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Artificial Intelligence and Immersive Technologies in Instructional Design for Islamic Education in Indonesia: A Systematic Review

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Abstract: This study examines how artificial intelligence and immersive technologies inform instructional design for Islamic education in Indonesia. The review framework covers publications from 2018 to 2024 and identifies Scopus, Google Scholar, DOAJ, and SINTA-accredited journal portals as search sources. Methodological reconstruction follows PRISMA 2020 reporting guidance and proposes descriptive mapping, thematic synthesis, and critical appraisal. The provisional synthesis identifies applications involving automated feedback, assessment, worship simulations, and contextual learning. Reported benefits concern feasibility, engagement, and selected learning outcomes, but heterogeneous designs and incomplete appraisal prevent conclusions about consistent effectiveness. Instructional alignment, teacher mediation, infrastructure, and Islamic ethical considerations emerge as important dimensions for interpretation. The study's originality lies in an organizing perspective that distinguishes technological capabilities, instructional practices, and demonstrated outcomes rather than assuming that innovation guarantees educational improvement. It provides a basis for evaluating technology use through pedagogical relevance, content accuracy, accessibility, and responsible implementation. Findings remain provisional pending completion of the study inventory and appraisal. Carefully evaluated pilots, sustained teacher development, and longitudinal research are recommended before broader adoption across diverse Indonesian institutions and educational levels.

Abstrak*: Penelitian ini mengkaji peran kecerdasan buatan dan teknologi imersif dalam desain pembelajaran pendidikan Islam di Indonesia. Kerangka tinjauan mencakup publikasi tahun 2018 hingga 2024 dengan sumber pencarian Scopus, Google Scholar, DOAJ, dan portal jurnal terakreditasi SINTA. Rekonstruksi metodologis mengacu pada pedoman pelaporan PRISMA 2020 serta mengusulkan pemetaan deskriptif, sintesis tematik, dan penilaian kualitas penelitian. Sintesis sementara mengidentifikasi aplikasi berupa umpan balik otomatis, penilaian, simulasi ibadah, dan pembelajaran kontekstual. Manfaat yang dilaporkan berkaitan dengan kelayakan, keterlibatan, dan hasil belajar tertentu, tetapi keragaman desain serta penilaian kualitas yang belum selesai membatasi kesimpulan mengenai efektivitas secara konsisten. Keselarasan pembelajaran, mediasi guru, infrastruktur, dan pertimbangan etika Islam menjadi dimensi penting dalam interpretasi. Kebaruan penelitian terletak pada perspektif pengorganisasian yang membedakan kemampuan teknologi, praktik pembelajaran, dan hasil yang dibuktikan, tanpa mengasumsikan bahwa inovasi menjamin peningkatan pendidikan. Kontribusinya berupa dasar evaluasi penggunaan teknologi berdasarkan relevansi pedagogis, ketepatan konten, aksesibilitas, dan penerapan bertanggung jawab. Temuan tetap bersifat sementara sampai inventarisasi studi dan penilaian kualitas diselesaikan. Uji coba yang dievaluasi secara cermat, pengembangan kompetensi guru secara berkelanjutan, dan penelitian longitudinal direkomendasikan sebelum penerapan lebih luas pada beragam lembaga.*

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INTRODUCTION

Digital transformation presents Indonesian Islamic education with an instructional challenge: how to use emerging technologies to support learning while sustaining its moral, spiritual, and intellectual purposes. Discussions of technology integration in Islamic education emphasize opportunities to expand access to learning resources and reconsider established teaching practices (Isti'ana, 2024). For pesantren, these developments also raise questions about how to accommodate technological change within existing educational traditions and institutional conditions (Adri Lundeto, 2021). The central concern, therefore, is how particular technologies can serve clearly defined educational purposes. This requires attention to instructional design, teacher mediation, the accuracy of religious content, and the conditions under which learners can participate meaningfully.

Artificial intelligence (AI) has attracted attention within this context because of its potential applications in personalized learning, feedback, assessment, and educational data analysis. Indonesian discussions have connected these applications to the development of Islamic digital platforms and more responsive educational provision (Baharuddin Baharuddin, 2025). Other work has explored their potential to help teachers identify learners' needs and adapt instruction accordingly (Lestari et al., 2023). These possibilities nevertheless require critical examination. In their systematic review of AI applications in higher education, Zawacki-Richter et al. (2019) identified applications in prediction, assessment, adaptive learning, and intelligent tutoring, while highlighting weak connections to pedagogical theory and insufficient consideration of ethical challenges. Although that review focuses on higher education more broadly, it provides a relevant rationale for examining the educational purposes and assumptions underlying AI adoption in Islamic education.

AI should also be distinguished from immersive technologies. AI encompasses computational approaches that support functions such as pattern recognition, prediction, language processing, and adaptive decision-making. Virtual reality (VR), by contrast, creates simulated environments, while augmented reality (AR) overlays digital information on the physical environment. Neither VR nor AR necessarily incorporates AI, and their educational uses should not be treated as evidence of AI implementation unless an identifiable AI component is present. This distinction is important when comparing instructional applications and interpreting claims about their outcomes. It also allows researchers to examine the separate and combined uses of these technologies without presuming that technological integration has occurred.

Within Islamic religious education, or Pendidikan Agama Islam (PAI), VR has been discussed as a medium for supporting the study of worship procedures, particularly hajj and umrah (Yahya et al., 2025). An Indonesian review of AR and VR applications identified examples involving tajwid, daily prayers, hijaiyyah letters, religious tourism, and wudhu procedures (Hasan Ruzakki, 2024). AR has also been discussed in relation to teaching Qur'anic interpretation and contextualizing

religious learning materials (Yusuf, 2024). These applications warrant careful distinctions between representing observable procedures or historical contexts and claiming theological realities. Assess their educational value by the materials' accuracy, the learning activities they support, and the outcomes they actually measure.

International research provides grounds for investigating these possibilities without assuming that benefits transfer uniformly across settings. Garzón et al. (2019), in a systematic review and meta-analysis of AR in education, reported positive overall learning effects while identifying shortcomings in accessibility. Such findings support further investigation, but they do not establish equivalent effects in Indonesian Islamic education, where content, learner characteristics, resources, and teaching practices may differ. Local discussions likewise identify infrastructure, human resources, and funding as constraints on VR adoption (Sudiro, 2024). Research on digital transformation in madrasah further highlights the challenge of introducing technology while maintaining core Islamic educational values (Agus Wedi, 2025). These considerations make context and implementation conditions central to assessing educational outcomes.

Instructional design provides a basis for examining how technological capabilities are translated into learning activities. The ADDIE framework organizes development through analysis, design, development, implementation, and evaluation (Zuhro et al., 2022). Applying it in Islamic education provides a structured way to connect learner needs, educational objectives, learning materials, and assessment (Zuhro et al., 2022). More recent discussion has also considered ADDIE in developing digital PAI media (Ps et al., 2026). However, adopting a development framework does not, by itself, establish instructional effectiveness. Evaluation must consider how the framework is implemented, whether activities align with the intended outcomes, and whether the resulting evidence supports claims about learning.

The Cognitive Affective Model of Immersive Learning offers a complementary perspective. Makransky and Petersen (2021) explain how features of immersive VR may influence learning through presence, agency, and cognitive and affective processes, including motivation, cognitive load, and self-regulation. This perspective helps distinguish immersion from achieving educational objectives. For this review, it supports examining whether studies explain how technology features, instructional activities, and assessment practices connect. It also provides a rationale for distinguishing motivation and engagement from conceptual understanding, procedural performance, and knowledge transfer.

The ethical purposes of Islamic education add a further dimension to instructional design. Discussions of AI in this field emphasize the relationship between technological development and Islamic ethical commitments (Baharuddin et al., 2025). Similarly, a review of AR in Islamic education identified technology integration, pedagogical transformation, and values and ethics as interconnected themes, alongside concerns about teacher competence and unequal digital access (Ajmain @ Jima'ain et al., 2025). The maqasid al-syari'ah perspective offers a normative basis for considering these issues through the protection of religion, life, intellect, lineage, and property. In instructional practice, this invites examination of content accuracy, teacher oversight, learner privacy, accessibility, and the

appropriateness of digital representations. Such principles should inform explicit design decisions rather than function only as general statements of ethical intent.

Existing scholarship thus provides several complementary perspectives. International reviews examine AI applications or AR outcomes across broad educational settings. At the same time, the Islamic education literature cited above considers technology-specific applications, worship-related learning, and ethical or institutional concerns. Taken together, these strands motivate a more focused examination of the relationship between technology, instructional design, and evidence within Indonesian Islamic education. The question extends beyond which tools have been introduced to how they are used, which outcomes are assessed, and how strongly the reported findings support educational conclusions. A synthesis organized around these relationships can also distinguish documented benefits from proposed possibilities and identify where further evaluation is needed.

Accordingly, this systematic review examines AI, VR, and AR applications in instructional design for Islamic education in Indonesia, including their separate use and their combined use where explicitly documented. It aims to connect technological functions with instructional frameworks, learning activities, reported outcomes, and Islamic educational considerations. Four research questions guide the review: (1) What AI, VR, and AR applications are reported in Islamic education in Indonesia, and in which educational settings and subject areas are they used? (2) Which instructional design frameworks and pedagogical principles guide these applications, and how are Islamic educational values incorporated? (3) What learning, engagement, and implementation outcomes are reported, and how do study design and methodological limitations affect their interpretation? (4) What institutional, pedagogical, technical, and ethical conditions shape implementation, and what priorities for practice and further research follow from the available evidence?

By addressing these questions, the review aims to provide a contextually grounded account of technology use in Islamic education and a proportionate basis for instructional development. Conclusions about effectiveness should follow from the quality and relevance of the evidence, rather than from the novelty of the technologies themselves.

METHOD

Review Design and Reporting Framework

This study adopts a systematic literature review design to examine the use of artificial intelligence (AI), virtual reality (VR), and augmented reality (AR) in instructional design for Islamic education in Indonesia. The review addresses technological applications, instructional frameworks, reported educational outcomes, and implementation conditions. The original methodological account describes identification, screening, eligibility assessment, and inclusion as the main stages of the review process (Afifah and Irwansyah, 2024). The revised review will document these procedures explicitly and use PRISMA 2020 as a reporting guideline, not as a study-specific protocol or a guarantee of methodological quality (Page et al., 2021).

The procedures below specify the methodological reconstruction required for the revised review. We will record any changes to the original eligibility criteria, search strategy, or synthesis approach, along with the rationale. We will report protocol availability and registration status based on the actual review records. We will identify any protocol prepared during revision as retrospective.

Eligibility Criteria

The publication window will remain January 1, 2018, to December 31, 2024, consistent with the original eligibility statement. Publications outside this period may inform the background or discussion but will not contribute to the included-study synthesis.

Eligible publications will be peer-reviewed journal articles written in English or Indonesian and published in journals accredited by SINTA or indexed in Scopus. These restrictions will be treated as publication eligibility criteria, not as indicators of study quality. Their potential effects on coverage will be acknowledged.

Studies must report primary empirical research concerning AI, VR, or AR in the teaching or learning of Islamic education in Indonesia. Eligible settings will include PAI instruction in general schools, madrasah, pesantren, and higher education. Studies of Islamic financial literacy or zakat instruction will qualify only when their content and instructional purpose are explicitly connected to Islamic education. Studies involving multiple countries will qualify only when findings from the Indonesian setting can be extracted separately.

Eligible designs include quantitative, qualitative, and mixed-methods research. Development studies will qualify when they report empirical evaluation, such as expert assessment, usability testing, classroom implementation, or learner outcomes. These evaluation forms will be distinguished during extraction and synthesis.

AI, VR, and AR may be examined separately or in combination. We will classify a study as combining AI with immersive technology only when the intervention documents an identifiable AI function. General use of learning management systems, digital presentations, or online communication will not qualify without a relevant AI, VR, or AR component. Studies concerning pedagogical deep learning will not be classified as AI research unless they document an actual AI application.

Editorials, opinion papers, non-empirical proposals, and secondary reviews will be excluded from the primary evidence synthesis. Existing reviews may be used for contextual interpretation and reference searching. Research focused exclusively on institutional administration, without a direct instructional connection, will also be excluded.

Information Sources and Search Strategy

The original account identifies Scopus, Google Scholar, DOAJ, and SINTA-accredited journal portals as information sources. Searches will be reconstructed or rerun across these sources using documented strategies. Scopus will provide structured bibliographic searching, while Google Scholar, DOAJ, and relevant journal portals will provide supplementary discovery routes. The individual journal portals searched will be listed, together with the rationale for their selection.

The search will combine English and Indonesian terms for technology and Islamic education. Geographic eligibility will primarily be assessed during screening because requiring the word "Indonesia" in every search could omit studies that identify only a locality or institution.

The proposed Scopus strategy is:

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TITLE-ABS-KEY(
("artificial intelligence" OR "generative AI" OR chatbot* OR
"intelligent tutoring" OR "adaptive learning" OR
"kecerdasan buatan" OR "virtual reality" OR
"augmented reality" OR "mixed reality" OR
"immersive technolog*" OR "realitas virtual" OR
"realitas tertambah
AND
("Islamic education" OR "Islamic religious education" OR
"pendidikan Islam" OR "pendidikan agama Islam" OR
madrasah OR madrasa* OR pesantren OR
"Islamic school*" OR "Islamic boarding school*" OR
Quran* OR "Qur'an" OR tajwid OR fiqh OR zakat OR
hajj OR umrah)
)
AND PUBYEAR > 2017
AND PUBYEAR < 2025
AND DOCTYPE(ar)
```

This strategy will be tested against known relevant publications before final execution. Retrieval through broad terms such as zakat or adaptive learning will not establish eligibility; each record must meet the educational and technological criteria.

For platforms with limited Boolean functionality, shorter searches will be used, including "artificial intelligence" "Islamic education", "virtual reality" "pendidikan Islam", "augmented reality" "pendidikan agama Islam", "kecerdasan buatan" madrasah, and "kecerdasan buatan" pesantren. Supplementary searches will combine "instructional design" or "desain instruksional" with Islamic education terms. Instructional design terminology will not be mandatory in every search because relevant studies may describe design decisions without using that exact phrase.

We will record the exact strategies executed, search dates, filters, sorting options, retrieval counts, and any platform-imposed limits. For Google Scholar, the number of accessible results screened for each query and any truncation will be documented. The team will also check reference lists of eligible studies and relevant reviews. Search reporting will follow PRISMA-S recommendations (Rethlefsen et al., 2021).

Study Selection and Record Management

Retrieved records will be entered into a master register containing bibliographic information and source identifiers. Duplicate records will be identified using DOI, title, authorship, and publication year, then manually checked.

Multiple publications reporting the same underlying study will be linked so that participants and findings are not counted twice.

Selection will proceed through title and abstract screening followed by full-text assessment. We will first test eligibility rules on a subset of records to identify ambiguities. Where feasible, we will independently check screening decisions, and the final report will describe the personnel, checking arrangements, and disagreement-resolution procedure. Any single-person screening will be disclosed as a limitation.

For reports that cannot be retrieved initially, we will check publisher websites, institutional repositories, and other legitimate access routes. Reports remaining unavailable will be recorded as not retrieved rather than automatically classified as methodologically ineligible.

A selection log will record full-text decisions and reasons for exclusion. The revised Results section will include a flow diagram distinguishing records, reports, and studies. All counts will be derived from the search and screening records rather than reconstructed from the reference list.

Data Extraction

We will develop and pilot a structured extraction form before using it across the included studies. Building on the original extraction categories, it will capture research objectives, methodology, technological applications, instructional design models, findings, challenges, and recommendations.

Additional fields will include study location, educational level, participant characteristics, sample and group sizes, intervention duration, comparator, teacher involvement, assessment instruments, and follow-up periods. Each quantitative finding will include its outcome definition, measurement scale, time point, and available uncertainty estimates. We will record source pages or tables to support verification.

Extraction will distinguish feasibility, usability, motivation, engagement, knowledge, procedural performance, and longer-term outcomes. Expert validation will not be treated as evidence of improved student learning. We will code Islamic ethical considerations separately as stated principles, implemented design features, or evaluated outcomes. Missing information will be recorded as not reported.

Critical Appraisal

Eligible empirical studies will be assessed using design-appropriate criteria from the Mixed Methods Appraisal Tool, where applicable (Hong et al., 2018). Appraisal will consider the appropriateness of data collection and analysis, sampling, outcome measurement, confounding, data completeness, and the integration of qualitative and quantitative components.

Development studies will be assessed according to the design of their empirical evaluation. Product feasibility ratings will remain distinct from assessments of intervention effects. Any evaluation that does not fit the selected appraisal categories will be described transparently rather than assigned an inappropriate rating.

Judgments will be presented by criterion with supporting explanations. We will not use an overall numerical quality score to equate different study designs.

The appraisal will inform interpretation of the findings, including whether conclusions depend mainly on studies with substantial methodological limitations.

Data Synthesis

The synthesis will combine descriptive mapping with separate analyses of qualitative findings and quantitative outcomes. Consistent with the original thematic orientation, it will examine patterns, implementation challenges, and research gaps (Dluha et al., 2024).

Descriptive mapping will summarize studies by publication year, educational setting, technology, research design, and instructional framework. Counts and percentages will use explicit denominators. Claims about the prevalence of ADDIE or other frameworks will distinguish models explicitly reported by study authors from frameworks inferred during analysis.

Qualitative findings will be synthesized through coding, development of descriptive themes, and construction of analytical themes, drawing on Thomas and Harden (2008). Initial categories will address instructional design, teacher mediation, institutional capacity, and Islamic ethical considerations, while allowing additional themes to emerge. The coding record will link interpretations to study identifiers and source passages, including contradictory findings.

We will group quantitative results by technology, study design, comparator, and outcome. Where meta-analysis is inappropriate, reporting will draw on the Synthesis Without Meta-analysis guideline (Campbell et al., 2020). We will not combine raw score changes, normalized gains, adoption percentages, feasibility ratings, and standardized effects as equivalent measures. Statistical significance will not be treated as sufficient evidence of educational importance.

Interpretation will consider methodological limitations, consistency across studies, relevance to Indonesian Islamic education, and the precision of reported estimates. Recommendations will distinguish conclusions supported by the included evidence from proposals requiring further evaluation.

Transparency and Supporting Materials

The revised submission will include the executed search strategies, selection flow diagram, included-study inventory, full-text exclusion log, extraction matrix, appraisal judgments, and coding framework. These materials will provide an auditable connection between the search process, the included evidence, and the conclusions. We will explicitly discuss limitations arising from language restrictions, journal eligibility, incomplete retrieval, screening arrangements, and missing data.

RESULTS AND DISCUSSION

Results

Scope and Interpretation of the Evidence

The following synthesis considers the findings attributed to publications within the specified 2018–2024 period. It distinguishes descriptions of technological applications, product feasibility, user experience, and measured educational outcomes. These categories address different questions and should not be interpreted as interchangeable evidence of effectiveness. Publications outside

the eligibility period and studies addressing broader institutional digitalization are considered separately in the discussion.

The evidence summarized below remains provisional pending completion of the included-study inventory, full-text eligibility assessment, and methodological appraisal. Consequently, no study-selection totals, publication trends, framework prevalence estimates, or formal certainty ratings are reported. Publication year alone does not establish eligibility, and each source must also satisfy the specified requirements concerning research design, setting, technology, and instructional relevance.

Artificial Intelligence Applications in Islamic Education

The cited literature identifies several potential instructional functions of AI in Islamic religious education, or Pendidikan Agama Islam (PAI). These include personalized learning, feedback, assessment, and support for identifying learners' needs (Lestari et al., 2023). Fitriani (2023) discusses chatbots, speech recognition for Qur'anic reading, and sentiment analysis. Sofyan and Wahab (2024) considers AI-supported assessment and its potential contribution to feedback and evaluation.

These applications differ in their instructional purposes. Chatbots support dialogue and access to explanations; speech recognition may assist practice and feedback; sentiment analysis summarizes expressed opinions; and automated assessment processes learner responses. However, identifying a possible function does not establish that the function was implemented successfully or produced measurable learning gains. In particular, sentiment classification should not be interpreted directly as a measure of understanding, and automated scoring should not be assumed to be objective without evidence of accuracy and validity.

Table 2 distinguishes the applications described in the cited literature from the evidence required to evaluate their instructional contribution.

Table 2. AI applications described in the cited literature and requirements for evaluating their contribution

Application	Instructional purpose	Cited source	Interpretation
Conversational systems	Support questions, explanations, and classroom discussion	Fitriani (2023)	Educational value depends on response accuracy, task design, and teacher supervision
Speech recognition	Support Qur'anic reading and pronunciation practice	Fitriani (2023)	Claims about improvement require validation against appropriate human assessment
Sentiment analysis	Examine learners' expressed perceptions	Fitriani (2023)	Expressed sentiment is distinct from knowledge, achievement, or religious understanding
Personalized learning	Adapt support to learners' needs	Lestari et al. (2023)	A personalization claim requires documentation of how adaptation operates
Automated assessment	Assist scoring and feedback	Sofyan and Wahab (2024)	Efficiency, accuracy, fairness, and learning outcomes require separate evaluation

The reported applications suggest that AI can serve different roles within an instructional sequence. Nevertheless, the available summaries do not establish comparative effectiveness across applications. They also do not demonstrate that AI and immersive technologies were necessarily combined within the same intervention.

Immersive Technologies and Learning Activities

VR applications are represented by research on worship-related learning and classroom teaching management. Zainal Asril (2023) describes the development of a VR Hajj module using the ISI-ARE approach. The study involved validation by three evaluators and testing with 140 students across four integrated Islamic elementary schools in Padang. The reported evaluation emphasizes suitability, comprehensibility, engagement, and user experience. These findings support consideration of the module as a feasible instructional resource, but they do not by themselves establish a controlled improvement in knowledge or procedural performance.

Sudiro and Munjin (2024) examines VR-supported PAI teaching through a qualitative approach involving interviews, observations, and document analysis. The reported teaching process comprises preparation, action, and evaluation. Although the publication also reports an engagement increase exceeding 35%, this figure should not be treated as a standardized intervention effect. Its interpretation requires a clear account of the engagement measure, baseline, denominator, and calculation.

AR is discussed in relation to contextual support for Qur'anic interpretation (Yusuf, 2024) and Islamic financial literacy (Nurbaiti and Suyanto, 2022). The latter study is described as comparing an experimental group with a control group and reporting normalized gains of 0.7 and 0.09, respectively. This result warrants examination as an outcome comparison, but its interpretation depends on the gain formula, group characteristics, assessment instrument, and statistical analysis.

These examples indicate different instructional uses of immersive media. VR can provide simulated environments for examining spatial or procedural content, whereas AR can connect digital information with physical materials or learning contexts. Neither capability guarantees successful learning. The relevant question is how the representation supports a specified task and how the resulting learning is assessed.

Table 3. Reported findings from selected immersive technology studies within the publication window

Source	Technology and setting	Reported evidence	Appropriate interpretation
Zainal Asril (2023)	VR Hajj module; 140 students across four integrated Islamic elementary schools	Expert validation and student responses	Evidence concerning feasibility and user experience, not a controlled estimate of learning improvement
Sudiro and Munjin (2024)	VR-supported PAI teaching in junior high school	Qualitative account of teaching management and a reported engagement increase exceeding 35%	Contextual implementation evidence; the numerical claim requires clarification before comparative use
Nurbaiti	AR-supported Islamic	Reported normalized	A potentially relevant outcome

and Suyanto (2022)	financial literacy in elementary education	gains of 0.7 and 0.09	comparison requiring verification of design, measures, and analysis
Yusuf (2024)	AR in Qur'anic interpretation instruction	Reported participation, motivation, and understanding	Findings must be distinguished by outcome and supported by the original measurement procedures

Instructional Design and Evaluation

The cited literature describes structured development and implementation processes, but the available information does not support ranking their prevalence or effectiveness. S Syahrizal (2024) discusses ADDIE in the development of teaching materials, while Zainal Asril (2023) reports an ISI-ARE development process. Whether the former meets the review's technology criteria depends on documentation of an identifiable AI, VR, or AR component. General multimedia development is not sufficient for inclusion.

A development framework organizes activities such as identifying learning needs, designing materials, implementing instruction, and evaluating the resulting product. Its use should therefore be distinguished from evidence that the product improves learning. Expert validation, learner satisfaction, observed participation, and assessment performance each require separate interpretation.

The available summaries also do not establish that ADDIE is the dominant framework in the eligible corpus. Such a conclusion would require a complete study inventory, explicit coding of framework use, and a defined denominator. Similarly, no comparative conclusion concerning ADDIE, 4D, ASSURE, or other frameworks can be drawn from general descriptions of their stages.

Implementation and Capacity Building

Some publications concern the introduction of technologies or the development of educator capacity rather than direct evaluation of learner outcomes. Rizqi Putri Nourma Budiarti (2022) describes a community-service activity introducing VR and AR in a pesantren and reports a 45% knowledge-related result. The meaning of this percentage requires verification against the instrument and calculation. It should not be described as an improvement merely because it was obtained from a posttest.

Aceng Badruzzaman Aceng (2024) similarly addresses AI introduction and teacher competence in a pesantren. Its relevance to the review depends on whether the publication reports an empirical evaluation meeting the inclusion criteria. Even where eligible, participation in a training activity, increased familiarity with a tool, and improved teaching competence are distinct outcomes.

These reports may inform implementation feasibility and professional development. They do not establish durable improvements in student learning without corresponding outcome evidence. They also highlight the need to distinguish initial exposure to technology from sustained classroom use.

Discussion

Instructional Design as the Link Between Technology and Learning

The cited findings are more informative when organized around instructional purposes than when treated as a catalogue of technological tools. AI-supported feedback, VR simulations, and AR representations address different learning needs. Their contribution depends on the relationship between the technology, the task, teacher guidance, and assessment.

This interpretation is consistent with international scholarship. Zawacki-Richter et al. (2019) identified a weak connection between AI applications and pedagogical perspectives in higher education research. Radianti et al. (2020) similarly found that immersive VR development frequently lacked explicit links to learning theory and that evaluation often emphasized usability rather than learning outcomes. Garzón et al. (2020) demonstrated the relevance of pedagogical approaches to interpreting outcomes in AR interventions. These publications provide comparative perspectives rather than direct evidence about Indonesian Islamic education.

For the present topic, the implication is that instructional design should specify what students are expected to learn, why a particular technological function is appropriate, and how achievement will be assessed. A VR Hajj environment, for example, may support orientation and rehearsal, but its instructional value depends on guided activities and assessment of the intended knowledge or procedures. Likewise, an AI system may provide rapid feedback, but speed alone does not establish that the feedback is accurate, comprehensible, or educationally useful.

Interpreting Later Studies Without Extending the Review Corpus

Several publications cited in the original discussion fall outside the 2018–2024 eligibility period. They remain relevant for contextual comparison but cannot be counted as findings of the primary synthesis.

Dewi et al. (2025) discusses AR-based games and motivation, while Siti Khoiriyah (2025) examines VR in conjunction with Active Deep Learner Experience. Al Muhdhar (2025) considers teacher strategies for using AR, including structured practice and alignment with learning theories. These contributions raise questions about how gamification, guided activity, and learner autonomy interact with technological features. They do not establish that similar effects occurred in the earlier review corpus.

Muttaqin Choiri (2025) reports zakat learning scores of 72 and 86 and expert validation percentages of 90.8% and 90.5%. The score contrast represents a 14-point difference, but its causal interpretation depends on whether the comparison concerns the same students, different groups, or different instructional conditions. Expert validation percentages address product assessment rather than learner achievement. Ahmad Shofiyuddin (2025) also discusses AR and VR in higher education distance learning, but the relationship between these publications should be checked before treating their findings as independent evidence.

These later studies can help identify directions for future investigation. They should not be used to increase the apparent size, consistency, or effectiveness of the 2018–2024 evidence base.

Instructional Frameworks and Islamic Educational Values

Later conceptual discussions extend the relationship between instructional design and Islamic values. PS et al. (2026) discusses digital ADDIE-based design, while Ach Syaikhu (2026) proposes TPACK-I as an approach incorporating an Islamic dimension. M. Fauzan (2025) considers the combination of digital learning with spiritual reflection.

These sources suggest questions for framework development, but they do not establish the superiority of TPACK-I or the inadequacy of established frameworks. ADDIE, 4D, and ASSURE concern development or instructional planning, whereas a TPACK-based framework concerns relationships among forms of teacher knowledge. Their functions should be distinguished before comparison. Moreover, the cultural origin of a framework is not sufficient evidence that it excludes Islamic educational purposes.

A more productive evaluation would examine whether a particular implementation explicitly addresses religious content accuracy, ethical reasoning, teacher mediation, reflective activities, and appropriate assessment. These features can be investigated within different frameworks. Claims about spiritual or character development require measures and study designs suited to those outcomes, rather than inference from satisfaction or short-term knowledge tests.

Teacher Readiness and Institutional Conditions

The implementation of AI and immersive technologies takes place within broader institutional conditions. Akhmad Habibi (2021) identifies technological, financial, and pedagogical barriers in pesantren instruction during the COVID-19 period. This provides useful contextual evidence, but general barriers to remote instruction should not automatically be interpreted as barriers specific to AI or VR.

Later studies address related aspects of educator readiness. Zalisman (2025) examines relationships involving AI knowledge and digital competence, while Nur Ainun Amalia B Ayi (2025) reports AI use among teachers. The reported adoption figure of 73.08% describes use within a particular sample; it does not establish proficiency, workload reduction, or improved instruction. Those outcomes require separate measures.

Agus Pahrudin (2025) examines readiness for a deep learning-based curriculum. Interpretation requires distinguishing deep learning as a pedagogical approach from deep learning as a computational technique. Findings about the former cannot be recoded as AI readiness without explicit evidence. Similarly, Hilyah Ashoumi (2025) discusses hybrid learning and teacher digital literacy, which may inform professional development but does not directly demonstrate the effectiveness of AI or immersive instruction.

Habib Rachman Wafiq (2025) compares AR adoption readiness in Indonesian and Thai institutions. The comparison offers contextual insight into differences between managerial support and resource availability. However, the study is outside the review period, and the Thai findings cannot be treated as Indonesian evidence. The comparison is therefore relevant to discussion of implementation conditions rather than to the primary synthesis.

Together, these sources motivate differentiated professional development that addresses instructional planning, content evaluation, technical operation, and assessment. They do not justify assuming that access to devices or attendance at training is sufficient for competent classroom implementation.

Ethical Interpretation and Religious Content

Islamic educational values require attention to how technology changes instructional relationships and representations. Muslim (2024) discusses opportunities and concerns associated with digital technology in Islamic education. Later contributions address the risks of excessive reliance on automated systems, reduced interpersonal interaction, and inadequate attention to moral or spiritual aims (Al Jumhuri, 2025; Berliana et al., 2025).

These concerns should be distinguished from demonstrated harms. Unless a study measures changes in teacher-student interaction, religious understanding, or moral development, such claims remain ethical considerations or hypotheses requiring investigation. Similarly, statements that AI improves critical thinking or character formation should not be inferred from increased participation alone.

The discussion of AR also requires careful boundaries. Digital media may represent observable procedures, historical settings, textual relationships, or symbolic teaching materials. Such uses should not be conflated with literal representation of divine reality or validation of theological understanding. Content should be reviewed for accuracy and appropriateness, with attention to interpretive differences and the educational context.

Ajmain @ Jima'ain et al. (2025) discusses the relationship between AR, pedagogy, and Islamic ethical principles, while Arsya Naya (2025) considers connections among AI, AR, and STEM learning. These sources can inform the development of safeguards, but their proposals should not be presented as outcomes established by the eligible primary studies.

Appropriate safeguards include teacher review of generated explanations, clear correction procedures, protection of learner information, and alternative activities for students unable to use immersive devices. These are recommendations for responsible instructional design, not findings that all reviewed interventions implemented or evaluated them.

Digital Transformation and the Boundaries of Instructional Evidence

Broader digital transformation research provides institutional context. Sedya Santosa (2022) discusses the digital madrasah, while Cecep Nikmatullah (2023) addresses the development of digital pesantren. Syawal Kurnia Putra (2025) considers web-based learning and learning management systems. These contributions concern educational infrastructure and organizational change, but general digital provision does not establish the use of AI, VR, or AR.

The same distinction applies to organizational outcomes. Sudirman Sudirman (2025) reports a secondary synthesis concerning technology adaptation and pesantren management, including estimates relating to financial management and administrative efficiency. These estimates are not learning outcomes and were not calculated by the present review. They should therefore not be pooled with student-level results or used to support instructional effectiveness claims.

Akhmad (2024) discusses the balance between modernization and pesantren traditions, while Badriello Chenny Waita (2025) emphasizes collaboration in educational digital transformation. These sources help frame institutional considerations. Their relevance lies in explaining the environment in which instruction occurs rather than demonstrating that particular technological interventions improve learning.

Implications for Evaluation and Development

The distinction between technological adoption and educational benefit has implications for future evaluation. Achmad Faqihuddin (2024), for example, reports an R-squared value of 0.761 and mean scores of 60.40 and 85.40 in research on digital learning design. The R-squared value concerns variance accounted for by a statistical model, not a causal percentage attributable to course participation. The 25-point score difference also requires interpretation in relation to the design, assessment scale, and comparison conditions. Unless an eligible AI or immersive component is documented, this study should inform discussion of digital capacity rather than the primary technology-specific synthesis.

A stronger evaluation would separate feasibility, usability, engagement, and achievement. It would report the intervention and comparator clearly, identify the contribution of teacher support, and assess whether learning is retained or transferred beyond the immediate activity. Where practical, studies should also examine accessibility, maintenance costs, and the resources needed for sustained use.

Table 4 translates these considerations into priorities for implementation and evaluation. The priorities are analytical recommendations rather than estimates of how frequently particular barriers occurred.

Table 4. Priorities for instructional implementation and evaluation

Priority	Recommended action	Evidence needed
Alignment with learning objectives	Identify the specific task that AI, VR, or AR is intended to support	Evidence that the activity and assessment address the same objective
Teacher mediation	Define teacher responsibilities for guidance, verification, and correction	Observation of implementation and assessment of teacher practice
Content accuracy	Review religious explanations and representations before use	Documented expert review and procedures for correcting errors
Outcome evaluation	Separate usability and engagement from knowledge and performance	Valid measures, appropriate comparisons, and follow-up where relevant
Accessibility and resources	Provide alternatives and assess implementation demands	Participation data, accessibility assessment, and resource requirements
Sustainability	Evaluate continued use beyond an initial demonstration	Evidence on maintenance, staff support, and repeated classroom implementation

Limitations and Overall Interpretation

The principal limitation of the current synthesis is the absence of a finalized and appraised study corpus. Search yields, full-text decisions, study overlap, and quality judgments must be established before the section can support claims about the overall literature. The language and journal-indexing restrictions specified in the methods may also limit coverage.

The reported outcomes differ in their constructs, measures, and study designs. Expert ratings, user responses, normalized gains, and qualitative accounts cannot be combined into a single statement that AI and immersive technologies are effective. The descriptions also do not establish whether favorable responses persist beyond initial exposure or whether they reflect technology, additional instructional support, gamification, or other intervention components.

The defensible interpretation is therefore that the cited literature describes several relevant applications and reports encouraging findings in particular settings, while leaving important questions about validity, transferability, and sustained educational benefit unresolved. The contribution of the review should be to clarify these relationships and uncertainties. Claims of general effectiveness, framework dominance, or national implementation trends should await completion of the documented selection, extraction, and appraisal procedures.

CONCLUSION

The literature examined suggests that the educational value of artificial intelligence and immersive technologies in Indonesian Islamic education depends on their alignment with instructional objectives, teacher guidance, and appropriate assessment. Reported applications include AI-supported feedback and assessment, VR-based worship simulations, and AR-supported contextual learning. Although individual publications describe favorable findings concerning feasibility, engagement, and selected learning outcomes, these findings do not establish consistent effectiveness across technologies or educational settings. The synthesis therefore challenges the assumption that technological sophistication alone produces better learning and directs attention to the pedagogical and contextual conditions under which these tools may support Islamic education.

The study contributes to scholarly discussion by distinguishing technological capabilities from instructional practices and demonstrated educational outcomes. Its interpretation is consistent with previous research emphasizing pedagogical design, while questioning conclusions that equate expert validation, learner satisfaction, or short-term engagement with improved learning. Rather than establishing the superiority of a particular technology or framework, the review proposes an organizing perspective that connects technological functions, instructional activities, teacher mediation, and Islamic ethical considerations. This perspective provides a basis for examining how content accuracy, reflective learning, and responsible technology use can be incorporated into instructional design without assuming that their educational benefits have already been demonstrated.

The conclusions remain provisional because the included-study inventory and methodological appraisal have not been finalized. Differences in study designs, outcome measures, and educational settings further restrict comparison and generalization, while findings from small or context-specific studies require particular caution. Future research should employ larger and more diverse samples, appropriate comparison groups, validated measures, and longitudinal designs to examine retention, transfer, and moral or spiritual outcomes. Educational institutions should prioritize carefully evaluated pilot implementations, sustained teacher development, and accessible learning alternatives before wider adoption. Policymakers and developers should support equitable infrastructure and collaborate with educators and Islamic subject specialists to establish content review, learner privacy, and evaluation procedures that connect innovation with demonstrable educational value.

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