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Artificial Intelligence in Islamic Religious Education: A Systematic Review of Applications, Challenges, and Future Directions

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Abstract

Background: The rapid advancement of artificial intelligence (AI) has created transformative opportunities across educational sectors, yet its application within Islamic religious education (IRE) remains insufficiently examined in the academic literature. Purpose: This study systematically reviews existing research on AI integration in IRE, identifying key applications, implementation challenges, and future research directions. Methods: Following PRISMA 2020 guidelines, a comprehensive literature search was conducted across Scopus, Web of Science, Google Scholar, and SINTA databases, yielding 38 studies published between 2018 and 2024 that specifically addressed AI applications within IRE or madrasah contexts. Results: The analysis revealed three principal AI application clusters: (1) intelligent tutoring systems for Quranic recitation and tajweed correction, (2) adaptive learning platforms for Islamic jurisprudence instruction, and (3) natural language processing tools supporting Arabic language acquisition. Key challenges encompass inadequate technological infrastructure in madrasah institutions, insufficient educator digital competency, content authenticity concerns, and tensions between algorithmic personalization and Islamic pedagogical values. Conclusions: AI integration in IRE holds significant transformative potential; however, successful implementation requires culturally sensitive design frameworks, sustained educator professional development, and coherent institutional policies grounded in Islamic educational philosophy. Future research should prioritize empirical outcome measurement and indigenous AI tool development.

Keywords Artificial Intelligence; Islamic Religious Education; Madrasah; Educational Technology; Systematic Review.

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1. INTRODUCTON

The intersection of artificial intelligence (AI) and education has emerged as one of the most consequential developments in contemporary educational discourse. AI technologies—encompassing machine learning, natural language processing (NLP), computer vision, and adaptive systems—are increasingly embedded in learning environments worldwide, promising unprecedented personalization, accessibility, and efficiency in teaching and learning processes (Zawacki-Richter et al., 2019; Miao et al., 2021). Within this global transformation, Islamic religious education (IRE) occupies a distinctive position: it constitutes one of the oldest formal educational traditions in the world, serving

hundreds of millions of learners across diverse institutional contexts, including madrasah, pesantren (Islamic boarding schools), and Islamic universities (Azra, 2019; Arif, 2022).

Despite its global reach, IRE has received comparatively limited attention in the educational technology literature. The majority of AI-in-education research focuses on STEM disciplines, higher education settings, or general K-12 contexts in Western and East Asian nations (Zawacki-Richter et al., 2019; Hwang & Tu, 2021). This disciplinary and geographic concentration obscures significant opportunities and challenges inherent in applying AI tools within IRE contexts, where subject-specific requirements—such as Quranic recitation accuracy (tajweed), Arabic morphology (sarf) and syntax (nahwu), and Islamic jurisprudence (fiqh)—demand highly specialized pedagogical and technological solutions (Alkhouli, 2020; Mansur et al., 2022).

Indonesia presents a particularly significant case for examination. As the world's largest Muslim-majority nation, Indonesia operates approximately 82,000 madrasah institutions, enrolling over nine million students across various educational levels (Kemenag RI, 2023). The Ministry of Religious Affairs has progressively advanced digital transformation policies within these institutions, most recently through the Madrasah Digital Transformation Roadmap 2023-2028, which positions AI as a strategic enabler of quality improvement. Yet empirical evidence regarding effective AI implementation strategies, student outcomes, and contextual barriers within Indonesian IRE remains fragmented and underdeveloped (Mukhtar et al., 2020; Fauzi et al., 2023).

Beyond Indonesia, parallel challenges are evident across Muslim-majority contexts globally. Studies from Malaysia, Saudi Arabia, Egypt, and Pakistan suggest that while enthusiasm for educational technology is high among Islamic educators, structural barriers—including connectivity limitations, teacher readiness, and concerns about the compatibility of technological approaches with Islamic values—impede systematic adoption (Al-Harbi, 2021; Rahman et al., 2022; Saeed et al., 2023). The question of whether and how AI tools can authentically support, rather than displace, the distinctively relational and spiritually oriented pedagogical traditions of IRE remains a significant unresolved scholarly concern (Nashir, 2021; Arif, 2022).

Against this backdrop, the present study undertakes a systematic literature review to synthesize existing evidence on AI integration in IRE. Specifically, this review addresses three research questions: (1) What AI applications have been developed or studied within IRE contexts? (2) What challenges and barriers have been identified in AI implementation across IRE settings? and (3) What recommendations and future research directions emerge from the existing literature? By consolidating and critically appraising available evidence, this review aims to provide a rigorous foundation for researchers, practitioners, and policymakers engaged with the future of Islamic education in the digital age (Holmes et al., 2019; Luckin et al., 2016).

2. METHOD

This study employed a systematic literature review methodology following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). The systematic review approach was selected for its transparency, reproducibility, and capacity to synthesize heterogeneous evidence across diverse scholarly traditions. It provides a structured framework for minimizing bias and ensuring comprehensiveness in the identification and appraisal of relevant literature (Thomas & Harden, 2008).

2.1. Search Strategy

A comprehensive literature search was conducted between January and March 2024 across four major databases: Scopus, Web of Science (WoS), Google Scholar, and the Science and Technology Index (SINTA). Search strings were constructed using Boolean operators combining terms related to AI (e.g., "artificial intelligence," "machine learning," "intelligent tutoring system," "natural language processing," "chatbot," "deep learning") with IRE-specific terms (e.g., "Islamic education," "madrasah," "Islamic religious education," "Quran learning," "tajweed," "Arabic language," "pesantren"). Searches were conducted in both English and Indonesian to ensure comprehensive coverage of the Indonesian-language literature indexed in SINTA.

2.2. Inclusion and Exclusion Criteria

Studies were included if they: (1) examined AI tools, systems, or applications in IRE or closely related educational contexts; (2) were published in peer-reviewed journals or conference proceedings between January 2018 and December 2024; (3) were available in full text; and (4) were written in English or Indonesian. Studies were excluded if they: (1) focused exclusively on AI in general education without substantive IRE content; (2) were grey literature, editorials, or opinion pieces without empirical or analytical basis; or (3) constituted duplicate publications.

2.3. Study Selection and Data Extraction

Initial database searches yielded 892 records. After deduplication (n = 187 removed), titles and abstracts of 705 records were screened independently by two reviewers. Full-text assessment was conducted for 94 potentially eligible studies, resulting in a final sample of 38 studies included in the synthesis. Data were extracted using a structured form capturing: author(s), year, country, study design, AI technology type, IRE subject domain, key findings, and identified challenges. A thematic synthesis approach was adopted (Thomas & Harden, 2008), with iterative theme refinement between the research team. Inter-rater reliability assessment using Cohen's kappa yielded $\kappa = 0.81$, indicating strong agreement.

3. FINDINGS AND DSICUSSIOUN

Findings

3.1. AI Applications in Islamic Religious Education

The 38 reviewed studies documented a range of AI applications across three primary thematic clusters: (1) Quranic learning and tajweed assessment, (2) adaptive content delivery for Islamic subjects, and (3) Arabic language instruction support. These clusters are discussed in turn below.

3.1.1. Intelligent Systems for Quranic Recitation and Tajweed

The most extensively documented AI application in IRE involves automated recognition and evaluation of Quranic recitation. Tajweed—the set of phonological rules governing correct Quranic pronunciation—has historically required expert human evaluation, creating significant access limitations particularly in regions with insufficient qualified teachers (Alkhouli, 2020). Several studies have developed automatic speech recognition (ASR) systems specifically trained on Quranic Arabic phonemes, demonstrating promising accuracy rates in controlled environments. Al-Rashidi et al. (2022) developed an ASR-based tajweed correction system achieving 87.3% phoneme recognition accuracy across four tajweed rule categories. Similarly, Hasanah et al. (2023) reported that Indonesian madrasah students using an AI-assisted Quran recitation application demonstrated significantly improved tajweed accuracy compared to control groups following an eight-week intervention ($p < 0.01$, $d = 0.74$).

These systems represent a meaningful technological breakthrough, addressing a longstanding challenge in scaling quality Quranic instruction. The use of deep learning architectures—particularly convolutional neural networks (CNNs) and recurrent neural networks (RNNs)—has enabled substantially improved recognition of the subtle phonological distinctions central to tajweed (Mansur et al., 2022). However, researchers consistently note that current ASR models perform less consistently with non-Arabic speaker accents and dialectal variation (Alkhouli, 2020), limiting broader applicability across the diverse global Muslim learner population. Furthermore, most existing systems address individual tajweed rules in isolation rather than holistic recitation evaluation, a limitation that future development must address (Hasanah et al., 2023).

3.1.2. Adaptive Learning Platforms for Islamic Jurisprudence and Theology

A second cluster of AI applications encompasses adaptive learning systems designed for Islamic subjects including fiqh (Islamic jurisprudence), aqidah (Islamic theology), and Islamic history. Adaptive learning platforms dynamically adjust content difficulty, sequencing, and pedagogical approach based on individual learner performance data, theoretically optimizing learning efficiency for diverse student populations (Hwang & Tu, 2021; Roll & Wylie, 2016). Within IRE, five reviewed studies examined such platforms. Rahman et al. (2022) found that Malaysian secondary school students using an AI-adaptive fiqh learning platform achieved significantly higher post-test scores than control groups, with

particularly strong effects for lower-performing students ($p < 0.05$). Conversely, Saeed et al. (2023) reported implementation challenges in Pakistani madrasah contexts, where educators expressed concern that algorithmically driven content sequencing conflicted with traditional mnemonic and oral transmission pedagogies central to Islamic scholarly tradition.

This tension between adaptive personalization and the holistic, character-formation dimensions of IRE pedagogy constitutes a recurring theme across the reviewed literature. Multiple authors argue that effective AI integration in IRE must engage substantively with Islamic educational philosophy—particularly the tarbiyah (holistic formation) paradigm—rather than applying generic technological solutions derived from secular educational contexts (Arif, 2022; Nashir, 2021; Azra, 2019). This represents both a scholarly and a design imperative for the field.

3.1.3. Natural Language Processing for Arabic Language Learning

NLP tools—including grammar checkers, morphological analyzers, vocabulary support systems, and AI writing assistants—represent the third identified application cluster. Arabic language proficiency is foundational to advanced Islamic study, yet Arabic instruction presents distinct NLP challenges including right-to-left script, highly complex morphological structure, and significant differences between Modern Standard Arabic and Classical Quranic Arabic (Habash, 2022). Within the reviewed IRE-specific studies, chatbot-based Arabic conversation practice tools reported positive learner engagement outcomes, with students demonstrating increased willingness to practice conversational Arabic when interacting with AI partners compared to traditional classroom settings (Al-Harbi, 2021; Fauzi et al., 2023). AI-assisted morphological analysis tools demonstrated potential for reducing vocabulary acquisition time by up to 34% in one Malaysian university study (Zulkifli et al., 2022). Indonesian-language studies highlighted the added complexity of supporting Arabic learning among students whose first language is Bahasa Indonesia, with AI tools requiring careful localization to be effective in this context (Mukhtar et al., 2020; Mansur et al., 2022).

3.2. Challenges in AI Implementation Across IRE Settings

Beyond application-specific findings, the reviewed literature consistently identified five overarching implementation challenges that cross-cut AI type, country, and educational level.

Infrastructure and Connectivity. The most frequently cited barrier concerned inadequate technological infrastructure in madrasah institutions. Mukhtar et al. (2020) documented that approximately 64% of rural Indonesian madrasah lacked reliable internet connectivity sufficient for cloud-based AI tools, while a national survey found that only 38% of madrasah ibtidaiyah (elementary) possessed sufficient devices for individual student technology access (Kemenag RI, 2023). Similar infrastructure gaps are reported in Pakistani, Egyptian, and sub-Saharan African IRE contexts (Saeed et

al., 2023; Osman, 2021), suggesting this is not an Indonesia-specific challenge but a structural characteristic of many IRE institutions globally.

Educator Digital Competency. A second systemic challenge involves teacher readiness for AI-mediated instruction. Multiple studies found that IRE educators—particularly those trained primarily in traditional Islamic scholarly traditions—possessed limited digital literacy and expressed ambivalence or resistance toward AI tools (Rahman et al., 2022; Saeed et al., 2023; Arif, 2022). Professional development programmes that meaningfully integrate Islamic pedagogical values with technical skill-building are identified as a critical success factor but remain institutionally underdeveloped. Kim (2023) similarly identifies educator preparedness as the most critical determinant of successful AI integration across educational contexts globally.

Content Authenticity and Reliability. Specific to IRE, concerns about AI-generated content reliability carry particular salience. Several educators in interviewed studies expressed anxiety about AI systems providing incorrect Quranic interpretations or misguiding students on matters of Islamic law, emphasizing that such errors carry spiritual and communal dimensions beyond typical educational mistakes (Hasanah et al., 2023; Mansur et al., 2022). This concern calls for rigorous validation protocols, scholarly review mechanisms, and ongoing human oversight in IRE AI system design and deployment.

Alignment with Islamic Pedagogical Values. The literature surfaces a deeper philosophical challenge: whether AI-driven personalization and efficiency orientation are compatible with IRE's formative goals, which encompass character development (akhlaq), spiritual cultivation, and the living transmission of a scholarly tradition. Several authors argue that over-reliance on AI risks reducing IRE to information transfer while neglecting its tarbiyah dimension (Azra, 2019; Arif, 2022; Nashir, 2021). This critique, while sometimes overstated, raises legitimate design imperatives for IRE-specific AI development and highlights the need for interdisciplinary dialogue between AI researchers and Islamic education scholars.

Equity and Access. The reviewed literature consistently indicates that AI-mediated learning benefits accrue disproportionately to learners in well-resourced urban institutions, potentially exacerbating existing educational inequalities within IRE systems (Osman, 2021; Miao et al., 2021). Equity-centered design frameworks prioritizing low-bandwidth, low-device-dependency solutions are identified as an important research and development priority. UNESCO's guidance for AI in education policy specifically emphasizes equity as a non-negotiable design principle (Miao et al., 2021), a standard that IRE-focused AI development must actively uphold.

Discussion

The findings of this systematic review illuminate a field at an early but consequential juncture. AI technologies demonstrably hold potential to address longstanding challenges in IRE, including tajweed

instruction scalability, Arabic language support, and individualized learning. However, the evidence base remains limited in both volume and methodological rigor, with few randomized controlled studies and significant reliance on small-sample quasi-experimental designs with limited follow-up periods. Future research must prioritize rigorous outcome measurement, longitudinal evaluation, and participatory design approaches that center the perspectives of IRE educators and learners (Cope et al., 2021; Selwyn, 2019).

The tensions identified between AI capabilities and IRE pedagogical values are not unique to Islamic contexts—similar debates occur in culturally grounded educational traditions globally (Selwyn, 2019). What distinguishes the IRE context is the specific combination of specialized linguistic demands, spiritual formation goals, and institutional diversity that collectively require purpose-built rather than general-purpose AI solutions. The development of indigenous AI tools grounded in Islamic educational epistemology represents both a scholarly imperative and a significant opportunity for researchers in Muslim-majority nations. Drawing on Luckin et al.'s (2016) framework for intelligence-augmented learning, we propose that IRE-focused AI development should aim not to replicate human Islamic educators, but to extend their reach and capacity—particularly in contexts where qualified teachers are scarce.

Comparisons with parallel developments in other faith-based educational traditions—such as AI applications in Catholic, Buddhist, and Jewish educational institutions—remain absent from the literature, representing a productive future research direction that could surface broadly applicable design principles for values-aligned AI in education (Holmes et al., 2019; Cope et al., 2021).

4. CONCLUSIONS

This systematic review synthesized 38 studies on AI integration in Islamic religious education, identifying three principal application clusters—Quranic recitation assessment, adaptive Islamic subject learning, and Arabic NLP tools—alongside five recurring implementation challenges spanning infrastructure, educator competency, content authenticity, pedagogical alignment, and equity. The evidence indicates that AI holds genuine transformative potential for IRE, offering pathways to scale quality instruction, personalize learning, and extend access in resource-constrained environments.

Several practical implications emerge for diverse stakeholders. Policymakers should invest in targeted infrastructure development for madrasah institutions, particularly in rural and underserved communities, while creating regulatory frameworks that ensure AI content reliability and Islamic scholarly oversight. Curriculum developers and teacher educators should design professional development programmes that meaningfully integrate digital pedagogy with Islamic educational philosophy, building educator confidence and critical AI literacy. AI system developers should

collaborate substantively with Islamic scholars, linguists, and IRE educators to ensure content reliability, theological accuracy, and alignment with tarbiyah goals.

This review is subject to limitations including potential publication bias toward positive findings and restricted coverage of non-English, non-Indonesian language literature. Future research should extend coverage to Arabic, Malay, Urdu, and French-language scholarly traditions to fully represent the global IRE landscape. Longitudinal empirical studies measuring sustained learning outcomes, randomized controlled trials where feasible, and participatory design research centered on learner and educator voices represent the most pressing priorities for the emerging field of AI in Islamic religious education.

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