait a few moments and the 3D view will automatically appear realistically. Views of 3D objects working through augmented reality technology are shown in figure three. 3D objects can display animations and videos to make it easier for students to understand marriage Islamic religious education material, the image below provides an example of adding animation and learning videos presented in the Augmented Reality application:



Figure 2: The main menu in the Augmented Reality Application that has been developed



Markers available in textbooks

The process of scanning learning markers

Display on augmented reality applications

Figure 3: Appearance of 3D objects working through augmented reality technology

In addition to the video learning menu, there is a quiz menu which contains questions related to basic competencies to measure students' ability to take part in learning. This application provides a test menu that is integrated with Google Forms. The image below shows the display of the test menu on the scan results feature from AR.

Isilah Soal di bawah ini dengan teliti!

nasikhinkhotifah@gmail.com
(tidak dibagikan) Ganti akun

Nama
Jawaban Anda

Kelas
Jawaban Anda

Berikutnya Kosongkan

Di bawah ini yang termasuk rukun nikah, kecuali...

☐ kedua mempelai

☐ shogho/ ijab qobul

☐ wali wanita

☐ dua saksi

☐ mahar

☐ Add option or add "Other"

Figure 4: Evaluation sheet containing multiple choice test questions

In terms of assessment by material experts, the products developed get an average score of 3.44. According to material experts, products that develop augmented reality in the adoption of Islamic religious education marriage material can lead students to be actively involved in learning activities. He believes that this product development can encourage students to actively seek information to solve problems. He provided input so that material related to marriage Islamic religious education needs to be improved because it has undergone many changes compared to the previous material, for example in adding information via YouTube and other animations. Meanwhile, the assessment of media experts showed an average score of 3.42. He provided revisions to aspects of color composition, concept maps, and aspects of administration/assignment of teaching materials as markers. The results of the expert's assessment demanded improvements in both the display aspect including color density or programming. The experts' suggestions were followed up by making prototype improvements, such as adding test questions in the analysis column and adding learning materials to suit learning objectives and competencies.

Preliminary Field Test

After product improvements were made according to the advice of experts, this research was continued by conducting field tests on a small scale. This treatment was carried out by involving 30 students. Preliminary trials were carried out with the help of Islamic religious education subject teachers as collaborators. The results of students' ability tests in the Islamic religious education of marriage study, the preliminary field trial stage can be seen in Figure 5.

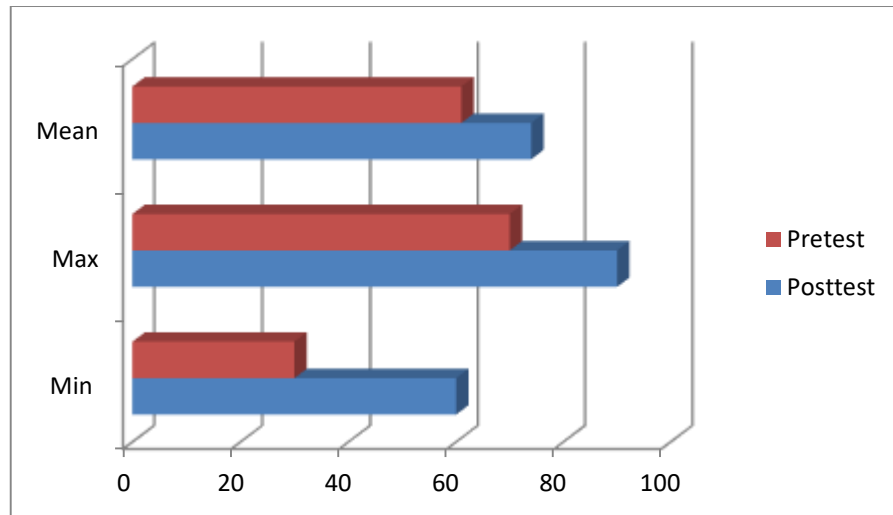


Figure 5: Field trial results are limited to the preliminary session

The data from the test results above shows an increase in students' cognitive abilities, compared to before using Augmented Reality-based learning products. This fact confirms that the product being developed can be continued at the main field trial stage. Table 2 below shows students' responses in using augmented reality-based learning multimedia.

No	Aspec	Score	Category
1	Learning materials	3.1	Good
2	Programming	3.5	Very good
3	Appearance	3.3	Good

Table 2: Student responses regarding product prototypes in preliminary field trials

Table 2 provides an explanation that students' responses to AR-based interactive multimedia are generally of good quality. The program component received the highest score with a score of 3.5. Preliminary Field Test Data Students view the developed multimedia prototype as attractive and not difficult to use. Input from students at this limited trial stage was that AR cameras were not yet adaptive in detecting markers arranged on objects.

4.3 Main Field Testing

In order to test the effectiveness of the media, the main field test stage was carried out through studying the Islamic religious education of marriage using a revised prototype. All forms of improvement are adjusted to the results of preliminary field tests. The main field trial involved 94 students along with a science teacher. The main field test results are presented in Figure below.

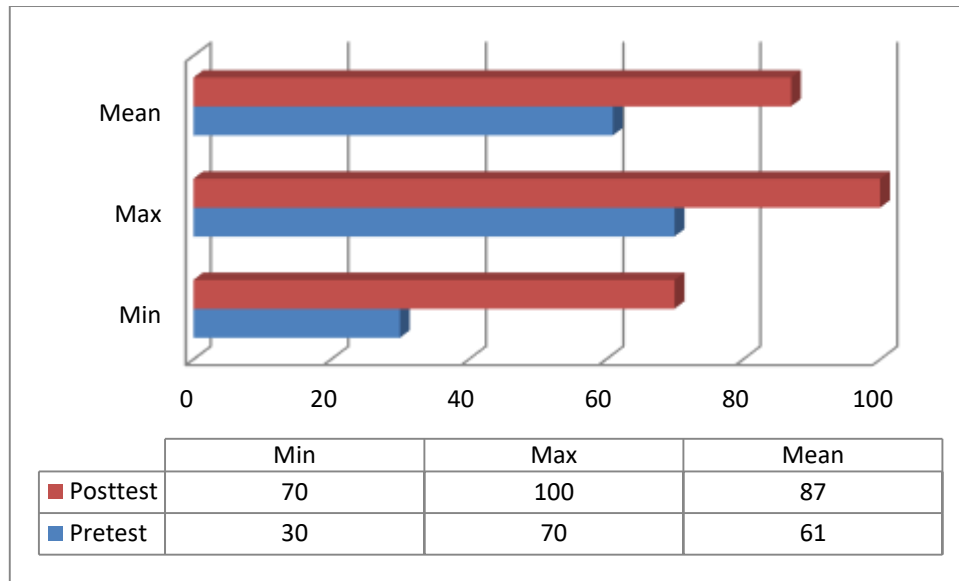


Figure 6: Results of the main field trials in the preliminary session

The picture above provides an explanation that the developed augmented reality-based learning media is classified as effective in increasing students' abilities in learning Islamic religious education. The paired sample t-test tested after measuring normality with the Kolmogorov Smirnov, this research shows that the normality test at a significance level of 5% gets a value of 0.437 in the pretest data and 0.052 in the posttest data. The Y magnitude of 0.05 obtained from the normality test indicates that the test data is normally distributed. We also used a paired sample t-test to obtain data on the significance of the differences in the pretest and posttest mean values in the sample groups. The results of the research data are shown in the table below.

	Paired Differences					t	df	Sig. (2-tailed)
	Me an	Std. Deviat ion	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair Prete st- Postt est	- 12. 98	8.5053 9	1.4586 6	-15.96	-10,02 8,905	8.905	33	.002

Table 3: Paired Sample t-test results

The results of this study show that the paired sample t test is at a value of $Y = 0.002 < 0.05$, meaning that H_0 is rejected. Thus it is proven that at the 95 percent confidence level the average post-test score of Islamic religious education ability on marriage material is not the same as the pre-test score so that it can be said that our product plays an effective role in improving student learning outcomes. In addition to the trial results, we present data related to student responses to the use of Augmented Reality products in the study of Islamic jurisprudence at Madrasah Aliyah Sunan Kalijaga Bawang during the main field trial stage.

No	Aspec	Score	Category
1	Learning materials	3.7	Very good
2	Programming	3.7	Very good
3	Appearance	3.5	Very good

Table 4: Student responses regarding the product prototype in the main field trials

The data above shows students' interest in the prototype being developed. They said that Augmented Reality-based multimedia could help facilitate the understanding of marriage Islamic religious education material. They see the product as an interesting medium that encourages the creation of fun learning. The results of this main test are different from the initial conditions which indicate that students are not interested in studying Islamic religious education marriage material. Students are of the view that Islamic religious education education with the help of Augmented Reality encourages them to be actively involved in class.

DISCUSSION

This study shows that the use of Augmented Reality-based learning media has a positive impact on students' cognitive abilities. This is shown by the significant difference between the pretest and posttest scores, with an average difference of -12.98. In this analysis, the average difference indicates that after students used Augmented Reality-based learning media, there was a significant increase in their achievement. The average posttest score is higher than the pretest score. In addition, the standard deviation of 8.50539 shows variation in improving results between students. This implies that not all students experience the same improvement. However, with a 95% confidence interval, we are confident that the difference between the pretest and posttest scores is in the range -15.96 to -10.02. This range confirms that there has been a significant change in student achievement after using Augmented Reality-based learning media. The results of the t-test hypothesis test with a t value of 8.905 and degrees of freedom (df) of 33 indicate that the difference between the pretest and posttest is statistically significant. The low p value (0.002) also indicates strong evidence to reject the null hypothesis, which states that there is no significant difference between the pretest and posttest scores. Therefore, Augmented Reality-based learning media significantly increases student achievement in this trial.

In line with this research, several other studies also found results that support the use of Augmented Reality-based learning media in increasing student achievement. For example, Anuar, Nizar and Ismail (2021) show that the use of Augmented Reality in learning significantly increases students' understanding of concepts and engagement. Similar results were also found in the analysis of Chen et.al (2017), which highlighted a significant increase in students' understanding of historical topics through the use of Augmented Reality-based media. On the other hand, some studies may produce contradictory findings. For example, Khan (2019) notes that the use of Augmented Reality-based learning media does not always result in a significant increase in student achievement. Similar to the findings of Lin, Cheng, and Chang (2015) who found that the positive effects can vary depending on the learning context and how this technology is implemented in the curriculum. Additionally, Criello et al. (2021) suggest that although there is an improvement in test results after the use of Augmented Reality, the long-term effects may not always be sustainable. They found that students can lose the understanding they gain through the use of this technology if there is no emphasis on deep understanding of concepts in Augmented Reality-based learning. In order to understand more deeply the impact of using Augmented Reality-based learning media, it is necessary to consider the context and research methods used in the research, as well as additional factors that can

influence the results (Sommerauer, 2018).

This research reveals striking differences in results because various augmented reality features provide unique contributions in increasing students' interactivity and engagement during the learning process (Setiawan, 2023). By utilizing AR technology, learning material can be presented dynamically and visually stunning, allowing students to experience learning directly and be actively involved in the experience (Abdussalem, 2020). Previous research results recorded a significant increase in students' pretest and posttest scores, and t-test hypothesis test analysis showed statistical significance, confirming that AR plays a major role in increasing students' understanding and achievement in certain subjects (Turka, 2017). Moreover, with a very limited confidence interval at the 95% level, we can confidently state that the positive impact of AR in learning is consistent and reliable, providing strong evidence that this technology has great potential in improving the overall quality of education (Jamrus, 2019).

In connection with the research results that prove the effective use of AR in Islamic boarding school-based schools, several steps need to be taken so that the use of the media can be felt further. The first step is to understand AR technology in depth and assess its potential benefits in the context of Islamic boarding school education. Then, it is necessary to involve teachers and school staff in relevant training related to AR so that they can master its use (Dunser, 2012). Next, it is necessary to create a learning plan that integrates AR into the Islamic boarding school curriculum, by selecting the most appropriate materials for this approach. Additionally, it is necessary to ensure access to AR-enabled devices (Yeniunglu, 2021), such as smartphones or tablets, and ensure adequate connectivity. Finally, collaborating with AR technology and education experts and monitoring the development and learning outcomes of AR to continuously improve its effectiveness are important steps for success in implementing this technology in Islamic boarding school-based schools (Chien, 2019).

CONCLUSION

This study shows that the development of augmented reality-based learning media in Islamic religious education in Islamic boarding schools can improve students' religious abilities. The preparation of Augmented Reality-based learning multimedia on marriage Islamic religious education material refers to good multimedia aspects, consisting of aspects learning materials, uncomplicated programming, as well as an attractive display for students. The prepared media prototypes were considered very good by experts. The results of the implementation of the preliminary trials in this study were also in the good category, indicated by an increase in the pre-test and post-test results. However, the prototype must continue to be improved according to input from users in limited trials. The results of the repair of the media prototype were then tested on a wider scale, its use had a positive impact on student learning outcomes.

The results of this study provide a new way of saying that the accusation of Islamic boarding schools as educational institutions that cannot adapt to technological developments is not an appropriate statement. This is evidenced by an increase in students' religious abilities between before and after learning using augmented reality applications as Islamic religious education learning media. Furthermore, this data has implications for the formation of a modern educational culture that is able to coexist with the traditional-based curriculum in Islamic boarding schools. This implication can fortify traditional pesantren educational institutions so that they do not fall into dogmas that are

hostile to technological developments. This effort is important to be applied to all Islamic boarding school educational institutions so that their educational development can compete and adapt to the times.

This study has limitations on aspects of data and data analysis. The data only involved 93 students as research subjects. Data limitations have an impact on the limitations of the applied analytical techniques. Furthermore, the limitations of these two aspects lead to a less comprehensive generalization formulation. For this reason, further research is needed which involves more informants, participants and respondents from various schools and from various regions using a grounded research approach, so that sufficient data can be produced to serve as the basis for formulating generalizations that are more comprehensive and close to actual conditions occurring in the field. . In line with that, the results of this follow-up research can be used as a reference for the authorities in formulating educational technology development policies in strengthening the role of Augmented reality for the native generation.

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