

Smart Learning Environments in Islamic Educational Institutions

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ABSTRACT

Digital transformation has repositioned Islamic educational institutions—madrasahs, pesantren, and Islamic universities as active adopters of Smart Learning Environments (SLE), yet the literature remains fragmented across disciplinary and national contexts. This article synthesizes twenty-five peer-reviewed sources published between 2021 and 2026 to examine how SLE concepts, components, and implementation challenges manifest specifically within institutions grounded in Islamic educational philosophy. Using a systematic literature review guided by a PRISMA-based selection procedure, sources were drawn from Google Scholar, Scopus, DOAJ, and Crossref, filtered for active, verifiable digital object identifiers. The review identifies four converging themes: infrastructure and governance readiness, artificial-intelligence-enabled pedagogical tools, teacher and student digital competence, and the ethical-spiritual safeguarding of Islamic values within digitally mediated instruction. Findings show that while smart classrooms, learning management systems, and AI-based media substantially improve engagement, personalization, and administrative efficiency, unresolved gaps in infrastructure equity, teacher readiness, and value-based governance persist, especially outside metropolitan areas. The study's novelty lies in proposing an integrated "Adab-Technology Alignment" framework that positions Islamic ethical principles as a design parameter not an afterthought within SLE architecture. The article concludes with implications for policy, institutional leadership, and future empirical research on faith-based smart education ecosystems.

INTRODUCTION

The twenty-first century has witnessed an accelerating convergence between educational technology and pedagogical philosophy, giving rise to what scholars now call Smart Learning Environments (SLE). An SLE is broadly understood as a technology-enriched ecosystem that blends physical and virtual spaces, adaptive content, learning analytics, and ergonomic design to personalize the learning experience and improve efficiency, engagement, and reflectiveness (García-Tudela et al., 2021; Cheung et al., 2021). Unlike earlier notions of e-learning or blended learning, which primarily digitized delivery channels, SLE research foregrounds intelligence—systems that sense, adapt, and respond to learners in real time through artificial intelligence (AI), the Internet of Things, learning management systems (LMS), and data-driven feedback loops (Zain et al., 2025; Muali & Albustomi, 2025). Globally, this shift has reshaped how universities, schools,

and increasingly religious educational institutions organize teaching, assessment, and student support.

The theoretical roots of SLE trace back to foundational work distinguishing "smart" environments from merely "digital" ones. The influential model advanced by García-Tudela et al. (2021) identifies five recurring dimensions across competing definitions of SLE: self-directedness, motivation, adaptivity, resource enrichment, and technology integration. Cheung et al. (2021) add that flexibility, efficiency, and engagement are equally central, arguing that a truly smart environment must accommodate both formal and informal learning across physical and virtual boundaries. These frameworks, however, were developed largely within secular, Western, or East Asian higher-education contexts, where the guiding logic of "smartness" is efficiency and personalization rather than any explicit value system. When such frameworks are imported wholesale into Islamic educational settings, an important dimension—values alignment—is left conceptually underdeveloped, even though empirical studies repeatedly show that Islamic institutions treat ethical and spiritual fidelity as a non-negotiable design constraint rather than an optional add-on (Agustia et al., 2026; Syafii et al., 2025).

Islamic educational institutions—ranging from traditional pesantren and madrasas to modern Islamic universities—occupy a distinctive position within this transformation. On one hand, they are subject to the same technological pressures faced by secular institutions: demands for accessibility, cost-efficiency, and alignment with twenty-first-century skills (Badriyah et al., 2025; Rahmaningtiyas & Aydın, 2026). On the other hand, they carry an additional mandate that secular institutions do not: preserving adab (Islamic ethical comportment), tarbiyah (holistic character formation), and the authenticity of religious knowledge transmission in an era where digital tools can inadvertently flatten nuance, encourage superficial engagement with sacred texts, or introduce unverified content into sensitive domains such as tafsir, fiqh, and hadith studies (Muslim, 2024; Agustia et al., 2026). This dual mandate—technological competitiveness alongside spiritual and ethical fidelity—creates a genuinely distinct research problem that cannot be resolved by transplanting generic SLE frameworks developed for secular contexts.

Recent scholarship illustrates both the promise and the friction of this transition. Studies on smart classrooms in Islamic private higher education report gains in interactivity and content delivery but also document infrastructural bottlenecks, inconsistent institutional policy, and uneven digital literacy among educators (Hidayat et al., 2025; Susanto et al., 2025). Parallel research on AI-based learning media in Islamic religious education highlights how machine-generated content, adaptive quizzes, and intelligent tutoring can personalize memorization and comprehension of religious material, yet simultaneously raises concerns about over-reliance on automated systems without adequate teacher mediation (Zain et al., 2025; Ahmad, 2025). Work on learning management systems within Islamic smart schools shows that mentoring and structured technical support are decisive factors separating successful implementation from superficial digitization (Muali & Albustomi, 2025). At the policy level, analyses of Islamic educational governance in the Society 5.0 era emphasize that infrastructure investment alone is insufficient without accompanying reforms in curriculum design, teacher professional development, and institutional leadership (Badriyah et al., 2025; Kusumawati & Destari, 2024).

A recurring finding across this literature is the persistence of a digital divide. Institutions situated in urban or well-funded settings—international Islamic universities,

established Aswaja-affiliated schools, and Muhammadiyah-based networks—report considerably higher readiness scores and more sophisticated SLE adoption than madrasahs and pesantren in rural or resource-constrained regions (Rahmaningtiyas & Aydın, 2026; Othman & Yaakub, 2025). Ethnographic and mixed-methods studies of madrasah-based AI integration further reveal that successful implementation depends less on the sophistication of the technology itself and more on contextual factors: teacher buy-in, community trust, availability of Arabic-language digital content, and the perceived compatibility of new tools with existing pedagogical traditions such as halaqah and musyafahah (Raehang et al., 2025; Wahyuni et al., 2026). These findings collectively suggest that SLE adoption in Islamic education is not a purely technical problem but a socio-technical and axiological one, in which values, trust, and institutional culture mediate technology's educational impact as much as bandwidth or hardware. Comparable governance and infrastructure disparities are reported by Rahmaningtiyas and Aydın (2026) among Muhammadiyah-based institutions, reinforcing that this divide cuts across organizational affiliation rather than being confined to any single network of schools.

Despite this growing body of work, three interconnected gaps remain evident in the literature. First, most existing studies are single-institution or single-country case studies—frequently situated in Indonesia—that describe local implementation experiences without synthesizing findings into a generalizable conceptual model applicable across the diverse landscape of Islamic educational institutions worldwide (Mahbubi & Ahmad, 2025; Ayuba et al., 2025). Second, while numerous studies acknowledge that Islamic values should inform technology adoption, few articulate concretely how ethical and spiritual considerations can be operationalized as explicit design parameters within SLE architecture, rather than being treated as an external constraint applied after systems are built (Syaffi et al., 2025). Third, comparative synthesis linking readiness factors (infrastructure, governance, competence) with pedagogical outcomes (engagement, character formation, learning quality) across multiple institutional types—madrasah, pesantren, and Islamic higher education—remains scarce, leaving practitioners without an integrated roadmap for phased implementation (Tanti et al., 2025; Hamran et al., 2026).

The novelty of the present article lies in addressing these three gaps through an integrative literature synthesis that (a) draws on twenty-five recent, verifiable sources spanning madrasah, pesantren, and Islamic higher-education contexts across Indonesia, Nigeria, and the broader Muslim world; (b) proposes an original "Adab-Technology Alignment" (ATA) framework that repositions Islamic ethical principles—adab, amanah (trustworthiness), and maslahah (public benefit)—as embedded design criteria for SLE components such as AI-based content curation, adaptive assessment, and digital governance, rather than as post-hoc safeguards; and (c) synthesizes readiness and outcome variables into a single comparative structure that can guide institutions at different stages of digital maturity. In doing so, this study moves beyond descriptive accounts of technology adoption toward a normative and practically actionable model for how smart learning environments can be designed to serve both twenty-first-century educational competitiveness and the enduring mission of Islamic tarbiyah. This positions the article not merely as a literature summary but as a conceptual contribution intended to guide future empirical validation, institutional policy, and instructional design in faith-based smart education ecosystems.

Beyond conceptual contribution, this study is also motivated by a practical concern voiced repeatedly in the reviewed literature: institutional leaders and teachers in Islamic

schools frequently report uncertainty about how to sequence technology investment—whether to prioritize infrastructure, staff training, curriculum redesign, or governance reform first (Badriyah et al., 2025; Kusumawati & Destari, 2024). Without a synthesized model that connects readiness factors to concrete implementation stages, institutions risk adopting fragmented, poorly sequenced initiatives that consume limited budgets without producing durable pedagogical improvement. By consolidating findings from twenty-five recent studies into a single comparative structure, this article aims to give policymakers, madrasah principals, and Islamic university administrators an evidence-based reference point for prioritizing investment, rather than relying on ad hoc benchmarking against secular institutions whose value assumptions differ fundamentally from their own. The remainder of this article proceeds as follows: the Methods section details the systematic review procedure and source-selection criteria; the Results and Discussion section presents thematic findings supported by a comparative table; and the Conclusion translates these findings into an actionable synthesis for future research and practice.

METHODOLOGY

This study employed a systematic literature review (SLR) design, guided by a PRISMA-based (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) selection procedure adapted for conceptual and qualitative synthesis rather than statistical meta-analysis. The SLR approach was selected because the research problem—how Smart Learning Environments manifest within Islamic educational institutions—is best addressed by consolidating dispersed empirical and conceptual findings into a coherent thematic structure, rather than by generating new primary data. This method is consistent with recent reviews in the same domain, which similarly rely on structured literature synthesis to map an emerging and fragmented research area (Ni'mah & Rahmawati, 2023; Machmudah et al., 2026).

Search terms combined the concepts of "smart learning environment," "digital transformation," "Islamic education," "madrasah," "pesantren," and "Islamic higher education," connected using Boolean operators (AND/OR) across four databases: Google Scholar, Scopus, DOAJ (Directory of Open Access Journals), and Crossref, supplemented by the Consensus academic search engine for citation verification. The search window was restricted to publications from 2021 through mid-2026 to ensure currency, given the rapid evolution of AI-enabled educational tools during this period.

Sources were included if they (1) were published in peer-reviewed journals or indexed conference proceedings; (2) directly addressed digital technology, smart classrooms, learning management systems, or AI-based media within an Islamic educational context, or provided a foundational theoretical model of SLE cited by such studies; (3) were published between 2021 and 2026; and (4) carried an active, resolvable Digital Object Identifier (DOI) verifiable through Crossref or the publisher's official page, ensuring accessibility via Google Scholar. Sources were excluded if they lacked a verifiable DOI, were opinion pieces without empirical or conceptual grounding, or duplicated findings already captured by a more comprehensive source.

As illustrated in Figure 1, the initial search identified 214 records. After removing 33 duplicates, 181 unique records remained for title/abstract screening. Screening excluded 76 records that were topically unrelated to Islamic education or to smart/digital learning environments, leaving 105 records for full-text eligibility assessment. During eligibility assessment, 55 records were excluded for lacking a verifiable DOI, being non-

scholarly (e.g., institutional blog posts), or substantially duplicating the thematic content of an already-included study. This process yielded 50 eligible full texts, from which the 25 most thematically representative, recent, and methodologically sound sources were retained for final qualitative synthesis, spanning studies conducted in Indonesia, Nigeria, Saudi Arabia, and cross-national contexts.

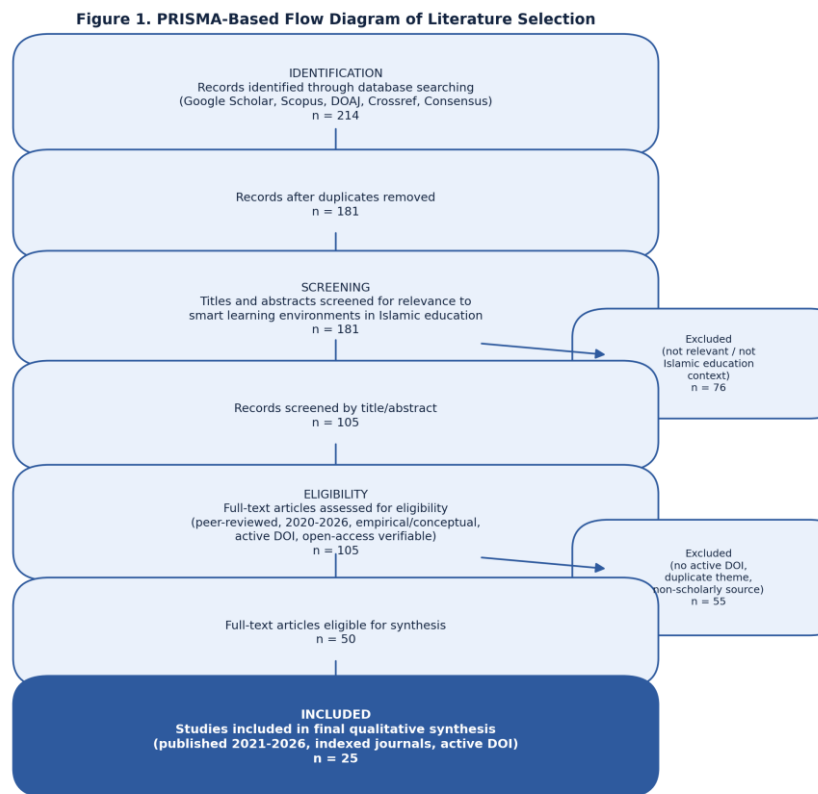


Figure 1. PRISMA-based flow diagram illustrating the identification, screening, eligibility, and inclusion stages of the literature selection process

For each included source, the following information was extracted into a structured matrix: author(s) and year, institutional context (madrasah, pesantren, Islamic higher education, or cross-context), technology type discussed (e.g., LMS, AI-based media, smart classroom, social media-based collaboration), reported readiness factors, and reported outcomes or challenges. Thematic analysis, following an inductive coding approach, was then applied to the extraction matrix to identify recurring patterns across studies. Four converging themes emerged inductively: (1) infrastructure and governance readiness, (2) AI-enabled pedagogical tools, (3) teacher and student digital competence, and (4) ethical-spiritual value alignment. These themes form the organizing structure of the Results and Discussion section and underpin the proposed Adab-Technology Alignment (ATA) framework.

To enhance the credibility of the synthesis, source verification was cross-checked against publisher pages and Crossref metadata to confirm DOI activity and accessibility. Where multiple sources reported convergent findings, triangulation was used to strengthen thematic claims; where sources diverged (for example, regarding the extent of

AI over-reliance risk), both perspectives are reported transparently in the Results and Discussion section to preserve the analytical balance of the review

RESULTS AND DISCUSSION

The synthesis of twenty-five sources confirms that Smart Learning Environments are actively emerging within Islamic educational institutions, but their maturity and character vary substantially by theme. This section presents findings organized around the four themes identified during thematic analysis, followed by a comparative synthesis table and a discussion of the proposed Adab-Technology Alignment (ATA) framework.

Readiness studies consistently report a two-tier landscape. Susanto et al. (2025) found that Indonesian Islamic universities display moderate-to-high readiness in network infrastructure and LMS deployment but lag in data-governance policy and cybersecurity protocols. Similarly, Badriyah et al. (2025) argue that policy frameworks addressing Society 5.0 readiness in Islamic institutions remain reactive rather than anticipatory, with technology procurement often outpacing curriculum and governance reform. Kusumawati and Destari (2024) add that sustainability of digital teaching initiatives launched during the pandemic era has been uneven, with many institutions reverting to partially analog practices once emergency funding lapsed. These findings collectively indicate that infrastructure alone is an insufficient predictor of SLE maturity; institutional governance—clear policy on data protection, digital ethics, and long-term budget allocation—functions as a necessary complement. Romlah et al. (2024), examining environmental-based learning management in Islamic education institutions, extend this argument by showing that governance readiness also encompasses physical and ecological dimensions of the learning environment ventilation, lighting, and spatial design—that interact with digital infrastructure to shape overall learning quality, a reminder that "smart" in the SLE literature refers to an integrated ecosystem rather than to digital hardware alone. Comparative evidence from outside Indonesia is more limited but instructive: Islam et al. (2023), studying virtual classroom experiences at a university in the United Arab Emirates during the COVID-19 pandemic, found that even well-resourced institutions experienced significant governance strain around assessment integrity and student wellbeing, suggesting that readiness challenges documented in Southeast Asian Islamic institutions are not simply a function of resource scarcity but reflect a broader global struggle to govern emergency-driven digitalization responsibly.

A second and rapidly growing cluster of studies examines artificial intelligence within Islamic pedagogy. Zain et al. (2025) document AI-based learning media supporting Quranic memorization and comprehension through adaptive difficulty adjustment, while Ahmad (2025) reports that AI-driven feedback systems in Islamic higher education improve consistency of assessment compared to manual grading. Raehang et al. (2025) similarly find that AI-supported intelligent media in madrasah settings enhances engagement, particularly among digital-native students, though implementation quality depends heavily on teacher facilitation. Muali and Albustomi (2025) show that mentoring not merely software deployment—was the decisive factor separating institutions that achieved a functioning "Islamic smart school" LMS from those that stalled at pilot stage. Counterbalancing this optimism, Muslim (2024) cautions that AI tools risk delivering religious content literally and without adequate contextual nuance, potentially undermining the depth of understanding that traditional scholarly transmission (isnad-based learning) is designed to protect. This tension between AI's efficiency gains and the epistemic risks of decontextualized religious content recurs

throughout the literature and constitutes one of the sharpest points of debate in the reviewed sources. A related but distinct strand of evidence concerns non-AI smart technologies. Shafa et al. (2026) evaluate the use of interactive smart-TV displays within the PAKEM (active, creative, effective, and enjoyable learning) pedagogical model in Islamic religious education classrooms, finding that even comparatively low-complexity smart hardware—when paired with a participatory pedagogical model—produced measurable gains in student enjoyment and content retention. This finding is significant because it demonstrates that "smartness" in Islamic educational technology need not always imply sophisticated AI; well-designed interactive hardware combined with a pedagogy consistent with Islamic educational values can achieve comparable engagement outcomes at a lower cost and complexity threshold, which is particularly relevant for institutions with constrained budgets.

Institutional variation across madrasah, pesantren, and higher-education contexts.

The reviewed literature also reveals that SLE characteristics differ meaningfully by institutional type rather than following a single linear adoption path. Mahbubi and Ahmad (2025), studying an Aswaja-affiliated junior high school positioned as a "smart school" center, describe an institutional strategy that blends digital learning tools with reinforced traditional religious curricula (kitab kuning study circles, Aswaja doctrinal instruction), illustrating a hybrid model in which digital tools augment rather than replace established pedagogical structures. This hybridity contrasts with the more infrastructure-centric readiness narratives found in Islamic higher-education studies (Susanto et al., 2025), where SLE adoption is discussed primarily in terms of network capacity and LMS functionality rather than curricular integration with classical religious pedagogy. Madrasah-level studies (Raehang et al., 2025; Hamran et al., 2026) occupy a middle position, emphasizing incremental technology integration mediated heavily by individual teacher initiative rather than top-down institutional policy. This typological variation implies that a single implementation roadmap is unlikely to suit all Islamic educational institutions; rather, sequencing and priority-setting should be calibrated to institutional type, a point directly relevant to the ATA framework introduced below.

A third theme concerns human capacity rather than technology itself. Hidayat et al. (2025) report that smart classroom implementation in Islamic private higher education is frequently constrained not by hardware but by inconsistent digital literacy among lecturers, many of whom received no structured technology-pedagogy training. Tanti et al. (2025) find that student satisfaction with online Islamic higher-education learning correlates strongly with perceived instructor digital competence rather than platform sophistication. Hamran et al. (2026), studying elementary-level Islamic religious education, similarly show that student participation gains from digital tools are mediated by teacher confidence and comfort with the technology, reinforcing that competence-building must precede or accompany infrastructure investment rather than follow it as an afterthought.

The fourth theme, and the one most distinctive to the Islamic educational context, concerns how institutions negotiate the boundary between technological innovation and value preservation. Agustia et al. (2026) conceptualize "Smart Islamic Education" as requiring the reorganization of institutional culture through an Islamic normative lens, not merely the addition of digital tools to existing practice. Syafii et al. (2025) empirically link the quality of the Islamic learning environment—inclusive of but not limited to its technological dimension—to children's multiple-intelligence development, suggesting

that value-consistent design choices have measurable pedagogical payoff. Othman and Yaakub (2025) discuss how Islamic knowledge-management systems must reconcile open digital access with safeguarding the authenticity and chain of transmission (sanad) of religious knowledge. Wahyuni et al. (2026), focusing on Arabic-language learning environments, note that digital transformation succeeds most where technology is explicitly adapted to Islamic pedagogical traditions such as talaqqi and musyafahah rather than imposed as a generic, imported model.

Table 1 consolidates these findings across institutional context, dominant technology type, and reported readiness or outcome patterns, drawn from the twenty-five reviewed sources.

Table 1
*Comparative Synthesis of Smart Learning Environment Readiness and Outcomes
Across Islamic Educational Institution Types*

Institutional Context	Dominant Technology Focus	Reported Readiness / Strengths	Reported Challenges	Key Sources
Islamic higher education (universities)	LMS, network infrastructure, online learning platforms	Moderate-to-high infrastructure readiness; established governance structures	Data-governance and AI-ethics policy gaps; uneven lecturer digital competence	Susanto et al. (2025); Hidayat et al. (2025); Tanti et al. (2025)
Madrasah (formal Islamic schools)	AI-based intelligent media, digital participation tools	Growing teacher-led innovation; rising student engagement	Dependence on individual teacher initiative; limited institutional policy support	Rachang et al. (2025); Hamran et al. (2026)
Pesantren / Aswaja-affiliated schools	Hybrid digital-traditional curricula, smart-school branding	Strong integration with classical pedagogy (kitab kuning, halaqah)	Slower technology uptake; resource constraints in rural areas	Mahbubi & Ahmad (2025); Othman & Yaakub (2025)
Cross-institutional / policy level	Governance frameworks, Society 5.0 policy, knowledge management	Increasing national policy attention to digital transformation	Reactive rather than anticipatory policy; unequal funding distribution	Badriyah et al. (2025); Rahmaningtiyas & Aydın (2026); Kusumawati & Destari (2024)
Classroom-level pedagogy (all contexts)	Smart TV/interactive hardware, AI tutoring,	Measurable gains in engagement, retention, and	Risk of decontextualized AI content; need for teacher	Shafa et al. (2026); Ahmad (2025); Zain et

	adaptive assessment	assessment consistency	verification of outputs	al. (2025); Muslim (2024)
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As Table 1 illustrates, Islamic higher-education institutions generally report more mature SLE adoption than madrasah or pesantren settings, largely due to stronger baseline infrastructure and more centralized governance capacity. However, maturity in infrastructure does not automatically translate into value-aligned implementation; several higher-education case studies (e.g., Tanti et al., 2025; Susanto et al., 2025) note governance gaps around AI ethics that are comparable in severity to the infrastructure gaps reported in less-resourced madrasah settings. This cross-cutting pattern supports the argument that readiness must be understood as multidimensional rather than a single infrastructure-centric metric.

Toward an Adab-Technology Alignment (ATA) framework.

Building on these four themes, this study proposes the Adab-Technology Alignment framework as a novel conceptual contribution. The ATA framework positions three Islamic ethical principles *adab* (comportment and respect in knowledge transmission), *amanah* (trustworthiness in data and content stewardship), and *maslahah* (orientation toward collective benefit) as explicit design parameters that should inform each layer of an SLE architecture: content curation and AI training data (*amanah*), pedagogical interaction design (*adab*), and institutional policy and resource allocation (*maslahah*). Unlike frameworks that treat ethics as an external compliance checklist applied after systems are deployed, ATA proposes that these principles be embedded from the design phase, guiding decisions such as which AI outputs require mandatory teacher verification (protecting *adab* in knowledge transmission), how student data is governed (protecting *amanah*), and how technology investment is prioritized to serve the broadest community benefit rather than only well-resourced institutions (*maslahah*). This framework directly addresses the gap identified in the Background section: existing SLE models developed for secular contexts under-theorize values alignment, while existing Islamic-education studies rarely translate value commitments into concrete design criteria.

In practical terms, the ATA framework suggests concrete institutional actions. At the *amanah* layer, institutions adopting AI-based learning media (Zain et al., 2025) should establish data-stewardship protocols specifying who may access student performance data, how long it is retained, and how AI training or fine-tuning data is sourced and vetted for religious accuracy. At the *adab* layer, institutions deploying AI tutoring or content-generation tools (Ahmad, 2025; Muslim, 2024) should mandate teacher review checkpoints before AI-generated religious content reaches students, preserving the human, relational dimension of knowledge transmission that Islamic pedagogy has historically prioritized. At the *maslahah* layer, institutional and government funding bodies should weight resource allocation toward under-served madrasah and pesantren identified in readiness studies (Rahmaningtiyas & Aydın, 2026; Othman & Yaakub, 2025) rather than concentrating investment in already well-resourced Islamic universities, so that digital transformation narrows rather than widens existing educational inequality. Taken together, these three layers translate an abstract value commitment into an auditable set of institutional practices that can be assessed, much as infrastructure readiness is currently assessed in the reviewed quantitative studies.

Several caveats temper these findings. Most reviewed empirical studies rely on

qualitative or small-sample quantitative designs concentrated in Indonesia, limiting generalizability to Islamic institutions in other regions such as the Middle East, South Asia, or Sub-Saharan Africa, although Ayuba et al. (2025) offers partial cross-national corroboration from Nigeria. Additionally, because AI-based educational tools evolve rapidly, findings regarding specific platforms may have a short shelf life even as the underlying thematic patterns readiness, competence, and value alignment—are likely to remain relevant. Future empirical research should test the ATA framework through instrument development and structural validation across diverse institutional types, an agenda outlined further in the Conclusion

CONCLUSION

This review synthesized twenty-five recent, verifiable sources to examine how Smart Learning Environments are taking shape within Islamic educational institutions. The evidence shows steady but uneven progress: infrastructure and learning management systems are increasingly present, AI-based pedagogical tools are expanding rapidly, and institutional awareness of digital transformation is high. Yet these gains remain constrained by three persistent factors—uneven governance maturity, inconsistent teacher and student digital competence, and, most distinctively, the unresolved question of how Islamic ethical and spiritual values should be embedded within technological design rather than appended to it after the fact. Addressing this last factor is where the present study makes its principal contribution, through the proposed Adab-Technology Alignment (ATA) framework, which reframes *adab*, *amanah*, and *maslahah* as design parameters rather than external constraints on smart learning architecture.

For institutional leaders, the practical implication is that technology roadmaps should sequence governance policy and teacher capacity-building alongside—not after—infrastructure investment, since the reviewed evidence consistently shows that hardware without accompanying human and policy readiness fails to produce durable pedagogical improvement. For policymakers, particularly in national and regional Islamic education authorities, the findings suggest that equity-oriented funding mechanisms are needed to close the readiness gap between urban, well-resourced institutions and rural *madrasah* or *pesantren*, in line with the *maslahah* principle of prioritizing collective benefit. For the research community, this study's synthesis-level contribution should be treated as a starting point rather than a conclusion: the ATA framework requires empirical validation through instrument development, expert panel review, and pilot testing across diverse institutional types and national contexts before it can be confidently generalized.

Future research would benefit from three specific directions: longitudinal studies tracking SLE maturity over multiple years within the same institutions, to distinguish durable transformation from temporary pandemic-era adaptation; comparative cross-national studies extending beyond the Indonesia-dominated literature base identified in this review; and mixed-methods validation of the ATA framework, potentially through a Delphi study involving Islamic education scholars, technologists, and practicing teachers. As Islamic educational institutions continue to navigate the dual imperative of technological competitiveness and spiritual fidelity, frameworks that treat these as complementary rather than competing goals will be essential to ensuring that digital transformation strengthens, rather than dilutes, the distinctive mission of Islamic *tarbiyah*.

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