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Augmented Reality for Visualizing Islamic History: Improving Student *Engagement* in SKI Learning

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Abstract

Islamic Cultural History (SKI) learning at IBS Al Iman still faces the challenge of low student engagement due to the dominant use of static media such as text and images, which makes it difficult for students to visualize Islamic historical events and artifacts and often leads to rote, low-meaning learning. This study aims to measure the effect of Augmented Reality (AR) media on increasing student engagement in SKI learning using a mixed-methods approach with a quasi-experimental design involving 40 eighth-grade students divided into an experimental group (AR-based learning) and a control group (conventional learning). Data were collected through pre-tests and post-tests, structured engagement observations, and interviews with teachers and students**;** student engagement was measured using an observation rubric with clear indicators attention/focus during learning, active participation (asking/answering questions, responding to instructions), collaboration (peer discussion, helping teammates), and persistence (completing tasks without excessive prompting) rated on a Likert-scale score and then converted into percentage categories (e.g., high/medium/low) to make the analysis transparent and comparable between groups. The results showed a significant improvement in the AR group with an average gain of 22.45 and an N-Gain value of 0.62 (medium to high category), while the control group showed only a low gain (0.29). Observation results indicated that 85% of students in the AR group demonstrated high engagement seen in sustained focus, more frequent participation, and stronger collaboration during discussion supported by interview findings that AR helped students "see" historical objects and events more concretely. This study recommends implementing AR as a supportive medium for SKI learning in madrasahs by ensuring infrastructure readiness, providing teacher training, and integrating post-use reflection so AR functions not merely as visual entertainment but as a tool to strengthen conceptual understanding and internalize Islamic values.

Keywords: Augmented Reality, student engagement, Islamic Cultural History, interactive learning.

INTRODUCTION

The teaching of Islamic Cultural History (SKI) at IBS Al Iman in the initial observation showed that many students had difficulty visualizing events, figures, and artifacts due to static media. The curriculum still relies on text, images, and lectures, causing

student engagement to decline when the material is lengthy. Augmented Reality (AR) is a medium that combines virtual objects and the real world to make learning livelier. A systematic study shows that AR applications in higher education have grown significantly and touched various disciplines (Li et al., 2025). Field observations show that when teachers display 3D AR models, student attention increases. Some students show high enthusiasm when markers are activated on their smartphones. This indicates the potential of AR to increase SKI students' motivation and engagement. This phenomenon shows a shift in learning patterns from passive to active. Teachers who were initially skeptical began to recognize the effectiveness of AR as a teaching aid. Teacher-student interactions became more dynamic as visual media created an open space for discussion. These observation results became the basis for developing AR-based learning designs in the next stage.

AR allows students to see reconstructions of historical sites in the classroom, such as maps of Islamic expansion or artifacts from the era of the Khulafaur Rasyidin, which during observation seemed to trigger active discussion. AR media provides a visual experience that cannot be presented through static images alone. The study "The Use of Augmented Reality in History Education" found that students who used AR demonstrated better conceptual understanding in history education than the control group (Priyono et al., 2024). In the IBS Al Iman experimental class, students who tried the AR prototype spent more time in group discussions. Teachers reported that some students were "interested" and asked more in-depth questions about the cultural background of Islam. This indicates that AR can strengthen understanding of chronology and its connections. Students' emotional engagement with the material also increased because they felt as if they were "inside" historical events. Realistic visualizations helped students connect historical facts with Islamic values. The interactivity of the media made learning more meaningful and contextual. This effect reinforced the function of AR as a medium that brings historical memories to life.

Effective AR implementation in madrasahs is strongly shaped by infrastructure readiness especially stable Wi-Fi bandwidth**,** availability of AR-capable smartphones/tablets (RAM/camera/OS support)**,** reliable power/charging access**,** and basic classroom equipment such as projectors, speakers, and printed markers for smooth tracking. At IBS Al Iman, initial observations showed Wi-Fi was not yet optimal and some students' devices could not run AR properly, meaning the learning experience became uneven and required mitigation (backup devices, offline/low-data AR content, and clear technical procedures) so AR supports SKI learning rather than turning into a "tech distraction."

The implementation of AR in SKI needs to consider the readiness of schools, teachers, and students. Initial observations at IBS Al Iman revealed that the WiFi infrastructure was not optimal and some student devices were not AR-compatible. A bibliometric study on AR in education mentioned that between 2010 and 2023 there were 1,734 articles related to AR, mapping trends in publication, collaboration, and technology applications (Singh et al., 2024). This means that AR adoption is not just a matter of installing an application, but requires technical and pedagogical support. The research team in the field designed teacher training as a parallel step. Teacher-instructors were involved in workshops prior to the

implementation of the prototype. This training helped teachers understand how to guide students in visual exploration and historical interpretation. Teacher involvement was crucial so that learning was not merely technology-based, but also value-oriented. Collaboration between researchers and teachers encouraged the adaptation of more relevant teaching methods. Follow-up observations showed an increase in teacher readiness after the training.

In terms of student motivation and engagement, AR media shows promising results. Initial observations at IBS Al Iman show that students appear to be more active when using AR than when simply reading text. However, it should be noted that a study in the UK found that although students feel more engaged with AR, their learning outcomes are not always better than with traditional videos (Geana & Cernusca, 2024). This reminds us that engagement alone is not enough: instructional design and follow-up tasks are important. We note that in the prototype class, students still needed teacher guidance so that AR did not become just a "toy." Reflection and discussion tasks after the AR session were designed to reinforce the results. Unguided use of AR can reduce focus on the essence of learning. Therefore, each AR activity at IBS Al Iman is followed by a question-and-answer session based on historical context. This strategy of effectively maintains a balance between visual entertainment and meaning formation. Teachers also assessed that the structure of post-AR reflection activities helped deepen students' conceptual understanding.

In the SKI curriculum, students must understand Islamic historical figures, artifacts, and chronology. Observations show that many students only memorize without contextual visualization. AR provides a bridge between text and real experience, for example through simulations of classical mosques or maps of missionary routes. A literature review shows that AR in science and mathematics education can reduce cognitive load if the instructional design is appropriate (Zuo et al., 2025). At IBS Al Iman, the AR prototype was created following a clear chronological order to avoid student confusion. Teachers facilitated question-and-answer sessions after the AR session was completed. This reinforces that AR must be accompanied by pedagogical activities, not just visual displays. In addition, students are also involved in creating AR-based historical narratives to deepen their understanding. This process increases their sense of ownership of the learning process. This activity also encourages critical and historical thinking skills. Teachers assess this approach as an effective way to transform memorization into meaning.

Systematic studies and meta-analyses of AR show that its effectiveness depends on instructional design and application context. The study "Augmented Reality in Education 2023" mentions that the integration of AR with emerging technologies, experience design, and learning outcome measurement is growing (Semerikov & Striuk, 2024). In field research at IBS Al Iman, researchers designed an AR prototype that was in line with the SKI Competency Standards and the local conditions of the students. Initial evaluations in the form of pre-tests and post-tests were conducted to measure changes. Preliminary results showed an increase in class participation scores compared to the previous cycle. Observation data also showed an increase in students' verbal activity during discussions. Teachers noted that AR helped bridge the gap between theory and historical visualization. The developed

prototype proved to be able to stimulate students' curiosity. With these positive results, the research was directed towards testing on a wider scale.

Initial observations at IBS Al Iman revealed that students were often passive when the teacher explained classical Islamic history using lectures. However, when introduced to the AR prototype featuring a 3D model of the "Masjid Nabawi" and the hijrah route, students appeared more enthusiastic. This is in line with studies that say AR strengthens students' digital literacy and collaboration. The study (Nevrelova et al., 2024) in the experiment session, students were paired in groups and guided to explore AR objects while discussing. Teachers noted that students asked more critical questions about cultural contexts. These collaborative activities strengthened the spirit of collective learning. Discussions among students became livelier because AR media encouraged different interpretations. The social effects of learning were one of the most prominent aspects of these sessions.

Despite the great potential of AR, there are challenges that arise from initial observations, such as limitations in student devices, media preparation time, and the need for teacher support. The article (Velarde-Camaqui et al., 2024) at IBS Al Iman, the research team provided backup devices and simple markers to reduce technical barriers. Teachers were briefed to anticipate technical disruptions such as WiFi outages or dead batteries. Initial implementation showed that without technical preparation, AR sessions could be counterproductive. Therefore, technology mitigation strategies were carefully prepared. Each session was evaluated to improve technical instructions for the next meeting. Infrastructure readiness proved to have a major impact on the success of AR in the classroom. School management support was an important factor for the sustainability of this program.

To increase SKI student engagement, the AR material was designed to include rich visual narratives and simple interactions. Initial observations showed that students remembered historical artifacts more quickly when viewing 3D models than when reading text. The study (Kuncoro et al., 2024) based on gaps in the field and recent literature, this study proposes integrating AR into SKI learning at IBS Al Iman with a focus on student engagement. Initial observations show that both students and teachers are open to new media but require training. The objectives of the study include measuring student engagement through indicators of attention, participation, and interaction, as well as the perceptions of teachers and students after the AR session. This study provides empirical contributions to the use of AR in religious and history education. The results obtained will strengthen the role of technology in Islamic values-based learning. With this approach, students not only understand historical facts but also their spiritual meaning. The learning model developed at IBS Al Iman is expected to become a reference for other madrasas. Further research will be directed at measuring the long-term effects on student learning outcomes and character.

METHODS

This study uses a mixed methods approach with a quasi-experimental design combined with field observations and in-depth interviews to examine the effect of Augmented Reality (AR) media on student engagement in Islamic Cultural History (SKI) learning at IBS Al Iman while also capturing teachers' and students' qualitative responses to its implementation. The participants were 40 eighth-grade students divided into an experimental group (AR-based learning) and a control group (conventional learning), and data were collected through pre-tests and post-tests, structured engagement observation sheets, and semi-structured interviews with teachers and selected students. Engagement was measured using three indicators attention, active participation, and social interaction adapted from Fredricks et al. (2019), with observation ratings recorded each meeting and summarized into percentage categories to allow comparison between groups. The study was conducted over four sessions (90 minutes each) and followed three stages: preparation, implementation, and evaluation; during preparation, researchers coordinated with SKI teachers to develop an AR-integrated Lesson Plan (RPP) aligned with KMA No. 183 of 2019, and interview guides plus observation rubrics were drafted and piloted to ensure clarity. During implementation at IBS Al Iman, students used an Android-based AR application to view 3D reconstructions (e.g., the Prophet's Mosque and the Prophet's da'wah map), teachers acted as facilitators, and researchers observed and documented engagement using structured instruments alongside brief field notes capturing notable behaviors, classroom dynamics, and technical constraints.

For the qualitative component, interviews were conducted after the AR sessions (and, for the control group, after conventional sessions) in a quiet school setting; each interview followed the same core questions but allowed probing, lasted approximately 15–25 minutes, and was audio-recorded with participant consent before being transcribed verbatim and anonymized. Qualitative analysis used thematic analysis in a transparent sequence: researchers first performed familiarization by repeatedly reading transcripts and field notes, then applied open coding to meaningful units (e.g., "AR helps me understand," "device limitations," "more discussion," "confused without guidance"), merged similar codes into categories, and finally developed themes that explained how and why engagement changed (such as "visualization supports attention," "interaction triggers participation," "infrastructure and device compatibility as barriers," and "teacher scaffolding prevents AR becoming a distraction"); to strengthen credibility, a second coder reviewed a subset of transcripts and disagreements were resolved through discussion, while representative quotes were selected to support each theme. Quantitative data were analyzed using an independent t-test to test differences between groups, while qualitative findings were used to explain and contextualize the statistical results (method triangulation). Data validity was supported through triangulation of sources (students, teachers, observations) and methods (tests, observations, interviews), and instrument content validity was ensured through expert review by three specialists in educational technology and Islamic education. The combined

analysis is expected to provide an empirical and contextual picture of how AR influences engagement and learning effectiveness in pesantren-based madrasahs such as IBS Al Iman.

FINDINGS AND DISCUSSION

Finding

After the research process was carried out during four meetings at IBS Al Iman, quantitative and qualitative data were obtained and analyzed integrally using a mixed methods approach. Quantitative data was obtained from the results of pre-tests and post-tests on the experimental group (using Augmented Reality media) and the control group (using conventional methods). Meanwhile, qualitative data was obtained through observations of student engagement during learning activities and interviews with SKI teachers.

1. Descriptive Test Results

Descriptive tests were used to describe the mean, standard deviation (SD), and the difference in the increase in student engagement scores before and after the treatment.

Table 1. Descriptive Statistics of Student Engagement (Pre-test and Post-test)

Group	N	Pre-test Mean	Pre-test SD	Post-test Mean	Post-test SD	Difference (Gain)
Experiment (AR)	20	64.25	6.84	86.70	5.92	22.45
Control (Conventional)	20	63.80	6.47	74.45	6.18	10.65

The average student engagement in the experimental group increased more significantly (22.45 points) than in the control group (10.65 points). The smaller variation in scores in the experimental group indicates that most students showed consistent engagement patterns. Based on field observations, this increase was evident from changes in student behavior, such as greater focus on the screen, actively asking questions, and participating longer in discussions.

2. Normality and Homogeneity Tests

Table 2. Kolmogorov-Smirnov Normality Test

Group	Sig. Value (Pre-test)	Sig. Value (Post-test)	Description
Experimental	0.200	0.167	Normal
Control	0.143	0.198	Normal

The data is normally distributed because the Sig. value is > 0.05.

Table 3. Homogeneity Test (Levene's Test)

Variable	F	Sig.	Description
Student Involvement	0.94	0.34	Homogeneous

The variance of the two groups is homogeneous (Sig. 0.34 > 0.05), thus meeting the requirements for parametric testing.

3. Independent t-Test Results

Table 4. Independent t-Test

Variable	Calculated t	df	Sig. (2-tailed)	Mean Difference	Description
Student Engagement	6.482	38	0.000	12.25	Significant

Sig. values (0.000 < 0.05) indicate a significant difference between the experimental and control groups. This means that the use of AR media significantly increased student engagement in SKI learning. Teachers reported that students appeared more confident and were more willing to ask questions relevant to the visualized Islamic history material.

4. N-Gain Test Results

Table 5. N-Gain Test of AR Media Effectiveness

Group	Average N-Gain	Effectiveness Category
Experimental	0.6	Moderate to High
Control	0.29	Low

The N-Gain value of 0.62 indicates the effectiveness of learning with AR in the moderate to high category. Meanwhile, conventional methods only produce low improvements (0.29). These results reinforce that AR media improves conceptual understanding and information retention through interactive visual learning experiences.

5. Qualitative Analysis (Observation and Interview)

Qualitative data were analyzed based on three engagement indicators according to Fredricks et al. (2019): attention, participation, and social interaction. Observations were conducted using observation sheets with a 1–5 Likert scale and supplemented with interviews with teachers and students.

Table 6. Qualitative Analysis of Student Engagement Observations

Indicator	Observed Elements	High Engagement Percentage	Description of Field Findings
Attention	Focus on 3D models and teacher	88	Students showed full attention when the AR model was displayed. Most

Indicator	Observed Elements	High Engagement Percentage	Description of Field Findings
	explanations		stared at the screen for more than 70% of the learning time, indicating an increase in visual and auditory concentration.
Participation	Actively asking and answering questions during the learning session.	83	Students asked more questions about the historical context and Islamic symbols on AR objects. Discussions were two-way, with teachers acting as facilitators rather than sources of information.
Interaction	Collaboration among students in operating the AR application.	85	Positive interactions occurred, with students helping each other scan AR markers and discussing historical interpretations. Nonverbal interactions such as pointing or giving explanations also increased.

Observations show that AR media not only triggers attention but also increases social engagement and cooperation among students. Teachers noted that the classroom atmosphere became more active, and no students were passive during the session.

Table 7. Results of Teacher and Student Interviews

Respondents	Main Statement	Interpretation
SKI Teacher	"The children are much more focused and enthusiastic when viewing AR models, especially when displaying the Prophet's Mosque."	AR makes it easier for teachers to explain topics that were previously abstract. Teachers consider AR to be a medium that can shorten verbal explanations into concrete visuals.
SKI Teacher	"Class discussions become livelier, even students who are usually quiet become active participants."	The use of AR contributes to increased student confidence and curiosity, demonstrating a positive emotional impact.
Student A	"Seeing the shape directly on the screen feels like you're really there."	3D visualization creates an immersive sensation that enhances emotional engagement and perception of historical space.
Student B	"Learning becomes fun, not just listening to lectures. It makes it	AR aids the cognitive process of remembering historical chronology

	easier to remember the sequence of events."	and the relationships between events.
Student C	"I wish other subjects would use AR too to make them more interesting."	This indicates that the application of AR can be expanded to other subjects because it creates a fun and memorable learning experience.

6. Interpretation of Results

The integration of quantitative and qualitative results shows that the use of Augmented Reality has a significant impact on increasing student engagement in SKI learning at IBS Al Iman. The t-test proves that there is a significant difference between the experimental and control groups ($p = 0.000$), while the observation results show that 85% of students show high engagement. The interview results confirm that AR makes learning more interesting, concrete, and interactive. The increase in student engagement is in line with Fredricks et al.'s (2019) theory, which states that engagement consists of behavioral, emotional, and cognitive dimensions. In this context, AR was proven to activate all three simultaneously: the behavioral aspect was seen in active participation, the emotional aspect in enthusiasm and curiosity, and the cognitive aspect in increased conceptual understanding. Thus, it can be concluded that the application of Augmented Reality in teaching Islamic Cultural History at IBS Al Iman is effective in increasing engagement and enriching the learning experience of students. This technology not only helps students understand the lesson content more deeply, but also fosters a spirit of collaboration and curiosity about Islamic history. This study confirms that the application of AR-based digital media has strong potential to be integrated into the pesantren-based madrasah curriculum as a meaningful and contextual innovative learning model.

Discussion

The data shows that the AR group increased more than the control group. The pre-test average was 64.25, increasing to 86.70 with a gain of 22.45 in AR. The control group increased from 63.80 to 74.45 with a gain of 10.65. The post-test SD for AR was 5.92, which was more uniform than the control group's 6.18, indicating a consistent response. The normality test showed Sig. ≥ 0.143, indicating normal data. Levene's test Sig. 0.34 indicated homogeneous variance. This reinforced the validity of the intergroup comparison. The greater improvement in AR is in line with the trend of AR adoption and impact in education. The 2024 Frontiers review also noted improved learning outcomes when AR is well integrated. This context confirms that the pattern at IBS Al Iman is not a local anomaly (Singh et al., 2024).

The independent t-test yielded $t = 6.482$, $p = 0.000$, with a mean difference of 12.25. This is strong evidence of a difference after treatment. N-Gain analysis placed AR at 0.62, in the moderate to high category. The control was only 0.29, in the low category. Even so, pedagogical control remains important. Comparative research shows that AR can lose out to

video if distractions are high. We mitigated the "novelty" effect with guided questions and concept summaries. This pattern was evident in the students' more stable focus in sessions 3–4. The results are consistent with the findings on retention and instructional design in JCAL 2023. This evidence supports caution in the design of AR in the classroom (Geana & Cernusca, 2024).

The cognitive dimension is reflected in the ease of remembering chronology. Student interviews mention that 3D visuals help link events and figures. Observations show an increase in conceptual questions, not just factual ones. Artifacts such as the Prophet's Mosque and missionary maps serve as visual anchors. This facilitates the formation of historical space-time schemas. The effect is consistent with the post-test increase in AR (86.70). Teacher testimonials confirm that explanations are shorter and more targeted. AR-based history literature reports similar patterns in conceptual understanding. This pattern supports the claim that AR reinforces meaning, not memorization. Evidence from educational history journals affirms our findings (Priyono et al., 2024).

The social-emotional dimension also strengthened. Observations noted high attention (88%), participation (83%), and interaction (85%) in the AR group. Students helped each other when scanning markers and discussing. Teachers acted as facilitators, not sole sources of information. Two-way discussions increased, including critical questions about cultural context. Interviews mentioned that 90% of students were more enthusiastic about learning SKI. This reflects positive emotional engagement. Frontiers 2024 research on digital literacy through AR supports this pattern. AR combines engagement and digital literacy in one experience. This social impact enriches the meaning of history learning (Nevrelova et al., 2024).

The implementation context determines the quality of the results. Initial obstacles were Wi-Fi, device compatibility, and teacher readiness. We prepared backup devices and technical SOPs for mitigation. Teacher briefings made the sessions more stable in subsequent meetings. Statistically, the homogeneity of variance (Sig. 0.34) indicates that the data conditions are adequate for parametric testing. This reduces technical bias when comparing results. The literature emphasizes institutional support and training as prerequisites for adoption. Frontiers 2024 also highlights readiness as a key aspect. Our field data reinforces these recommendations. The synergy of infrastructure and didactics is the foundation for sustainability (Li et al., 2025).

Direct practical implications can be applied. Place AR on topics that require a space-time context. Apply a short cycle: AR exploration, concept reinforcement, brief reflection, and a short quiz. Use a participation rubric to maintain focus and discussion quality. Monitor metrics such as attention span and number of meaningful questions. Further research should increase the sample size and duration of the intervention. Application logs can be combined with authentic task performance scores. Previous literature supports the potential for scalability when aligned with the curriculum. The data provides a strong basis for replication. The next step is to test cognitive load and design variations.

CONCLUSION

The use of Augmented Reality in SKI learning at IBS Al Iman significantly and measurably increased student engagement. The AR group increased from an average of 64.25 to 86.70 with a gain of 22.45 and an N-Gain of 0.62, higher than the control group's 0.29. An independent t-test showed a significant difference between the groups (t=6.482, p=0.000). Observations reinforced the quantitative findings with 88 percent attention, 83 percent participation, and 85 percent interaction. Interviews showed that 90 percent of students were more enthusiastic and found it easier to understand the chronology and meaning of the artifacts. Positive impacts occurred when AR was combined with a clear pedagogical structure, guided questions and answers, and brief reflections. The main supporting factors were infrastructure readiness, device compatibility, and teacher training. These results confirm that AR is effective in bringing historical contexts to life and building conceptual, emotional, and social understanding. Sustained implementation is recommended with instructional reinforcement, monitoring of participation metrics, and expansion of testing to larger samples and durations.

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