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Mapping Research Trends on Technology and Artificial Intelligence in Islamic Education: A Bibliometric Analysis of Scopus Database (2019–2025)

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Abstract:
The integration of Artificial Intelligence (AI) into Islamic education institutions reflects a shift from basic digital adoption toward more advanced technological applications. This study examines the development of research on technology and AI in Islamic education using data from the Scopus database. Bibliographic records published between 2019 and 2025 were collected using a set of predefined keywords and refined through several filtering limitations, resulting in a dataset of 222 documents. Bibliometric analysis was conducted using VOSviewer, focusing on publication trends, country contributions, and keyword co-occurrence through network, overlay, and density visualizations. The results indicate a moderate growth in publications during 2019–2021, followed by a marked increase from 2022 to 2025. Indonesia and Malaysia emerge as the most prolific contributors, reflecting the prominence of this topic within regional institutional contexts. The analysis also identifies a thematic shift from the use of basic digital learning tools during the pandemic period to discussions on AI integration, institutional management in Pesantren (Islamic boarding schools), and ethical considerations in more recent literature. While studies on general e-learning effectiveness appear to be saturated, limited attention has been given to the ethical alignment of AI with Islamic values. Therefore, future research should place greater emphasis on the development of ethical frameworks that integrate AI with Islamic educational principles.

Keyword: Artificial Intelligence; Bibliometric Analysis; Islamic Education; Islamic values; VOSviewer.

Introduction

The integration of technology in Islamic education has evolved from a supplementary visual aid into a strategic imperative within the Society 5.0 era. Institutions like *Madrasah* and *Pesantren* now face the dual challenge of embracing modern intelligent systems ranging from automated *Tajwid* correction to complex *Fiqh* comprehension—while preserving traditional values (Faizin et al., 2025; Rajuroy & Emmanuel, 2025; Tolchah & Mu'ammar, 2019; Wedi et al., 2025). While recent adoptions of IoT and digital *Kitab Kuning* demonstrate institutional resilience and enhanced student motivation (Ibda et al., 2023; Syakroni et al., 2019), successful implementation requires more than infrastructure; it necessitates a fundamental transformation in teachers' pedagogical competence (M. Ritonga, 2023). However, this rapid technological acceleration has created a complex and fragmented landscape, where the intersection of advanced innovation and traditional pedagogy remains insufficiently mapped.

Previous literature reviews have predominantly documented the initial phase of pandemic-driven digitalization, focusing on basic platforms like Google Classroom (Ni'mah & Rahmawati, 2023; M. Ritonga et al., 2023). However, these studies largely overlook the post-pandemic shift toward Artificial Intelligence (AI), particularly within the unique ecosystem of Islamic education. Furthermore, given the rapid evolution of technology and AI in education, bibliometric mappings conducted even a few years ago often lose their relevance (Alhammad et al., 2025). Consequently, continuous bibliometric analysis is essential to provide an up-to-date mapping of research trends to capture this recent shift. In the absence of such mapping, future studies are likely to face redundancy and encounter challenges in generating research novelty.

To address this gap, this study formulates the following research question: (1) What are the research trends in scholarly publications on technology and artificial intelligence in Islamic education? (2) What are the dominant research themes and keyword clusters within the existing literature? (3) What emerging topics and research gaps can be identified for future studies? This study does not aim to experimentally test specific tools or platforms; rather, it answers these questions by employing a bibliometric analysis to visualize the knowledge structure and identify shifts in academic focus within this domain. The resulting mapping is intended to provide researchers and policymakers with an objective overview of saturated research areas, while simultaneously uncovering future research avenues that remain open for exploration.

Literature Study

A review of recent bibliometric studies (2023–2025) indicates a clear thematic polarization in Islamic education research, which predominantly converges on two major domains: institutional management and character education. On the first domain, the discourse is heavily saturated with administrative frameworks. Ariona et al. (2023) and Ansori et al. (2024) consistently identified that scholarly attention is fixated on traditional managerial governance. This trend is further reinforced by Lathifah et al (2025), whose mapping of quality assurance in *Pesantren* highlights a preservationist tendency towards local wisdom rather than digital adaptation. Collectively, these studies suggest that the "modernization" discourse in Islamic education is still largely interpreted through managerial, not technological, lenses.

On the second domain, scholars have extensively mapped the axiological dimensions of Islamic education. Recent bibliometric works by Zamroni et al. (2025), Kistoro et al. (2023), and Nirwana et al. (2025) confirm that topics such as "religious moderation" and "character building" remain the central intellectual gravity. Even in non-formal contexts, Pratama et al. (2025) found that community engagement outweighs technological integration.

While these existing mappings successfully visualize the "humanware" (character) and "orgaware" (management) aspects of Islamic education, they exhibit a notable gap regarding "technoware" (technology and AI). There is a lack of bibliometric studies that critically link the rapid advancement of AI technologies with Islamic pedagogy. Consequently, existing literature has yet to fully capture how the technological shift specifically the transition to intelligent systems—is influencing the research landscape. This study addresses this gap by shifting the bibliometric focus from management and character toward the specific intersection of technology and Artificial Intelligence in Islamic education.

Methods

This study employs a quantitative bibliometric approach to map the scholarly structure and evolutionary trends of technology and AI integration within Islamic education. ibliometric analysis was chosen for its

capacity to unpack the evolutionary nuances of a specific field, while shedding light on the emerging areas in that field (Donthu et al., 2021).

Data were retrieved from the Scopus database, selected as the primary source due to its rigorous content selection policy compared to Google Scholar and its broader coverage of high-impact journals in social sciences compared to Web of Science (WoS) (Mongeon & Paul-Hus, 2016). While the exclusive use of a single database imposes limitations regarding the coverage of non-indexed local literature, Scopus ensures that the analyzed dataset meets international scientific standards, thereby minimizing the inclusion of predatory or low-quality publications. Furthermore, Scopus provides standardized metadata essential for accurate bibliometric analysis using VOSviewer.

The data retrieval was conducted on December 12, 2025. To capture relevant literature, a specific search string utilizing Boolean operators was employed within the “Article Title, Abstract, and Keywords” fields. The search query was defined as follows: (“Islamic Education” OR “Pendidikan Agama Islam” OR “Pesantren” OR “Madrasah”) AND (“Artificial Intelligence” OR “AI” OR “Technology” OR “Digital Learning”).

This search yielded a total of 259 documents. Subsequently, limitations were applied to the publication timeframe (2019–2025) to ensure data relevance with current technological developments; document types were restricted to journal articles and conference papers to ensure peer-reviewed quality; and languages were limited to English and Indonesian. The final dataset comprised 222 documents, which were then exported in CSV and RIS formats for analysis. The comprehensive research workflow, from data retrieval to final selection, is illustrated in Figure 1.

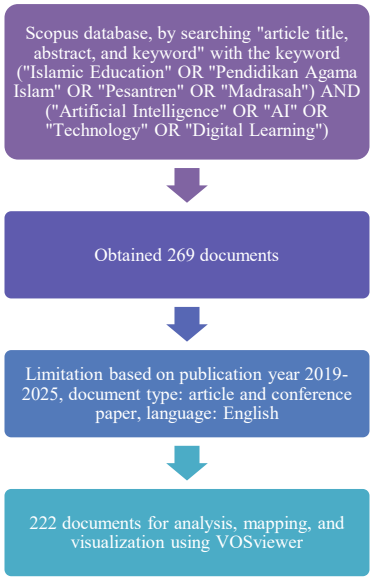

Figure 1. Flowchart of Data Collection

The retrieved data were analyzed using VOSviewer software version 1.6.20. The analysis employed was co-occurrence analysis with keywords as the unit of analysis. The counting method used was Full Counting. The keyword occurrence threshold was set to a minimum of 4 occurrences to filter out insignificant keywords and focus the analysis on the main thematic map. Data cleaning was also conducted using the

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Thesaurus File feature in VOSviewer to merge synonymous terms with different spellings, thereby avoiding data redundancy.

The retrieved data were analyzed using VOSviewer software version 1.6.20. The analysis focused on co-occurrence analysis with "All Keywords" (Author Keywords and Index Keywords) as the unit of analysis. The counting method used was Full Counting, where each co-occurrence is weighted equally.The keyword occurrence threshold was set to a minimum of 4 occurrences to ensure the thematic map's clarity and modularity. This threshold was empirically determined to filter out ad-hoc terms (noise) while retaining the core semantic structure of the research domain. Out of 1033 keywords, 34 met this threshold. Furthermore, synonymic terms (e.g., "e-learning" and "electronic learning") were merged using a Thesaurus File to prevent data redundancy and ensure accurate quantitative calculation. In the resulting visualization, node size is determined by keyword occurrences, reflecting their frequency within the dataset. Total Link Strength (TLS), meanwhile, is employed in the analytical interpretation to capture the cumulative strength of co-occurrence relationships between keywords.

Results

Publication Volume and Growth Trends

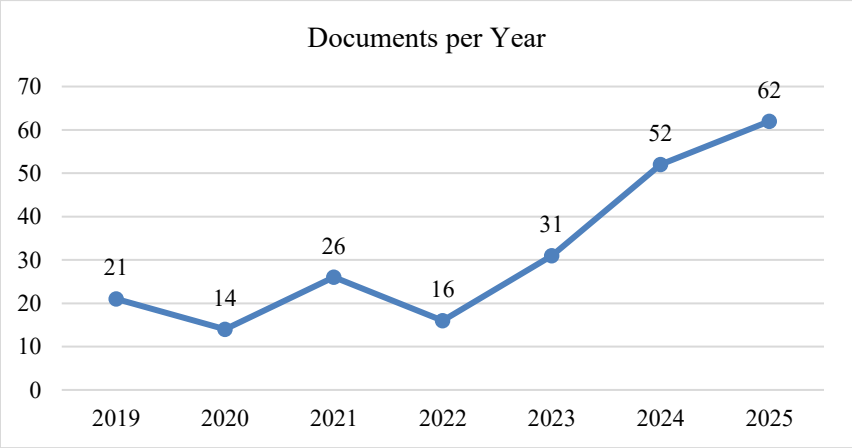

Figure 2. Documents per Year About Technology and AI in Islamic Education

The annual distribution of research publications on technology and AI in Islamic education from 2019 to 2025 is presented in Figure 2. The data reveals a fluctuating trajectory followed by an exponential surge. In the initial phase (2019–2022), the research output was relatively unstable, experiencing slight declines in 2020 (n=14) and 2022 (n=16).

However, a turning point occurred in 2023. The publication volume nearly doubled from 16 documents in 2022 to 31 documents in 2023. This upward trend continued, reaching 52 documents in 2024 (a 67.7% increase from the previous year) and peaking at 62 documents in 2025. The period from 2023 to 2025 accounts for 65.3% (145 documents) of the total cumulative publications, representing a 287.5% growth compared to the 2022 baseline.

Geographical Distribution of Research

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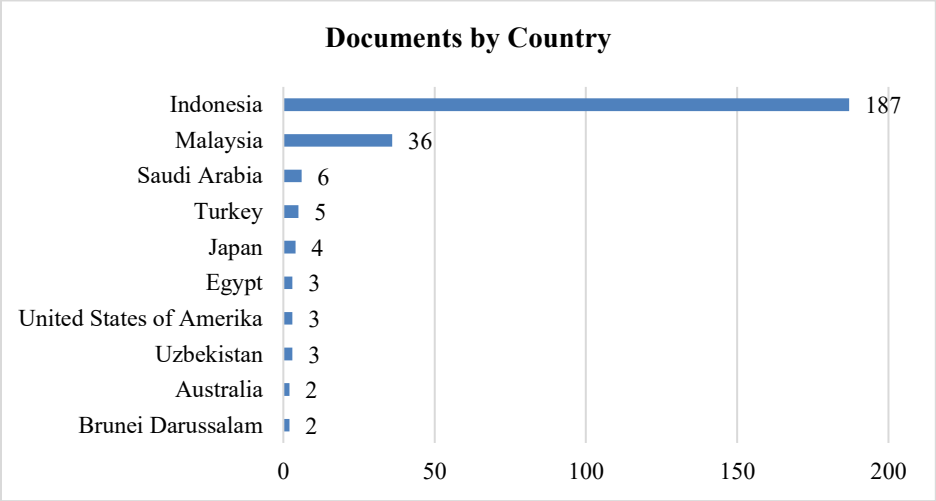

Figure 3. Productive Country in The Field of Technology and AI in Islamic Education

The geographical analysis highlights the countries contributing to this dataset. As shown in Figure 3, the distribution is heavily concentrated in Southeast Asia. Indonesia emerges as the leading contributor with 187 documents, which constitutes approximately 84.2% of the total publications. Malaysia follows in second place with 36 documents (16.2%). In contrast, contributions from other regions are minimal. Saudi Arabia (n=6), Turkey (n=5), and Japan (n=4) show limited output, while Western nations like the United States (n=3) and Australia (n=2) have marginal representation in this specific dataset.

Keyword Co-occurrence Network

The network visualization (Figure 4) maps the intellectual structure of the research domain. In this map, the size of each node correlates with the frequency of the keyword's appearance (occurrence), while the thickness of the connecting lines (links) represents the link strength between terms.

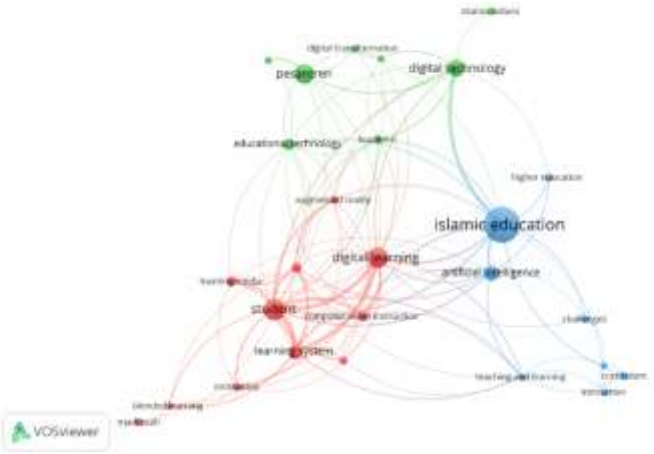

Figure 4. Network Visualization Technology and AI in Islamic Education Based on Co-occurrence Analysis

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The network visualization above displays three clusters: red, blue, and green. The nodes and their occurrence frequencies for each cluster presented below.

Table 1. Keyword Distribution and Frequency by Cluster

No.	Cluster 1 (Red)	Cluster 2 (Blue)	Cluster 3 (Green)
1.	Student (23)	Islamic education (51)	Pesantren (20)
2.	Digital learning (21)	Artificial intelligence (13)	Digital technology (16)
3.	Learning system (12)	Challenges (5)	Educational technology (7)
4.	Computer aided instruct (6)	Curriculum (5)	Islamic values (5)
5.	Learning media (6)	Higher education (4)	Teachers' (5)
6.	Learning process (6)	Innovation (4)	Digital transformation (4)
7.	Augmented reality (5)	Islamic education teachers (4)	Management (4)
8.	Information & communication (5)	Teaching and learning (4)	Santri (4)
9.	Madrasah (5)		
10.	Motivation (5)		
11.	Blended learning (4)		

Thematic Evolution based on Average Publication Year

The overlay visualization (Figure 5) displays the temporal distribution of keywords based on their average publication year. The color spectrum ranges from purple (earlier publications) to yellow (recent publications), indicating the chronological appearance of specific terms within the dataset.

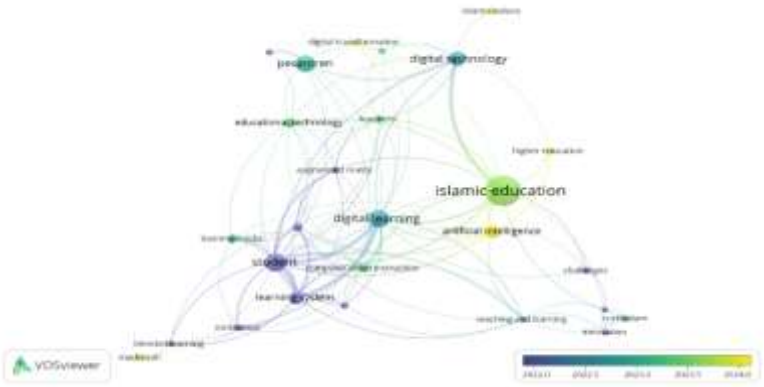

Figure 5. Overlay Visualization Technology and AI in Islamic Education Based on Co-occurrence Analysis

Details of the temporal distribution of keywords, as measured by the average publication year (Avg. Pub. Year), are presented in Table 2.

Table 2. Temporal Distribution of Keywords based on Average Publication Year

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No.	Early Phase (Purple Nodes) Range: ~2020 – 2022	Middle Phase (Green Nodes) Range: ~2022 – 2023	Recent Phase (Yellow Nodes) Range: ~2023 – 2024
1.	Innovation (2020.25)	Digital technology (2022.50)	Islamic values (2023.80)
2.	Santri (2020.75)	Digital learning (2022.67)	Madrasah (2023.80)
3.	Information & comm. (2020.80)	Teaching and learning (2022.75)	Higher education (2024.00)
4.	Blended learning (2021.50)	Curriculum (2022.80)	Digital transformation (2024.25)
5.	Learning system (2021.67)	Pesantren (2022.95)	Artificial intelligence (2024.31)
6.	Augmented reality (2021.80)	Learning media (2023.00)	
7.	Student (2021.83)	Management (2023.25)	
8.	Learning process (2021.83)	Educational technology (2023.29)	
9.	Motivation (2022.00)	Computer Aided instruct (2023.33)	
10.	Challenges (2022.00)	Teachers (2023.40)	
11.	Islamic Edu. teacher (2022.00)		

Density Visualization

The density visualization (Figure 6) provides a spatial representation of research concentration. In this map, areas of high luminosity (bright green or yellow) indicate high keyword density, representing heavily researched topics, whereas faded or transparent areas indicate low density.

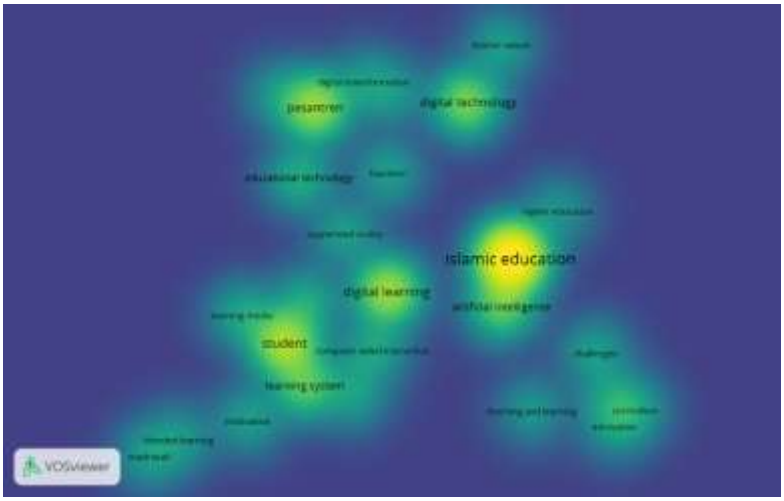

Figure 6. Density Visualization Technology and AI in Islamic Education Based on Co-occurrence Analysis

Discussions

From Pandemic Response to Strategic AI Integration

The bibliometric trends reveal a fundamental shift from reactive to proactive technological adoption. The initial moderate growth (2019–2022) was largely driven by pandemic-induced adaptation, where research prioritized basic e-learning platforms as crisis management tools (Ni'mah & Rahmawati, 2023; M. Ritonga et al., 2023). In contrast, the exponential surge peaking in 2025 correlates with the rise of Generative AI, signaling a new phase where scholars are exploring intelligent systems for personalized Islamic instruction rather than mere content delivery (Alhammad et al., 2025; Faizin et al., 2025).

Geographically, the dominance of Indonesian and Malaysian research underscores that this technological discourse is locally situated within Madrasah and Pesantren contexts. This trend reflects a unique institutional struggle to maintain traditional authority while remaining globally competitive (Tolchah & Mu'ammar, 2019). Thus, the high publication volume signifies a strategic effort to build institutional resilience and harmonize Islamic values with digital transformation (Merliana et al., 2025; Munifah et al., 2019).

Evolution of the Pedagogical Ecosystem

The strong co-occurrence between "Digital Learning" (TLS=42), "Student" (TLS=54), and "Learning System" (TLS=35) in the red cluster reflects a digitization of the pedagogical ecosystem. This cluster symbolizes the digitization of the pedagogical ecosystem that has penetrated the learning system and significantly impacted student engagement. The evolution of this cluster began with the mass implementation of blended learning as a standard post-pandemic response (Nurdin et al., 2024; M. Ritonga et al., 2023; R. L. Ritonga et al., 2025). However, the trend has since matured from basic infrastructure toward the integration of immersive tools, such as Augmented Reality (AR) and Computer-Aided Instruction (CAI), which are increasingly utilized to concretize abstract religious concepts (Habibi et al., 2024; Nursyahidin et al., 2021; Pradibta et al., 2019).

The linkage to the "Motivation" (TLS=10) indicates that technology is considered not merely a delivery medium, but also a factor associated with student interest and self-regulated learning in religious subjects (Dalgıç et al., 2024; Marzuki & Mabrur, 2020; Nurdin et al., 2024; Rahmatulloh & Napis, 2023; Syakroni et al., 2019; Wibowo et al., 2025). In addition, the linkage between "learning process" and "student" indicates the pedagogical shift from passive knowledge transfer toward student-centered learning. The use of digital media in Islamic Religious Education enhances not only accessibility but also the effectiveness of feedback and student cognitive engagement (Alhammad et al., 2025; Rajuroy & Emmanuel, 2025).

Strategic AI Adoption and Ethical Challenges

The blue cluster contains one large node, "Islamic education," and a smaller node, "artificial intelligence (AI)," accompanied by several nodes related to institutional strategy. The integration of AI in Islamic education is increasingly viewed as a strategic step toward institutional efficiency, particularly in enhancing institutional data management, service quality, and the automation of academic administration, which have historically lagged behind general institutions (Hermawan et al., 2025; Jasafat et al., 2025; Musolin et al., 2025; Salim & Aditya, 2025; Siregar et al., 2025). However, comparative studies reveal heterogeneity in institutional responses, largely contingent upon the readiness of existing knowledge infrastructure (Syukur et al., 2024).

Closely related to the institutional aspect, the presence of the "Islamic education teacher" and "teaching and learning" nodes highlights that the primary barriers to technology adoption lie in human resource factors, particularly the readiness of lecturers and teachers. Many educators continue to face challenges in adopting AI-assisted deep learning approaches due to uneven levels of digital literacy (Pahrudin et al.,

2025). As a result, students' enthusiasm for technology-enhanced learning often exceeds teachers' preparedness to integrate AI effectively into instructional practices (Faizin et al., 2025).

The presence of nodes such as "curriculum," "innovation," "Islamic education teacher," and "artificial intelligence" linked to "challenges" indicates that AI introduces substantial pedagogical and evaluative challenges for Islamic education. Conventional evaluation models are increasingly questioned and no longer considered valid, as AI systems are capable of answering exam questions with high accuracy (Jawabreh & Itmazi, 2025). Moreover, the ease of access to instant answers may foster cognitive dependence, potentially undermining students' critical thinking skills (Adiyono et al., 2025). Nevertheless, when appropriately integrated into the Islamic education curriculum, AI has been shown to enhance students' cognitive and psychomotor competencies (Nirwana et al., 2025). To address these pedagogical challenges, several scholars argue that AI integration must be framed within an Islamic ethical framework. The *Maqashid Syariah* approach (specifically *hifz al-aql* or preservation of the intellect) is proposed as a regulatory foundation to prevent AI misuse that could degrade human values (Rifai et al., 2025; Salim & Aditya, 2025; Wibowo et al., 2025).

Institutional Resilience and Value Transformation

The green cluster features prominent nodes related to "pesantren" and "digital technology," which are interconnected with several other key nodes. This cluster reflects the ongoing integration of digital technology into traditional Islamic educational institutions, particularly pesantren. Pesantren are Islamic educational institutions that are expected to preserve longstanding religious traditions while simultaneously adapting to technological developments (Alhammad et al., 2025; Merliana et al., 2025).

As shown in the network visualization, the "management" node acts as a bridge linking "pesantren," "teacher," "digital transformation," and "digital technology" highlighting the central role of effective institutional management in facilitating digital transformation within pesantren. Modern management strategies have become essential for pesantren to maintain institutional relevance and attract public interest amid increasing competition in the educational sector (Munifah et al., 2019). However, despite the strong spirit of institutional modernization, the "teacher" node within this cluster points to persistent challenges at the implementation level. The integration of educational technology is frequently constrained by human resource readiness, particularly among teachers. Research highlights the urgency of continuous ICT training, as the digital competence of Islamic education teachers often lags behind the available technological infrastructure (Miskiah et al., 2019).

The presence of the "Islamic values" node further indicates that pesantren do not regard technology as value-neutral. Instead, technological tools are selectively filtered and reconstructed to align with religious missions and pedagogical objectives. A case study on the development of *Maktabah Syumilah NU 1.0* software illustrates how technology can be purposefully engineered to strengthen *Kitab Kuning* literacy while simultaneously functioning as a counter-narrative medium against digital radicalism (Ibda et al., 2023). Overall, *pesantren* tend to adopt a selective approach, positioning technology as an instrument to reinforce scholarly traditions and promote religious moderation, while consistently emphasizing the importance of embedding Islamic values within technological innovation.

Thematic Evolution Over Time

In the early period (2019–2021), the research landscape was characterized by reactive experimentation. The presence of terms such as 'blended learning' and 'online learning' mirrors the global educational response to the COVID-19 pandemic. During this period, research was predominantly operational and instrumental,

focusing on teacher strategies to maintain learning continuity via various digital platforms (Riyan Rizaldi et al., 2021; Taufik, 2020). Consequently, studies in this phase heavily prioritized technical adaptation over pedagogical innovation.

Entering the middle period (2022–2023), the research focus expanded from the classroom to managerial domains. The emergence of "management" and "educational technology" marks a transitional phase, indicating an institutional awareness that technology adoption necessitates robust governance. In this phase, literature began to examine how Islamic educational institutions build human resource capacity and management strategies to integrate technology sustainably, rather than merely as a temporary solution (Huda et al., 2024; Munifah et al., 2019).

The most recent phase (2024–2025) is marked by the proliferation of keywords such as "artificial intelligence," "digital transformation," and "islamic values." This shift signals that academic discourse has moved from technical to systemic discussions. Interestingly, the re-emergence of the "*madrasah*" context in the recent timeframe suggests that *madrasah*s have become the primary locus for research on intelligent technology application and complex digital transformation. However, this technological advancement is counterbalanced by the emergence of "islamic values," emphasizing the imperative of framing AI integration within robust ethical boundaries. Current research highlights that the primary challenge now lies in balancing AI efficiency with the preservation of human and Islamic values (Rifai et al., 2025; Wedi et al., 2025).

Research Saturation and Opportunities

Referring to the density analysis (Figure 6), the research landscape exhibits a high concentration on generalist themes, particularly regarding digital learning adoption and students. This saturation indicates that studies focusing on mainstream digital technology applications have become increasingly repetitive, thereby offering limited potential for novelty. Consequently, the field has reached a point where general adoption studies are no longer sufficient to drive the discourse forward.

In contrast, more specific technological domains such as "augmented reality (AR)" and "computer-aided instruction (CAI)," along with psychological dimensions including "motivation" and "challenges," reflecting low density. This suggests that implementations of specific technologies and their psychological implications in learning contexts remain underexplored, thus offering high opportunities for novelty. Similarly, the node "Islamic values" also exhibits low density, which aligns with the overlay analysis indicating that this theme has only recently gained research attention. Taken together, these findings suggest that future research should move beyond basic media effectiveness studies toward the exploration of advanced and specialized educational technologies, the psychological dimensions of instructional technology use, and the role of Islamic values as an ethical framework for AI adoption in educational institutions.

Limitation of the Study

While this study provides a comprehensive mapping of the research landscape, it acknowledges limitations related to the exclusive use of the Scopus database. This methodological constraint may result in the exclusion of relevant non-indexed local literature, particularly from grassroots Islamic educational institutions. Consequently, future bibliometric studies are recommended to incorporate comparative data from other databases, such as Web of Science (WoS) or Google Scholar, to capture a broader spectrum of local scholarly discourse that Scopus might overlook.

Conclusion

The bibliometric analysis presented in this study illuminates a significant trajectory in Islamic education research, moving from reactive pandemic-driven adaptations toward a more proactive exploration of Artificial Intelligence (AI). The data suggests that the current intellectual structure rests on three thematic pillars: the digitization of the pedagogical ecosystem, strategic institutional management, and the emerging discourse on AI ethics. However, the density analysis reveals a saturation of generalist studies on 'digital learning' adoption, while creating a noticeable gap regarding the specific ethical alignment of AI systems with Islamic values and their psychological impacts on students.

These findings offer critical implications for the field. For educational stakeholders, the saturation of adoption-focused literature implies that future policies should pivot from mere infrastructure acquisition toward developing robust digital literacy guidelines that address AI ethics. For the scholarly community, there is a compelling need to move beyond descriptive research. Future scholarship would benefit from experimental studies testing specific immersive tools (such as AR/VR) or qualitative inquiries into the 'humanware' aspects of technology—specifically how AI interacts with the character-building mission of Islamic education. Finally, broadening the geographical scope beyond Southeast Asia remains essential to validate whether these technological trends are globally consistent across the Muslim world.

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