

Development of Religious Moderation Learning Media Based on Augmented Reality Using Fast Corner Detection Algorithm

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Abstract

The religious moderation program aims to streamline religious life in diverse Indonesian society to create a religious society and nation that lives in peace, tolerance, and harmony. Internalization of religious moderation must be implemented in the madrasah environment to provide a strong understanding to students so that they can understand and apply the values of religious moderation in everyday life. Therefore, this study aims to develop Augmented Reality (AR)-based religious moderation learning media for madrasa students. The research method used is a modified System development life cycle (SDLC) model. The data collection technique in this study is a test. Pretest-posttest tests the product's effectiveness on learning outcomes, and observations and interviews are conducted to strengthen field data. At the same time, the participants in this study were elementary madrasah (MI) students in West Bandung Regency and Garut Regency, with 160 participants from seven schools. The selection of locations is based on the researcher's affordability and access. The results of this study indicate that the use of augmented reality (AR)-based religious moderation learning media has effectively improved student learning outcomes in religious moderation learning significantly. The results of the difference test show an Asymp. Sig. (2-tailed) value of 0.000, indicating that H_0 is rejected, and H_a is accepted. This means there is a significant difference in student learning outcomes before and after the treatment using Augmented Reality (AR) learning media, with an average pre-test score of 64.94 and an average post-test score of 93.50. Therefore, this study concludes that Augmented Reality learning media can improve student learning outcomes.

Keywords: Augmented Reality Learning Media, Madrasah Ibtidaiyah (MI), Religious Moderation

Abstrak

Program moderasi beragama bertujuan untuk merapikan kehidupan keagamaan di masyarakat Indonesia yang sangat beragam, dengan tujuan menciptakan masyarakat beragama dan bangsa yang hidup secara damai, toleran, dan harmonis. Internalisasi moderasi beragama menjadi hal yang penting untuk diterapkan di lingkungan madrasah, dengan maksud memberikan pemahaman yang kuat kepada siswa agar mereka dapat memahami dan menerapkan nilai-nilai moderasi beragama dalam kehidupan sehari-hari. Oleh karena itu tujuan dari penelitian ini adalah pengembangan media pembelajaran moderasi beragama berbasis Augmented Reality (AR) pada siswa madrasah. Metode penelitian yang digunakan adalah model System development life cycle (SDLC) yang dimodifikasi. Teknik pengumpulan data dalam penelitian ini adalah tes. Pretest-Posttest diberikan untuk menguji efektivitas produk terhadap hasil belajar, observasi dan wawancara dilakukan untuk memperkuat data lapangan. Sedangkan partisipan dalam penelitian ini adalah siswa madrasah ibtidaiyah (MI) di Kabupaten Bandung Barat dan Kabupaten Garut, dengan 160 partisipan dari tujuh sekolah. Pemilihan lokasi berdasarkan keterjangkauan dan akses yang dimiliki peneliti. Hasil dari penelitian ini menunjukkan penggunaan media pembelajaran moderasi beragama berbasis Augmented Reality (AR) telah secara efektif mampu meningkatkan hasil belajar siswa secara signifikan dalam pembelajaran moderasi beragama. Hasil uji perbedaan menunjukkan nilai Asymp. Sig. (2-tailed) sebesar 0,000 yang berarti H_0 ditolak dan H_a diterima. Hal ini berarti terdapat perbedaan yang signifikan hasil belajar siswa sebelum dan sesudah perlakuan menggunakan media pembelajaran Augmented Reality (AR), dengan rata-rata skor pre-test sebesar 64,94 dan rata-rata skor post-test sebesar 93,50. Dengan demikian, penelitian ini menyimpulkan bahwa media pembelajaran

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Augmented Reality dapat meningkatkan hasil belajar siswa. Oleh karena itu, guru perlu kreatif dan inovatif dalam memanfaatkan berbagai media pembelajaran.

Kata kunci: Media Pembelajaran Augmented Reality, Madrasah Ibtidaiyah (MI), Moderasi Beragama

BACKGROUND

Religious moderation is one of the priority programs of the Ministry of Religion. The application of religious moderation values needs to be championed in the madrasa environment, in line with KMA Number 184 of 2019, which requires every subject teacher to install the values of religious moderation. Applying religious moderation values to students is not only related to learning administration but also involves teachers in creating a conducive classroom atmosphere and practicing habits that encourage a culture of moderate thinking in religion.

Religious moderation is when a person understands and practices religious teachings fairly and balanced, intending to avoid extreme or excessive behavior when implementing them. The importance of religious moderation is emphasized to students in madrasas, considering the challenges of extremism, radicalism, and hate speech that are currently a problem in Indonesia. As an educational institution with Islamic characteristics, madrasah is expected to pioneer the development of moderate attitudes, aiming to create harmony. Indicators of success in instilling the principles of religious moderation in madrasah students in Indonesia can be measured from the development and improvement of understanding, attitudes, and behavior of moderate religion among them (Direktorat KSKK Madrasah, 2021).

For Islamic Religious Education teachers tasked with instilling the principles of religious moderation to students, communicating the principles of proper religious moderation is challenging. Saefuddin et al. in their research results, showed that radicalism in Indonesia has recently increased. Ironically, this increase is often associated with the failure of religious education to form moderate attitudes and behavior. In the current era of globalization, religion, and technology are two elements of life that continue to go hand in hand. However, there is disharmony, where the use of technology by some people harms technological progress that should make human life easier. The core problem involves the relationship between technology and religious messages, the relevance of technology and religion, and religious moderation in technological and information developments (Saefuddin et al., 2023).

Therefore, innovative efforts are needed to integrate technology and Islamic religious education to produce innovative products that can support the implementation of religious moderation values in the madrasah environment, especially for elementary school students. One solution is to use Augmented Reality (AR) technology in learning. Instilling religious moderation values in elementary school students or elementary schools is crucial. The elementary school phase is a crucial time in shaping children's character education because, during this period, they experience rapid development in various aspects such as physical, motoric, personality, emotional, intellectual, language, character, and moral aspects (Rusmana, 2019).

Augmented Reality (AR) is a technology that projects virtual objects in 2D or 3D into the real world. The advantage of AR technology is its ability to display more attractive images with 3D objects that appear in the real environment (Pradana, 2020). Augmented Reality combines the virtual world and the real world created by a computer. Virtual objects, such as text, animation, 3D

models, or videos, are combined with the real environment so that users feel the virtual objects exist (Priantama et al. 2021). 3D objects integrated into the real environment through smartphone applications make AR a simple technology. AR positively impacts the education sector by involving multimodal learning, increasing access to educational content, giving students more control over educational materials, opening up opportunities for collaborative learning, encouraging active student participation, and turning abstract concepts into concrete experiences (Sari et al. 2020).

The use of Augmented Reality (AR) technology in learning media is closely related to the development of students' learning interests. The presentation of 3D objects, improved sound quality, use of supporting images, and the combination of entertainment elements (games) that involve various senses are considered capable of creating an innovative learning environment. With this approach, students can engage in learning activities while playing, increasing their interest in learning and making it easier for them to understand the information presented. Previous studies have used AR technology as a learning medium, such as AR, for thematic learning in grade 5 elementary school students. The results of this study indicate that AR applications can increase students' interest and learning abilities (Nugraha et al. 2021).

Several previous studies, including Jumahir et al. (2025), have investigated the use of technology to develop religious values in elementary school students; the goal of this study is to examine the effect of interactive learning methods based on artificial intelligence (AI) on elementary school student's understanding of Quranic values. The study's scope involves the use of AI technology as an interactive and adaptable learning medium to help students internalize Quranic ideals in elementary school. The next study by Mubarak et al. (2024) aims to analyze the impact of TikTok social media on the character education of elementary school pupils in the era of technology 4.0. Utami and Muqowim's (2020) study seeks to examine the implementation of integrating Islamic principles with ICT courses at the primary school level. According to these investigations, the technology used did not explicitly leverage AR technology.

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On the other hand, some earlier research, like Sangi and Bata (2023), have investigated the benefits of augmented reality technology in elementary school student learning, namely the development of augmented reality applications for learning human circulatory system information. Furthermore, Wibowo et al. (2022), investigated the construction of augmented reality-based learning media for animal classification material. Meanwhile, Setyawan et al. (2019), investigated the use of Augmented Reality technology in Android applications for science learning media. According to these studies, there has been no usage of AR technology for the formation of religious values.

Although there have been technological advances, research gaps remain, especially in using AR for religious moderation education, especially for MI or SD students. Meanwhile, some previous studies have focused on using AR for non-religious learning. Based on what has been explained, this study seeks to develop augmented reality technology in Islamic religious learning. Thus, this study aims to develop religious moderation learning media based on augmented reality using a fast angle detection algorithm to improve learning outcomes.

RESEARCH METHODS

This study uses the R&D method with a System Development Life Cycle (SDLC) development design. After the product is developed, it is tested on some research samples. Before being tested, the product receives a review or assessment through forum group discussion (FGD) activities and assessments by media and material experts. Meanwhile, the research sample used was some fifth-grade students of State and Private Madrasah Ibtidaiyah (MI) in West Bandung Regency and Garut Regency, with as many as 160 students spread across seven schools. The selection of locations in these two regencies was carried out to obtain a wider but still measurable sample. In addition, the selection of locations was carried out because of the availability of researcher access to samples or research participants. Meanwhile, the system development life cycle (SDLC) model approach was used in developing this system, namely the planning, analysis, design, implementation, and testing stages. (Satzinger, et al., 2002), "SDLC provides a framework for how to develop a software system". Several researchers (Al-Khalidi, 2014; Passerini & Granger, 2000) have adopted SDLC in developing ICT-based learning models. (Pressman, 2001), explain the stages in the software development process model using the linear sequential or waterfall model by adding a testing stage after the implementation/coding stage.

Referring to Figure 1, namely the software development stages of Satzinger et al. for the System Development Life Cycle (SDLC) model research, the researcher modified it as follows:



Figure 1 Modified System Development Life Cycle (SDLC)

1. Research Planning Stage

This stage is the stage where the research is planned. The research starts after determining and defining the problem (problem limitation), conducting a literature study, and conducting a review. The planning stage has, in principle, been implemented when compiling the research proposal.

2. Research Needs Analysis

The main objective of this stage is to understand and document the information needs and processes required in the development of learning media. The information needed consists of school conditions, teacher conditions, student conditions, facilities and infrastructure, and learning conditions. Information collection is obtained through field observation and interview activities. Religious moderation learning is a special program of the Indonesian Ministry of

Religion to increase student awareness of differences in religious life in Indonesia. This learning is still in the implementation stage of socialization. Therefore, for this learning to be more easily absorbed and implemented on a wider and more massive scale, an interesting and interactive model or teaching media approach is needed.

3. Learning Model Design

This stage contains activities on designing the developed learning media. The design stage consists of designing a religious moderation learning plan using Augmented Reality (AR) media and designing learning software—finally, the learning evaluation design. The evaluation uses pretest and posttest tests, including compiling question grids and testing the validity and reliability of test instruments. The test is given to a number of students to test the effectiveness of learning media on the success of achieving learning objectives.

4. Implementation/coding

This stage is where the learning software design is built into software components, data conversion or input of knowledge data into learning software. This stage is carried out by experts verifying and testing the model. Forum group discussions (FGD) are conducted to obtain direction and product improvements before being tested through religious moderation learning for elementary madrasah (MI) students. The final activity is system installation and training for testing the learning model.

5. Testing

The learning media that is ready is then tested for its effectiveness on a number of grade 5 MI students. Before learning begins, students are given a pretest to determine their knowledge and understanding of the concept of religious moderation. Next, students were given a learning treatment on religious moderation using Augmented Reality (AR)-based learning media. At the evaluation stage, students were given a posttest to measure the achievement of learning outcomes using AR learning media.

Furthermore, the primary data collection technique used in this study is a test, specifically to assess the effectiveness of the media by giving learning treatment through Augmented Reality (AR) technology-based media. This test is designed based on indicators to assess students' understanding of the values of religious moderation. After the instrument was prepared, it was first tested for validity and reliability on a number of samples outside the research sample, totaling 36 students. Only valid questions and good reliability can be used for research instruments. So, the test used in this study amounted to 30 items. The next stage of the test was given to a number of research samples, namely elementary madrasah (MI) students from seven schools totaling 160. Students were given pretests and posttests to evaluate their learning outcomes. Data were analyzed using statistics assisted by SPSS version 26. Meanwhile, observations and unstructured interviews were conducted to strengthen empirical evidence.

RESULT AND DISCUSSION

Learning Model Design

The development of AR learning media in this study aims to improve students' knowledge and understanding of the values of religious moderation in Indonesia. This AR learning media is an innovative learning media that can combine 2D or 3D virtual objects in a real-world environment and then project the virtual objects into reality in real time. In this learning design stage, an appropriate religious moderation learning design is developed, namely the design of the learning

plan, implementation, and evaluation. A pretest is given to students before learning begins. This is done to determine initial knowledge about religious moderation. In comparison, the posttest is given after learning is completed to determine whether there is a difference in knowledge and understanding of the material after the learning process is given.

Augmented Reality (AR) Application Design

Design is the second stage after the learning design, which is creating system specifications. Figure 2 is the design stage of the AR religious moderation application that will be created (see supplementary file for clearer picture).

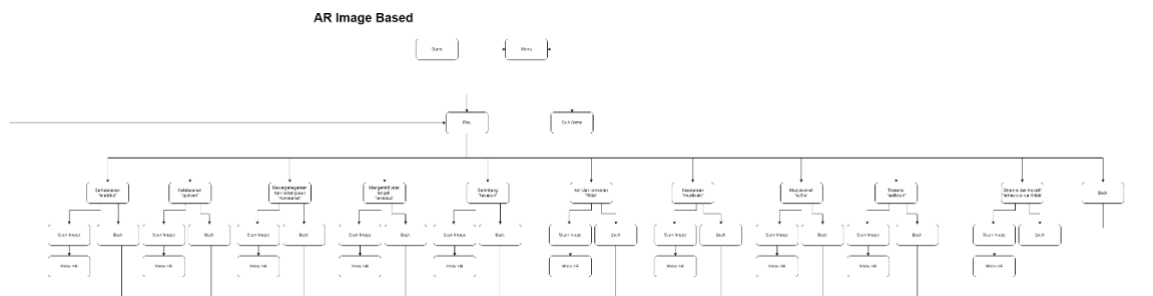


Figure 2 AR Development flowchart for religious moderation

The process of creating image designs as targets for displaying 3d objects available in Figure 3.



Figure 3. Image design as targets

Uploading target image designs into the Vuforia database for use in unity available in Figure 4.

<input type="checkbox"/>	Image	Target Name	Type	Rating	Status	Date Modified
<input type="checkbox"/>		kesetaraan	Image	★★★★☆	Active	Sep 29, 2024
<input type="checkbox"/>		inovatif	Image	★★★★★	Active	Sep 29, 2024
<input type="checkbox"/>		toleransi	Image	★★★★☆	Active	Sep 29, 2024
<input type="checkbox"/>		Musyawaharah	Image	★★★★☆	Active	Sep 29, 2024
<input type="checkbox"/>		berimbang	Image	★★★★☆	Active	Sep 29, 2024
<input type="checkbox"/>		konsisten	Image	★★★★★	Active	Sep 29, 2024
<input type="checkbox"/>		jalan-tengah	Image	★★★★☆	Active	Sep 29, 2024
<input type="checkbox"/>		kewarganegaraan	Image	★★★★★	Active	Sep 29, 2024
<input type="checkbox"/>		Keteladanan	Image	★★★★★	Active	Sep 29, 2024
<input type="checkbox"/>		keberadaban	Image	★★★★★	Active	Sep 29, 2024

Figure 4 Rating markers on vuforia

Creating application interface designs and layouts are available in Figure 5. Then, the testing process for displaying 3d objects on the appropriate target image is available in Figure 6.

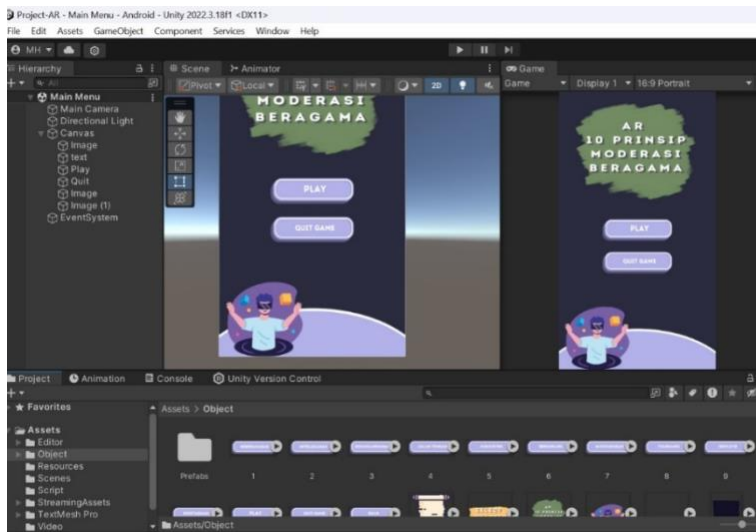


Figure 5 Interface design and layout

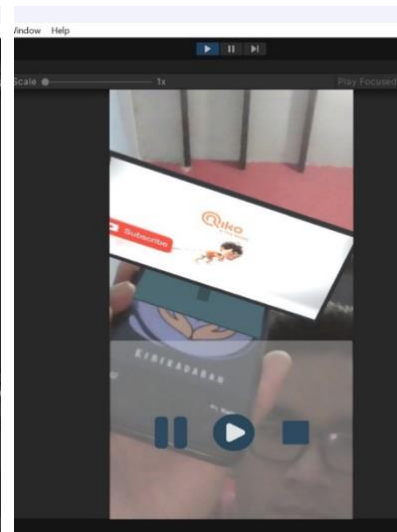


Figure 6 Target image testing process

Implementation /coding

The model design that has been prepared is then implemented into the syntax of the programming language that forms a learning media application product. This stage includes the creation of database software to manage religious moderation knowledge and AR learning process data. When the product or design of a model or learning media is applied in the field, it requires a review or assessment of feasibility. The feasibility test is obtained from media and learning material experts. Hopefully, the media that will be used will improve students' understanding of religious moderation learning. The result of product development is an augmented reality (AR) application

that will be installed on an Android cellphone and contain the principles of religious moderation values. This application was developed using Indonesian. It is built for learning media intended for elementary school students in two districts in Indonesia. Figure 7 is a display of the application's initial menu.



Figure 7 Initial menu display of the application

The initial menu display is the home page of this application. On this initial display, there is a "Play" button to start opening the learning menus. While the "Exit" button is used to exit the application.



Figure 8 Menu display based on theme

On this display (Figure 8), there are 10 menus that users can access when opening the application: balanced value material, equality, exemplary, civilized, deliberation, seeking a middle way, citizenship, consistency, tolerance, and innovation (Direktorat KSKK Madrasah, 2021).

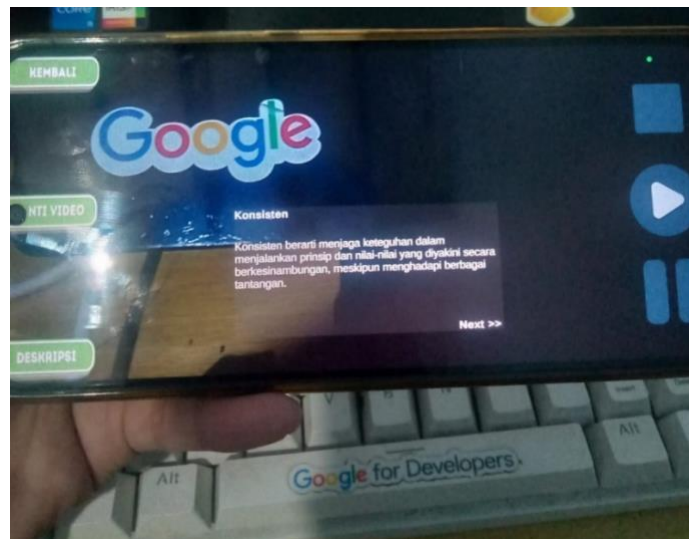


Figure 9 Displays video description

Figure 9 contains a display description of each learning video in this application menu. So that students can understand the initial picture of the video content displayed.

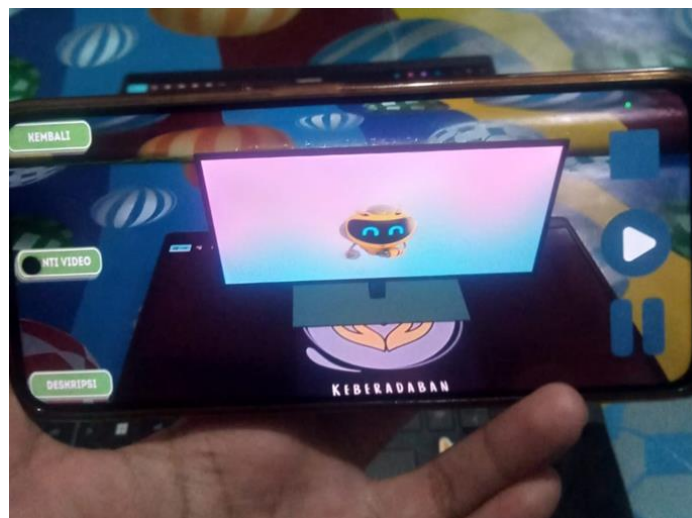


Figure 10 The final display of the AR application

The display in Figure 10 is the final display of Augmented Reality (AR) technology-based learning media that has gone through a revision process and suggestions from media experts.

Testing

The validity test results of the questions using the Anates application show that the valid correlation value is 0.581-0.966, with a reliability value of 0.98. These results can be interpreted that the questions can be used to collect research data. Testing is conducted to determine the effectiveness of Augmented Reality (AR) learning media on religious moderation learning. This testing stage provides tests at the beginning of learning (pre-test) and the end of learning (post-test). The initial test was intended to determine students' initial understanding of religious moderation learning, and the final test was intended to determine whether there was an increase

in students' understanding of religious moderation after being given religious moderation learning using Augmented Reality (AR)-based learning media. After the data is obtained, the data is analyzed using SPSS Version 26.

Descriptive Analysis

Table 1 Description of Pretest-Posttest

Descriptive Statistics						
	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Pretest	160	50	90	64.94	8.831	77.983
Posttest	160	30	100	93.50	9.918	98.365
Valid N (listwise)	160					

Table 1 shows that the inputted data is 160, with an average pretest value of 64.94 and a standard deviation of 8,831. The average posttest value is 93.50, with a standard deviation of 9,918. The variance of the pretest is 77,983 and 98,365 for the posttest.

Inferential Analysis

Inferential analysis is a statistical technique used to analyze sample data. In this study, it is used to determine whether there is a significant difference between the pretest and posttest values.

Normality test

The normality test is used to determine whether the distribution of the two data groups is normally distributed. The normality test is a prerequisite test to determine the type of statistical test to be used. The following are the results of the normality test for the two groups of data:

Table 2. Normality test

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest	.306	160	.000	.774	160	.000
Posttest	.288	160	.000	.632	160	.000

^aLilliefors Significance Correction

Table 2 shows that the significant value of the pretest data group is 0.000, and the significant value of the posttest data group is 0.000. Because the sig value is smaller than the alpha value of 5% = 0.05, it can be concluded that the data distribution of the two data groups is not normal. Because the data distribution is abnormal, the Wilcoxon test tests the significance of the difference between the two paired data groups. The Wilcoxon test is used to test the significance of the hypothesis of comparing two paired or correlated samples when the normal distribution requirements are not met (Sundayana, 2020).

Table 3. Wilcoxon test

Test Statistics ^a	
Posttest -	Pretest
Z	-10.335 ^b
Asymp. Sig. (2-tailed)	.000

^aWilcoxon Signed Ranks Test

^bBased on negative ranks.

Table 3 shows the Asymp. Sig. (2-tailed) value of 0.000. The hypothesis testing criteria are if the Asymp. Sig. (2-tailed) value $> \alpha = 5\% = 0.05$, then H_0 is accepted, and H_a is rejected. Because the Asymp. Sig. (2-tailed) value $= 0.000 < \alpha = 5\% = 0.05$, then H_0 is rejected, and H_a is accepted, meaning there is a difference in student learning outcomes between before and after treatment using Augmented Reality (AR) learning media.

Development of religious moderation learning media based on augmented reality using the fast corner detection algorithm

Based on the development results at the implementation stage, ten themes of religious moderation were developed, all included in the principles of religious moderation values contained in the guidelines for implementing religious moderation in madrasas (Amrullah et al., 2020). This development uses the System Development Life Cycle (SDLC) model, which includes the research planning stage, research needs analysis, learning model design, implementation/coding, and testing so that it becomes a media product that students can use.

Model design

The media development stage is part of the model design and implementation/coding stage. Two steps are taken in the model design: the learning model design and the AR application development design. The development of AR learning media in this study aims to improve the understanding of elementary madrasah (MI) students regarding religious moderation. *The first step*, compiling a learning design focuses on developing a learning plan, implementing teaching, and evaluating. The researcher uses a collaborative learning design at this stage, dividing students into small groups. This learning design is intended so students can work together to study and discuss teaching materials. Through cooperative learning, students learn to apply the values of cooperation, communication, creativity and learn to respect each other.

Religious moderation is an effort to maintain tradition and develop a friendly religious concept. Religious moderation is one way to maintain diversity in Indonesia without eliminating existing traditions and cultures (Direktorat KSKK Madrasah, 2021). Educational institutions have an important role in instilling and disseminating the values of religious moderation so that they can become part of everyday life. In this context, educational institutions act as a place to develop and foster the values of religious moderation. Primary and secondary education levels are crucial because understanding, experiencing, and applying the values of religious moderation at this level are the basis for the next stages (Munawir et al., 2023). Currently, religious life in Indonesia is characterized by variations in religious adherents who form community groups based on religious beliefs. Various social and cultural factors, such as differences in cultural background, ethnic diversity, and regional origin, also influence the state of religious life in Indonesia. Therefore, religious moderation can be a middle solution amidst the diversity of religious beliefs (Iddian, 2023).

The second step is AR application development design. The details of this stage have been explained in the previous section. This second stage is creating or developing Augmented Reality (AR) applications. In the education sector, Augmented Reality is used to support the learning process in order to create an interactive and enjoyable environment. Augmented Reality (AR) is a technology that combines 2D or 3D virtual objects into a real-world environment and then projects

the virtual objects into real objects directly. AR is often considered an important tool for visualizing abstract concepts because it can easily manipulate 3D objects without significant risk of error (Irsyad, 2016).

Implementation

The implementation stage is the stage that is carried out after the design stage is complete. The implementation stage is the programming language syntax that forms a software or application product. After the media product is completed in the first stage, it is tested for its feasibility through forum group discussion (FGD) activities by several media and materials experts. Their expertise is in advanced computing technology, computer programming, and information technology. Two of them are national-level religious moderation training tutors. The second stage is product improvement based on suggestions and assessments submitted through FGD. After the product has been repaired, the product is then evaluated or tested on a limited basis by the research team. After the product is considered suitable for widespread use, the next stage is when research and field testing begin. The results of the Augmented Reality development in the form of an application are installed on students' Android devices.

Challenges in implementation

The implementation of Augmented Reality (AR) in this study, as well as in several previous studies, faces various challenges. Some of these include limited infrastructure (Khasanah, 2024; Lutfiah, 2024) and high development costs (Hartati, 2025). Not all schools or religious institutions have devices that support AR, such as smartphones or tablets. Additionally, other obstacles include limited compatibility with certain smartphone models and unstable or slow internet connections. To address these infrastructure challenges, several meetings are necessary to facilitate the acceleration process and the procurement of devices required for AR-based learning practices. Another challenge relates to the readiness of teachers. Although they show enthusiasm for this new learning method, they still need time to understand and adapt to AR technology in teaching, including acquiring technical skills (Hafizah et al., 2024). Therefore, the researcher provides training and guidance beforehand to ensure effective collaboration in the classroom. Thanks to the synergy between researchers and schools—including principals, teachers, and students—this research has been successfully implemented.

Meanwhile, in religious education, various approaches have been implemented to enhance students' understanding and engagement. Conventional methods, such as lectures and discussions, are still widely used because they are easily accessible and do not require specific technological devices. However, these approaches are sometimes less appealing to younger generations who are accustomed to the digital world. Traditional learning methods often struggle to maintain students' attention when dealing with complex religious material (Abdullah & Noor, 2024).

As an alternative, gamification has been increasingly applied by incorporating game elements such as quizzes, challenges, and reward systems. This method has been proven to enhance learning motivation, although it still has limitations in providing realistic visualizations of religious concepts, such as worship practices or religious history. Meanwhile, Virtual Reality (VR) offers a more immersive experience by allowing users to explore virtual environments, such as viewing the Kaaba or other historical sites. However, this technology requires specialized devices that are relatively

expensive and less practical compared to Augmented Reality (AR). Among various modern methods, AR presents a more interactive solution than gamification or educational videos. With AR, students can see and interact directly with digital objects in the real world, making it easier to understand religious concepts in a more realistic and immersive way.

Testing the performance of religious moderation learning media based on augmented reality using the fast corner detection algorithm

Fast Corner Detection Algorithm is a common technique used in Augmented Reality (AR) technology to identify corner features in an image. This process plays a crucial role in AR, especially in feature tracking, environmental mapping, and determining the position and orientation of virtual objects in the real world. In creating interactive learning media for elementary school students, the performance evaluation of the Fast Corner Detection Algorithm plays an important role in creating a responsive and engaging AR experience. With fast corner detection, the system can recognize objects or printed images in real time, allowing animations or educational texts to appear without any obstacles. Accuracy and resilience to changes in lighting and viewing angles ensure that interactions remain smooth, even if students move or change the device's position. The optimal performance of this technology supports more immersive, interactive, and fun learning, thereby increasing student engagement in understanding the material visually and practically.

On the other hand, the testing stage determines the effectiveness of the learning media used. Therefore, the researcher gave several pretest questions to determine students' initial knowledge. Furthermore, students were given religious moderation learning using Augmented Reality-based learning media using the Fast Corner Detection Algorithm. After the learning was complete, students were given several questions in the form of a posttest. The collected data were analyzed using statistical analysis assisted by SPSS Version 26.

The descriptive analysis using SPSS version 26 statistics showed a significant difference in results between the average pre-test score of 64.94, with a standard deviation of 8.831 and the average post-test score of 93.50, with a standard deviation of 9.918. An inferential test is needed to test whether the difference in results is significant. The inferential test for the difference test of two groups of non-normally distributed data is used, using the Wilcoxon test. The results of the Wilcoxon test show the Asymp. Sig. (2-tailed) value is 0.000. Because the Asymp. Sig. (2-tailed) value = 0.000 < $\alpha = 5\% = 0.05$, H_0 is rejected, and H_a is accepted. Meanwhile, this study hypothesises that there is a difference between learning outcomes on students' understanding of religious moderation learning before and after using Augmented Reality (AR) learning media using the Fast Corner Detection Algorithm. In other words, Augmented Reality learning media can effectively improve religious moderation learning outcomes.

Observations and unstructured interviews with several students support the results of this statistical analysis. The observations and interviews show that students are enthusiastic about using AR learning media, and this technology has fostered students' interest in learning more about this media. For them, using augmented reality media is the first time 3D images produced from 2D image reflections have interested most students. Thus, learning becomes more interesting and interactive. Through Augmented Reality, teachers can create learning media that are fun, interactive, and easy to use (Mustaqim & Kurniawan, 2017). Teaching aids can facilitate learning, proven to improve student learning outcomes (Maulidiah et al. 2023).

Meanwhile, previous studies explain that religious moderation learning in Indonesia has not been implemented properly (Susana et al. 2022). At the same time, it is very important to instil religious moderation in the elementary school environment (Lessy et al. 2022). The basics of good character can be instilled solidly at this phase. However, implementing learning is still conventional, such as only using lecture methods and providing examples of teacher role models with an attitude of mutual respect and tolerance for religious differences (Lessy et al. 2022). Of course, this method is necessary for instilling values in students, but integrating technology into learning can be the right choice to improve religious moderation learning and make it more interesting.

However, one of the results of this study found that previously, students had not received specific religious moderation material, so the religious moderation learning provided in this study was the first learning. However, the values of religious moderation overlap with the norms of values contained in civic education subjects. So, religious moderation learning further strengthens and reinforces the norms that have been previously understood. For further research, improvements and refinements are still needed to make this product more attractive and easier for students.

CONCLUSION

From the presentation of the results and discussion of the study on the development of religious moderation learning media based on Augmented Reality (AR), it can be concluded that the development of religious moderation learning media based on Augmented Reality using the fast corner detection algorithm has provided a new form or innovation in the field of learning media based on religious moderation technology for elementary madrasah (MI) students. Students seem enthusiastic and interested in this learning. However, improvements and refinements to the product still need to be made to produce better products. In addition, Augmented Reality-based learning media can also be developed for other subjects to provide new colours in learning, especially religious subjects. Interesting and interactive learning media will help teachers in conveying learning messages. Further studies can try using longitudinal studies to obtain complete and reliable data.

Furthermore, based on the results of statistical analysis tests to test differences in learning outcomes before and after learning, it can be concluded that there is a significant difference between learning outcomes before and after learning. This means that Augmented Reality-based religious moderation learning media using the fast corner detection algorithm has effectively improved student learning outcomes in religious moderation learning. Further research is expected to apply this learning media to students more widely so that messages of religious moderation values can be conveyed to more students, especially madrasah-based students.

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