



Sustainable Development: Implementation and Impact of Augmented Reality in Islamic History Learning

Aina Almardiyah¹, Essalihy Khalid², Bayu Ramadhani Fajri³, Quratul Akyuni⁴

¹Universitas Negeri Padang, Indonesia

²Chang'an University, China

³Universiti Kebangsaan Malaysia, Malaysia

⁴University College London, United Kingdom

✉ aina.almardiyah22@gmail.com *

Abstract

This study aims to develop an Augmented Reality-based learning tool for Islamic history education in high schools. This research and development (R&D) adopts a six-stage approach: analysis, design, development, implementation, and evaluation (ADDIE). The resulting product has undergone rigorous validation by three experts in Augmented Reality, animation, and Islamic history education. Furthermore, this Augmented Reality-based learning material was tested on 120 students in four high schools. Student responses were carefully collected through questionnaires and analyzed using SPSS software version 26.0. The results showed that all experts agreed that the Augmented Reality product was valid and suitable for use as a learning medium. There are seven advantages to using this medium in learning, namely: the material is easy to understand, the content is clearly presented, the visual design is attractive, it provides a realistic learning experience, the learning experience is enjoyable, the Augmented Reality medium is easy to use, and there is a strong desire to return to learning using Augmented Reality. The use of this Augmented Reality-based learning module has significantly changed the learning experience of students to more concrete, enjoyable results and provided them with new experiences in Islamic history. These findings emphasize the need to continue designing and developing various Augmented Reality-based resources to strengthen the teaching of Islamic cultural history.

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INTRODUCTION

The massive increase in COVID-19 cases has had a significant impact on education (Masdaudi & Jamrizal, 2023). This prompted the government to issue a policy shifting from face-to-face learning to online distance learning (Mulyati, 2021; Tuwu, 2020). Online learning became one of the methods for delivering lesson material between teachers and students during the pandemic emergency. In online learning, students have the flexibility to choose when to study, and the learning process can be carried out anywhere (Santika, 2020). Almost all subjects are taught online, including Islamic Cultural History.

In this context, Islamic Cultural History is one of the subjects taught at Islamic High School. It is a compulsory subject in the *madrasah* curriculum (Hasmar, 2020).

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Islamic Cultural History contains many life values. One of these values is emulating Islamic figures who achieved success in the social, economic, scientific, and other fields to advance Islamic culture and civilization (Ahmad & Tambak, 2018).

In particular, the material on the Islamic Renewal Movement discusses influential figures in Islamic civilization who contributed to the social, economic, educational, and military fields after the dark period of Islam. This material is highly relevant for students, considering that the younger generation needs a common vision for the future (Prasetiawan & Ma'rifataini, 2020). However, no learning media currently meets the necessary criteria. Based on field findings, the learning media used by teachers in Islamic Cultural History classes consist of PowerPoint presentations, audio, and video. These media have several shortcomings. PowerPoint presentations often contain more text than images. In addition, educational videos suffer from inaccurate visualizations of images or illustrations. Finally, audio media provides one-way information delivery, resulting in a lack of interaction in the learning process (Muklim et al., 2021).

Thus, learning media is an important component of the learning process (Aghni, 2018; Dita, 2022; Yuliantika et al., 2025). Learning media can support teaching and learning by conveying information clearly so that learning objectives are properly achieved (Nurrita, 2018). Problems with learning media in online learning make the process less effective (Haryadi & Selviani, 2021). Therefore, it is necessary to improve learning media for the Islamic Renewal Movement material.

One improvement effort is to integrate Islamic Cultural History with Augmented Reality technology. Through this technology, lesson materials can be visualized as 3D objects in the real world in real time (Kaliraj & Devi, 2021). Augmented Reality can be developed in various ways, one of which is by using Assemblr Studio Web, a platform that enables the easy creation of Augmented Reality content (Averkin, 2023; Faridi et al., 2021; Fortuna et al., 2024; Syam et al., 2021).

This technology offers various advantages. Augmented Reality can help students understand learning materials by transforming them from abstract to concrete (Aripin & Suryaningsih, 2019). The learning experience using Augmented Reality can also increase students' motivation (Chlebusch et al., 2020). Motivation is an important factor in learning because it directly affects learning outcomes (Andriani & Rasto, 2019).

In addition, history lessons can be effectively constructed using Augmented Reality (Preece & Skandalis, 2024), providing students with a more engaging learning experience (Kaliraj & Devi, 2021). This technology also supports teachers by making the teaching process more efficient (Chlebusch et al., 2020). The use of Augmented Reality in learning has been found effective in achieving learning outcomes, especially during the COVID-19 pandemic (Eldokhny & Drwish, 2021). This is supported by research by (Uliontang et al., 2020), which demonstrated improved learning outcomes, particularly in history lessons about historical objects from the Majapahit era.

Based on this explanation, a solution is needed to help students understand Islamic Cultural History lesson material by developing an Augmented Reality-based learning medium. The integration of this technology can make material delivery more effective and efficient. Therefore, the researchers developed Augmented Reality for the Islamic Cultural History subject as a classroom learning medium.

Based on data from Scopus, previous studies used several keywords referring to research on Augmented Reality in Islamic studies, as shown in Figure 1 below:

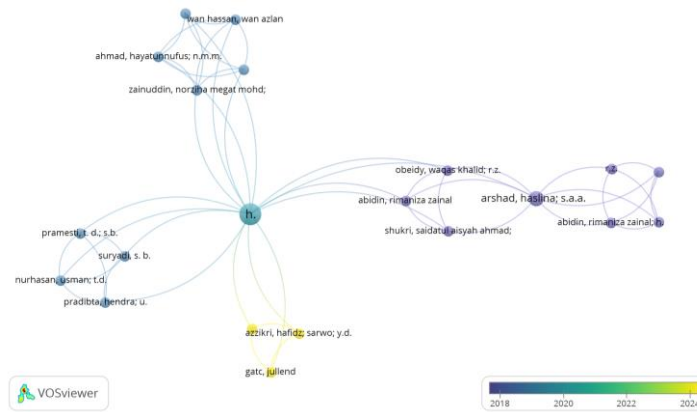


Fig 1. Several keywords referring to augmented reality in Islam by researchers worldwide (Scopus database)

Meanwhile, the title of the Scopus database on the use of Augmented Reality in Islamic religious education is still rarely found, as shown in Figure 2 below.

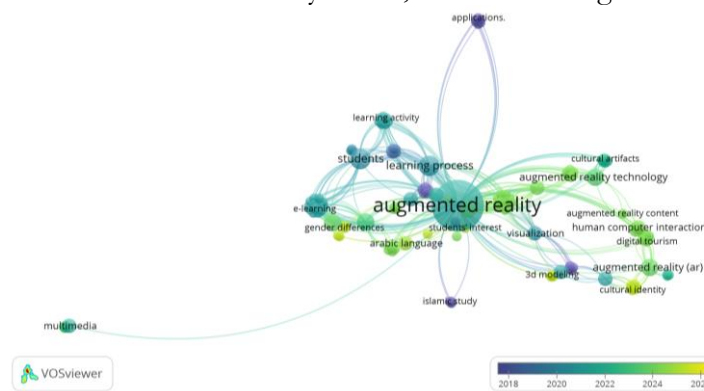


Fig 2. Scopus database titles on augmented reality in Islam for Islamic religious education

The use of Augmented Reality-based learning media in Islamic education across various countries remains underdeveloped. This is evidenced by VOSViewer data from the Scopus database, which shows that the gap between research on Augmented Reality and *tajweed* is still very wide. Moreover, the development of Augmented Reality for Islamic Cultural History subjects has never been undertaken. Therefore, this research is considered worthwhile, focusing on the development of Islamic Cultural History subjects in Islamic High School.

To understand it more deeply, Augmented Reality is a technology that can visualize multidimensionality at various levels of complexity. The information displayed takes the form of 3D models as representations (Yengui & Stechert, 2021). The characteristics of Augmented Reality lie in its interactive concept, which combines the real and virtual worlds. The virtual world is created as a real experience (Syafri, 2019), where real and virtual images are blended and viewed simultaneously (Windika et al., 2022).

Content presented in Augmented Reality consists of two types: static and dynamic (Diaz et al., 2015). Static content includes text, images, and 3D objects without animation (Grasset et al., 2008; Stojšić et al., 2020), while dynamic content contains animations and videos (Diaz et al., 2015; Grasset et al., 2008). The composition of content in Augmented Reality is tailored to the subject matter, and a combination of static and dynamic content is more effective than either used alone.

In terms of type, Augmented Reality has many forms, one of which is marker-based (Andrea et al., 2019; Damopolii et al., 2022; Sheng et al., 2024). It works by

pointing a smartphone camera at a marker created with a tracking system (Aji, 2020). Markers can be images printed on cards (Hilipito et al., 2023), books (Saca, 2021), comics (Agustiya et al., 2024), and others. Images used as markers must have unique patterns to be distinguishable (Karmila & Alfaridho, 2021).

One platform that supports this is Assemblr Studio Web, an online platform for easily building Augmented Reality content. Assemblr Studio Web features 3D gizmo controls that allow users to move, rotate, enlarge, or reduce 3D objects (Aripin & Suryaningsih, 2019). It also offers several features, including *Scene* for creating Augmented Reality cylinders (slides), where users can add 3D objects (Yuliono et al., 2023). In addition, an interactivity feature enables animation effects on 3D objects so that, when users click or tap on an object, other objects move according to the selected action (Goh et al., 2019).

In relation to the subject, Islamic Cultural History is an important field that contains values useful for life (Azizeh, 2021). It is not merely about memorization but goes beyond that (Rofik, 2015). Through this subject, students can study the roles of accomplished figures in Islamic history. At the Islamic High School level in particular, students are expected to emulate the fighting spirit of Islamic figures in defending the existence of Islam (Azzahra et al., 2023).

One of the important topics is the Islamic Reform Movement, which discusses the modernization of Islam in the 19th century (Zayyadi, 2020). Islamic modernism introduced new ideas about Islam without abandoning its essence, accompanied by a forward-looking orientation (Prasetiawan & Ma'rifatani, 2020). This material covers the thoughts of reformist figures such as Muhammad Ali Pasha, Jamaluddin Al-Afghani, Muhammad Abduh, Rasyid Ridha, and Muhammad Iqbal. Their ideas aimed to liberate Islam from colonialism and restore its glory (Karo, 2020). Efforts were made by changing the dogmatic traditional mindset of the time and fostering a spirit of collegiality among Muslims as a form of actualizing Islamic teachings, particularly through active participation in the political, economic, and legal arenas (Fauzi, 2017).

METHODS

The development of this learning media was carried out using the ADDIE model. The ADDIE development model is based on the needs that will be obtained. The components of this model interact with one another according to the existing phases (Rayanto & Sugianti, 2020). The ADDIE development model is an acronym for each stage, namely: analysis, design, development, implementation, and evaluation (Yeh & Tseng, 2019; Zou et al., 2024).

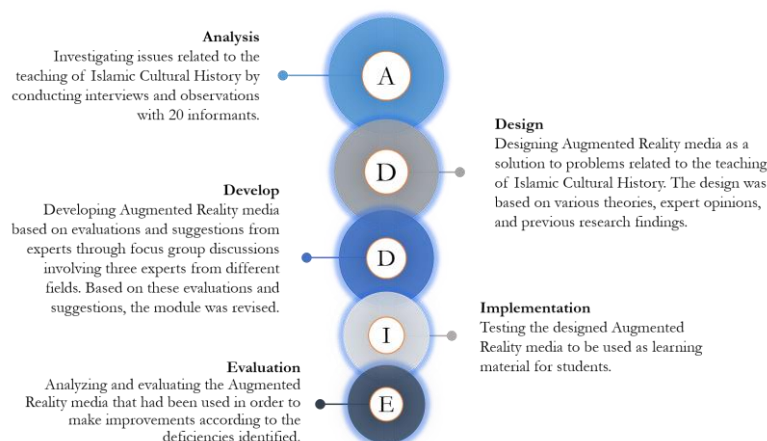


Fig 3. Sources, data collection techniques, and data sources

During the analysis stage, the steps taken consist of needs analysis, material analysis, student analysis, and analysis of the software and hardware requirements. This is done as a preliminary step to develop learning media (Engkizar et al., 2018; Febriani et al., 2022; Fricke et al., 2023; Saha et al., 2022). Next, during the design stage, the steps taken consist of designing storyboards and designing the art direction of the 3D objects to be created.







Then, in the development stage, the steps taken are preparing 3D objects and arranging 3D objects in the Assemblr Studio Web application (Kurniawan & Yudha Pradatama, 2021). In addition, at this stage, a guidebook and markers are also created, then tested to measure the feasibility of the learning media developed. After that, it enters the implementation stage. This testing is carried out on two parties, namely students and teachers. This aims to obtain comprehensive results to see the practicality of the learning media. The trial was conducted at Islamic senior high school.

The final stage is evaluation. At this stage, an evaluation of the learning media that has been created is carried out. The data obtained from the feasibility and practicality tests is used as a basis for concluding whether the developed media can be used in learning or not (Adeoye et al., 2024; Adriani et al., 2020; Nadiyah & Faaizah, 2015).

RESULT AND DISCUSSION

The development of Augmented Reality consists of several components, namely 3D objects and marker books. The 3D objects created include characters and items that represent the ideas of each figure. These characters are adapted from the material on the Islamic Reform Movement, and they include Muhammad Ali Pasha, Jamaluddin Al-Afghani, Muhammad Abduh, Rasyid Ridha, and Muhammad Iqbal. Below are the 3D objects of the Islamic Reform figures.

Table 1. Description triangulation of research data

Figure	Reference	3D Object
Muhammad Ali Pasha		
Jamaluddin Al-Afghani		
Muhammad Abduh		



3D objects are produced using stylized models by simplifying the shape of the object without losing its original form. In addition, 3D objects are created in low poly form, with fewer polygons so that the size of the resulting 3D object is lighter. Furthermore, there are 3D objects that represent the idea of Islamic renewal in each character. The existence of 3D objects as a visualization of the Islamic renewal movement. Here is an example of the 3D object in question.

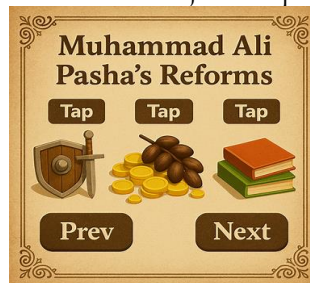


Fig 4. 3D Object of the Islamic renewal movement

The next component developed was the marker. The marker functions as a tool to detect Augmented Reality that will appear in the application (Arifitama et al., 2022). In this development, the marker corresponds to the image of each different character. The following are the results of the marker design for the Islamic renewal movement material.

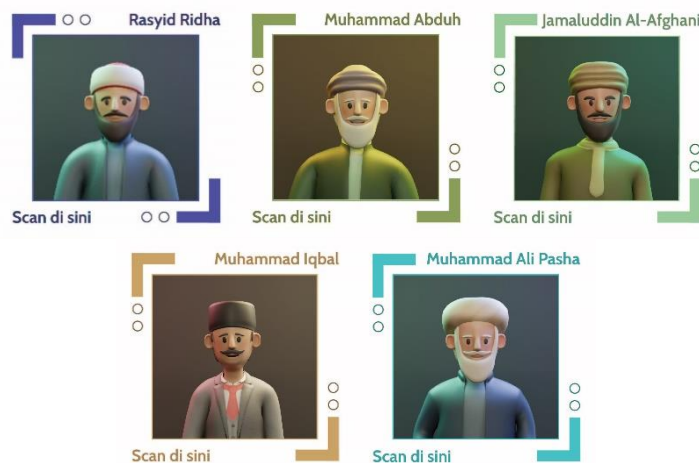


Fig 5. Marker of the Islamic renewal movement

The use of Augmented Reality can be carried out in a relatively straightforward manner. The process begins with opening the Assemblr application, which can be downloaded from the Play Store or App Store. After selecting the **Scan** menu and pointing it toward the available marker, the corresponding Augmented Reality

content is displayed.

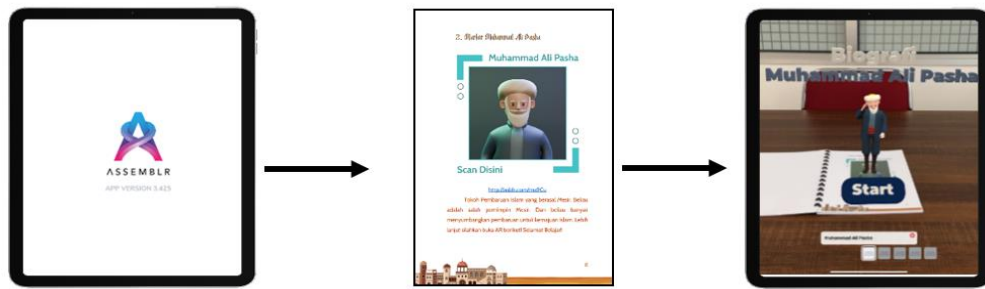


Fig 6. Augmented Reality usage flow

The development of Augmented Reality involved a stage of testing both the validity of the material and the media. The material feasibility test was carried out to assess the alignment of the Islamic Cultural History content with the Augmented Reality that had been developed. Subsequently, the media feasibility test was conducted to evaluate whether the Augmented Reality met the required standards. The results of the material feasibility test are presented below.

Table 2. Material validity results

Aspect	Percentage	Category
Content/material quality	84%	Highly Appropriate
Learning objectives	90%	Highly Appropriate
Language	97%	Highly Appropriate
Benefits and usefulness	89%	Highly Appropriate
Average	90%	Highly Appropriate

The material feasibility test was based on four aspects, namely content/material quality, learning objectives, language, and benefits and usefulness. Each aspect was categorized as highly suitable. It can be concluded that the test results were categorized as “Highly Suitable.”

Table 3. Media validity results

Aspect	Percentage	Category
Design and Appearance	91%	Very Suitable
Interactivity	92%	Very Suitable
Benefits and Usefulness	93%	Very Suitable
Average	92%	Very Suitable

Furthermore, the test results were categorized as “Very Suitable.” In addition, practicality tests were conducted to assess the usability of the developed Augmented Reality. These tests involved both teachers and students. The following are the results of the practicality test conducted by teachers.

Table 4. Teacher practicality results

Aspect	Percentage	Category
Easy to use	80%	Practical
Student interest and motivation	80%	Practical
Honing student skills	80%	Practical
Average	80%	Practical

Practicality testing was conducted at the Islamic High School, with the Islamic Cultural History teacher serving as the evaluator. Based on the table above, the teacher’s assessment indicated that the media was categorized as practical in every aspect tested. Furthermore, practicality testing was also conducted by thirty-two eleventh-grade students, and the results showed that the media was categorized as

very practical.

Table 5. Student practicality

Aspect	Percentage	Category
Design and appearance	92%	Very Practical
Learning design	92%	Very Practical
<i>Software</i>	87%	Very Practical
Benefits	89%	Very Practical
Average	90%	Very Practical

Learning media assists teachers in facilitating students' learning so that the process becomes more effective and efficient (Zega, 2022). However, many of the learning media currently used still do not meet the required criteria, particularly in Islamic Cultural History. The PowerPoint and video media employed by teachers often consist of lengthy text in slides, while the videos display images or illustrations that are not accurate in representing the material on the Islamic Reform Movement. Therefore, further development of learning media is necessary to ensure that the teaching of Islamic Cultural History is carried out effectively (Mardiana et al., 2022).

Good learning media should be integrated with technology (Mahbuddin, 2020). One such technology is Augmented Reality, which is capable of displaying 3D objects in real-life contexts (Alam, 2021). Moreover, learning media should present information concisely without overloading text (Bernard et al., 2019). Augmented Reality-based media can also enhance students' mastery of concepts (Yuliono et al., 2023). Thus, the integration of Augmented Reality into Islamic Cultural History supports teachers in presenting 3D historical objects, thereby improving students' understanding of the material.

Several methods can be used to develop Augmented Reality, one of which is through Assemblr Studio Web. This platform provides an accessible way to create Augmented Reality content, reducing barriers to development and allowing users to design and implement technology-based learning media more easily and efficiently (Hilipito et al., 2023).

In developing Augmented Reality, feasibility testing was conducted to examine whether the product met the specified criteria (Astriani & Alfahnum, 2023). The Assemblr Studio Web-based Augmented Reality was evaluated through two types of assessment: material validity and media validity. The testing involved one subject matter expert and three learning media experts. The material assessment was based on four aspects: content/material quality, learning objectives, language, and benefits and usefulness. The content/material quality aspect was reviewed in terms of the suitability and scope of the Islamic Renewal Movement material. The learning objectives aspect focused on the alignment between objectives and students' characteristics. The language aspect evaluated the appropriateness of the language used in the media, while the benefits and usefulness aspect considered the extent to which the media could provide support in learning. The results of the material validity test indicated that the content was categorized as "Very Suitable."

Developing high-quality learning content is considered an important way to help students understand the material, enabling them to process and construct new concepts in relation to their prior knowledge (Rahmi & Azrul, 2021). In this study, the development of Augmented Reality-based Islamic Renewal Movement content combined static and dynamic elements with the aim of supporting students' understanding of the material.

Media validity testing was carried out based on four aspects: display design, interactivity, and benefits and usefulness. The display design aspect was reviewed

according to the accuracy of 3D objects, animations, and instruction manuals. The interactivity aspect examined the degree of interactivity and the functionality of buttons within the media. The benefits and usefulness aspect assessed ease of use, potential benefits, and effectiveness. The attractiveness and interactivity of learning media are noted as important to reduce student boredom during lessons (Fanny & Suardiman, 2013). The results of the media validity test categorized the product as “Very Suitable,” suggesting that it can be considered appropriate for use in the learning context.

A practicality test was also conducted to evaluate how the learning media functioned when used by teachers and students. The involvement of both groups was intended to provide a more comprehensive view. For the teacher practicality test, the aspects assessed included ease of use, ability to foster interest and motivation, and application in teaching. For the student practicality test, the aspects evaluated were design and appearance, learning design, software, and benefits. The results showed that teachers categorized the media as “Practical,” while students provided a positive response with the category “Very Practical.” Taken together, these findings suggest that Assemblr Studio Web-based Augmented Reality meets the criteria of practicality.

CONCLUSION

Assemblr Studio Web-based Augmented Reality was developed using the ADDIE method, resulting in learning media that meet the standards for classroom use, particularly in Islamic Cultural History subjects. This Augmented Reality was categorized as feasible and practical, indicating that it can be implemented in the learning process. The developed learning media are expected to support both students and teachers in conducting learning activities.

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DECLARATIONS

Author Contribution

Aina Almardiyah: Writing-Preparation of original manuscript, **Essalihy Khalid:** Conceptualization, Methodology, **Bayu Ramadhani Fajri:** Visualization, Improve Content, **Quratul Akyuni:** Data accuracy, Improve Language.

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The authors declare that this research was conducted without any conflict of interest in the research.

Ethical Clearance

The place or location studied has agreed to conduct research and is willing if the results of this study are published.

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