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Mapping technology research in islamic education: a bibliometric analysis of research trends, intellectual structure, and emerging themes

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ABSTRACT

The integration of technology into Islamic education has accelerated over the past decade, yet the resulting body of research remains scattered across disciplines, institutions, and thematic traditions. This study maps the collaborative, intellectual, relational, and conceptual structure of research on technology in Islamic education using bibliometric analysis and science mapping. Bibliographic records were retrieved from the Scopus database using a search string combining Islamic-education terms (Islamic education, madrasah, madrasa, pesantren, Islamic school, Islamic higher education) with technology terms (technology, digital, ICT, educational technology). The initial search returned 627 records; after applying database-level filters (publication years 2020–2026, English language, article document type, and journal source type) the interface reported 430 documents. Auditing the exported dataset against the same criteria yielded 385 verifiable journal articles, which were used as the analytical corpus; the discrepancy is reported transparently in the Methods. Four analyses were performed in VOSviewer: author co-authorship, author co-citation, bibliographic coupling of documents, and all-keyword co-occurrence. Results show a rapidly expanding but geographically concentrated field dominated by Indonesian and Malaysian scholarship, a fragmented collaboration structure composed of many small and loosely connected author groups, an intellectual base that draws simultaneously on Islamic-education foundations, Islamic epistemology, and imported quantitative and qualitative methodologies, and a conceptual space organized around five thematic clusters. Temporal mapping indicates that early work centered on e-learning, teaching, and instructional systems, whereas artificial intelligence, digital literacy, digital transformation, and Islamic higher education have emerged as recent research fronts. The study offers an evidence-based agenda for consolidating a still-fragmented field.

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Introduction

The digitalisation of education has reshaped how knowledge is produced, transmitted, and assessed, and educational technology has moved from a peripheral concern to a central object of pedagogical and institutional reform. Technologies ranging from learning management systems and interactive learning media to serious games and, most recently, generative artificial intelligence now mediate everyday teaching and

learning. Understanding how these tools are studied, adopted, and contested is therefore essential for any educational sector seeking to modernise without losing sight of its core purposes.

Islamic education constitutes a distinctive and demographically significant sector within this broader landscape. Encompassing formal Islamic schools, madrasah, pesantren (Islamic boarding schools), and Islamic higher education institutions, it serves large populations across the Muslim world and combines the transmission of religious knowledge with general academic instruction. Because it is charged with cultivating both intellectual competence and moral-spiritual character, the adoption of technology in this sector raises questions that extend beyond efficiency to matters of religious authority, values, and identity.

Over the past decade, technology has entered Islamic educational settings along several fronts. Islamic schools and madrasah have adopted e-learning platforms, interactive quiz media, and computer simulations to strengthen instruction, as documented in studies of Quizizz-based Arabic learning and simulation-based science teaching in Madrasah Ibtidaiyah (Hanif et al., 2023; Habibi et al., 2024). Pesantren, historically defined by embodied, face-to-face transmission, have negotiated the tension between scriptural tradition and digital mediation (Pabbajah et al., 2021; Assa'idi, 2021). Islamic higher education institutions have engaged more recently with artificial intelligence, digital transformation, and questions of academic integrity (Achruh et al., 2024; Adiyono et al., 2025; Syukur et al., 2024). Across these settings, digital literacy and online religious authority have become recurring concerns (Indah et al., 2022; Rusli & Nurdin, 2022; Hefner, 2022). Despite this proliferation, the research base remains fragmented. Studies are dispersed across educational, technological, and Islamic-studies journals; they employ heterogeneous methods and vocabularies; and they are produced by many small, often nationally bounded research groups. As a result, it is difficult to discern the field's overall collaborative structure, its intellectual foundations, the relationships among its documents, and its dominant and emerging themes. Narrative reviews, valuable as they are, cannot fully capture these structural properties across hundreds of publications.

Bibliometric analysis and science mapping address precisely this problem. By treating publications, authors, references, and keywords as networked data, bibliometric methods make it possible to reconstruct the architecture of a research field at scale and to identify its trajectories with reproducible, evidence-based procedures (Donthu et al., 2021; Zupic & Čater, 2015; van Eck & Waltman, 2010). In educational and Islamic-education contexts, bibliometric mapping has increasingly been used to chart research trends and future directions (Syafaruddin et al., 2022; Nofmiyati et al., 2023; Darmawati et al., 2025). Yet, to date, no bibliometric study has specifically mapped the intersection of technology and Islamic education as an integrated research domain across the 2020–2026 period. Existing bibliometric work tends to examine Islamic education or educational technology separately, leaving the collaborative, intellectual, relational, and conceptual structure of their intersection largely uncharted. This constitutes the research gap the present study addresses.

This study contributes a comprehensive, four-pronged bibliometric map of technology research in Islamic education. It characterises the field's collaboration structure, reconstructs its intellectual foundations through author co-citation, groups its documents into research fronts through bibliographic coupling, and identifies its dominant and emerging themes through all-keyword co-occurrence. In doing so, it provides researchers, institutions, and policymakers with an empirically grounded orientation to a fast-growing but still loosely organised field.

Accordingly, the study is guided by four research questions:

RQ1. How is the research collaboration structure in technology research in Islamic education formed based on author co-authorship networks?

RQ2. What is the intellectual structure of technology research in Islamic education based on author co-citation networks?

RQ3. How are research documents related through bibliographic coupling, and what major research clusters can be identified in technology research in Islamic education?

RQ4. What are the dominant and emerging research themes in technology research in Islamic education based on all-keyword co-occurrence?

Literature Review

Technology in Islamic Education

Educational technology refers to the systematic application of digital tools, resources, and processes to support teaching and learning. In practice it spans information and communication technology (ICT) infrastructure, digital learning platforms, learning media, and, increasingly, intelligent systems. Within Islamic education, technology has been mobilised both to improve conventional instruction and to extend access, for example through e-learning applications adopted during the COVID-19 pandemic (Riyan Rizaldi et al., 2021) and through interactive and simulation-based media designed for madrasah learners (Hanif et al., 2023; Habibi et al., 2024). Technology integration in this sector is therefore not merely instrumental; it interacts with pedagogical traditions, teacher readiness, and institutional culture (Susanto et al., 2022; Fauzan et al., 2022).

Digitalization and Educational Technology in the Islamic Educational Context

The Islamic educational context is institutionally plural. Islamic schools and madrasah operate within national education systems while retaining a religious curriculum; pesantren preserve a distinctive model of communal, character-focused formation; and Islamic higher education institutions combine advanced disciplinary training with religious scholarship. Digitalisation affects each differently. In madrasah, digital transformation has been linked to management reform and cultural change (Mahsusi et al., 2024; Rokhman et al., 2023). In pesantren, digital mediation reshapes long-standing relationships of authority and transmission (Pabbajah et al., 2021; Roqib, 2021). In Islamic higher education, the adoption of artificial intelligence and digital technologies raises questions of compatibility, integrity, and quality (Abubakari et al., 2024; Achruh et al., 2024; Adiyono et al., 2025). Cross-cutting all three, online platforms and social media have become arenas for religious authority, contestation, and the negotiation of Islamic values (Hefner, 2022; Rusli & Nurdin, 2022; Maemonah et al., 2023).

Bibliometric Mapping in Educational Research

Bibliometric analysis quantifies patterns in scholarly literature to reveal the structure and dynamics of a field. Science mapping, a subset of bibliometrics, visualises relationships among research entities and typically distinguishes four complementary techniques (Zupic & Čater, 2015; Donthu et al., 2021). Co-authorship analysis reconstructs collaboration networks among authors. Author co-citation analysis, building on the foundational insight that documents frequently cited together are intellectually related (Small, 1973), maps the intellectual base of a field. Bibliographic coupling, which links documents that share references (Kessler, 1963), groups the current research front. Keyword co-occurrence analysis reveals the conceptual and thematic structure of a field. These techniques are commonly operationalised through dedicated software (Cobo et al., 2011; Aria & Cuccurullo, 2017; Moral-Muñoz et al., 2020), among which VOSviewer is widely used for network construction and clustering (van Eck & Waltman, 2010). In Indonesian educational research specifically, bibliometric mapping has been applied to educational supervision, religious learning motivation, and digital media to identify trends and future directions (Syafaruddin et al., 2022; Nofmiyati et al., 2023; Darmawati et al., 2025).

Research Gap

Although bibliometric methods are well established and technology in Islamic education is an active area of inquiry, the two have rarely been brought together in a single, structure-oriented mapping. Prior reviews tend to be narrative, to focus on a single institution type, or to treat Islamic education and educational technology as separate domains. Consequently, the field lacks a consolidated account of who collaborates with whom, which intellectual traditions underpin the work, how its documents cluster into research fronts, and which themes are established versus emerging. This study addresses that gap by mapping the collaboration structure, intellectual structure, document-level research clusters, and conceptual themes of technology research in Islamic education for 2020–2026.

Method

Research Design

This study employed bibliometric analysis and science mapping. The purpose was to map the collaborative, intellectual, relational, and conceptual structure of research on technology in Islamic education. The design is descriptive and non-inferential: it characterises the observed structure of the literature rather than testing causal hypotheses. All analyses were conducted on bibliographic metadata exported from a single database and processed with a single mapping tool to ensure internal consistency.

Database and Search Strategy

Scopus was selected as the data source because of its broad coverage of peer-reviewed journals and its structured, exportable metadata. The following search string was applied to titles, abstracts, and keywords:

("Islamic education" OR madrasah OR madrasa OR pesantren OR "Islamic school" OR "Islamic higher education") AND (technology OR digital OR ICT OR "educational technology")

The initial query returned 627 records spanning multiple document types, languages, and publication years.

Eligibility and Data Filtering

Four inclusion criteria were applied at the database level: publication years 2020–2026; English language; article document type; and journal source type. Conference papers, conference reviews, book chapters, books, reviews classified under a document type other than article, errata, editorials, notes, and letters were excluded, as were non-English records and any records outside the 2020–2026 window. The selection process was documented transparently in line with contemporary reporting standards for evidence syntheses (Page et al., 2021). When these filters were applied in the Scopus interface, the reported count was 430 documents.

A data audit was then performed on the exported CSV file. Re-applying the same four criteria to the exported records yielded 385 journal articles rather than 430. In keeping with the study's anti-fabrication protocol, this discrepancy was not adjusted away. The most plausible explanations are the timing of the export relative to the interface count (Scopus is updated continuously, and articles-in-press for 2025–2026 are frequently re-indexed or reclassified), and differences between how the interface counts source and document types at query time and how those fields appear in the exported metadata. Because bibliometric indicators can only be computed from records actually present in the export, the 385 verifiable journal articles were adopted as the analytical corpus, and all reported indicators derive from this corpus. The record-selection flow is summarised in Table 1.

Table 1. <Search strategy and dataset selection>

Stage	Records
Initial Scopus records (search string)	627
Database-level filters applied (2020–2026 + English + Article + Journal), interface count	430
Verifiable records in exported CSV meeting all four criteria (analytical corpus)	385

Data Extraction and Cleaning

The exported file contained 44 metadata fields, including authors, author identifiers, affiliations, source titles, citation counts, author keywords, index keywords, references, and abstracts. The audit confirmed no duplicate DOIs or titles within the corpus. Abstracts were complete for all records. Author keywords were missing for six records, and index keywords were absent for 378 of the 385 records; consequently, the all-keyword analysis in this corpus is driven predominantly by author keywords, a point that is revisited in the Limitations. Minor normalisation was applied to keywords (case folding and merging of obvious singular/plural and spelling variants) and to author names where identifiers confirmed identity. No normalisation was performed that would alter the substantive meaning of the data.

Bibliometric Analysis

Four analyses were performed, each aligned with one research question. Author co-authorship analysis (RQ1) assessed the collaboration structure. Author co-citation analysis (RQ2) assessed the intellectual structure, following Small's (1973) principle that co-cited authors represent related intellectual traditions. Bibliographic coupling of documents (RQ3) assessed similarity among documents based on shared references (Kessler, 1963). All-keyword co-occurrence analysis (RQ4) assessed the conceptual and thematic structure of the field.

Author Co-authorship

Co-authorship links authors who appear together on the same documents, allowing the identification of collaborative groups and the overall connectedness of the research community.

Author Co-citation

Author co-citation links authors who are cited together in the reference lists of the corpus, revealing the foundational scholars and intellectual clusters on which the field draws.

Bibliographic Coupling

Bibliographic coupling links documents that cite the same earlier works; documents with many shared references are treated as thematically proximate and are grouped into research fronts.

All-Keyword Co-occurrence

All-keyword co-occurrence links keywords that appear together in the same documents, exposing dominant concepts, their relationships, and thematic clusters, and—through temporal overlay—their evolution over time.

VOSviewer Procedures

Network construction, clustering, and visualisation were performed in VOSviewer, which builds distance-based maps in which node size reflects weight, proximity reflects relatedness, and colour reflects cluster membership or, in overlay mode, average publication year (van Eck & Waltman, 2010). For each analysis, VOSviewer computed items, links, total link strength, and clusters using its default association-strength normalisation and modularity-based clustering. Where a specific numerical threshold or counting method was not recoverable from the exported metadata or the supplied visualisations, no value was assumed or invented; such cases are reported as limitations rather than filled with estimated figures. The four supplied visualisations were interpreted jointly with the metadata: a value or relationship was reported only when it could be corroborated by the exported data, the visualisation, or both. It is noted that several document nodes in the bibliographic-coupling map carry pre-2020 labels, indicating that the coupling map was generated from a broader record set than the strictly filtered corpus; this scope difference is treated interpretively rather than as a contradiction.

Results and Discussions

Dataset Characteristics

The analytical corpus comprised 385 journal articles published between 2020 and 2026, authored by 1,413 distinct authors across 185 source titles, and cited 1,652 times in total (mean 4.29 citations per document; maximum 48). Annual output rose steeply, from 19 articles in 2020 to 113 in 2025, with 93 articles already recorded for 2026 at the time of export, confirming a rapidly expanding field. Roughly 28% of documents (107) had not yet been cited, consistent with the youth of much of the corpus. Table 2 summarises the principal characteristics.

Table 2. <Dataset characteristics>

Indicator	Value
Initial Scopus records	627
Interface-reported filtered records	430
Verifiable records analysed	385
Publication period	2020–2026
Language	English
Document type	Article
Source type	Journal
Distinct authors	1,413
Distinct source titles	185
Total citations	1,652
Mean citations per document	4.29
Highest cited document	48 citations
Uncited documents	107 (27.8%)
Mean authors per document	3.99

The corpus is geographically concentrated. Indonesian affiliations appeared in 311 of the 385 documents, followed at a distance by Malaysia (56), with smaller contributions from Turkey, Saudi Arabia, Australia, Thailand, the United Arab Emirates, Brunei, Egypt, the United States, and the United Kingdom. Seventy-seven documents involved affiliations from two or more countries, indicating a modest but non-trivial level of international collaboration. The most productive sources were Indonesian and regional Islamic-education and educational-technology journals, led by Nazhruna: Jurnal Pendidikan Islam (22), Jurnal Pendidikan Agama Islam (20), and Munaddhomah (18), alongside internationally indexed outlets such as the International Journal of Learning, Teaching and Educational Research (16) and Cogent Education (10). Table 3 lists the most productive source titles.

Table 3. <Most productive source titles>

Source title	Articles
Nazhruna: Jurnal Pendidikan Islam	22
Jurnal Pendidikan Agama Islam	20
Munaddhomah	18
International Journal of Learning, Teaching and Educational Research	16
Jurnal Ilmiah Peuradeun	14
Jurnal Pendidikan Islam	14
Kharisma	11
Cogent Education	10
International Journal of Evaluation and Research in Education	6
Journal of Education and Learning	5

Author Co-authorship Analysis (RQ1)

Co-authorship analysis addresses RQ1 by reconstructing the collaboration structure of the field. The corpus is highly collaborative at the level of individual papers—3.99 authors per document on average, rising to 4.37 among multi-authored works, with a maximum of 13 co-authors and only 44 single-authored articles—yet fragmented at the level of the community as a whole. The 1,413 distinct authors are distributed across a large number of small teams, and no author dominates output: the most productive contributors, Supriyadi T. and Tambak S., produced only four documents each, followed by a cluster of authors with three documents (including Qudsy S.Z., Arif M., Azizah N., and Faqihuddin A.). This flat productivity distribution, combined with the large author base, indicates a collaboration structure composed of many loosely connected groups rather than a few dominant, well-integrated research schools. Because the four supplied visualisations did not include a dedicated co-authorship network map, the collaboration structure is characterised here from the extracted co-authorship metadata; the available metadata did not provide sufficient evidence to determine a single giant connected component reliably, and this is reported rather than estimated. Table 4 lists the most productive authors.

Table 4. <Most productive authors (co-authorship units)>

Author	Documents	Citations	Rank
Supriyadi T.	4	12	1
Tambak S.	4	17	1
Qudsy S.Z.	3	38	3
Arif M.	3	22	3
Azizah N.	3	22	3
Faqihuddin A.	3	19	3
Hudaa S.	3	21	3
Rusydi I.	3	15	3
Pahrudin A.	3	11	3
Islamy M.R.F.	3	10	3

Author Co-citation Analysis (RQ2)

Author co-citation analysis addresses RQ2 by reconstructing the intellectual base of the field (Figure 1). The map reveals a multi-polar intellectual structure rather than a single unified tradition. A dense central cluster is organised around methodological authorities whose work is co-cited across the corpus, including Clarke V. (associated with thematic analysis in qualitative research; Braun & Clarke, 2006) and Sarstedt M. (associated with partial least squares structural equation modelling), indicating that the field's empirical work leans heavily on imported qualitative and quantitative analytic frameworks. Distinct peripheral clusters correspond to different knowledge traditions: a cluster around Huda M. and Ismail A. reflects foundational scholarship on Islamic education and value formation; a cluster around Rassool G.H. and Nasr S.H. reflects Islamic epistemology and the philosophy of Islamic education; a cluster around Robinson F. and Zaman M.Q. reflects religious and pesantren studies; a cluster around Khasawneh M.A.S. reflects technology acceptance and e-learning research; and a smaller node around Foucault M. signals the presence of critical social theory. The co-existence of Islamic foundational scholarship, Islamic epistemology, and secular methodological and theoretical sources indicates that the field is intellectually hybrid, drawing its authority simultaneously from within and beyond the Islamic scholarly tradition.

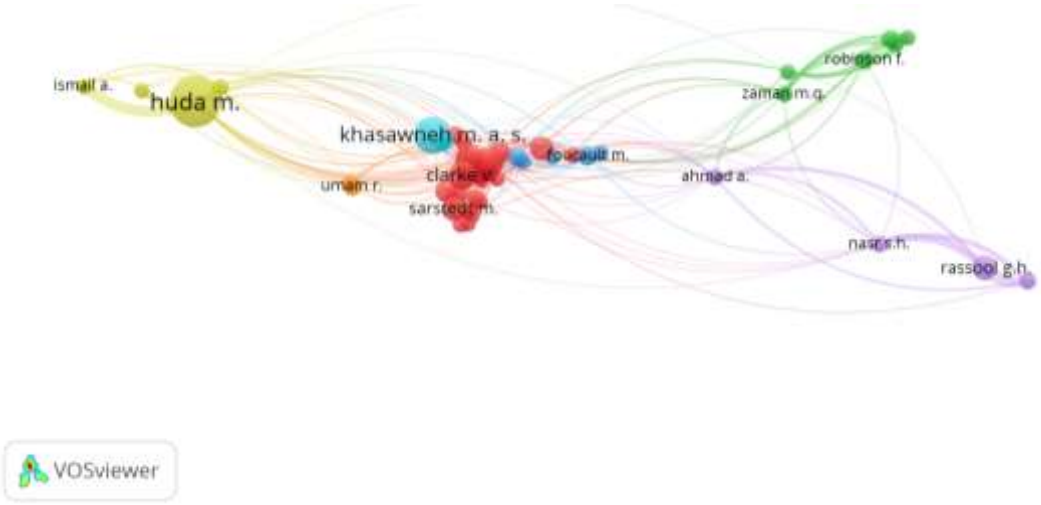

Figure 1. <Author co-citation network of technology research in Islamic education (VOSviewer). Node size reflects co-citation weight; colours denote co-citation clusters.>

Table 5 summarises the co-citation clusters interpreted from the map. Because exact co-citation counts and total link strength were not recoverable from the supplied visualisation, these indicators are reported qualitatively; the available metadata did not provide sufficient evidence to determine precise co-citation frequencies reliably.

Table 5. <Author co-citation clusters (intellectual structure)>

Cluster (colour)	Representative authors	Intellectual tradition
Central (red/blue)	Clarke V., Sarstedt M., Foucault M.	Imported research methodology (qualitative thematic analysis, PLS-SEM) and critical social theory
Yellow	Huda M., Ismail A.	Foundations of Islamic education and value/character formation
Purple	Rassool G.H., Nasr S.H.	Islamic epistemology and philosophy of Islamic education
Green	Robinson F., Zaman M.Q.	Religious studies and pesantren/Islamic institutional studies
Cyan	Khasawneh M.A.S.	Technology acceptance and e-learning

Bibliographic Coupling Analysis (RQ3)

Bibliographic coupling of documents addresses RQ3 by grouping documents that share references into research fronts (Figure 2). The map is notably sparse: many documents appear as isolated or weakly connected nodes (rendered in grey), and the coloured groupings are small. This pattern indicates a low degree of shared referencing across the corpus and, therefore, a fragmented research front in which studies frequently build on separate literatures rather than on a common evidentiary base. Reading the titles, abstracts, and keywords of the more strongly coupled documents allows several substantive research fronts to be named rather than merely colour-coded. One front centres on digital literacy and academic competence, anchored by highly cited work on the research competence, critical thinking, and digital literacy of Indonesian students (Indah et al., 2022) and on lecturers' pandemic-era digital literacy (Fauzan et al., 2022). A second, distinctly recent front concerns artificial-intelligence adoption in Islamic higher education, linking studies of AI challenges and opportunities, student reliance on AI, and cross-country AI integration (Achruh et al., 2024; Adiyono et al., 2025; Syukur et al., 2024). A third front addresses leadership, management, and digital transformation in madrasah and pesantren (Hariadi et al., 2024; Mahsusi et al., 2024; Asmendri et al., 2024). A fourth, smaller front concerns technology-mediated heritage and instructional media, including 3D documentation of Islamic architectural heritage and virtual-reality learning games (Kęsik et al., 2021; Nurhayati & Arif, 2023). The presence of several pre-2020 document labels in the map confirms that the coupling analysis drew on a broader record set than the filtered corpus, which is consistent with the sparse, front-based rather than tightly integrated structure observed.

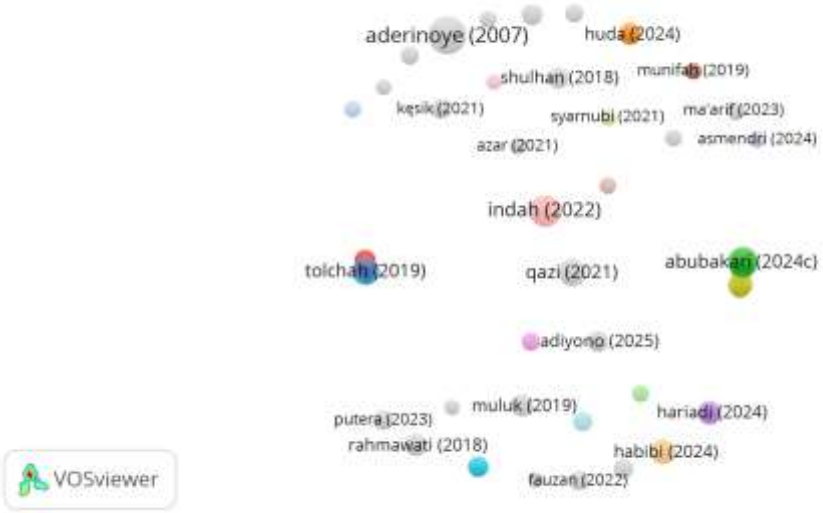

Figure 2. <Bibliographic coupling network of documents (VOSviewer). Each node is a document labelled by first author and year; grey nodes are weakly coupled.>

Table 6. <Bibliographic coupling research fronts>

Research front	Representative documents
Digital literacy and academic competence	Indah et al. (2022); Fauzan et al. (2022)
Artificial intelligence in Islamic higher education	Achruh et al. (2024); Adiyono et al. (2025); Syukur et al. (2024)
Leadership, management, and digital transformation	Hariadi et al. (2024); Mahsusi et al. (2024); Asmendri et al. (2024)
Technology-mediated heritage and instructional media	Kęsik et al. (2021); Nurhayati & Arif (2023); Habibi et al. (2024)

All-Keyword Co-occurrence Analysis (RQ4)

All-keyword co-occurrence addresses RQ4 by revealing the conceptual structure of the field (Figure 3). The term islamic education is by far the most frequent keyword (69 occurrences) and occupies the network's centre, connecting to all other regions. It is surrounded by high-frequency terms including pesantren (21), islamic higher education (19), indonesia (16), artificial intelligence (16), higher education (15), islamic religious education (14), digital literacy (11), digital learning (11), social media (10), and technology (9). The network

resolves into five conceptual clusters. A central cluster couples islamic education with educational technology and learning systems, representing the conceptual core that binds the field. A second cluster links indonesia and social media to digital literacy, digital learning, islamic values, character education, and critical thinking, representing the interface between digital transformation and value formation. A third cluster groups education, curriculum, ict, technology adoption, and islamic higher education, representing ICT adoption and curriculum development in higher education. A fourth cluster gathers religion, islam, challenges, and teaching, representing the religious and pedagogical framing of the field. A fifth cluster contains engineering education, education computing, augmented reality, and computer-aided instruction, representing the technical and instructional-systems perspective. Table 7 reports the most frequent keywords.

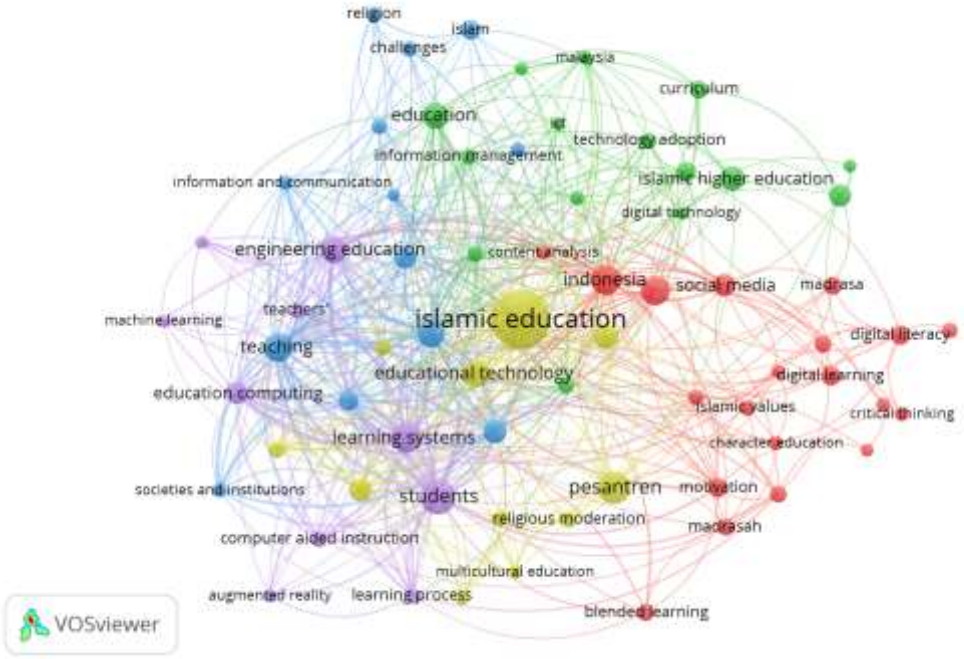

Figure 3. <All-keyword co-occurrence network (VOSviewer). Node size reflects occurrence frequency; colours denote thematic clusters.>

Table 7. <Most frequent keywords (all-keyword co-occurrence)>

Keyword	Occurrences	Cluster theme
islamic education	69	Conceptual core
pesantren	21	Core / institutional
islamic higher education	19	ICT & higher education
indonesia	16	Digital & values
artificial intelligence	16	Emerging
higher education	15	ICT & higher education
islamic religious education	14	Conceptual core
digital literacy	11	Digital & values
digital learning	11	Digital & values
social media	10	Digital & values
technology	9	Conceptual core
religious moderation	8	Religion & pedagogy
educational technology	7	Conceptual core
digital transformation	7	Emerging

Dominant and Emerging Research Themes

The temporal overlay of the all-keyword network (Figure 4) situates each keyword by its average publication year and thereby distinguishes established from emerging themes. Terms rendered in darker (earlier) tones teaching, students, learning systems, education computing, computer-aided instruction, engineering education, and augmented reality represent the field's earlier concerns, largely centred on e-learning infrastructure and instructional systems consolidated around the pandemic period. Terms rendered in brighter (more recent) tones artificial intelligence, digital technology, digital literacy, digital learning, technology adoption, islamic higher education, islamic values, character education, and critical thinking represent the field's current research fronts. This temporal pattern is corroborated by the citation and coupling evidence: the most recent highly cited documents concern AI adoption and student reliance on AI (Achruh et al., 2024; Adiyono et al., 2025), while digital transformation and digital literacy recur across the newest clusters (Mahsusi et al., 2024; Indah et al., 2022). Emerging themes are therefore identified from the convergence of temporal position, occurrence, cluster relevance, and network centrality, not from colour alone.

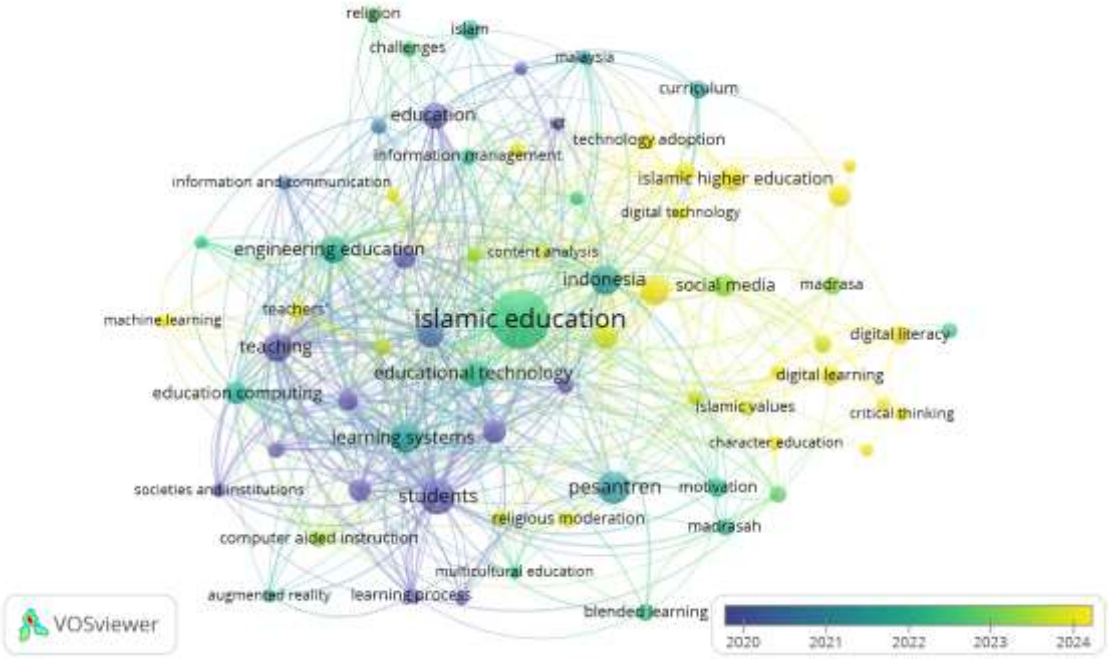

Figure 4. <Temporal overlay of the all-keyword co-occurrence network (VOSviewer). Colour reflects average publication year, from earlier (dark) to more recent (bright).>

Table 8. <Dominant (established) and emerging themes>

Established themes (earlier)	Emerging themes (recent)
E-learning and learning systems	Artificial intelligence in education
Teaching and students	Digital transformation
Educational technology (general)	Digital literacy and digital learning
Engineering education / computing	Technology adoption in Islamic higher education
Computer-aided instruction; augmented reality	Islamic values, character education, critical thinking

The co-authorship findings indicate that technology research in Islamic education is collaborative within individual papers but remains fragmented across the broader research community. The relatively high mean authorship per document, combined with a flat productivity distribution and a very large author base, suggests a field characterised by many small research teams rather than a few highly integrated scholarly schools. This structure is typical of a young and rapidly growing field that has not yet undergone substantial consolidation and is consistent with patterns reported in bibliometric studies of related Indonesian educational domains

(Syafaruddin et al., 2022; Nofmiyati et al., 2023). The strong geographic concentration of research in Indonesia and Malaysia further reinforces this interpretation, indicating that the field remains nationally anchored, while international collaboration, although present, is still relatively limited.

The co-citation results demonstrate that the intellectual structure of the field is distinctly hybrid. The prominence of methodological authorities such as Clarke and Sarstedt indicates that empirical research is largely validated through established qualitative and quantitative methodological frameworks, while separate intellectual clusters centred on Huda, Nasr, and Rassool provide foundations related to Islamic education and Islamic epistemology. The simultaneous reliance on established methodological traditions and Islamic scholarly perspectives represents a defining characteristic of the field. On the one hand, this combination provides methodological rigour; on the other hand, it raises an unresolved question concerning the extent to which technological adoption is genuinely integrated with Islamic educational philosophy rather than simply being added to existing educational practices. Consequently, the intellectual foundation of the field supports substantial research productivity while also contributing to its thematic dispersion.

The bibliographic-coupling results reveal a relatively sparse and front-based research structure. Four principal research fronts, namely digital literacy and competence, artificial intelligence in Islamic higher education, leadership and digital transformation, and technology-mediated media and heritage, are only weakly connected through shared references. This finding corroborates the evidence of fragmentation identified through the co-authorship analysis, but at a different analytical level. The fragmentation is therefore evident not only among research groups but also among the scholarly documents and knowledge bases that they produce. The field currently appears to advance through several parallel research trajectories that rarely converge around a common intellectual core, thereby limiting the development of cumulative and integrated knowledge.

The keyword and overlay analyses reveal a clear thematic trajectory within the field. The conceptual core continues to centre on the relationship between Islamic education and educational technology; however, the research frontier has shifted increasingly toward artificial intelligence, digital transformation, and digital literacy, while maintaining a persistent concern with Islamic values and character education. The close association between artificial intelligence, digital technologies, and value formation is particularly significant because it indicates that technology is not generally conceptualised as value-neutral within Islamic educational contexts. Instead, technological developments are continually negotiated in relation to religious, ethical, and moral commitments (Hefner, 2022; Maemonah et al., 2023; Chotimah et al., 2025). This characteristic distinguishes technology research in Islamic education from broader educational-technology research and represents one of the field's most distinctive contributions.

Taken together, these findings portray technology research in Islamic education as a rapidly expanding field that is regionally concentrated, intellectually hybrid, structurally fragmented, and increasingly oriented toward artificial intelligence and digital transformation while retaining a strong commitment to Islamic values. For Islamic educational institutions, the practical implication is twofold. Technological adoption has become increasingly unavoidable and is progressing at a rapid pace, while its implementation is most academically and institutionally defensible when explicitly aligned with the formative and value-centred mission of Islamic education rather than pursued merely as an end in itself.

The bibliometric evidence further indicates several interconnected research gaps that can guide future scholarship. The fragmented collaboration structure, characterised by numerous small and nationally bounded research teams with limited international integration, indicates the need for stronger cross-institutional and international research collaboration capable of consolidating expertise and facilitating comparative and multi-country studies. At the same time, the sparse bibliographic coupling among research fronts suggests that studies of artificial intelligence, digital literacy, leadership and digital transformation, and instructional media frequently develop along parallel trajectories with limited conceptual and bibliographic integration. Future research should therefore develop integrative reviews and shared conceptual frameworks capable of connecting these research fronts and strengthening cumulative knowledge development. In addition, although Islamic epistemology and established methodological traditions are frequently co-cited, their relationship remains insufficiently synthesised. Future scholarship should move beyond juxtaposing Islamic educational philosophy with technology-adoption theories and instead develop theoretical models that explicitly integrate Islamic educational principles with contemporary perspectives on technology adoption and digital transformation. The rapid emergence of artificial intelligence also represents an important research frontier, yet the current knowledge base remains relatively recent and weakly connected. This condition highlights the need for programmatic, longitudinal, and ethics-oriented research examining artificial intelligence in madrasah, pesantren, and Islamic higher education. These research directions are derived directly from the mapped structure of the corpus and remain focused on themes that are demonstrably represented in the dataset,

particularly artificial intelligence, digital transformation, digital literacy, educational technology, technology integration, and value-based Islamic education.

Theoretically, this study provides an integrated structural account of technology research in Islamic education and demonstrates that the field is better understood not simply as a subset of educational technology but as a hybrid scholarly domain in which technological adoption is continuously mediated by Islamic epistemology, educational philosophy, and values. This reframing provides a structural and evidence-based complement to the predominantly narrative forms of theorising that have characterised scholarship in this area. It consequently contributes to a more systematic understanding of how the intellectual, thematic, and relational structures of the field have developed. From a practical perspective, the research map provides useful insights for teachers, educational leaders, Islamic higher education institutions, and policymakers. Teachers and educational leaders in Islamic schools, madrasah, and pesantren can use the mapped literature to identify validated instructional technologies and value-sensitive practices associated with their implementation. Islamic higher education institutions can use these findings to anticipate governance challenges associated with artificial intelligence, particularly in relation to academic integrity and responsible technology use. Policymakers can also identify areas in which research collaboration and institutional capacity are relatively concentrated or remain limited, providing a basis for more targeted investment in under-served regions and institutional contexts. For researchers, the study offers a clearer orientation toward established research areas and emerging knowledge spaces by identifying well-populated thematic cores, particularly Islamic education and educational technology, alongside emerging and less-consolidated fronts involving artificial intelligence and digital transformation. These areas may provide opportunities for research contributions with greater potential to shape the future direction of the field. The findings also demonstrate the value of systematic bibliometric mapping as a means of identifying research opportunities and guiding scholarly agendas in Islamic educational research (Darmawati et al., 2025).

Several limitations should nevertheless be considered when interpreting these findings. The corpus is restricted to Scopus-indexed publications, meaning that relevant studies indexed in other databases or published in local and non-indexed venues are not represented, which may result in an under-representation of scholarship originating from some parts of the Muslim world. The study also includes only English-language journal articles, thereby excluding non-English publications and other forms of scholarly output and consequently narrowing the linguistic and formal coverage of the literature. In addition, the analysis is limited to publications from 2020 to 2026, restricting the historical perspective available for examining the longer-term development of technology research in Islamic education. All bibliometric indicators further depend on the completeness and accuracy of the exported metadata. In particular, index keywords were unavailable for the majority of records, meaning that the all-keyword analysis was driven primarily by author-provided keywords. A discrepancy was also observed between the interface-reported number of records, namely 430 documents, and the verifiable number of exported records, namely 385 documents; consequently, the analysis prioritised the verifiable exported records rather than relying on the interface figure. Several precise VOSviewer indicators, including exact thresholds, counting methods, co-citation counts, and total link strength values, could not be recovered from the supplied materials and were therefore interpreted qualitatively rather than estimated. A dedicated co-authorship network map was also unavailable. Finally, citation-based measures are inherently affected by citation-age bias, while network visualisation demonstrates relationships and structural associations but cannot establish causal relationships. These limitations should therefore be taken into account when interpreting the results and considering the broader implications of the study.

Conclusions

This bibliometric science-mapping study charted the structure and trajectory of technology research in Islamic education across 2020–2026, drawing on 385 verifiable Scopus journal articles and four VOSviewer analyses. In answer to RQ1, the collaboration structure is highly collaborative within papers but fragmented across the community, comprising many small, predominantly Indonesian and Malaysian teams with modest international integration. In answer to RQ2, the intellectual structure is hybrid, resting simultaneously on Islamic-education foundations and Islamic epistemology and on imported qualitative and quantitative methodologies. In answer to RQ3, bibliographic coupling reveals a sparse, front-based structure organised into four loosely connected research fronts: digital literacy and competence, artificial intelligence in Islamic higher education, leadership and digital transformation, and technology-mediated media and heritage. In answer to RQ4, the conceptual space is organised into five clusters around a core coupling of Islamic education and educational technology, with the research front shifting toward artificial intelligence, digital transformation, and digital literacy while retaining a strong orientation to Islamic values and character formation. The overarching contribution is an evidence-based map that reframes the field as a distinctive, value-mediated

domain and offers a concrete agenda for consolidating its currently fragmented structure through broader collaboration, integrative frameworks, and programmatic research on emerging technologies.

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