

Trends in Artificial Intelligence and Digital Technology Research in Islamic Education: A Scopus-Based Bibliometric Analysis

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Abstract: The objective of this research is to outline the trends, intellectual framework, and thematic progression of artificial intelligence (AI) and digital technology within Islamic education, using Scopus database records from 2018 to 2026. The study focuses on publication rates, top authors, key institutions, and leading countries, and identifies research gaps to guide future studies. Guided by the PRISMA 2020 guidelines, an initial 225 documents from Scopus underwent identification, screening, and eligibility evaluations, resulting in a final selection of 52 articles from 35 journals, written by 196 authors. A quantitative assessment was conducted via the Bibliometrix (R package) and Biblioshiny, encompassing performance metrics, thematic mapping, and visual networks of keyword co-occurrences. The research area shows significant expansion, boasting a 27.54% Annual Growth Rate (AGR), well above the average for scientific publications, and an international collaboration rate of 30.77%. With 224 citations, Indonesia leads in citation count, while UIN Sunan Kalijaga is the top-contributing institution. The analyzed data includes 225 author keywords and 2,766 references, with an average document age of 1.73 years, indicating the topic's novelty. Thematic evaluations highlight "Islamic education" and "higher education" as primary drivers. Meanwhile, "ChatGPT," "generative AI," "sentiment analysis," and "deep learning" are considered niche topics yet to enter mainstream discussions. Although "digital transformation" and "Islamic religious education" stand out as strategic themes, notable gaps remain in methodologies, themes, geography, and values, especially within *madrasah* and *pesantren* contexts. The results suggest that studies on AI in Islamic education are still in their foundational, exploratory phases. Consequently, three main strategies are proposed: enhancing global partnerships, conducting empirical research on generative AI grounded in Islamic principles, and developing AI tools tailored to Islamic educational environments.

Keywords: artificial intelligence, Islamic education, bibliometric analysis, Scopus, digital technology.

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■ INTRODUCTION

The emergence of artificial intelligence and digital technology has greatly impacted the education sector over the last decade (Duart, 2024). It has been pointed out in a study conducted by UNESCO (2023) that more than 60% of institutions of higher education across the globe are currently using at least one form of technological advancements of artificial intelligence in the process of providing education, be it in the form of recommendation systems,

educational chatbots, or advanced learning analytics tools. The global investments expected in artificial intelligence for the education sector by 2027 will amount to USD 20 billion, clearly demonstrating the seriousness and urgency with which the academic fraternity and policymaking institutions are treating this digital revolution (Faizrakhmanova et al., 2025). This phenomenon not only changes how learning materials are delivered to learners but also transforms the roles of teachers and institutions in the process. In light

of all this, there is an urgent need to conduct extensive research into its impact on Islamic education.

Given that Islamic education is among the oldest and largest education systems worldwide, it faces the challenge of sustaining the authenticity of its values while adapting to the demands of the modern-day and the age of digitization. According to statistics from the Organization of Islamic Cooperation (OIC), more than 1.8 billion Muslims worldwide receive Islamic education in various forms, ranging from traditional Islamic madrasa education to modern Islamic universities (Fatmawati et al., 2023). This urgency is pedagogically distinct from that of general education, since Islamic education is fundamentally oriented toward spiritual formation, moral character (akhlaq), and doctrinal fidelity; consequently, the adoption of AI in this context raises not merely technical questions of efficiency, but also risks of theological distortion, overreliance, and erosion of the teacher's role as a faith mentor if such technologies are applied without careful pedagogical mediation (Qaruty et al., 2025). Despite this, research indicates a substantial disparity in the implementation of digital technology across Islamic educational frameworks, with certain institutions employing deficient pedagogical methods (Hidayat et al., 2025). While the COVID-19 pandemic significantly accelerated the integration of digital tools in Islamic education, concerns persist regarding institutional readiness in terms of infrastructure, personnel competence, and the alignment of digital content with Islamic principles (Arim et al., 2024). This trend is particularly evident in *pesantren*, where the pandemic forced various typologies (traditional, semi-traditional, and modern) to utilize digital platforms for both administrative tasks and pedagogical activities, such as the virtual instruction of classical texts (kitab kuning), even amidst ongoing conflicts with established traditional values (Muzayanah et al., 2025). Consequently, a systematic review

examining the role of AI and digital technologies in Islamic education is highly warranted.

Bibliometric analysis is widely recognized as one of the most accurate methods for outlining research within a specific scientific domain. Unlike conventional narrative reviews, which can be influenced by authorial bias, the bibliometric method enables the simultaneous examination of numerous publications to uncover publication trends, collaborative networks, and emerging thematic interests (Donthu et al., 2021). Such techniques use quantifiable measures such as citations, h-index, co-citations, and bibliographic coupling, allowing for a more reliable image of the subject field of study (Donthu et al., 2021). In the field of education, bibliometric techniques have been applied effectively in research areas such as learning technologies (Nawaz et al., 2025), e-learning (Gao et al., 2022), and mobile learning (Arici et al., 2019). Nevertheless, bibliometric approaches have not been applied in the field at the intersection of artificial intelligence, digital technologies, and Islamic education, creating opportunities for further research in the area.

Scopus was chosen as the database for this research due to its broad coverage and reputation as one of the world's most authoritative scientific citation indexes. The database includes over 87 million citations from 26,000 academic journals in different fields of research, such as education, computer science, and Islamic studies (Baas et al., 2020). Many bibliographic studies on specific areas of digitalization in Islamic education have been conducted previously, including Gao et al. (2022), which mapped AI research in e-learning, and Pabbajah et al. (2021), which examined the development of technology-based Islamic education in Indonesia. Despite these efforts, there is a clear lack of comprehensive bibliometric analyses of global AI and digital technology trends in Islamic education, as evidenced by Scopus data. Therefore, this study is highly topical and firmly justified as a standalone contribution to the

ongoing development of Islamic education and its technological integration.

The urgency of such research is further amplified by the rapid proliferation of academic literature concerning AI and digital technologies in the educational sector. Simultaneously, there remains a notable scarcity of critical examinations specifically contextualized within Islamic education. It is crucial to formulate a clear research roadmap for this domain to prevent repetitive studies in saturated areas, pinpoint essential research gaps, and facilitate the adoption of technologies that align seamlessly with Islamic pedagogical paradigms. Conversely, Islamic educational establishments that lack information about up-to-date developments in the field are unlikely to produce curricula or other strategic documents that align with them. In this regard, this bibliometric study seeks to address this research gap by providing a comprehensive overview of the quantity, growth dynamics, geographic distribution, co-authorship networks, and thematic dynamics of scientific output on AI and digital technology in Islamic education.

Based on the discussion above, this study seeks to explore research trends in artificial intelligence and digital technology in Islamic education through a bibliometric analysis of Scopus-indexed journals from 2018 to 2026. Although the year 2026 had not ended at the time of writing this paper, this period was chosen because the data were collected on May 12, 2026. By that time, all the literature included in this analysis had been published and peer-reviewed. It should be noted that, because data collection ended in May 2026, the 2026 publication count reflects only a partial year and should not be directly compared with complete calendar years such as 2025. Given the limited number of bibliometric mappings of AI and Islamic education worldwide, there is enormous potential for research in this domain. To guide

the identification of themes and research gaps addressed in RQ4 and RQ5, this study adopts a four-dimensional gap-analysis framework commonly used in bibliometric and systematic literature reviews, namely thematic gaps (underexplored topics), methodological gaps (underused research designs), geographical-institutional gaps (uneven regional representation), and contextual-value gaps (the absence of context-specific theoretical grounding, such as Islamic values) (Donthu et al., 2021). This framework provides the conceptual lens through which the results from the thematic map, keyword network, and density map are subsequently interpreted. Hence, this study poses the following research questions:

- RQ1. What are the trends in the development of AI and digital technology research in Islamic education for the 2018-2026 period?
- RQ2. Who are the most influential authors, institutions, and countries?
- RQ3. What is the scientific productivity in this field?
- RQ4. What are the main themes, emerging themes, and specific themes identified?
- RQ5. What are the research gaps and future directions for AI research in Islamic education?

■ **METHOD**

Research Design

This research adopted a bibliometric approach to trace the research trends, knowledge structures, and development of Artificial Intelligence in Islamic education. The reason for selecting this approach for this research is that the bibliometric method enables objective analysis of publication metadata and, consequently, helps trace research trends, knowledge structures, and collaborative networks in science (Donthu et al., 2021).

To answer the above question, a detailed bibliometric study of the literature on artificial intelligence and digital technologies in Islamic education from 2018 to 2026 has been conducted. Specifically, the bibliometric analysis included annual publication trends, key authors and organizations, keyword evolution, thematic maps, and research gaps. This subject has been chosen as a topic for bibliometric study because bibliometrics provides a way to consolidate knowledge collected from many studies.

Data collection and research procedures complied with the PRISMA 2020 scheme. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) scheme helps to ensure transparency in the document selection process, namely, at the identification, screening, eligibility, and inclusion steps (Page et al., 2021). Also, applying these specific data-screening criteria serves as a supplementary measure to ensure research excellence (Javidan et al., 2023).

The research methodology comprises several sequential phases: establishing inclusion and exclusion criteria, selecting appropriate sources, filtering the literature, extracting data, and isolating specific items for the final review. For the quantitative evaluation, the Bibliometrix (R package) and Biblioshiny applications were employed to conduct the bibliometric assessment, map keyword networks, and examine co-authorship patterns. The findings this analysis are subsequently visualized through graphs, thematic maps, and statistical tables (Ghorbani, 2024).

Search Strategy

All the bibliographic details for this research paper were obtained from the Scopus database. The justification for using the Scopus database to obtain data was its availability of metadata, including title, authors' names, year of publication, affiliations, keywords, abstracts, citations, and other data required for the bibliometric analysis (Baas et al., 2020). Moreover, Scopus is one of the most widely used sources, providing data that can be analyzed with software such as Biblioshiny-R (Kara et al., 2025). Despite that, researchers understand that relying solely on a specific database can have limitations, namely, failing to account for studies in other databases, such as Web of Science.

The Scopus search conducted for this research did not include a Subject Area filter, as the subject matter of artificial intelligence in Islamic education is interdisciplinary and may span a range of disciplines, from education and computer science to the social sciences and Islamic studies. Limitation by Subject Area may reduce the pool of sources. In total, 225 results were retrieved using two keyword groups joined by the Boolean AND operator in the TITLE-ABS-KEY field. This number does not reflect technical limitations but rather reflects the actual state of global publications on this highly specific and relatively new topic. This simultaneously underscores the novelty and urgency of the research in providing a comprehensive research map in this field of study. The complete search strategy is presented in Table 1.

Table 1. Databases and search strategy

Database	Scopus
Data retrieval date	May 12, 2026
Group I Keywords	"artificial intelligence" OR "generative AI" OR "generative artificial intelligence" OR "digital technology" OR "machine learning"
Group II keywords	"Islamic education" OR "Islamic religious education" OR "Islamic studies" OR "Islamic learning" OR "Qur'anic education" OR "Quranic education" OR "pesantren" OR "madrasah"

Logical operators	TITLE-ABS-KEY (("artificial intelligence" OR "generative AI" OR "generative artificial intelligence" OR "digital technology" OR "machine learning") AND ("Islamic education" OR "Islamic religious education" OR "Islamic studies" OR "Islamic learning" OR "Qur'anic education" OR "Qur'anic education" OR "pesantren" OR "madrasah")) AND PUBYEAR > 2017 AND PUBYEAR < 2027
Year range	2018-2026
Search field	TITLE-ABS-KEY
Initial number of records	225 Documents
Final document count	52 Documents

During the literature retrieval phase, “artificial intelligence” and “digital technology” were merged into a single keyword category. This decision was driven by methodological practicalities rather than conceptual equivalence. Because early educational technology literature often uses these terms interchangeably, combining them in the initial search prevented the accidental exclusion of pertinent AI research categorized under the broader “digital technology” umbrella. Nevertheless, because AI and general digital tools

have vastly different pedagogical consequences, the 52 articles in the final dataset were separated during the analysis phase. Consequently, AI-focused studies and general digital technology studies, along with their distinct pedagogical impacts, are addressed independently in the Results and Discussion section.

An initial Scopus search yielded 225 articles. During the identification stage, 63 documents were removed for invalid document types (e.g., review articles, conference articles,

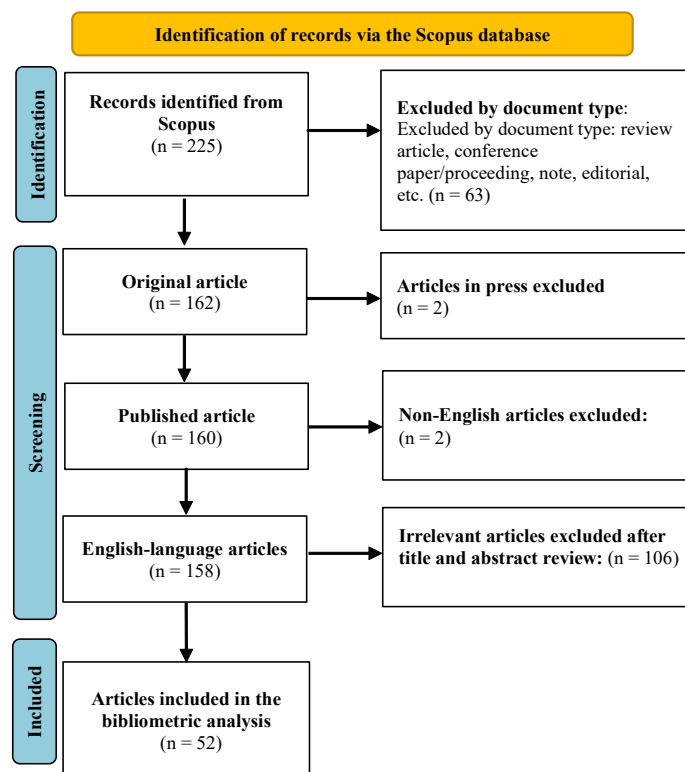


Figure 1. PRISMA diagram

notes, editorials), leaving 162 original articles. In the subsequent screening phase, 2 articles were omitted because they were “in press,” and 2 others were excluded for being written in foreign languages. Therefore, 158 articles remained. Among these, 106 articles were dismissed for having titles and/or abstracts irrelevant to the research question, or for being either not free-access articles or too narrowly scoped. As a result, 52 articles could be used as a corpus. The document selection process based on the PRISMA 2020 framework is presented in Figure 1.

However, due to inconsistencies in keyword spelling and organization names within Scopus metadata, the resulting visualizations would be erroneous. Data cleaning was performed before conducting any analysis of the dataset using Biblioshiny. This involved fixing synonyms used for keywords and author/institution names. However, not all terminological differences can be reconciled, as some terms appear identical yet embody distinct nuances

within academic discourse, making their consolidation an exercise fraught with the risk of blurring distinctions, such as research. The possibility of fragmented, unresolved results is a constraint that should be recognized when analyzing these findings (Donthu et al., 2021).

Inclusion and Exclusion Criteria

To maintain the transparency and reproducibility of our results, inclusion and exclusion criteria for the literature were defined prior to the initial screening process. As Petersen and Guyatt (2025) note, when conducting systematic reviews, having well-defined inclusion and exclusion criteria is fundamental, as it ensures the impartial identification of the scope of the evidence analysis. For this review, such criteria were established with the scope of the analysis in mind, namely the role of AI and digital technology in Islamic education. Additional information on the inclusion and exclusion criteria is provided in Table 2.

Table 2. Inclusion and exclusion criteria

Category	Inclusion	Exclusion
Document type	<i>Original</i> research article	Review article, conference paper, book chapter, editorial, note, letter, and erratum
Time range	Published between 2018 and 2026	Published after 2017 and before 2027
Topic relevance	Discusses AI or digital technology in the context of Islamic education	Not relevant to the topic of AI or digital technology in Islamic education
Language	Available in English	Not available in English
Publication Status	Article officially published	Article in press

The inclusion and exclusion criteria were set to ensure the dataset comprises high-quality, methodologically comparable research. Priority was given to empirical papers, as suggested by Kara (2025) and in line with the PRISMA guidelines, with other forms of literature, such as conference papers, book chapters, and editorials, disregarded because the methodology of their research cannot be guaranteed. The period 2018-

2026 was chosen to maintain relevance and transparency in the search (Page et al., 2021), with only research on the topic being covered. Only English-language articles were used, as is typical for systematic reviews (Neimann Rasmussen & Montgomery, 2018).

It should be clarified that “document type” and “publication status” in Table 2 are independent, non-overlapping exclusion criteria.

The document-type criterion filters out categorically distinct publication formats (e.g., review articles, conference papers, book chapters). In contrast, the publication status criterion specifically identifies articles that are still listed as “in press” in Scopus, regardless of document type. Because an article’s publication status is not determined by its document type, these two criteria were necessarily applied as separate, sequential screening steps in the PRISMA flow diagram, rather than combined into a single step.

This constraint towards OA papers is a methodological choice that stems from three practical reasons. Firstly, peer-reviewed papers included in Scopus that qualify as open access have been independently verified to demonstrate methodological rigor (O’Kelly et al., 2019). Secondly, the entire dataset comprises independently verifiable papers, thereby meeting the requirement for reproducibility in bibliometric analysis (Donthu et al., 2021). Thirdly, the impact of OA papers is significantly higher than that of

paywalled articles, thereby making them more representative in capturing mainstream developments in the field (Clark et al., 2024). However, despite the above filtering, some high-quality papers published in closed journals may go unnoticed. Therefore, the findings of this analysis can be regarded as a trend map for the subfield of OA studies within AI and Islamic education

Data Analysis

Bibliometric analysis has been carried out using Biblioshiny, the graphical interface for the bibliometrix package in RStudio Version 2026.04.0+526. This software was selected because it provides comprehensive coverage of all types of bibliometric analyses, including metadata,

performance, and concept structure analyses. Moreover, all the algorithms used by this software are open source and written in R. More detailed information regarding the analysis data is presented in Table 3.

Table 3. Analysis data

Research Question	Analysis Techniques
RQ1	Annual Scientific Production
RQ2	Most Relevant Affiliations and Most Cited Countries
RQ3	Authors' Output Over Time
RQ4	Tree Map, Thematic Map, Density Map, and Co-occurrence Network

The findings from the visualization and bibliometrics have been interpreted and discussed in relation to the aims of the research project. Findings have been explained not only in terms of their quantitative value but also in light of advances in the literature and trends in the field. The complete analysis was performed using Biblioshiny in RStudio version 2026.04.0+526. This ensures that the process will be replicable for future researchers.

RESULT AND DISCUSSION

The following section highlights the findings of a detailed bibliometric mapping of the literature dealing with the application of Artificial Intelligence (AI) technology in the field of Islamic Education. Conducted over a period of time from 2018 to 2026, the purpose of this mapping exercise is to identify the structure, development, and changes in topics associated with this field. This bibliometric study was undertaken to understand

how this technology has been utilized in Islamic education.

The presentation of the findings of this analysis is structured systematically around certain critical dimensions. To begin with, a statistical overview of the dataset is provided to assess the volume of publications, the number of authors, and the annual growth rate of research on AI and

digital technologies in Islamic education. Following that, the analysis focuses on the annual trend in scientific output, the geographic distribution of citations, authors' contributions, and prominent institutions. Thematic analysis is performed using tree maps, thematic maps, keyword density maps, and keyword network analysis.



Figure 2. Overview of bibliometric data

Data collected from Scopus show that studies on artificial intelligence and digital technologies in Islamic education have increased steadily from 2018 to 2026. The final database contains 52 papers from 35 journals, written by 196 authors, with an average of 3.88 authors per paper. Only 9 papers (17.3%) are single-authored. This is notably lower than the broader Islamic education literature, where single authorship is far more common, and the average co-authorship rate is only 2.36 authors per paper (Nirwana et al., 2024). This pattern suggests that AI-related research in Islamic education is shaped less by the humanities tradition of Islamic studies, which favors individual scholarship, and more by computational and educational-technology traditions, which favor team-based research. In other words, the high co-authorship rate reflects a shift toward more collaborative, data-driven research as AI becomes part of this field.

The most obvious trend is an Annual Growth Rate (AGR) of 27.54%. This remains high even

when compared to closely related sub-disciplines. Bibliometric studies on AI in education report an AGR of 18.94% (Prayuda et al., 2026), while studies on digital technologies in classrooms report an AGR of 21.5% (Alam et al., 2025). The AGR in this study is therefore still higher than these more equivalent benchmarks, though the gap is narrower than when compared to global science publication growth of 4-8% (Irfan et al., 2025). This suggests that the field is still in an emerging stage and moving toward wider popularity. This trend may be attributed to three reasons: (1) the acceleration of digitalization in the education sector following the COVID-19 pandemic after 2020, (2) the growing availability of AI-based tools such as machine learning and natural language processing for educators, and (3) increasing awareness among Islamic educational institutions of the need for digitalization.

The level of international collaboration (International Co-Authorship) of 30.77%

indicates that almost one-third of all publications in this corpus are joint efforts by researchers from multiple countries. This rate is notably high compared to other fields in Islamic studies. Bibliometric studies on Islamic education and character report an international co-authorship rate of only 8.77%, while studies on Quranic and Biblical scholarship report an international co-authorship rate of 8.56%. Against this benchmark, the 30.77% rate found in AI-related Islamic education research is more than three times higher. There is a well-established correlation between international cooperation and increased citations in bibliometric analyses (Alamah et al., 2023), making this finding a good indicator. However, the 30.77% value also implies that almost 69% of publications remain domestic. This means there is still much work to be done in expanding international collaboration, especially among Muslim-majority countries.

The total number of keywords proposed by authors (Author's Keywords/DE) was 225 across 52 papers, suggesting a wide range of concepts discussed in the documents. This high frequency of keywords is due to the

multidisciplinary nature of the analyzed works; they include machine learning, e-learning, gamification, blended learning, natural language processing, and specialized concepts in Islamic education, such as *madrasah*, *pesantren*, and Islamic pedagogy. In total, 2,766 references were cited, on average 53 per document, a significant number suggesting the maturity of the reviewed literature.

The Document Average Age of 1.73 years indicates that most documents in this field are fairly recent, supporting the view that the field under consideration is among the fast-developing ones. The age of the documents suggests that the information they contain is rather up to date for the field, since the field has recently undergone technological changes. What is more, the citation rate of 7.135 documents per paper shows that the scientific impact in this case is moderate.

Annual Publication Trends Reflect the Dynamics of Scientific Productivity

The annual publication trend shows a non-linear growth model, with a relatively static first phase between 2018 and 2022. From the

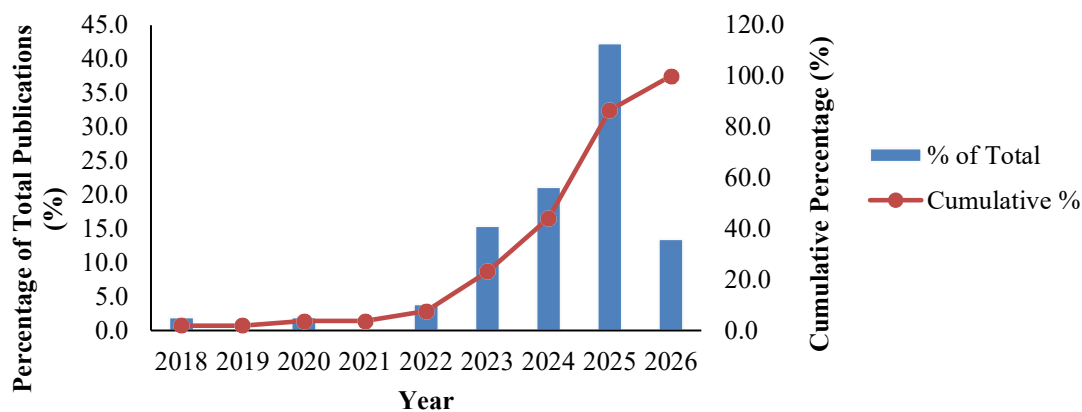


Figure 3. Annual scientific production percentage distribution and cumulative trend

publications made during this period, one can infer that the integration of Artificial Intelligence in Islamic education had not become a major research issue, as only a few publications were

available. The fact that research emerged in this phase does not indicate that the topic already had a clear research direction. This can be regarded as the initial exploration period, during which the

topic had not gained scientific recognition or integration within wider research frameworks (Panqueban & Huincahue, 2024).

The changes were even more pronounced after 2023, with a marked increase in the number of studies that continued through 2025. It should be noted that the apparent decrease in the 2026 figure (13.5% of the corpus) does not reflect an actual decline in research activity. Rather, it is a methodological artifact of the data collection cutoff on May 12, 2026, meaning the 2026 count represents less than five months of publications rather than a complete annual total. Excluding this partial year, the trend from 2018 to 2025 shows a consistent and accelerating increase, particularly from 2023 onward. Such a change can be viewed as one of how academia reacts to the rapid development of the technologies involved and to changes in educational practices. Technologies such as large language models have contributed to increased academic interest in using AI for educational purposes (Jyothy et al., 2024). However, while the connection between technological development and publication growth may appear to be a simple cause-and-effect relationship, it is not.

The positive trend observed over the past few years also warrants special attention. A high number of studies does not necessarily indicate scientific progress, because in the early stages of a branch, output tends to increase without the development of strong ideas and methods. The need for improvement is clearly demonstrated by a new bibliometric analysis, which shows that AI studies in education remain in the early stages and require further development of the theoretical base and research direction (Kesgin, 2025). Therefore, although the trend points toward growth, this is insufficient to conclude that this field of study has matured.

In addition, the number of publications from 2023 to 2025 indicates that most of the literature

is relatively recent. This means there is no citation buildup, and no reference books that can serve as the main basis of knowledge in this area have been developed yet. Therefore, at this stage, we should consider this topic in its initial development phase.

As such, the general impression from this trend in publications is that the topic of AI in Islamic Education has gained recognition recently, despite being in an immature developmental stage that needs further bolstering. Specifically, the non-linear development path indicates that this academic field has not yet reached its mature form, instead remaining at the innovative diffusion stage, implying that while there has been an increase in academic recognition of this topic, theory has yet to follow suit.

Most Relevant Institutional Affiliations

Institutional affiliations can be analyzed to provide insight into the institutional hubs researching AI and digital technologies for Islamic education worldwide. From the data collected, it is evident that the State Islamic University Sunan Kalijaga, Yogyakarta leads the pack with 3 articles, being the sole institution to have published more than 2 articles in this database. This leading position may be linked to UIN Sunan Kalijaga's documented institutional strategy of establishing multiple research centers to catalyze research output, as part of its transformation from a teaching-oriented institution toward a research university in Islamic studies (Suyadi et al., 2022). It should be noted, however, that bibliometric data alone cannot establish a causal link between this institutional strategy and the specific research output analyzed in this study. The explanation offered here is therefore a plausible contextual factor, not a confirmed finding.

In the following category, nine other institutions produced a total number of 2 articles apiece. While these are comparable in quantity,

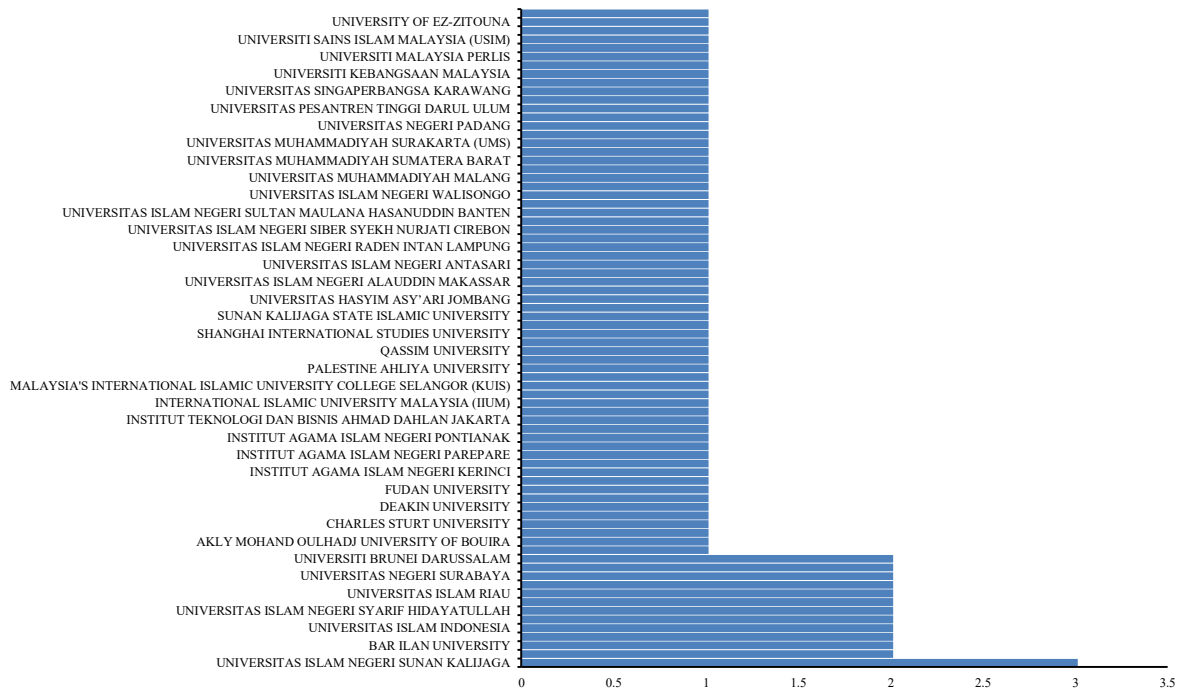


Figure 4. Institutional affiliations

they differ in geographic location and institutional identity. The first of such institutions in Indonesia comprises of four UINs, namely, UIN Syarif Hidayatullah (the same institution appears twice in this list, as it comes with the additional designation “Jakarta”, implying that while the process of normalization is done, yet some indexing inconsistency in the source, Scopus, can result in having to show the same institute twice in the data set: in such a case, this would mean that, despite normalization, two versions of UIN Syarif Hidayatullah exist), UIN Mataram, and two other institutions which do not have UIN designation in their titles, i.e., Universitas Islam Indonesia (UII) and Universitas Negeri Malang (UM).

Apart from Indonesian organizations, three institutions in the international setting also merit special attention. The Egyptian institution of Al-Azhar University contributed two articles. The university’s status as the world’s oldest Islamic institution makes it relevant to contemporary Islamic educational technology. Another

interesting finding is the contribution of Bar-Ilan University, an Israeli university contributing two articles. Considering the geopolitical setting of the region, this is definitely an academically interesting observation since it signifies comparative analysis or research conducted among the Muslim minority community in Israel. Lastly, one Tanzanian organization also merits mention. The Kondoia Islamic Secondary School contributed two articles, thereby emerging as the lone institution representing Sub-Saharan Africa.

From the data mentioned above, we can derive two important insights about this distribution model. First, studies on the application of AI and digital technologies in the Islamic education system have been conducted primarily by state-owned Islamic universities in Indonesia, highlighting the comparative advantage of Indonesia’s Islamic education research system in the global context. Second, while there is representation from Egypt, Israel, and Tanzania, the absence of prominent universities from Pakistan, Malaysia, Turkey, Nigeria, and the Arab

Gulf countries indicates a notable institutional shortfall. This shortfall provides an ideal opportunity for institutions like UIN Sunan Kalijaga to engage in international collaborations with Islamic universities from these countries.

Countries with the Most Citations on Artificial Intelligence in Islamic Education

An analysis of the distribution of citations by country reveals an extremely unbalanced pattern. However, it provides valuable insights

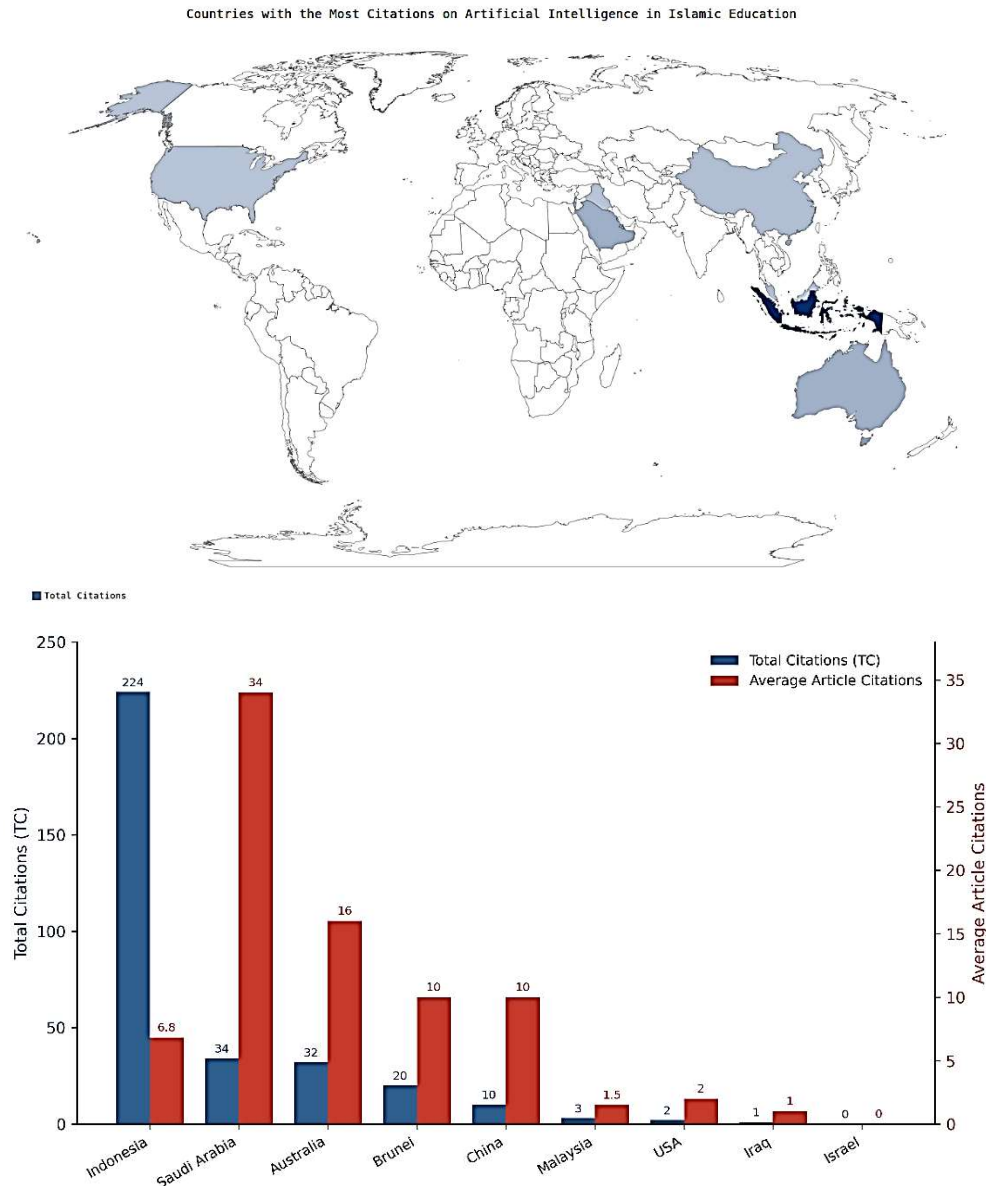


Figure 5. Most cited countries

into the gravity centers of research on artificial intelligence and digital technologies in the context of Islamic education at the international level. If we look at the figures, Indonesia ranks first with 224 citations, exceeding all other countries in our

sample. While the statistics about an extremely unbalanced distribution play their role, we should also keep in mind that the population of Muslims in Indonesia totals more than 230 million. In addition, it should be taken into account that

Indonesia is one of the most populated countries with the largest Muslim community, which makes it the research hub of this issue. In fact, Indonesia has more than 50 State Islamic Universities (UIN), State Islamic Institutes (IAIN), and STAIN.

Malaysia came next with merely 3 citations, followed by the USA with 2, Iraq with 1, and Israel with zero. This observation is particularly striking given that Malaysia is widely acknowledged for possessing a strong Islamic education research environment. However, within the scope of this study, which is limited to the Scopus database, the reason behind Malaysia's low citation count cannot be determined. This gap is therefore noted as a limitation of the present dataset rather than explained, and is left as a direction for future studies that may extend beyond Scopus.

These are the two implications that follow from the pattern above. Firstly, the pattern above shows that Indonesia is ahead in the use of digital technology in Islamic education compared to other countries worldwide. Secondly, there is an immense disparity between Indonesia, which has been cited up to 224 times, and other countries, which have been cited at most 34 times. This implies that the subject matter is highly concentrated geographically; hence, collaboration among countries such as Pakistan, Bangladesh, Nigeria, and Turkey is necessary.

Author Productivity Over Time

The "Productivity of Authors Over Time" metric illustrates the research output of individual scholars concerning AI and digital technology in Islamic education between 2024 and 2026.

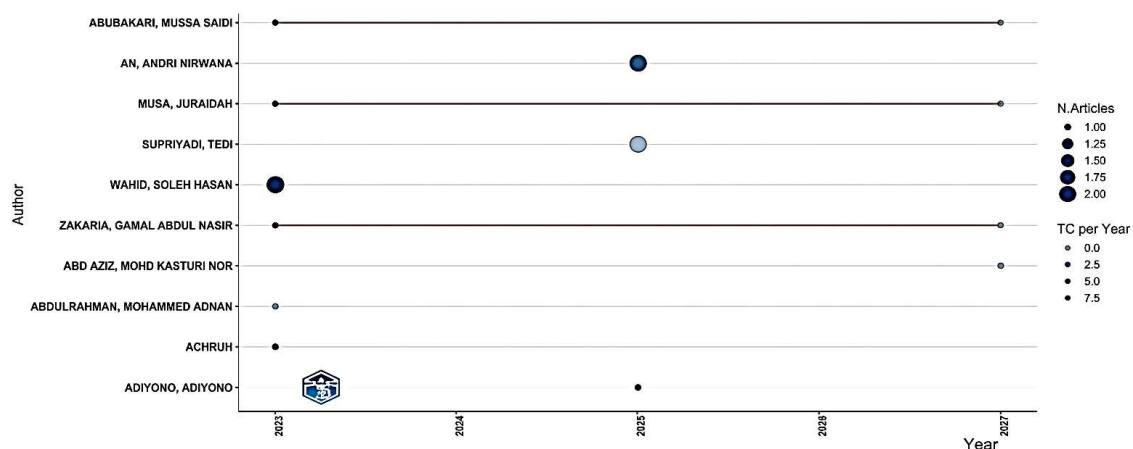


Figure 6. Authors' productivity

According to the Bibliometrix graph, 10 authors emerged as the most prolific, each exhibiting distinct trends in both annual publication volume and citation impact (CI per Year).

Based on the presented findings, Wahid Soleh Hasan exhibits the largest node size in 2024, indicating the highest publication frequency (approximately 2.00 articles) and the greatest annual citation impact (around 7.5 citations per year) within the dataset. His research primarily explores AI in relation to Islamic religious

authority, encompassing a bibliometric analysis of Islam and digital technology, an assessment of the precision of Islamic chatbots in accordance with *fiqh* principles, and an examination of AI's ethical and theological consequences for religious practices. It is this profound thematic depth, rather than mere publication quantity, that accounts for his foundational influence in this domain.

In 2025, An, Andri Nirwana, and Supriyadi Tedi emerged as the most prolific scholars. An contributed a comprehensive SWOT analysis

regarding the incorporation of AI into Islamic education, detailing its cognitive, affective, and psychomotor effects. Meanwhile, Supriyadi presented the DEEP-AI pedagogical model: a four-step approach (Decode, Explore, Examine, Project) designed to enhance Al-Qur'an interpretation literacy via AI-supported teaching. Notably, Supriyadi's work stands out as one of the rare instances in the dataset that provides an actionable pedagogical framework rather than broad theoretical commentary.

The three scholars displaying the longest timeline trajectories in the graph, Abubakari, Mussa Saidi; Musa, Juraidah; and Zakaria, Gamal Abdul Nasir, actually constitute a unified research group affiliated with Universiti Brunei Darussalam. From 2024 to 2026, their collaborative efforts centered on the adoption of technology within Islamic education. Their work includes validating a Technology Acceptance Model (TAM) for digital learning, evaluating the DigComp digital competence framework among Islamic education students, and formulating an Islamic ethical framework for AI governance. Their sustained visibility throughout the period indicates a cohesive, institutionally supported research agenda, rather than isolated or irregular individual contributions.

Among the newly prominent scholars, Abd Aziz and Mohd Kasturi Nor introduce the SEI-CHAT framework, an approach designed to investigate the epistemological, theological, and cultural frictions arising from AI in Islamic religious education. Meanwhile, Achruh explores both the practical hurdles and the potential benefits of integrating AI within Islamic higher education institutions in Indonesia. Taking a more cautious perspective, Adiyono investigates students' increasing dependence on AI to generate exam responses, drawing on empirical evidence from an Indonesian case study.

Overall, the trends in author output point to two main features of this research field. First,

it is clear that the discipline still relies heavily on solo authors who publish relatively little, underscoring the need to develop stronger collaborative research networks. Second, the authors come from a wide array of regions, such as Indonesia (Wahid, Supriyadi, Achruh, Adiyono), African Muslim areas (Abubakari), Southeast Asia (Musa, Zakaria, Abd Aziz), and the Middle East (Abdulrahman). This geographic spread shows that the study of AI in Islamic education has truly taken on a diverse, regional character.

Tree Map Visualization

The tree map represents the proportional frequency of author keywords, where box size corresponds to how often each keyword appears in the corpus, rather than any hierarchical or conceptual relationship between terms. The largest boxes, "artificial intelligence" and "Islamic education," indicate that these are the most frequently used keywords, suggesting that most studies in this corpus explicitly frame their work around this core pairing rather than more specific subtopics.

On the second level, the presence of keywords such as "ChatGPT," "digital transformation," "Islam," and "machine learning" suggests attempts to begin implementing AI ideas in the context of learning. Nevertheless, given the relatively small number of those keywords compared with the main ones, it can be concluded that this realization occurs at an early stage and has not yet become a central topic of study.

At the same time, the presence of so many low-frequency keywords indicates that the topics being studied are quite diverse. While this opens up plenty of opportunities to grow this field in new directions, it also points to a scattered focus, meaning some important issues are not getting the deep academic attention they need to be fully understood.



Figure 7. Topic distribution (tree map analysis)

C The way topics are distributed in this treemap points to an exploratory stage of research, where different approaches were tried to study the subject, with no single one becoming the primary focus. In this case, the research scope remains general, suggesting that a deeper study of the topics has not yet been undertaken.

Thematic Map on Artificial Intelligence in Islamic Education

Thematic maps are among the most helpful bibliometric tools used in defining the intellectual architecture of a particular research discipline (Kokate et al., 2025). This type of map identifies themes along the dual dimensions of centrality,

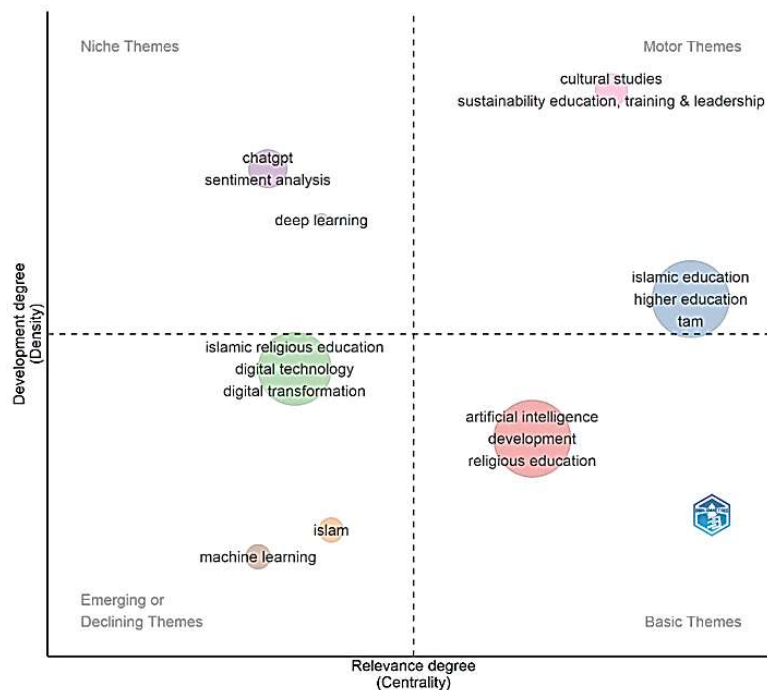


Figure 8. Thematic map

as measured by the horizontal axis. A bibliometric study of AI and digital technology research on Islamic education yielded the distribution of themes into the following four categories:

Top-left quadrant: This represents themes with high density but low centrality, indicating those that were developed independently and have not yet become integral parts of the general research framework. Three themes fall under this category: “ChatGPT,” “sentiment analysis,” and “deep learning.” Niche themes. These represent themes with relatively narrow, cohesive research networks, yet they have not established sufficient conceptual connections to major themes in the field.

The positioning of ChatGPT as a niche theme in this corpus contrasts with its trajectory in the broader educational technology literature, where ChatGPT has rapidly matured into a motor theme, both central and well-developed, since its release in late 2022 (as seen in bibliometric studies of AI in higher education management and of ChatGPT research in Asian education). This contrast suggests that research on Islamic education has been slower to mainstream generative AI discourse than the general education field, even though ChatGPT has already attracted a cohesive group of active researchers in this niche. This gap represents a concrete opportunity: researchers who connect generative AI applications, such as ChatGPT, more explicitly to Islamic educational theory and practice could help bridge this subfield with the broader AI-in-education literature. The same reasoning applies to deep learning and sentiment analysis, both of which remain niche rather than mainstream themes specifically within Islamic education research.

As for the lower-left quadrant, representing themes with both low centrality and low density, it comprises themes in transition. It may include new themes that are not yet fully formed but are on the rise, or themes that are already declining. There are two clusters within this quadrant. They include “Islam” and “machine learning” in the first

cluster, whereas the second one includes “Islamic religious education,” “digital technology,” and “digital transformation.”

It is noteworthy that, despite the presence of “machine learning,” which is considered the most widely used application subfield of AI, in the lower-left quadrant, its applications in Islamic education still lack cohesion and a conceptual network. Regarding the latter two clusters of Islamic religious education, digital technology, and digital transformation, located at the boundary between the emerging and niche themes quadrants, it can be inferred that these themes are undergoing a consolidation stage. There are enough publications available, but these themes do not yet exhibit a coherent thematic connection with one another, suggesting significant research potential.

Those clusters with high centrality and low density are found in the bottom-right quadrant, namely the “artificial intelligence,” “development,” and “religious education” clusters. The subjects in this quadrant are very well interconnected with the rest of the network; however, they are still not forming their own internal cohesive themes. That is why we may assume that AI, development, and religious education are cross-cutting themes that connect other research streams but lack the internal cohesion to constitute a specific subfield of the network.

The importance of recognizing AI as a base theme, not a motor one, is as follows. Although AI is one of the most-used topic keywords, it cannot be considered a theme in itself, as current research still treats it as a general term rather than a concrete theme in the context of Islamic education.

In summary, the strategic implications drawn from the existing thematic map are as follows. Firstly, it would be strategic to improve the relationships between

emerging and driving themes; particularly, to promote the integration of digital transformation and Islamic religious education into

the driving themes of Islamic education and higher education. This would allow these two themes to move from the emerging themes category to the driving themes category. Secondly, it is imperative to immediately investigate the potential of ChatGPT and generative AI as a new niche theme through empirical research that considers Islamic pedagogy, ethics, and academic cheating in the context of generative AI within Islamic education. Thirdly, improving the density of the thematic

cluster of AI from a basic theme to a motor one should be achieved by conducting research in which AI serves as both the object and the method of the study.

Keyword Co-occurrence Network: Cluster Structure and Thematic Research Connectivity

The network analysis conducted in RStudio provides a relational visualization of the intellectual

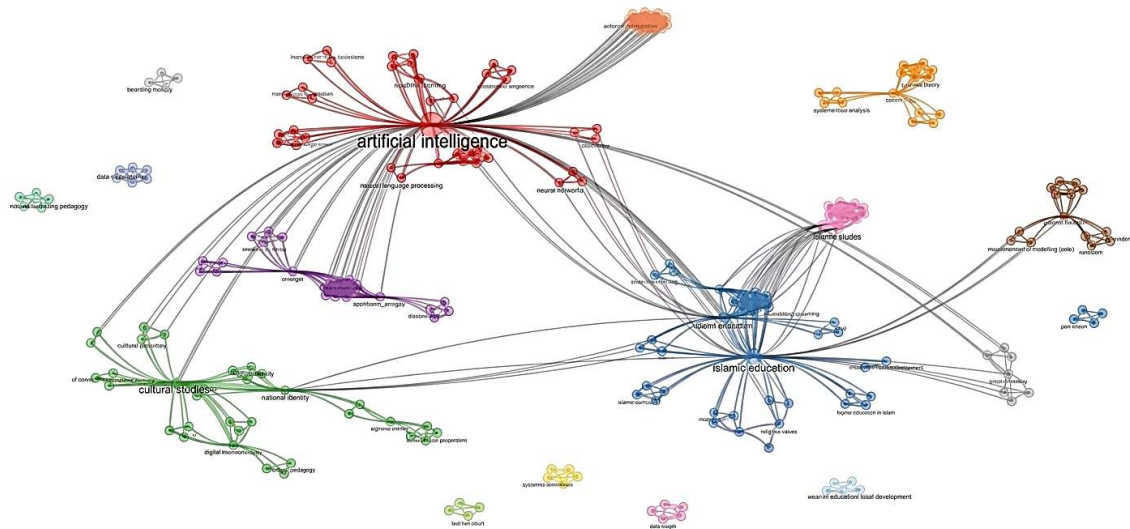


Figure 9. Keyword co-occurrence network

structure of research on AI and digital technologies in Islamic education. Each node in the network denotes a keyword; its size indicates frequency; edge thickness indicates the strength of co-occurrence between two keywords; and node color indicates thematic clusters. The analysis has revealed two main nodes and various thematic clusters, representing different research sub-streams.

Artificial intelligence and Islamic education are two main nodes with high connectivity, as evidenced by their prominent node sizes and the many lines emerging from them. Both nodes act as key hubs connecting almost all clusters in the network, making them both the intellectual basis and thematic connectors of research on this topic. Their high co-occurrence in a document is evident in the thick lines linking these two hubs.

Six major groups can be seen in the diagram by theme, each with a color. The red one focuses on artificial intelligence, with different AI subthemes, suggesting that research in this area is exploring these subthemes. The blue one focuses on Islamic education and addresses pedagogical concepts in this area. The green cluster on the left-hand side has formed a substantial community with themes including digital technology, digital transformation, and other subthemes. Nevertheless, it is relatively far from the two primary hubs, suggesting it is forming its own research cluster. The purple one is located in the middle, connecting the AI cluster and the Islamic Education one, acting as a mediator. The last clusters on the right-hand side of the network diagram are orange and brown, representing less-developed research sub-streams. Small clusters

like yellow, light green, pink, and grey ones are scattered around the diagram's edges and are regarded as emerging research areas.

From an overall perspective of network connectivity, the network appears to be characteristic of a scale-free network, in which some nodes have much more connectivity than others, a pattern usually observed in rapidly growing research fields where full development has not yet been achieved. From the perspective of future research, there should be attempts to create better connectivity between the clusters existing on the fringe of the network, namely, the digital technology cluster and new clusters in relation to major clusters, so that a more coherent thematic network would develop.

Research gaps and future directions for AI research in Islamic Education

From all the results presented in the bibliometric analysis above, four main research gaps have emerged as research priorities for future research.

Gaps in the themes include a preponderance of conceptual papers lacking substantial empirical evidence, particularly regarding *madrasah and pesantren*, where little research has been conducted in the literature. Generative AI and ChatGPT are identified as critical gaps in thematic concerns, given that no study has discussed the implications of these emerging technologies for fostering academic integrity and character building an Islamic perspective. In terms of methodology,

the gaps include a dearth of mixed-methods research, experiments, and computational studies, as well as the absence of assessment instruments for measuring values specific to Islamic education. Geographically-institutional gaps include the huge imbalance in terms of research conducted in Indonesia relative to other Muslim nations such as Pakistan, Nigeria, and Turkey, which appear to be underrepresented in research literature. At the level of keyword metadata, this corpus shows no specific Islamic legal-ethical terms, such as 'adl, *maslahah*, or *maqashid al-syariah*, among the extracted author keywords. This finding reflects keyword patterns only. The absence of these terms as keywords does not necessarily mean the underlying concepts are absent from the full text of the articles, since authors may discuss such values without listing them as keywords. Confirming this would require a qualitative content analysis of a sample of the corpus, which is beyond the scope of this bibliometric study and is recommended as a direction for future research. The specific principles mentioned here are therefore offered only as illustrative examples for future inquiry, not as confirmed findings.

Accordingly, three strategic initiatives are recommended: (1) advancing empirical research on generative AI specifically within non-university Islamic educational settings; (2) developing a comprehensive AI integration framework grounded in Islamic values; and (3) fostering robust cross-regional international collaboration.

Table 4. Research gaps and future directions for AI research in islamic education

Gap Theme	Bashori et al. (2024)	Nashrullah et al. (2025)	Achruh et al. (2024)	Hosna et al. (2026)	Khusniyah et al. (2026)	Suparto et al. (2025)
Thematic Gap (generative AI linked to academic integrity, akhlaq)	Addresses Islamic values (Maqāsid Shariah) in digital transformation , not academic integrity	Addresses teacher digital competence (TPACK), not integrity/akhlaq	Notes AI adoption challenges broadly, not integrity-specific	Direct match, develops AI-based Akidah Akhlak (faith and morals) teaching materials	Direct match, compares ChatGPT feedback vs. peer feedback, touching on originality/writing-skill development	Addresses assessment reliability via deep learning, integrity-adjacent (scoring fairness), not academic-integrity per se

Methodologic al Gap (mixed- methods/expe rimental/valid ated instruments)	Qualitative (interviews, FGD), not empirical/exp erimental	Strong match, quasi- experimental (pre/post-test) with expert- validated instrument (Aiken's V)	Qualitativ e interviews , not empirical	R&D method with material validation, partial match	Strong match, quasi- experimental design with control group (n=41)	Systematic review, not empirical/experim ental
Geographical Institutional Gap (concentration in Indonesia)	Indonesia- based (East Java pesantren)	Indonesia- based	Indonesia- based	Indonesia- based	Indonesia-based	Indonesia-based
ContextualVal ue Gap ('adl, masalah, maqashid al- syariah)	Direct match, explicitly examines Maqāsid Shariah principles in digital/econo mic transformation	-	-	Values- oriented (Akidah Akhlaq) but does not name maqashid al- syariah explicitly.	-	-

■ CONCLUSION

This study aimed to systematically map the prevailing research trends, prominent contributors, publication productivity, thematic frameworks, and existing gaps regarding AI and digital technology in Islamic education. Based on the analysis, several key conclusions can be drawn.

As for research trends (RQ1), the field is still in its infancy, marked by a recent, rapid spike in publications rather than a slow, steady climb. Turning to influential contributors (RQ2), the literature is currently clustered among a small group of authors and institutions in Indonesia. Because participation from other significant Muslim-majority regions remains sparse, the field’s intellectual leadership is not yet representative of the wider global landscape.

Regarding scientific productivity (RQ3), collaboration patterns indicate a field in the process of consolidation, shifting from isolated, individual work toward increasingly collaborative, multidisciplinary team efforts. In terms of thematic structure (RQ4), while the research is firmly grounded in the established pillars of Islamic and higher education, nascent technological applications such as ChatGPT, sentiment analysis,

and deep learning remain peripheral, with limited integration into core Islamic educational discourse. Regarding research gaps and prospective directions (RQ5), this analysis identifies persistent limitations in thematic depth, methodology, geographic representation, and value-based contextualization, all of which constrain the field’s scholarly maturity. Consequently, three strategic priorities emerge: bolstering international collaboration with underrepresented Muslim-majority regions; conducting rigorous empirical research that bridges generative AI with Islamic ethical values; and developing AI applications explicitly derived from Islamic pedagogical frameworks. Addressing these imperatives is essential to transitioning the field from its current nascent state toward a more mature and globally representative body of knowledge.

■ DECLARATION OF GENERATIVE AI USAGE IN THE WRITING PROCESS

During the preparation of this work, the authors utilized Claude (Anthropic) to refine language, grammar, and overall clarity. ChatGPT (OpenAI) was employed to evaluate the

manuscript's quality and competitiveness prior to submission. These AI tools were used solely for linguistic and structural improvements; they were not employed to generate research data, analysis, findings, or conclusions. The authors have reviewed, verified, and edited the final output, and therefore take full responsibility for the content, accuracy, and originality of this publication.

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