Ta'dibuna Jurnal Pendidikan Islam
P-ISSN: 2252-5793
E-ISSN: 2622-7215
Vol. 14, No. 4, Agustus 2025, hlm. 347-366
DOI: 10.32832/tadibuna.v14i4.20127
http://ejournal.uika-bogor.ac.id/index.php/TADIBUNA/

Development of VR Apps with Kodular & Sketchfab SIMUJI Hajj Pillars Simulation in Elementary School

Ani Nur Aeni[1]*, Arif Hidayat[2], Salwa Naofalia[3], Kania Indah Pratiwi[4], Desnawita Dwi Anggita[5]

[1,3,4,5]PGSD, UPI Sumedang Campus, Indonesia
[2] PGSD,UPI Cibiru Campus,Indonesia
*aninuraeni@upi.edu

Abstract

Religious education in elementary schools faces challenges in teaching the Hajj due to limited time, facilities, and costs for field practice. This results in students only understanding the Hajj theoretically without experiencing it firsthand, causing them to forget the sequence and meaning of each pillar of the Hajj. This study aims to develop a virtual reality application based on Kodular and Sketchfab called SIMUJI as a medium for teaching Islamic religion to fifth-grade elementary school students on the subject of the pillars of the Hajj. The method used in this study is Design & Development (D&D) using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The findings indicate that SIMUJI can enhance students' interest and understanding of the Hajj rituals, as well as provide an interactive learning experience. In conclusion, the use of VR technology in teaching the pillars of Hajj can address the shortcomings of traditional teaching methods and provide innovation to improve the quality of Islamic education in elementary schools. This application is expected to serve as a reference for the development of other learning media

Keywords: *Learning Islamic Education; Pillars of Hajj; Elementary School; Virtual Reality.*

Abstrak

Pendidikan agama di SD mengalami tantangan dalam pembelajaran haji, karena terbatasnya waktu, fasilitas, biaya praktik lapangan. Hal ini berdampak pada siswa yang hanya memahami secara teoritis tanpa merasakan pengalaman nyata, sehingga urutan dan makna setiap rukun haji sering terlewat dari ingatan. Penelitian ini bertujuan mengembangkan aplikasi virtual reality berbasis kodular dan sketchfab bernama SIMUJI, sebagai media dalam pembelajaran Agama Islam kelas 5 SD pada materi rukun haji. Metode yang digunakan dalam penelitian ini adalah Design & Development (D&D) menggunakan model ADDIE (Analysis, Design, Development, Implementation, Evaluation). Temuan menunjukkan bahwa SIMUJI dapat meningkatkan minat dan pemahaman siswa terhadap materi rukun haji, serta memberikan pengalaman belajar yang interaktif. Kesimpulan, penggunaan teknologi VR dalam pembelajaran tentang rukun haji dapat mengatasi kekurangan dalam metode pembelajaran tradisional, serta memberikan inovasi untuk

Diserahkan:31-05-2025 **Disetujui**: 25-07-2025 **Dipublikasikan**: 02-09-2025

Kutipan: Nuraeni, A., Hidayat, A., Naofalia, S., Pratiwi, K. I., & Anggita, D. D. (2025). No TitleDevelopment of VR Apps with Kodular & Sketchfab SIMUJI Hajj Pillars Simulation in Elementary School. Ta'dibuna Jurnal Pendidikan Islam, 14(4), 347–366. https://doi.org/10.32832/tadibuna.v14i4.20127

meningkatkan kualitas pendidikan agama islam di SD. Aplikasi ini diharapkan dapat menjadi referensi bagi pengembangan media pembelajaran lainnya.
Kata kunci : Pembelajaran; Pendidikan Agama Islam; Rukun Haji; Sekolah Dasar; Virtual Reality.

I. Introduction

As time progresses, all aspects of life experience continuous development, particularly in information and communication technology. Education must adapt to these changes, both in utilizing technology for learning and preparing students to innovate in the future. Thus, educators and learners are required to adjust to technological progress (Aeni, et al., 2024). In education, technology provides wide access to information sources, enabling teachers to use diverse media in the learning process (Aeni, et al., 2019).

With these demands, the various innovations made by teachers are increasingly diverse. This has brought significant changes in the world of education, encouraging the creation of more interactive and in-depth learning media (Setiawan et al., 2024). Apart from technological demands, making learning media is an important thing that must be prepared by an educator in undergoing education in the 21st century. This is because learning media has a position that is no less important than educators (Fadilah et al., 2023). Therefore, learning media must be very concerned in its design. Especially in 21st century learning, educators are expected to provide learning that provides real experience and hones 21st century competencies for students. Traditional methods, though valuable for moral and spiritual education, are less effective for developing 21st century competencies (Habib Zainuri, 2024). In applying these expectations, of course, many learning media innovations have been designed, one of which is learning media in the form of applications to support flexible and efficient learning activities (Aeni, et al., 2025).

Developing learning media technology is needed in all subjects, including Islamic religious education. This is appropriate especially because Religious education, particularly Islam, is crucial in shaping morals, mentality, and religious knowledge (Aeni, 2014). Therefore, it is appropriate that Islamic religious learning in schools must provide real experiences and hone 21st century competencies for students both through learning materials and media (Huda, 2020).

One example of learning media that can be used and actually provides a real experience is Virtual reality (VR) is a technology that presents a virtual environment with a display that resembles the real world. This technology allows users to feel the experience as if they are really in that environment, creating a more immersive and realistic impression (Andyani et al., 2022). Virtual reality (VR) technology is currently developing is rapidly developing as a tool to provide modern and interactive experiences (Serin, 2020). The characteristics and potential functions of Virtual reality (VR), such as

increasing user involvement, supporting experiential learning, problem-solving oriented, and providing more structured environmental control. These studies show that VR provides significant benefits compared to conventional learning methods (Munshi, 2022). The use of VR can also reduce students' cognitive load and allow them to focus on more complex practical tasks, because the use of VR refers to how to effectively approach instruction by integrating learning with practice (Yang et al., 2024).

The benefits of virtual reality include allowing learners to learn in an immersive and interactive way, facilitating the simulation of real-world situations that are not possible by physical means, good for distance learning. Challenges in implementing virtual reality include the cost of hardware and software, uneven access, requiring training for teachers, technical complexity and lack of infrastructure. Future trends and flows of virtual reality are increasingly integrated in the broader field of education, will cause a major transformation in learning efforts (Al-Ansi et al., 2023).

The use of virtual reality (VR) can be applied to learning Islamic religious education, one of which is in learning Hajj, which is growing over time. With this technology, students can learn and practice the Hajj pilgrimage in a more in-depth and interactive manner. This development shows great potential in increasing understanding of the Hajj in the future (Sidiq & Mustafidah, 2020). The use of virtual reality (VR)-based learning media has been researched among students in simulating the Hajj manasik which has a positive impact. In addition, the use of VR has also been applied to the community and has resulted in an impact that increases interest in Hajj in the community (Luthfiansyam et al., 2021). Therefore, this study seeks to prove whether learning the pillars of Hajj with the help of SIMUJI virtual reality application learning media can improve understanding and provide real experiences about the pillars of Hajj for grade 5 elementary school students. With the implementation of learning with real experience using virtual reality applications to simulate the pillars of Hajj in learning Islamic religious education is expected to improve learning outcomes. This is also based on previous research that shows the positive impact of using virtual reality, which should have a corresponding impact when used for learning for elementary school students. One of them is the results of research showing that the use of VR provides an immersive learning experience and is able to improve student competency development (Cabrera-Duffaut et al., 2024).

While previous research, such as the development of "VR Haji" using high-end tools like Unity 3D and Blender for Oculus Quest 2 (Setiawan et al., 2024), has successfully demonstrated the potential of VR for Hajj simulation, this present study introduces distinct and significant novelties. First, our "SIMUJI" application is built on the Kodular platform, a drastic shift from complex game engines. This strategic choice democratizes development, enabling educators with no advanced coding expertise to create and modify VR learning media, thus enhancing scalability and sustainability in typical school settings

with limited resources. Second, we move beyond a purely ritual simulation by integrating aa multimodal learning ecosystem. This combines Sketchfab's 3D visualization with Canva for design, Book Creator for digital flipbooks, and Wordwall for interactive evaluation, creating a comprehensive pedagogical package that supports not only experiential learning but also theoretical understanding and assessment. Finally, our research specifically targets and is validated for elementary school students, a crucial yet often neglected demographic in religious VR studies, ensuring the content and interface are age-appropriate and educationally sound. This combination of an accessible development platform, a holistic pedagogical approach, and a focused target audience constitutes the primary novelty and contribution of this study to the field.

II. Research Method

In this study, researchers used the Design & Development (D&D) method using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) by conducting research and development related to the design made. The ADDIE model is a systematic instructional design framework consisting of five stages: Analysis, Design, Development, Implementation, and Evaluation to produce effective, efficient, and engaging instructional solutions (Branch, 2009). The method was chosen because it is in accordance with the goals or objectives of the researcher to develop innovative learning products. In the context of this research, research and development is carried out in depth to ensure that the design produced really suits the needs in learning and is able to improve the quality of learning. The use of the ADDIE model has proven effective in various studies to produce systematic, measurable, and comprehensively evaluable learning products as explained in journal by Moses Adeleke Adeoye et al. (2024) which highlights the potential of ADDIE in transforming the learning process through a structured and continuous improvement-oriented approach.

The use of these methods is used to design and develop a VR application product that can later be used for learning. The stages involved include: (1) identifying problems, (2) determining the objectives, (3) designing and developing product designs, (4) product trials, (5) product evaluation, (6) make improvements to learning media products for Hajj material for grade 5 SD.

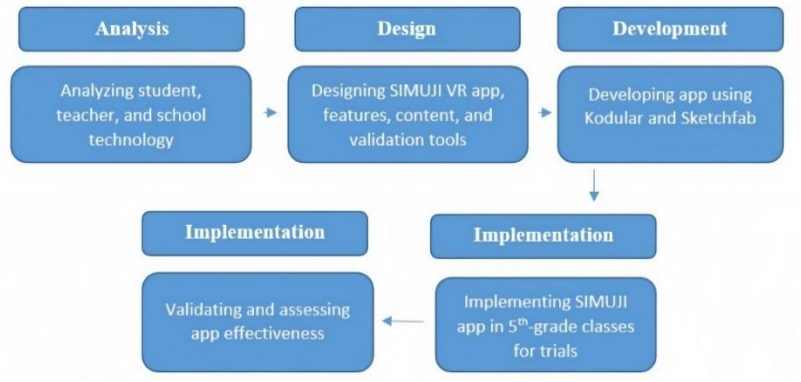

Figure 1. ADDIE Research Design

All of these stages certainly have an important position in this research from identifying problems to the improvement stage. Because basically each of these stages is continuous and influences each other. The design process is the process of developing the results of identifying and determining goals in the form of products. Furthermore, the trial stage is the stage of trying the "SIMUJI" application directly to students in elementary schools so that researchers know the advantages and disadvantages of the "SIMUJI" application developed for learning. The evaluation stage is to assess the performance and effectiveness of the product to increase understanding in learning Islamic religious education in the material of the pillars of Hajj. Finally, the coordination stage of the evaluation results is to see the feedback resulting from the use of the "SIMUJI" application to increase understanding in this learning. With the use of the "SIMUJI" application, of course, it is hoped that it can improve the learning experience and learning outcomes of students, especially in the material of the pillars of Hajj.

In this study, of course, there are other methods or completeness used, one of which is the method of determining the value of the researcher's product. The formula for determining the achievement value used in this study is in figure 2.

$$\textbf{Achievement level qualification} = \frac{number\ of\ points\ earned}{maximum\ number\ of\ points} \text{ x } 100$$

Figure 2. Formula for Determining Achievement Scores

The results of the above formula used to determine the improvement of student learning experience can be seen in table 1.

Table 1. Assessment Indicator

Achievement Level	Qualification
0%-20%	Not very good
21%-40%	Not good
41%-60%	Good enough
61%-80%	Good
81%-100%	Very good

In addition, to see the achievement of increased understanding of student learning, it was studied by analyzing the results of the pre-test and post-test done by students, the analysis process used descriptive statistical table analysis. The information from the table is that if the percentage of the research results is only up to 20%, it means that the achievement can be said to be very bad. If the value of the achievement is 21%-40%, then the research can be said to be not good. If the value of the research achievement is at 41%-60%, the achievement is said to be quite good. If the value obtained reaches between 61%-80%, it can be said that the value obtained can be called good. And, if the achievement value obtained reaches 81%- 100%, the value obtained reaches the perfect value which is very good. Therefore, it can be said, this research also uses a combined approach between quantitative and qualitative which functions to examine effective conditions based on natural conditions with the main key or research variable being the research itself.

The target or object of research is Class V students of SDN Sindang 2, Jatihurip District, Sumedang Regency, West Java. The situation and conditions at SDN Sindang 2 can be said to be in line with the results of the research needs analysis, which is suitable for future development. The reason for this is that this school has never used VR technology as a learning medium, especially in Islamic Education lessons. However, despite this, the school has the technological readiness to support the use of VR as an educational medium in the future. This information was obtained based on interviews with teachers and students, who stated that previously, students rarely, if ever, used diverse and interactive educational media, especially in Islamic Education lessons, despite the availability of suitable technology. The data collection techniques used in this study are questionnaire filling, observation with product trials and direct question filling, and interviews. Filling out the lift was done to find out the value of the product and the material contained in the product. The observation technique is carried out to see how the situation and conditions of student learning before using the product in Islamic learning and after students learn in Islamic learning using products made by researchers or "SIMUJI." Furthermore, there is a product trial technique used to determine the extent of the effectiveness of the product in achieving the objectives previously determined by the researcher. There is also a direct question filling technique used also in the post-test and pre-test stages of students. And the last is the interview, this technique is used to find out the real

experiences and real thoughts of students or teachers in the school which is certainly related to learning and using the product "SIMUJI." In addition to the techniques there are also research results delivered by researchers through counts added by a complete narrative that will make it easier for readers to understand the process and results of this study.

III. Results and Discussion

In the early stages of this research, researchers identified the problems faced by grade 5 students at SDN Sindang 2 in understanding the learning material on "the pillars of Hajj". The observation results showed that although the material had been taught before, most students still had difficulty in understanding the concepts presented. This is due to traditional learning methods and not utilizing interactive learning media. This condition encouraged researchers to find innovative solutions to improve students' understanding of the material.

As a first step, researchers designed and developed a technology-based learning application by utilizing the Kodular platform. Kodular was chosen because of its ability to create android applications without the need to write code manually, making it easier in the development process. The application developed was named SIMUJI, which stands for "Simulation of Virtual Hajj Manasik". This application is designed to provide a more interactive and fun learning experience for students. To access the SIMUJI application, users can visit the following link: https://bit.ly/SIMUJIApplication.

In developing this application, researchers also utilize various other supporting platforms. To display visualizations in the form of Virtual Reality (VR), the Sketchfab platform is used which allows users to view 3D models interactively. Canva was used as a tool in designing attractive and informative graphic elements. Meanwhile, Book Creator is utilized to develop e-flipbooks that contain learning materials in a digital format that is easily accessible and understood by students. For learning evaluation, researchers used Wordwall as a tool to create interactive and fun pre-tests, practice questions, and post-tests.

The interface of the SIMUJI application is designed with ease of use and convenience for students in mind. An attractive and intuitive design is expected to increase students' interest in learning and make it easier for them to access learning materials. The interface can be seen in Figure 3, which shows how various visual and interactive elements are integrated in one platform to support an effective learning process:

Figure 3. SIMUJI App Display

The pre-test, practice questions, and post-test contain quizzes in accordance with the material presented in the discussion, namely chapter 9 on the pillars of Hajj. Pre-test contains 5 multiple choice questions, practice questions contain 6 questions with matching quizzes, and Post-test contains 5 multiple choice questions. The quiz display can be seen in Figure 4.

Figure 4. Display of pre-test, post-test, and practice questions

Then, virtual reality (VR) on the sketchfab website linked to the SIMUJI application is used as a simulation medium in viewing the locations of the pillars of Hajj, such as the Grand Mosque, Arafat, Safa and Marwah, and Miqat. The virtual reality (VR) mode display of the pilgrimage simulation can be seen in Figure 5.

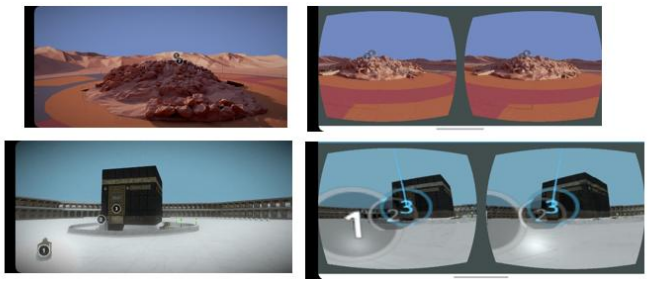

Figure 5. VR mode view on the sketchfab website linked to the SIMUJI application

In addition to Sketchfab which helps researchers to develop Hajj simulation visions, researchers also use a website for making e-flipbooks, namely book creator. The appearance of the e-flipbook page in the SIMUJI application can be seen in Figure 6.

Figure 6. View of the e-flipbook page in the SIMUJI application

Sketchfab was very helpful for the researcher to find the design of masjidil haram, arafah hill, sofa and marwah. In addition, researchers also used wordwall for Pre-tests, practice questions, and Post-tests, to be tested on students to determine learning effectiveness. Canva is also quite helpful in terms of design, especially in making application logos, making flipbook designs, learning outcomes pages, how to use, and development teams.

The discussion of the material contained in this application is as follows: (1) The pillars of Hajj are a series of activities that must be carried out in the implementation of Hajj. (2) There are 6 pillars of Hajj, namely Ihram, Wukuf in Arafat, Tawaf Ifadah, Sa'i, Tahalul, Order. (3) Ihram means intending to perform Hajj by wearing ihram clothes at the miqat. (4) Wukuf means being silent to multiply dhikr and prayer in the Field of Arafat

on the 9th of Zulhijah, until dawn breaks. (5) Tawaf Ifadah is circumambulating the Kaaba 7 times. (6) Sa'i is walking or running between Safa and Marwah hills 7 times. (7) Tahalul is cutting or shaving the hair when in Marwah, after sa'i. (8) Orderly is the implementation of all the pillars of Hajj in accordance with the appropriate order (Soleh & Hairil Muhammad Anwar, 2021).

Product testing activities went quite smoothly, researchers conducted trials in classroom 5 using a projector, 1 pair of Virtual reality headsets and several cellphones owned by researchers who were used alternately and the researcher's laptop to facilitate the implementation of quizzes and display features in the application more clearly. The number of respondents as many as 26 students participated in the activity with great enthusiasm until the end of the post-test implementation. Documentation of the product trial can be seen in Figure 7.

Figure 7. Documentation of product trial

The product evaluation stage is carried out with validation tests by media experts and validation tests by material experts. This intends to show the feasibility of applications and materials to be used in learning at the elementary school.

The product assessment process through media and material expert validation tests involves providing a product link to assess the quality and functionality of the SIMUJI application, as well as providing a validation sheet link to the material and media experts. After reviewing the product, the experts provide their assessments and notes, which are recorded on the validation sheet we have prepared. The results of the SIMUJI product validation test by media experts can be seen in Table 2.

Table 2. Assessment of product success according to media experts

Indicator	Assessment Description	Value			
		1	2	3	4
Product Suitability	Product design is in accordance with the characteristics of learners				v
	The colors used are in accordance with the material content				v
	The characters/images used are in accordance with the material content				v
	Appropriate font size (not too big and not too small)				v

	Typeface is appropriate for the age of the students in that phase/grade		v
Product Display	Attractive product design		v
	The picture looks clear		v
	Attractive color composition		v
	Voice/audio is clearly audible	v	
	Product comes with how to use		v
Ease of Access	Easy to use product		v
	The buttons on the product work		v
	There are various menus that can be accessed by users		v
	Products can be used anywhere		v
	Child-friendly products		v
Good Impact	Product design can motivate students to do good		v
	Product design can motivate students to study hard		v
	Product design can motivate students to care about others / the environment		v
	Product design can motivate students to improve the quality of worship		v
	Product design can motivate students to increase worship intensity		v

The results of the validation test and data according to table 2, show that the product has a good score with a few revision notes. The notes given by are in the audio section which is considered to be less clearly audible. This has been corrected so that the audio in the application sounds much better and in accordance with the characteristics of students. With this audio improvement, it is also expected to be better in delivering material to students.

Table 3 is a table for calculating the percentage of results from the total assessment obtained from media experts. In this table, the maximum total score is 80, while the total score obtained for the SIMUJI application assessment is 79 with a percentage of 98.75% out of 100%.

Table 3 . Total product success score according to media experts

Indicator	Maximum Value	Value obtained
Product Suitability	20	20
Product Display	20	19
Ease of access	20	20
Good Impact	20	20
Total	**80**	**79**
Percentage	**98,75%**	

Based on the above assessment, it can be concluded that the media expert gave an almost perfect assessment of the "SIMUJI" product. The rating scale in the table above is 3 and 4, which is in accordance with the eligibility criteria for use as learning media. Apart

from the value given, there are notes given by the expert for this "SIMUJI" application. The note highlights the absence of the Qur'anic verse included in the application. This is indeed appropriate to be included as a source of material development in the application. Therefore, after the notes given by the media expert, the research team immediately corrected the shortcomings of the application.

Table 4. Total product success score according to the material expert

Indicator	Maximum Value	Value obtained
Material Suitability	20	18
Material Presentation	20	19
Authoring	20	20
Good Impact	20	19
Total	**80**	**76**
Percentage	**95 %**	

Then, the results of the SIMUJI application product material expert validation test scored 95 out of 100 with a very good qualification based on the data in Table 4, so that the product can be declared as a product that is suitable for testing or use in schools in studying the pillars of Hajj. The assessment formula and qualification guidelines are presented in Table 1, while the formula used in the assessment can be seen in Figure 2

Table 5. Assessment of product success according to material experts

Indicator	Assessment Description	Value			
		1	2	3	4
Material Suitability	Suitability of material with learning outcomes				v
	Suitability of material with learning objectives			v	
	Suitability of material with student characteristics				v
	Suitability of the material with the subject matter taught in class			v	
	Appropriateness of material to phase/grade				v
Material Presentation	Material presentation is easy to understand				v
	The language used in the material content is easy to understand				v
	The material content presented is clearly legible			v	
	The material content presented is clear in meaning				v
	Sufficient material content (not too much or too little)				v
Authoring	There are no errors in the writing of the Quran/Hadith text.				v
	The writing of the material text does not contain typos.				v

	Material content with reference sources		v
	The writing of the material text pays attention to the provisions for the use of capital letters		v
	Text writing pays attention to the use of punctuation		v
Good Impact	Contains material that encourages students to have good character		v
	Contains material that encourages students to study hard		v
	Contains material that encourages student curiosity		v
	Contains material that encourages student empathy	v	
	Contains material that encourages students to adopt good habits		v

Table 5 shows the value of each assessment indicator. According to the material expert, overall the product is good and interesting, but there is a suggestion for the post-test quiz filling time to be extended so that students can answer the questions more optimally. This assessment shows that even though the product received excellent qualifications, it still requires improvement to fully qualify for the trial. The product was validated by media and material experts, then improved according to the experts' instructions. In other words, the shortcomings conveyed by the examiners along with their notes have been successfully carried out and refined again.

Therefore, it can be concluded that the "SIMUJI" application is very feasible to use in learning, especially on Hajj material. This is because this application has product suitability, appearance, convenience and good impact that have been tested by experts and get an assessment that is close to perfect. In other words, this application helps grade 5 elementary school students in understanding, thinking critically and providing an extraordinary learning experience for learning in Hajj material. The following are the results that researchers obtained after testing and processing data on Pre-test, practice questions, and Post-test values in the SIMUJI product trial activities at SDN Sindang 2. Obtained before learning based on the SIMUJI application (initial quiz), and Post-test is the value of the test results after learning based on the SIMUJI application (final quiz). The results obtained from the Pre-test, and Post-test are shown in figure 8.

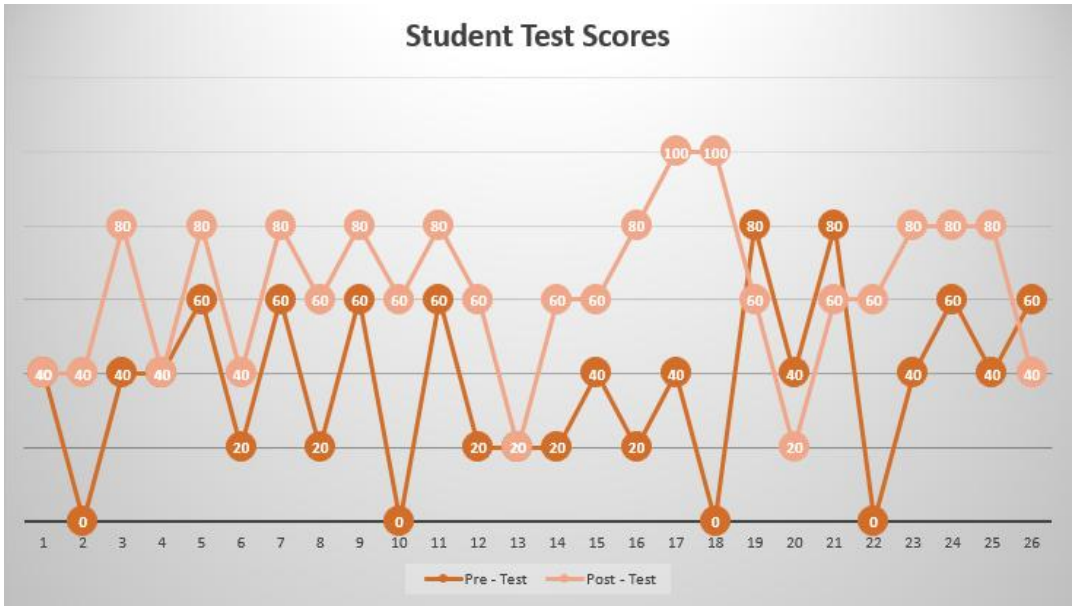

Figure 8. Data graph of Pre-test, Practice Questions, and Post-test scores

Based on Figure 8, it can be seen graphically that 19 respondents' scores or 73% of respondents increased from Pre-test scores to Post-test scores, 3 respondents' scores or 12% of respondents got the same score from Pre-test and Post-test results, and 4 respondents' scores or 15% of respondents decreased from Pre-test scores to Post-test scores. This shows that learning based on the SIMUJI application has a fairly good impact because most of the comparisons of respondents' scores between Pre-test and Post-test have increased.

In addition to graphical analysis as shown in figure 8, to assess whether there is a change in Pre-test and Post-test data whether there is an increase or decrease can be done through descriptive statistical table analysis (Aeni & et al, 2024) presented in table 6.

Table 6. Descriptive Statistics of Pretest and Posttest

	N		Average	Median	Variance	Range	Minimum	Maximum	Total
	Legal	Missing							
Pre-test	26	0	36.92308	40	544.3787	80	0	80	960
Post-test	26	0	63.07692	60	452.071	80	20	100	1640

Table 6 shows descriptive statistics of Pre-test and Post-test data that have been conducted. Based on the table, the average data (mean) of the pre-test value is 36.92 and the posttest value has an average of 63.08. This shows that there is an increase in value due to the difference in the average value of respondents based on the Pre-test and Post-test results. This means that there has been an increase in respondents' knowledge after

learning using the SIMUJI application media. In other words, the use of the SIMUJI application has succeeded in increasing student understanding through education by utilizing real experience.

To measure the success of the increased learning experience of students in carrying out learning using the virtual reality application "SIMUJI" regarding the material of the pillars of Hajj, researchers used a questionnaire that was filled in before and after the product trial. This questionnaire each contains 5 questions that have a maximum weight of 4, where the questions are designed to be adjusted so that they can represent the learning experience experienced by students. The maximum score that is considered perfect based on the maximum weight of each questionnaire from 26 students is 520. The results of the questionnaire before using the "SIMUJI" application obtained a result of 456 points which means (87%). While the results of the questionnaire after learning using the "SIMUJI" application were 497 points (95%). These results can be seen in table 7.

Table 7. Success Rate Qualification Results

Indicator	Value Before	After Value
Interesting material	98	106
Learning media	91	98
Ease of question	83	95
Real experience in learning	95	101
Interactive and creative learning	89	97
Total	**456**	**497**

Based on the results of the assessments conducted, the use of the SIMUJI app showed a significant improvement in the students' learning experience. After their scores were converted to percentage format, the pre and post-test scores obtained by the students were in the excellent category. This reflects the effectiveness of this app in improving understanding of the Hajj material. This significant increase in grades not only indicates an improvement in cognition, but also reflects an improvement in the emotional and psychomotor aspects of the students. These are key indicators of the overall learning process. This improvement follows the results of previous research showing that the simulation method is effective in understanding students and students for student recovery. The simulation method provides a more concrete and contextualized learning experience and allows students to understand the material more deeply. In this context, SIMUJI combines VR technology with an interactive learning approach to provide students with a more urgent and comfortable learning experience.

Furthermore, the effectiveness and efficiency of the learning process is clearly evident. These technologies enable the delivery of more interactive and engaging materials through various media such as videos, educational apps, e-learning and artificial intelligence (AI). The results show that using digital technology increases

students' interest in learning, deepens understanding of PAI materials, and allows for more flexible access to learning. Therefore, we can draw the conclusion that the use of SIMUJI app not only improves students' understanding, but also enriches the general learning experience. The integration of VR technology into islamic education learning offers a new interactive and contextual approach that can increase students' motivation and participation in the learning process. Therefore, it is highly recommended that the use of apps like SIMUJI be utilized in PAI learning in elementary schools to improve the overall quality of Islamic religious education.

Based on the results of research and assessment of the virtual reality application "SIMUJI" can be said to provide good results. SIMUJI application has shown significant success in providing an interactive and enjoyable learning experience for students, especially in Hajj material. By utilizing digital technology, SIMUJI offers various features that allow students to understand important concepts related to Hajj in more depth. Through engaging simulations and visualizations, the app helps students not only to remember the steps of performing Hajj, but also to understand the meaning and purpose of each ritual performed. SIMUJI app also plays a role in facilitating self-directed learning, where students can learn according to their own pace and learning style. Interactive features such as quizzes and educational games in the app encourage students' active engagement, so they are more motivated to learn. Research shows that students who use Simuji show a significant improvement in their learning outcomes compared to traditional learning methods. Thus, SIMUJI is not just a learning tool, but also an innovative tool that supports the development of religious understanding and spiritual values in children. This is reinforced by one of the studies that revealed that technology in the era of society 5.0, one of which is virtual reality, can provide an immersive experience for learning and understanding the material (Nur et al., 2022) .

In addition, based on the use of the SIMUJI application that utilizes Virtual Reality (VR) technology, students show a significant increase in understanding of the material on the pillars of Hajj. Students can experience the simulation of Hajj directly, making it easier for them to understand each pillar and procedure that must be performed. The pre-test results conducted before the use of the application showed that many students still had difficulty in remembering and understanding the order of the pillars of Hajj. However, after participating in VR learning through SIMUJI, the post-test results showed a marked improvement in their understanding of the material. Analyzed data from the pre-test and post-test indicated that students who used the SIMUJI app experienced a significant increase in scores, reflecting the effectiveness of the VR-based learning method in teaching the pillars of Hajj. Not only does it improve scores, but this learning experience also helps students to engage more emotionally and cognitively with the material. With realistic visualization and direct interaction in the simulation, students not only memorize the pillars of Hajj, but also understand the meaning and importance of each

step in the ritual. These results are in line with research that has been conducted on medical students by comparing two learning methods using VR and conventional lectures. The results showed that the group using VR had higher post-test scores than the lecture group (Omori et al., 2023) . This shows that VR technology can be a very effective tool in improving the quality of learning in the field of religion, especially in understanding worship practices such as Hajj (Barkati & Cahyadi, 2024) .

Therefore, based on the results of the research, the development and implementation of the virtual reality (VR) application "SIMUJI" has succeeded in achieving the stated objectives, namely increasing the understanding of grade 5 elementary school students on the material of the pillars of Hajj. Through an interactive and immersive learning approach, students not only gain theoretical knowledge, but also directly experience the process of Hajj in a virtual environment that resembles real conditions. This is in line with the findings of previous research which shows that the use of VR technology in learning Islamic Religious Education (PAI) can significantly increase student understanding and engagement.

The learning experience provided by SIMUJI enables students to develop 21st century competencies, such as critical thinking, collaboration, communication and creativity skills. By being directly involved in the simulation of the Hajj pilgrimage, students are invited to understand the meaning and procedures of the pilgrimage in depth. This not only strengthens the cognitive aspect, but also the affective and psychomotor aspects of students, which are important components in holistic learning. In addition, the use of SIMUJI also has a positive impact on increasing students' interest in learning, especially in PAI subjects. Learning that was previously considered monotonous and less interesting became more fun and motivated students to be more active in the learning process. This is in accordance with the results of research showing that VR technology can increase student learning motivation by presenting material in an attractive and interactive visual form.

Thus, it can be concluded that the development and application of SIMUJI application in PAI learning makes a significant contribution in improving the quality of learning. The integration of VR technology in the learning process not only enriches students' learning experience, but also encourages the development of competencies relevant to the demands of the 21st century. Therefore, the use of applications such as SIMUJI is highly recommended to be applied in PAI learning in elementary schools in order to improve the overall quality of Islamic religious education..

IV. Conclusion

This research aims to develop SIMUJI application, a Virtual Reality (VR) based learning media designed using Kodular and Sketchfab. This application is intended to

improve 5th grade students' understanding of the pillars of Hajj. Based on the trial results, the use of SIMUJI in learning Islamic Religious Education (PAI) showed a positive impact. Most respondents experienced an increase in understanding, as indicated by the difference between pre-test and post-test scores and respondents' questionnaire results. In addition to providing an alternative in delivering simulation material, SIMUJI is proven to create a more contextual and directed learning atmosphere. Visual displays integrated with the material content also encourage focus and active participation of learners.

Although this research shows success in improving student understanding, the implementation of SIMUJI is not free from obstacles. Some technical issues, such as limited VR headset devices and dependence on a stable internet network, remain challenges.

The implications of this research impact educational development at various levels. At the micro level, SIMUJI contributes to transforming Islamic Religious Education by providing sensory learning experiences that facilitate conceptual-procedural understanding. For learners, this technology enhances intrinsic motivation and knowledge retention while developing digital literacy and metacognitive awareness. At the meso level, this research provides a framework for teachers to integrate immersive technology into pedagogical practices and opens opportunities for professional development. Educational institutions can use these findings as a basis for digital infrastructure policies and resource allocation. At the macro level, this research supports efforts to bridge the digital divide in elementary education and strengthen technology integration in the national curriculum, while opening new research on immersive technology for character and values education.

As a recommendation, development of this VR application can be improved by adding interaction features, such as realistic simulations of pilgrimage movements. Interactive elements are expected to increase student engagement and provide a more immersive learning experience. Further research also needs to evaluate long-term effectiveness and integration into the primary school curriculum.

Furthermore, VR development such as SIMUJI can take inspiration from previous studies that implemented VR in Hajj learning. For example, research developing a VR Hajj application with the Rapid Application Design (RAD) method on Oculus Quest 2. This application, designed with Blender and Unity 3D, aimed to improve prospective pilgrims' readiness through a realistic learning process. Functionality testing showed a 100% success rate, while expert evaluation gave scores of 93% and 90%, classified as very feasible.

Considering previous findings, SIMUJI development can be directed toward improving visual quality, interactivity, and accessibility. Integration with the curriculum and teacher training will be important to ensure successful implementation. Based on test results, learner responses, and improvements, it can be concluded that SIMUJI is a

feasible learning media for PAI, especially on the pillars of Hajj. Its use is proven effective in improving students' understanding through a visual and interactive approach.

Bibliography

Aeni, A. N., & dkk. (2024). Development of S.Id. TABIR Website on Islamic Learning in Elementary School. Sekolah Dasar: Kajian Teori Dan Praktik Pendidikan, 33(01), 90–100.

Aeni, A. N., Hanifah, N., & Sunaengsih, C. (2019). The impact of the internet technology on teacher competence and student morality. Journal of Physics: Conference Series, 1318(1). https://doi.org/10.1088/1742-6596/1318/1/012046

Aeni, A. N. I. N. U. R., Nurlina, I. R. A., Masya, P. D. W. I., & Aenirrisallah, R. (2024). PENGEMBANGAN MEDIA WEBSITE EDUKATIF CEBAN (CEKATAN MEMBACA AL-QUR ' AN) PADA PEMBELAJARAN PAI KELAS 4 SD Learning for Grade 4 Elementary School. 11(02), 158–168.

Aeni, N., Fazriyah, R. R., Pendidikan, S., Sekolah, G., Indonesia, U. P., & Author, C. (2025). Pengembangan Aplikasi Android " SIWABARA " (Sifat Wajib Bagi Rasul) menggunakan Metode D & D yang diterapkan dalam Kehidupan Sehari-Hari Pada Pembelajaran SPAI Kelas 4 SD. 17(1), 1–10. https://doi.org/10.35457/konstruk.v17i1.3593

Al-Ansi, A. M., Jaboob, M., Garad, A., & Al-Ansi, A. (2023). Analyzing augmented reality (AR) and virtual reality (VR) recent development in education. Social Sciences and Humanities Open, 8(1). https://doi.org/10.1016/j.ssaho.2023.100532

Andyani, P., Majidah, N. N., Maulifia, R. R., & Aeni, A. N. (2022). Penggunaan Virtual Reality Sebagai Sarana Edukasi Dalam Mengenal Kabah Bagi Siswa Kelas 1 SD. Al Qalam: Jurnal Ilmiah Keagamaan Dan Kemasyarakatan, 16(4), 1335. https://doi.org/10.35931/aq.v16i4.1074

Ani, N. A. (2014). Pendidikan Karakter untuk Siswa SD dalam Perspektif Islam. Mimbar Sekolah Dasar, 1(1), 50–58.

Barkati, A., & Cahyadi, A. (2024). Teknologi Sebagai Pendekatan Dalam Optimalisasi Pendidikan Agama Islam (PAI). Jurnal Pendidikan Agama Islam, 3(1), 173. https://doi.org/10.52434/jpai.v3i1.3739

Branch, R. M. (2009). Instructional Design The ADDIE Approach. In Department ofEducational Psychology and Instructional Technology.

Cabrera-Duffaut, A., Pinto-Llorente, A. M., & Iglesias-Rodríguez, A. (2024). Immersive learning platforms: analyzing virtual reality contribution to competence development in higher education—a systematic literature review. Frontiers in Education, 9(July). https://doi.org/10.3389/feduc.2024.1391560

Fadilah, A., Nurzakiyah, K. R., Kanya, N. A., Hidayat, S. P., & Setiawan, U. (2023). Pengertian Media, Tujuan, Fungsi, Manfaat dan Urgensi Media Pembelajaran. Journal of Student Research (JSR), 1(2), 1–17.

Habib Zainuri. (2024). Blending Traditional and Modern Methods A New Curriculum Framework for PAI. Al-Mau'izhoh, 6(1), 656–673. https://doi.org/10.31949/am.v6i1.9544

Huda, M. (2020). Perkembangan Pendidikan Islam di Indonesia dan Upaya Penguatannya

dalam Sistem Pendidikan Nasional. Journal of Islamic Education Research, 1(02), 39–53. https://doi.org/10.35719/jier.v1i02.24

Luthfiansyam, B. N., Adjis, M. P., & Fauzi, A. H. (2021). Pengembangan Aplikasi Simulasi Haji Berbasis Mobile Menggunakan Teknologi Virtual Reality Prodi D3 Rekayasa Perangkat Lunak Prodi D3 Rekayasa Perangkat Lunak. 7(5).

Moses Adeleke Adeoye, Kadek Adrian Surya Indra Wirawan, Made Shania Satya Pradnyani, & Nyoman Intan Septiarini. (2024). Revolutionizing Education: Unleashing the Power of the ADDIE Model for Effective Teaching and Learning. JPI (Jurnal Pendidikan Indonesia), 13(1), 202–209. https://doi.org/10.23887/jpiundiksha.v13i1.68624

Munshi, K. (2022). Virtual reality training for Hajj pilgrims as an innovative community translation dissemination medium. September.

Nur, A., Rohmah, B., Romadhona, E. P., Putri, L. A., & Kartikasari, V. (2022). Pembelajaran Pendidikan Islam Melalui Virtual Reality (VR). Jurnal Tarbiyah Islamiyah, 7(2), 373–385.http://ejournal.stitru.ac.id/index.php/raudhah/article/view/450%0Ahttp:/ ejournal.stit-ru.ac.id/index.php/raudhah/article/download/450/231

Omori, K., Shigemoto, N., Kitagawa, H., Nomura, T., Kaiki, Y., Miyaji, K., Akita, T., Kobayashi, T., Hattori, M., Hasunuma, N., Tanaka, J., & Ohge, H. (2023). Virtual reality as a learning tool for improving infection control procedures. American Journal of Infection Control, 51(2), 129–134. https://doi.org/10.1016/j.ajic.2022.05.023

Serin, H. (2020). Artículo de investigación Virtual Reality in Education from the Perspective of Teachers Realidad virtual en educación desde la perspectiva de los docentes. AMAZONIA Investiga, 9, 291. www.amazoniainvestiga.info

Setiawan, A., Saputra, W., Ammaruddin, N., & Fisqiya, A. (2024). Pengembangan dan Evaluasi VR Haji untuk Pembelajaran Manasik Haji dan Umrah dengan Pendekatan Immersion Interface. 10(2), 138–148.

Sidiq, P., & Mustafidah, H. (2020). Rancang Bangun Aplikasi Simulasi Manasik Haji Berbasis Virtual 3D. Sainteks, 16(1).https://doi.org/10.30595/sainteks.v16i1.7014

Soleh, B., & Hairil Muhammad Anwar. (2021). Buku PAI SD Kelas 5 Kurikulum Merdeka Siswa (pp. 1–270).

Yang, C., Zhang, J., Hu, Y., Yang, X., Chen, M., Shan, M., & Li, L. (2024). The impact of virtual reality on practical skills for students in science and engineering education: a meta-analysis. International Journal of STEM Education, 11(1). https://doi.org/10.1186/s40594-024-00487-2