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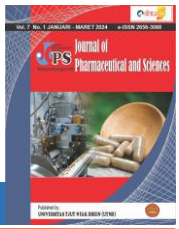

Trends in Bioethics, Genetics, and Education Research in the Muslim Context: A Bibliometric Analysis (2016–May 2026)

Tren Penelitian Bioetika, Genetika, dan Pendidikan dalam Konteks Muslim: Analisis Bibliometrik (2016–Mei 2026)

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Abstract
Rapid advancements in genomics, genetics, and biotechnology have generated ethical challenges that require scholarly engagement, including in Muslim contexts. This study maps global publication trends on bioethics, genetics, biotechnology, and education in Muslim contexts from 2016 to May 13, 2026. Data were retrieved from the Scopus database using a predefined search string and screened through a PRISMA-based selection procedure. Of the 343 records initially identified, 130 documents met the inclusion criteria. Bibliometric data were analyzed descriptively and visualized using VOSviewer to examine publication trends, source productivity, keyword co-occurrence, and collaboration networks. The findings show growing scholarly attention to bioethics and health-related issues, particularly since 2022, with bioethics and Islam serving as central thematic nodes. However, education-related terms, especially those connected to Islamic education beyond medical education, are relatively underrepresented in the analyzed dataset compared with health-oriented bioethics themes. This pattern indicates that existing Scopus-indexed literature has more strongly developed clinical, biomedical, and normative-religious discussions than curriculum- or pedagogy-focused studies. As a descriptive bibliometric study, this article does not evaluate curriculum quality or the actual implementation of bioethics education. Instead, it identifies a thematic gap that should be examined further through qualitative, curriculum-focused, and institution-based research in Islamic educational settings.

***Keywords*: Bioethics, Genetics, Islamic Education, Muslim Context, Bibliometrics, VOSviewer.**

Abstrak
Kemajuan pesat dalam genomik, genetika, dan bioteknologi memunculkan tantangan etis yang memerlukan keterlibatan akademik, termasuk dalam konteks masyarakat Muslim. Penelitian ini memetakan tren publikasi global tentang bioetika, genetika, bioteknologi, dan pendidikan dalam konteks Muslim dari tahun 2016 hingga 13 Mei 2026. Data diperoleh dari basis data Scopus menggunakan string pencarian yang telah ditentukan dan diseleksi melalui prosedur berbasis PRISMA. Dari 343 dokumen yang teridentifikasi pada tahap awal, 130 dokumen memenuhi kriteria inklusi. Data bibliometrik dianalisis secara deskriptif dan divisualisasikan menggunakan VOSviewer untuk mengkaji tren publikasi, produktivitas sumber, ko-okurensi kata kunci, serta jaringan kolaborasi. Temuan menunjukkan meningkatnya perhatian akademik terhadap isu bioetika dan kesehatan, terutama sejak 2022, dengan bioetika dan Islam sebagai simpul tematik utama. Namun, istilah yang berkaitan dengan pendidikan, khususnya pendidikan Islam di luar pendidikan kedokteran, masih relatif kurang terwakili dalam dataset yang dianalisis dibandingkan tema bioetika berorientasi kesehatan. Pola ini menunjukkan bahwa literatur terindeks Scopus lebih kuat berkembang pada diskusi klinis, biomedis, dan normatif-keagamaan daripada kajian yang berfokus pada kurikulum atau pedagogi. Sebagai studi bibliometrik deskriptif, artikel ini tidak mengevaluasi mutu kurikulum atau implementasi aktual pendidikan bioetika. Artikel ini mengidentifikasi kesenjangan tematik yang perlu diteliti lebih lanjut melalui studi kualitatif, berfokus kurikulum, dan berbasis institusi dalam konteks pendidikan Islam.

***Kata Kunci*: Bioetika, Genetika, Pendidikan Islam, Konteks Muslim, Bibliometrik, VOSviewer**

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Introduction

The contemporary era is marked by a biological revolution, driven by the convergence of large-scale genomic data, genetic analysis, biotechnology, and artificial intelligence [1]. This development extends beyond technical progress, representing an epistemological shift that challenges fundamental concepts of creation and human identity. In Muslim societies, advancements in genomics present both opportunities for transformative medical interventions and complex bioethical dilemmas. These challenges are particularly pronounced regarding the boundaries of human intervention in the creation of Allah SWT [2]. Insufficient and delayed responses to these issues have contributed to scientific stagnation and risk undermining religious ethical authority. The situation is compounded by the growing influence of secular science, which often advances without sufficient moral oversight.

The need to address bioethics, genomics, genetics, and biotechnology is increasingly urgent. However, these fields in many Muslim-majority countries continue to encounter significant obstacles, resulting in fragmented and reactive development [3]. Researchers from prominent scientific centers in the Muslim world, such as Saudi Arabia and Malaysia, have made substantial contributions to global genomics research [4], [5]. Despite this, preliminary reviews suggest that scholarly discourse remains largely focused on legal-formalistic debates within Islamic jurisprudence [6], [7], with academic discussions often centered on the permissibility (halal or haram) of specific genetic interventions. In contrast, philosophical and educational perspectives on contemporary bioethical issues in pedagogy receive limited attention in the global Islamic educational literature [8], [9].

Bioethical literacy rooted in the principle of tauhid is essential for equipping Muslim youth with the ethical competence required to engage with modern science [10], [11]. In the analyzed literature, studies addressing the integration of bioethics, genomics, genetics, and biotechnology into Islamic education remain relatively underrepresented compared with health-oriented bioethics discussions. This is particularly evident in relation to curriculum integration, pedagogy, and bioethics literacy in Islamic educational settings, including madrasahs, pesantrens, Islamic schools, and Islamic higher education institutions [12], [13]. Therefore, any curriculum-oriented implications derived from this bibliometric mapping should be understood as directions for future inquiry rather than as ready-to-implement curricular prescriptions. Within the Scopus-indexed literature analyzed in this study, explicit discussions on how Islamic educational institutions respond to genetic engineering and other bio-digital developments remain limited. A comprehensive bibliometric overview is thus necessary to determine how far these themes have been represented in scholarly discourse and to identify directions for further qualitative, curriculum-focused, and institution-based studies.

This study aims to address gaps in the existing literature by conducting a systematic bibliometric mapping. It examines global trends in bioethics, genomics, genetics, biotechnology, and education within Islamic or Muslim contexts from 2016 to May 13, 2026, using Scopus as the primary data source. The research situates education in Islamic or Muslim contexts within the broader landscape of international bio-digital research. The bibliometric analysis is descriptive and focuses on mapping publication trends, thematic structures, keyword relationships, and collaboration patterns. This study does not produce curriculum recommendations; rather, it maps the existing literature to inform future qualitative, curriculum-focused, and institution-based research agendas.

Methods

A quantitative bibliometric approach, supported by PRISMA-based document selection, was employed to systematically map trends, patterns, and key entities in the discourse on the integration of bioethics, genomics, genetics, biotechnology, and Islamic education. The document selection process followed a sequential and transparent procedure using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework [33], [34] with publication year, document type, and language considered to obtain a final, relevant dataset for bibliometric analysis.

To avoid conceptual ambiguity, several key terms were operationally defined in this study. The term "Muslim context" refers to publications that explicitly situate bioethics, genomics, genetics, biotechnology, or genetic engineering within Islamic, Muslim, or Muslim-majority social, cultural, legal, educational, or institutional settings. This term is not limited to Muslim-majority countries, because relevant studies may also be produced by scholars or institutions outside the Muslim world when the subject matter explicitly concerns Islam or Muslim communities. Meanwhile, "Islamic education" refers to educational discourse, institutions, curricula, pedagogical practices, or literacy development that are explicitly connected to Islamic values, Islamic epistemology, Muslim learners, madrasahs, pesantrens, Islamic schools, Islamic universities, or other formal and informal Islamic educational settings. The broader term "education" was retained in the search strategy to capture publications related to teaching, learning, curriculum, pedagogy, literacy, schools, or universities, although not all of these publications necessarily address Islamic education directly. Therefore, this study distinguishes between education-related literature in general and literature that explicitly addresses Islamic education.

The inclusion criteria comprised: (1) documents published from 2016 to May 13, 2026 and indexed in Scopus as of May 13, 2026, (2) written in English, and (3) relevance to the themes of bioethics, genomics, genetics, biotechnology, or genetic engineering within the context of Islam, Muslims, and education. Because the search was conducted on May 13, 2026, records from 2026 represent partial-year data and should not be interpreted as a complete annual publication output. Topical relevance was determined by searching within titles, abstracts, and keywords. The bibliometric analysis was conducted using VOSviewer software to visualize bibliographic data. The analysis included citation analysis, co-authorship by authors and countries, and co-occurring keywords. The objective was to reveal the intellectual structure and dynamics of the research field. VOSviewer was used to generate author keyword co-occurrence maps, author co-authorship, and country co-authorship networks. These analyses facilitated the identification of thematic structures, collaboration patterns, and evolving dynamics within the research area. Data were analyzed using bibliometric methods and systematic observation to provide a comprehensive understanding of the historical development and future directions of research in bioethics, genomics, and Islamic education [35] This approach enabled the synthesis of empirical findings and a strategic depiction of the research landscape. The research commenced with the formulation of keywords using a macro (top-down) approach beginning with broad terms and progressing to more specific ones. The evaluation of limitations in prior studies and the relatively limited representation of bio-digital topics in Islamic education formed the basis for conducting the Scopus search. This search was executed within titles, abstracts, and keywords using the following string: TITLE-ABS-KEY ((“bioethics” OR genomics OR genetics OR biotechnology OR “genetic engineering”) AND (Islam* OR Muslim*) AND (education OR curriculum OR pedagogy OR teaching OR learning OR literacy OR school* OR university*)).

The search string was intentionally constructed using umbrella terms such as "bioethics," "genomics," "genetics," "biotechnology," and "genetic engineering" to maintain a focused and reproducible corpus at the intersection of biosciences, Muslim contexts, and education. More specific terms, such as CRISPR, gene editing, gene therapy, and stem cell, were not included as separate search terms because the present study was designed to map broader thematic trends rather than to conduct a technology-specific review of particular biomedical interventions. Nevertheless, relevant publications using these specific terms could still be retrieved when they also contained the broader terms included in the search strategy within the title, abstract, or keywords.

The Scopus database was selected as the primary source due to its extensive coverage of reputable journals and provision of rich metadata essential for bibliometric analysis [36], [37]. Scopus also enables precise citation tracking [38], identification of Islamic bioethics experts, and monitoring of research trends. The adopted method is descriptive and focuses on literature mapping. Claims regarding curriculum

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development or educational effectiveness are presented as recommendations for future research, rather than direct evaluations based on bibliometric data.

The initial search identified 343 documents, which were subsequently screened in stages based on year, document type, and language. A total of 141 documents were excluded because they fell outside the defined publication coverage from 2016 to May 13, 2026. Furthermore, 64 documents were excluded because of inappropriate document types, and 8 documents were excluded because they were not written in English. The final dataset for bibliometric analysis comprised 130 documents. Although VOSviewer effectively maps keyword relationships and author collaboration patterns, this analysis does not assess the quality of educational content, curriculum implementation, or the effectiveness of bioethics integration into educational settings. Further qualitative, curriculum-focused, and institution-based research is required to examine the practical development of bioethics literacy in Islamic educational contexts. Another methodological limitation concerns the use of broader umbrella terms in the search strategy. Because specific biomedical terms such as CRISPR, gene editing, gene therapy, and stem cell were not included as independent search terms, some highly specialized publications may not have been captured if they did not also use the broader terms applied in this study.

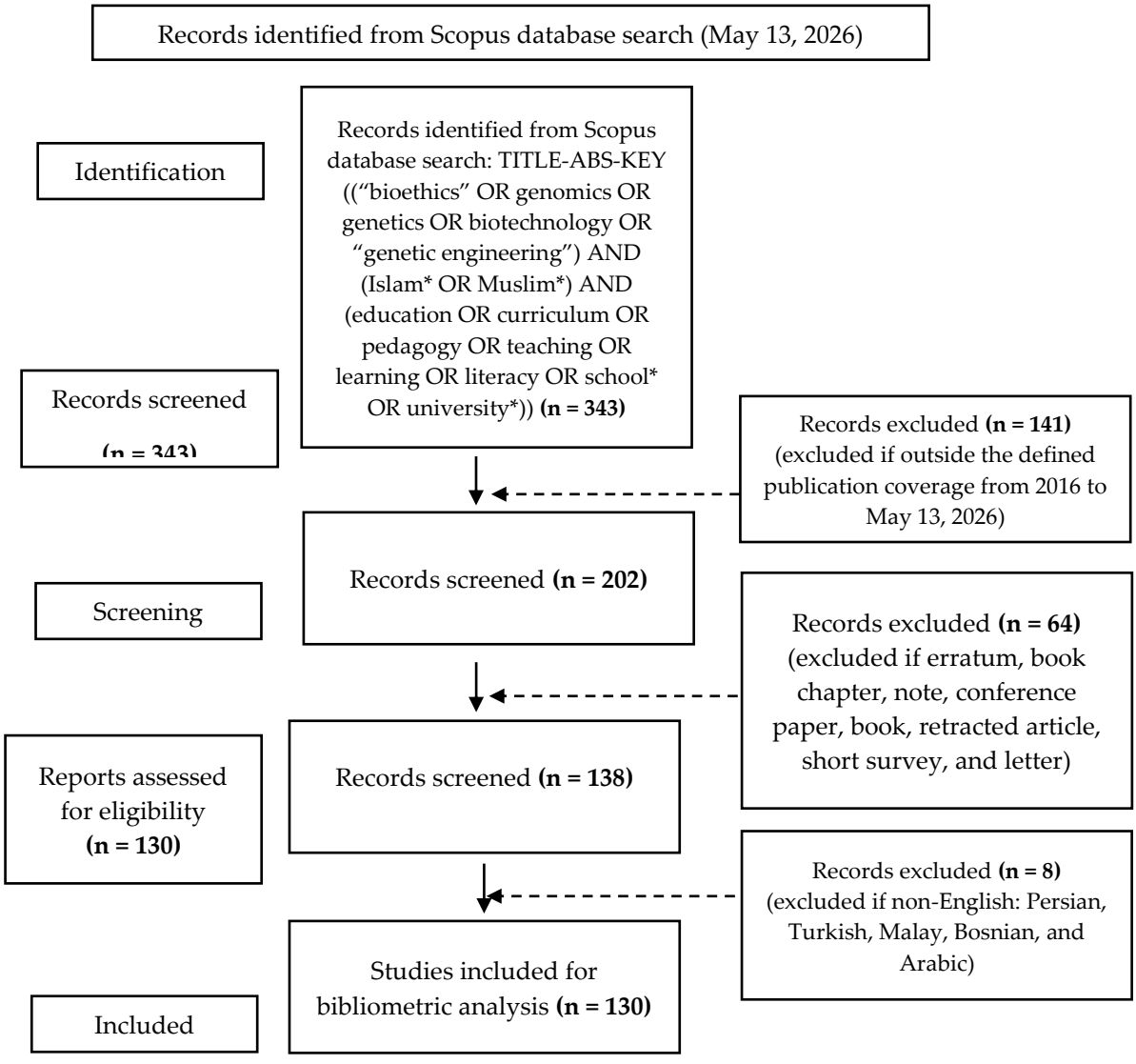

Diagram 1. PRISMA Framework. The diagram shows the study selection process for the bibliometric analysis based on records retrieved from the Scopus database on May 13, 2026. From 343 identified records, 141 records were excluded based on the defined publication coverage from 2016 to May 13, 2026, 64 records were excluded based on document type, and eight records were excluded because they were written in languages other than English. A total of 130 studies met the inclusion criteria and were included in the final bibliometric analysis. The 2026 data therefore represent partial-year coverage rather than a complete annual publication period.

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Results

A rigorous selection process using the Scopus database resulted in a final dataset of 130 documents published from 2016 to May 13, 2026. This dataset consists of 126 research articles and 4 review articles, with 128 documents fully published and 2 classified as articles in press. These documents have collectively received 974 citations, averaging 7.49 citations per document, which demonstrates the substantial impact and influence of research in this field.

The annual publication trend demonstrates a general increase, despite periodic fluctuations between 2016 to May 13, 2026. The lowest output occurred in 2016 (3 documents), followed by notable growth in 2017 and 2018 (14 and 15 documents, respectively), and sustained productivity in 2019 (14 documents). Publication numbers declined in 2020 (7 documents) but rose modestly in 2021 (8 documents). Both 2022 and 2023 recorded 13 documents each, with the highest complete annual output observed in 2024 (18 documents), followed by 16 documents in 2025. The 2026 figure, consisting of 9 documents, should be interpreted cautiously because the Scopus search was conducted on May 13, 2026 and therefore represents partial-year data rather than a complete annual output. Overall, these data indicate increasing scholarly interest in bioethics, genomics, genetics, biotechnology, and education within the Muslim context.

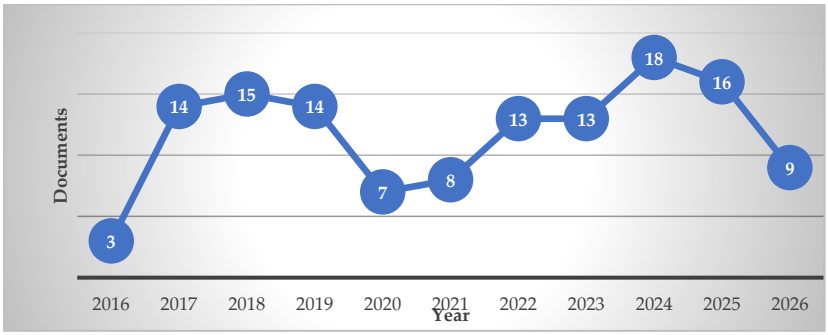

Figure 1. Annual publication trend (2016 – May 13, 2026)

An analysis of publication sources indicates that the Journal of the Pakistan Medical Association is the most prolific, contributing 12 documents. The Journal of the College of Physicians and Surgeons Pakistan, Journal of Bioethical Inquiry, Pharos Journal of Theology, and Scientific Reports each contributed 3 documents. Additional notable sources include Advances in Medical Education and Practice, Pakistan Journal of Medical Sciences, Journal of Religion and Health, Asia Pacific Journal of Clinical Nutrition, and American Journal of Medical Genetics Part A, each publishing 2 documents.

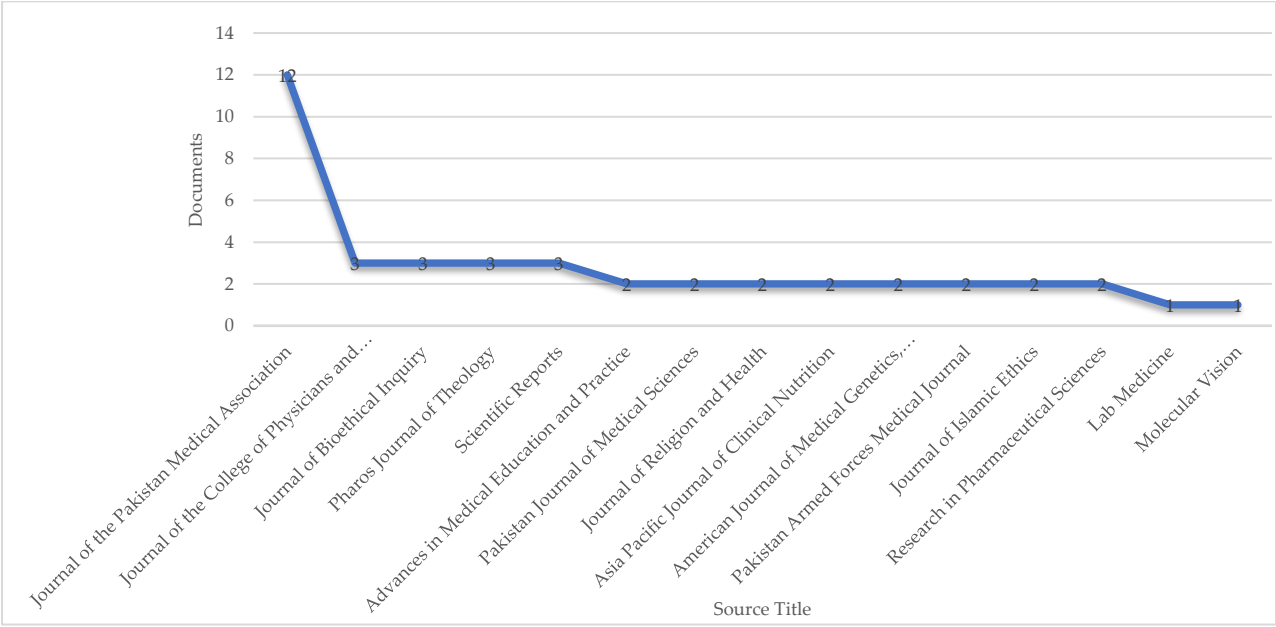

Figure 2. Most productive sources

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Padela A.I., Afzal M., and Naveed A.K. are the most prolific contributors, each with five publications. Khan M.A. and Iqbal M. follow, each having produced four publications. Other authors have contributed consistently, albeit with fewer publications. These findings indicate that the advancement of this research field depends on a relatively concentrated group of scholars. These researchers frequently investigate the intersections of bioethics, genetics, biotechnology, and education within the Muslim context.

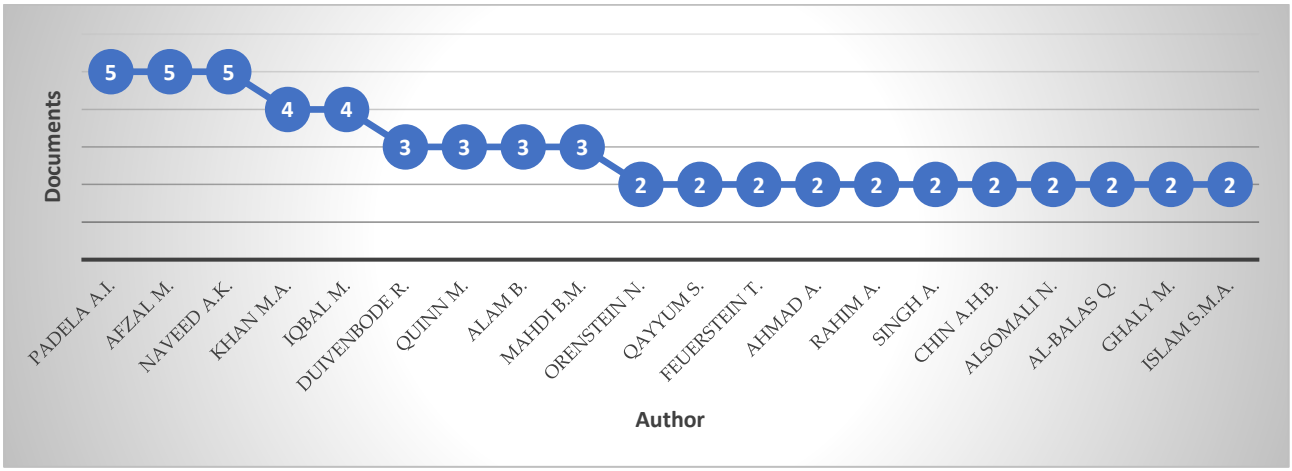

Figure 3. Most productive authors

Analysis of author affiliations indicates that Pakistan is the most productive country, with 46 published documents. The United States follows with 18 documents, Iran with 15 documents, and both Malaysia and Saudi Arabia contributing 10 documents each. Israel and Indonesia each account for 8 documents, while India, China, and the United Kingdom each contribute 7 documents. These results demonstrate that the research landscape on bioethics, genomics, genetics, biotechnology, and education in the Muslim context is influenced by contributions from both Muslim-majority countries and institutions outside the Muslim world.

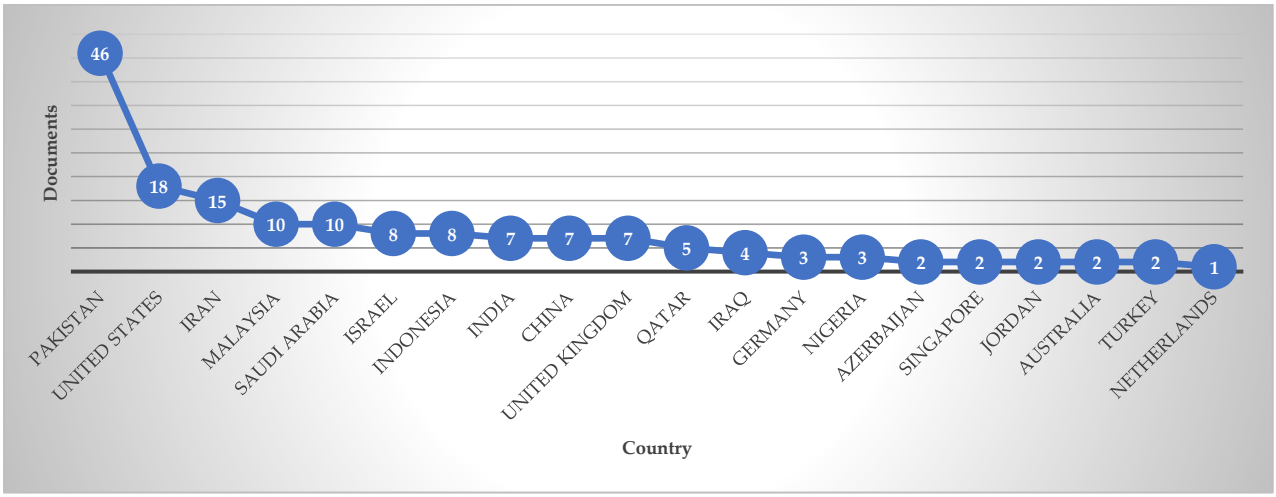

Figure 4. Most productive countries

The most highly cited publication in the dataset is "A Review of the Reproductive Consequences of Consanguinity" (2019), which has received 100 citations. Other notable works include "Improvement of Citral Antimicrobial Activity by Incorporation into Nanostructured Lipid Carriers" (2017) with 52 citations, "Probiotics and Their Use in Inflammatory Bowel Disease" (2018) with 35 citations, "Physiological and Biochemical Assisted Screening of Wheat Varieties Under Partial Rhizosphere Drying" (2017) with 34 citations, and "Congenital Myasthenic Syndrome in Israel: Genetic and Clinical Characterization" (2017) with 33 citations. The prominence of these frequently cited documents highlights the dataset's primary thematic focus on genetics, health sciences, and applied biosciences. Following the citation distribution analysis, a detailed examination of the dataset's thematic structure is undertaken.

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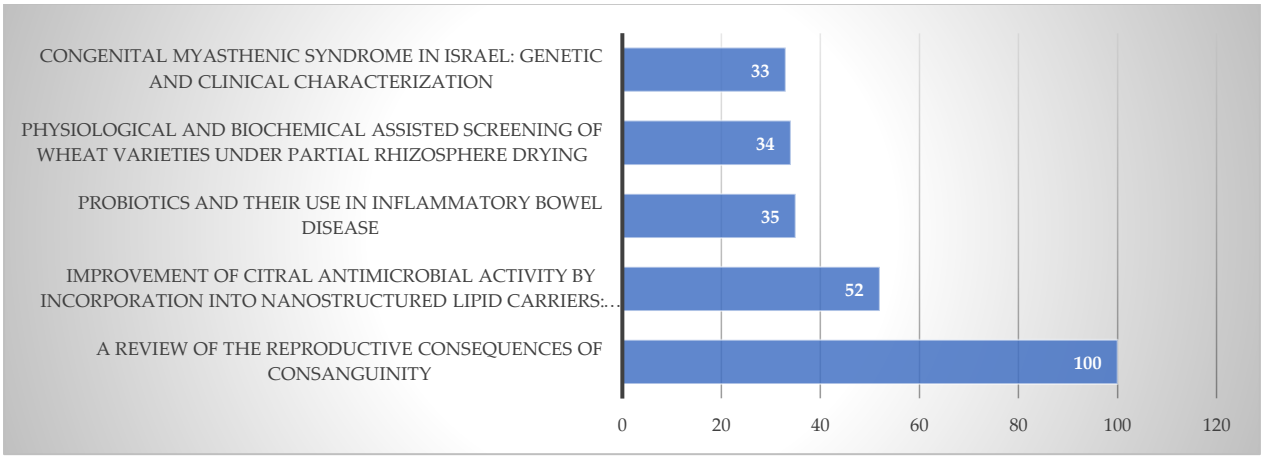

Figure 5. Most Cited Documents

To enable a more comprehensive exploration of the dataset's thematic structure, a keyword co-occurrence analysis was conducted using VOSviewer version 1.6.20. The aim of this analysis was to identify the principal thematic areas represented in the dataset. The analysis parameters included co-occurrence as the type of analysis, author keywords as the unit of analysis, full counting as the counting method, and a minimum occurrence threshold of two. During the verification phase, non-relevant terms such as country names, highly technical biomedical terminology, and non-substantive keywords were manually excluded to ensure the resulting thematic map was clear and focused.

The co-occurrence analysis of author keywords reveals that the thematic network is organized around bioethics and Islam as the two central nodes. Other keywords form thematically interrelated clusters, including Islamic bioethics, organ transplantation, religion, public health, human rights, human dignity, personhood, genetic engineering, medical education, medical students, euthanasia, and education. The visual representation of this network suggests that the dataset is primarily structured around bioethical issues within the Muslim context. In the author-keyword co-occurrence map, education-related keywords occupy a more peripheral and limited position relative to health- and ethics-oriented terms. This pattern indicates relative underrepresentation within the analyzed keyword network rather than the complete absence of educational research.

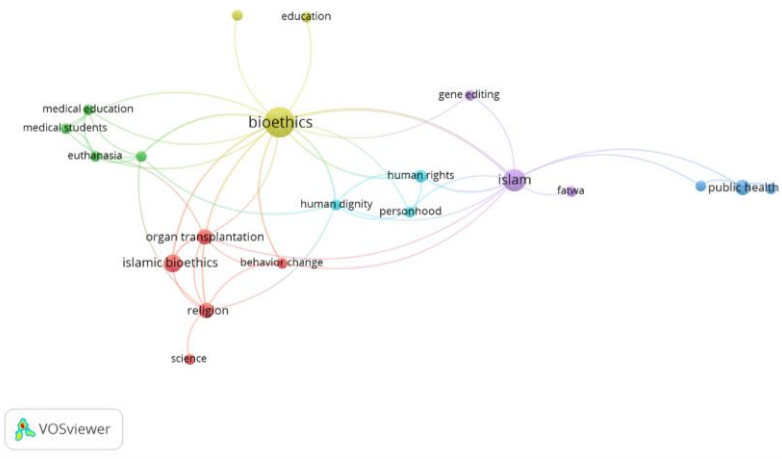

Figure 6. Network Visualization of Author Keyword Co-occurrence

Table 1 also shows that medical education has a higher total link strength than the broader term education. This indicates that educational discussions in the dataset are more closely connected to medical or health-professional training than to general or explicitly Islamic educational contexts.

The overlay visualization shows how themes in the dataset change over time. Earlier themes center on religion, science, public health, and education, while more recent themes include medical education, human rights, fatwa, and bioethics. Bioethics stands out as a central node with a relatively recent publication average, indicating its growing importance in current research. The emergence of medical education and fatwa as more recent terms suggests that bioethical issues are increasingly discussed in relation to health-professional

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training and Islamic normative responses. However, this pattern should not be interpreted as evidence that bioethics has been equally integrated into broader Islamic educational contexts. Rather, it indicates that education-related discussions in the recent thematic layer are more visible through medical education than through general or explicitly Islamic education.

Table 1. Top author keywords in co-occurrence analysis

No	Keyword	Occurrences	Total Link Strength
1	Bioethics	16	26
2	Islam	9	16
3	Islamic Bioethics	6	6
4	Organ Transplantation	4	8
5	Public Health	4	8
6	Religion	4	8
7	Human Rights	3	6
8	Education	2	1
9	Gene Editing	2	2
10	Medical Education	2	4

Source: VOSviewer analysis

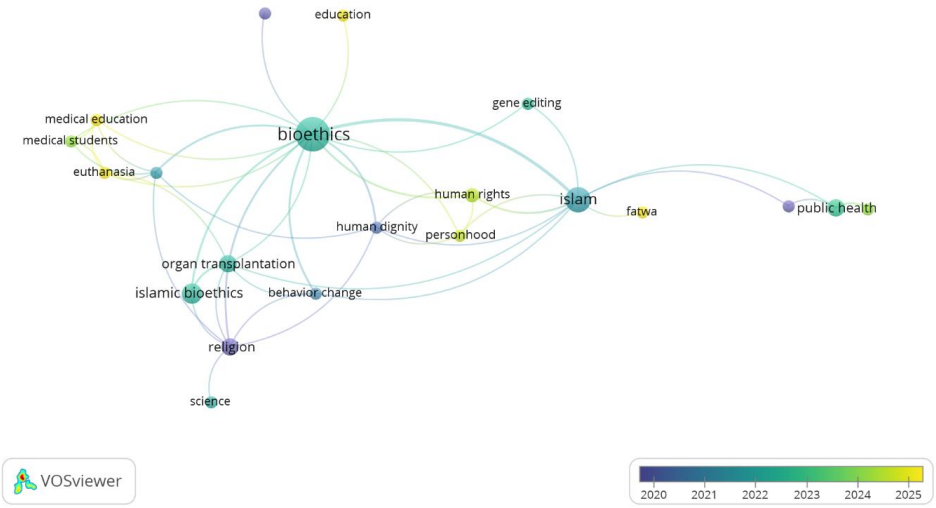

Figure 7. Overlay Visualization of Author Keyword Co-occurrence

The density visualization analysis demonstrates that the themes of bioethics and Islam are the most dominant and exhibit the highest degree of interconnectedness within the analyzed dataset. High-density areas are also identified around topics such as public health, Islamic bioethics, organ transplantation, and religion, indicating that these issues constitute the primary thematic concentrations in the analyzed literature. Conversely, education-related keywords, including education, medical education, and medical students, display lower density. This suggests that educational themes are present in the dataset but are less densely connected than bioethics, Islam, and health-oriented themes. Therefore, the density map should be interpreted as showing the relative position and connectivity of education-related terms within the keyword network, not as evidence of the absence of educational research.

The co-authorship analysis demonstrates that the collaboration patterns within the dataset predominantly form in limited and fragmented networks. Network visualization identifies several small groups of interconnected authors, with Afzal and Muhammad serving as central nodes. Furthermore, smaller collaboration clusters are evident, such as the group comprising Iqbal, Muhammad, Khan, Mueen Alam, Alam, Beena, and Iqbal, Rashid, as well as the group involving Naveed, Abdul Khaliq, Qayyum, Shazia, and Humphries, Steve E. These findings indicate that author collaboration in this field remains concentrated within specific groups and has not yet developed into an extensive collaborative network.

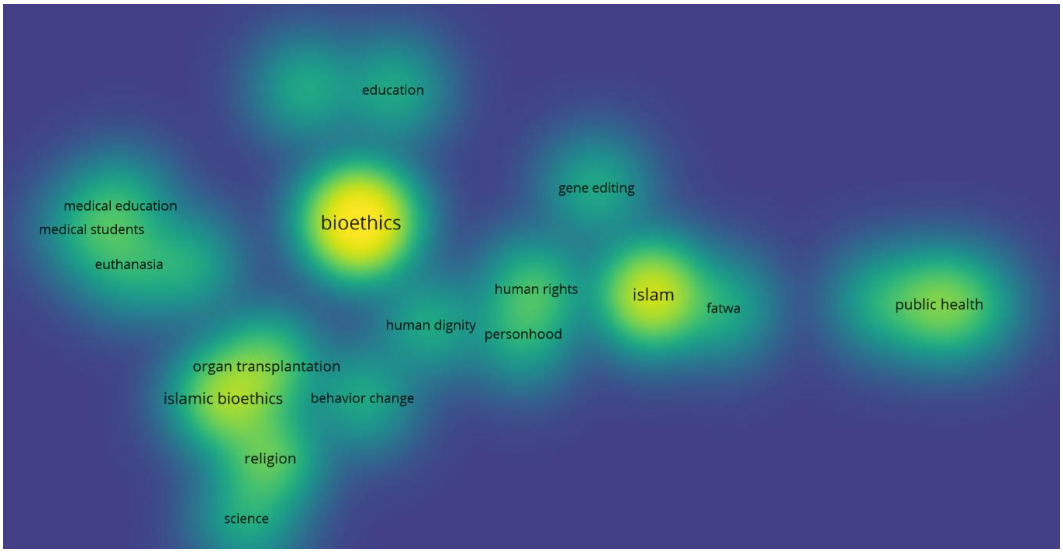

Figure 8. Density Visualization of Author Keyword Co-occurrence

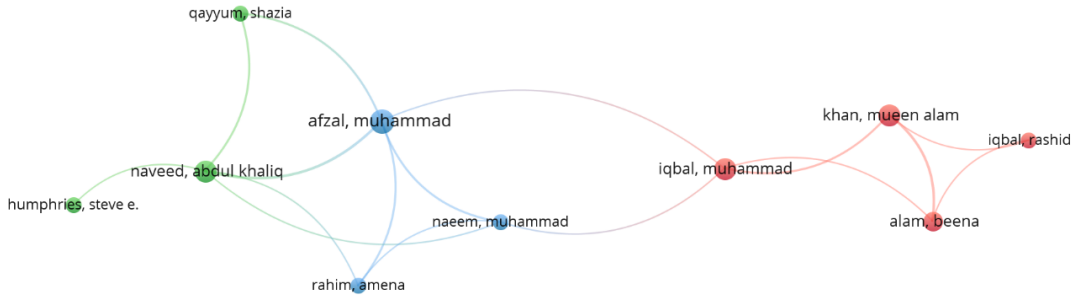

Figure 9. Network Visualization of Author Co-authorship

An inter-country co-authorship analysis indicates that international collaboration in this dataset forms several interconnected clusters, with Pakistan serving as the most dominant and central node in the network. Pakistan is connected to several countries, including China, Saudi Arabia, the United Kingdom, India, and Turkey, highlighting its role as a major collaboration hub in the analyzed dataset. Saudi Arabia also functions as a notable connecting node, being linked to China, Qatar, Jordan, and Malaysia. Another cluster demonstrates collaborations among the United States, India, Turkey, the United Kingdom, and Australia. Overall, this mapping shows that inter-country collaboration in research on bioethics, genetics, biotechnology, and education within Muslim contexts is present but remains concentrated among certain countries. This pattern should be understood as a feature of the analyzed Scopus-indexed dataset rather than as a complete representation of collaboration across the entire Muslim world.

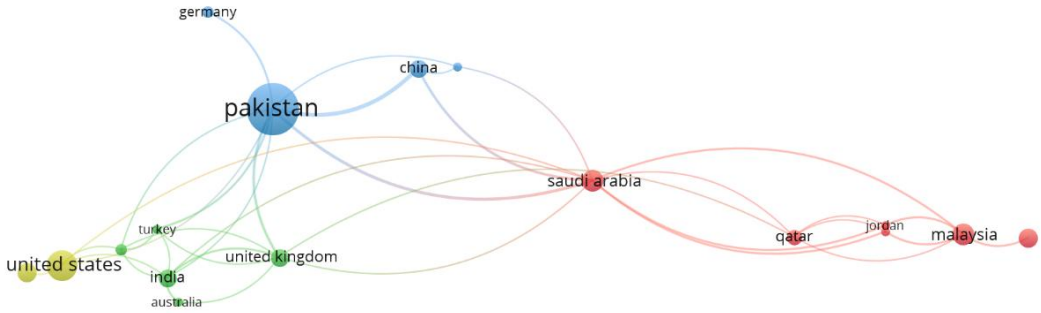

Figure 10. Network Visualization of Country Co-authorship

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Discussion

Analysis of the annual publication trend indicates growing scholarly attention to bioethics, genomics, and biotechnology within the Muslim context, with the highest complete annual output recorded in 2024. Figure 1 illustrates this upward tendency, particularly after 2022, and reflects an academic response to advances in bio-digital technologies that require ethically grounded guidance informed by Islamic values. However, the 2026 data should be interpreted cautiously because the Scopus search was conducted on May 13, 2026; therefore, the lower number of publications in 2026 represents partial-year data rather than a complete annual decline. This trend is consistent with global research showing that studies on Islam and morality also peaked in 2024, indicating a shift in scholarly focus from traditional legal issues to more complex contemporary bioethical concerns [39]. Despite the overall growth in publications, this expansion remains uneven, likely due to the complexities of aligning modern genomic discoveries with the ontological framework of Islam [40]. Consequently, Figure 1 provides quantitative evidence of increasing scholarly engagement while also showing that discourse on human identity in the genomic era has become an important focus in contemporary Islamic thought [41].

There is a notable imbalance in the distribution of publication sources, with the analyzed literature being more strongly represented in medical, biomedical, and public health-related outlets. Figure 2 shows that the Journal of the Pakistan Medical Association is the leading contributor, indicating that discussions on Islamic bioethics in this dataset are more visible in clinical and public health contexts than in curriculum- or pedagogy-oriented journals. This pattern suggests a relative underrepresentation of education-focused discussions, particularly those explicitly related to Islamic education beyond medical education. Therefore, the finding should not be interpreted as evidence that educational research is absent, but rather as an indication that health-oriented bioethics themes are more central within the Scopus-indexed corpus analyzed in this study. These findings point to the need for further qualitative studies to examine how bioethics can be pedagogically addressed in Islamic educational settings [42] Curriculum-focused research is also needed to clarify how genetics and biotechnology can be introduced without reducing Islamic education to purely biomedical instruction [43] In addition, institution-based studies may help explain how madrasahs, pesantrens, Islamic schools, and Islamic higher education institutions respond to contemporary bio-digital challenges [44].

The concentration of contributions among specific groups of authors, as shown in Figure 3, suggests that the field remains influenced by a limited number of recurring scholars. Individuals such as Padela A.I., who is recognized for bridging medicine and Sharia, have contributed significantly to the development of this discourse [45], [46]. While the consistency of authorship depicted in Figure 3 provides a degree of theoretical continuity, reliance on a relatively concentrated group of contributors may narrow the conversation toward medical bioethics and limit broader engagement with education, social sciences, and interdisciplinary curriculum studies [41]. Addressing this issue requires expanded collaboration among scholars from bioethics, Islamic studies, education, medicine, and social sciences so that future research can more adequately examine bio-digital challenges in Muslim educational contexts [39] [47].

The country-level analysis in Figure 4 shows that Pakistan is the most productive country in the dataset, followed by the United States, Iran, Malaysia, and Saudi Arabia. This pattern indicates that research on bioethics, genetics, biotechnology, and education in Muslim contexts is shaped by contributions from both Muslim-majority countries and institutions outside the Muslim world. However, the distribution also suggests that knowledge production remains concentrated in a limited number of countries. Similar patterns of uneven collaboration have been reported in bioethics and medical ethics research in Muslim-majority regions. Mardani et al. also noted that productive research networks may remain relatively fragmented when collaboration does not extend across broader institutional and geographic boundaries [48]. This fragmentation may limit the development of broader and more integrative Islamic perspectives in bio-digital discourse [49]. Therefore, Figure 4 should be interpreted not only as an indicator of national productivity, but also as evidence of the need for wider cross-national collaboration in future research.

Transitioning from publication productivity to scientific influence, Figure 5 shows that the most cited documents are mainly associated with genetics, reproductive health, clinical issues, and applied biosciences. This citation pattern indicates that the most visible publications in the dataset are more strongly connected to biomedical and health-related concerns than to educational or pedagogical themes. Such a pattern is consistent with the broader tendency of Islamic bioethics literature to engage with practical clinical problems and normative biomedical questions [47]. It also supports the argument that educational themes, particularly those

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related to Islamic education beyond medical education, are relatively less visible in the analyzed citation landscape [48]. However, this finding should be understood as a bibliometric indication of relative visibility, not as evidence that educational research is absent.

The co-occurrence analysis presented in Figure 6 and Table 1 clarifies the thematic structure of the analyzed dataset. The terms "bioethics" and "Islam" appear as the most central nodes, indicating that the literature is primarily organized around ethical and religious discussions within Muslim contexts. In contrast, "education" and "medical education" appear with lower occurrence values. Table 1 also shows that "medical education" has a higher total link strength than the broader term "education." This indicates that educational discussions in the dataset are more closely connected to medical or health-professional training than to general or explicitly Islamic educational contexts.

This pattern supports the argument that the integration of Islamic educational perspectives into bio-digital research remains relatively underrepresented within the analyzed keyword network [46]. It also aligns with previous discussions that call for broader engagement between bioethics, education, and Islamic values in responding to contemporary biomedical developments [49]. However, the finding should not be interpreted as evidence that educational research is absent. Rather, it indicates that education-related themes are less central than health- and ethics-oriented themes in the author-keyword network. Therefore, further studies are needed to examine how bioethics, genetics, and biotechnology can be translated into pedagogical frameworks for Islamic education beyond medical-professional contexts [53].

The overlay visualization in Figure 7 indicates a thematic shift from broader topics, such as religion, science, public health, and education, toward more recent topics, including medical education, human rights, fatwa, and bioethics. The emergence of fatwa and human rights as more recent terms suggests that contemporary discussions increasingly address practical and context-specific ethical responses to biomedical developments. This trend reflects the continuing role of Islamic normative reasoning in responding to modern biomedical technologies [51]. It also indicates that current bioethics discourse is moving toward more applied ethical deliberation in clinical, legal, and public contexts [52]. Nevertheless, the stronger visibility of medical education compared with general education confirms that pedagogical discussions outside health-professional training remain less central in the analyzed dataset.

The density visualization in Figure 8 reinforces the dominance of "bioethics" and "Islam" as central themes in the analyzed literature. High-density areas around public health, Islamic bioethics, organ transplantation, and religion indicate that the dataset is strongly shaped by health-oriented and normative-religious discussions. Conversely, education-related terms, including education, medical education, and medical students, show lower density. This pattern suggests that educational themes are present but less dominant than clinical and ethical themes. It does not demonstrate the absence of educational research; rather, it indicates that education-related discussions are less densely connected within the analyzed keyword network.

This distinction is important because medical education and broader Islamic education do not represent the same analytical category. Bioethics education in medical schools is directly associated with professional formation, clinical decision-making, and health-care ethics. In contrast, Islamic education may involve broader questions of curriculum, pedagogy, epistemology, religious literacy, and the formation of ethical awareness among Muslim learners. As a core component of educational science, the curriculum must be capable of accommodating the ever-changing needs of students and society; it does not merely address academic aspects but also encompasses the development of social skills [56]. Previous studies have shown that bioethics education in medical contexts may still face challenges of curricular integration. For example, bioethics courses may remain supplementary in some medical education systems [53], [57]. Ethics knowledge gaps among medical students have also been reported in relation to emerging biomedical issues [51]. These findings support the need for further research on bioethics literacy in educational settings, but they do not provide sufficient basis for direct curriculum prescriptions in Islamic educational institutions [58].

The co-authorship analysis in Figure 9 indicates that author collaboration remains concentrated in small and relatively fragmented networks. The presence of central nodes such as Afzal and Muhammad suggests that knowledge production in this field is shaped by recurring collaborative clusters rather than by a broad and integrated international network. Fragmented collaboration has also been identified as a challenge in bioethics research in Muslim-majority contexts. Mardani et al. reported limited coherence in inter-institutional collaboration networks in Iranian medical ethics research [48]. In the present study, this pattern reinforces the need for broader interdisciplinary collaboration involving bioethics scholars, medical researchers, Islamic studies experts, education scholars, and social scientists.

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At the country level, Figure 10 shows that Pakistan functions as the most central hub of international collaboration, with links to countries such as China, Saudi Arabia, the United Kingdom, India, and Turkey. Saudi Arabia also appears as an important connecting node, particularly in relation to China, Qatar, Jordan, and Malaysia. This mapping demonstrates that international collaboration exists, but it remains concentrated among a limited number of countries. Publication trends in the EMRO region similarly show the strong contribution of Pakistan and Saudi Arabia to medical ethics literature [59]. However, the concentration of collaboration within a small number of countries suggests that knowledge production in Islamic bioethics may not yet fully reflect the diversity of Muslim educational, cultural, and institutional contexts [51]. Broader participation from different Muslim-majority and Muslim-minority contexts is therefore needed in future studies to enrich the development of bioethics, genetics, biotechnology, and education research in Muslim contexts.

In summary, the findings indicate that discourse on bioethics, genomics, genetics, and biotechnology in Muslim contexts has developed dynamically, particularly in relation to clinical, biomedical, and normative-religious issues. However, within the analyzed Scopus-indexed dataset, general education and explicitly Islamic educational dimensions remain relatively underrepresented compared with health-oriented bioethics themes. This pattern supports the need for broader interdisciplinary engagement between bioethics, Islamic studies, education, medicine, and the social sciences. It also suggests that future studies should examine how bioethics literacy can be pedagogically addressed in Islamic educational settings without assuming that the present bibliometric findings directly represent curriculum implementation or institutional practice. Therefore, the findings should be understood as a bibliometric mapping of thematic visibility, not as a direct evaluation of curriculum quality. Further qualitative, curriculum-focused, and institution-based studies are needed before concrete curriculum models or policy recommendations can be proposed.

Conclusions

This bibliometric study mapped 130 Scopus-indexed documents (2016–May 2026) on bioethics, genetics, biotechnology, and education in Muslim contexts. Publication output has grown steadily, peaking in 2024, with 2026 data representing partial-year coverage. Bioethics and Islam emerged as the central thematic nodes. The literature is predominantly shaped by clinical, biomedical, and normative-religious discussions, while education-related themes—particularly Islamic education beyond medical training—remain relatively underrepresented. Methodologically, the PRISMA-VOSviewer approach effectively visualizes publication trends, thematic structures, and collaboration networks. However, these findings reflect thematic visibility in Scopus-indexed literature, not curriculum quality or institutional practice. Future qualitative, curriculum-focused, and institution-based studies are needed to examine bioethics literacy development in Islamic educational settings.

Conflict of Interest Statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. All authors have reviewed and approved the final manuscript and agree to its submission to this journal. The authors are solely responsible for the content and interpretation of the findings.

References

[1] Z. Ahmed, S. Wan, F. Zhang, and W. Zhong, "Artificial intelligence for omics data analysis," *BMC Methods*, vol. 1, no. 1, pp. 4, s44330-024-00004–00005, May 2024, doi: 10.1186/s44330-024-00004-5.

[2] M. J. Hosen, S. Anwar, J. Taslem Mourosi, S. Chakraborty, Md. F. Miah, and O. M. Vanakker, "Genetic counseling in the context of Bangladesh: current scenario, challenges, and a framework for genetic service implementation," *Orphanet J Rare Dis*, vol. 16, no. 1, p. 168, Apr. 2021, doi: 10.1186/s13023-021-01804-6.

Electronic ISSN : 2656-3088
Homepage: https://www.journal-jps.com

[3] S. B. Mohamed *et al.*, "Bioinformatics in Sudan: Status and challenges case study: The National University-Sudan," *PLoS Comput Biol*, vol. 17, no. 10, p. e1009462, Oct. 2021, doi: 10.1371/journal.pcbi.1009462.

[4] A. N. Abou Tayoun, K. A. Fakhro, A. Alsheikh-Ali, and F. S. Alkuraya, "Genomic medicine in the Middle East," *Genome Med*, vol. 13, no. 1, p. 184, Dec. 2021, doi: 10.1186/s13073-021-01003-9.

[5] E. Ambrosino *et al.*, "The WHO genomics program of work for equitable implementation of human genomics for global health," *Nat Med*, vol. 30, no. 10, pp. 2711–2713, Oct. 2024, doi: 10.1038/s41591-024-03225-x.

[6] M. Ghaly and E. M. Abdelalim, "Advanced human embryo research beyond the 14-day limit: A bioethical perspective from the Muslim world," *Stem Cell Reports*, vol. 19, no. 8, pp. 1048–1052, Aug. 2024, doi: 10.1016/j.stemcr.2024.06.008.

[7] A. Sodiqin, "Science-based Ijtihad: religious and scientific dialectic on fatwas regarding congregational worships amid the covid-19 pandemic," *Ijtihad : Jurnal Wacana Hukum Islam dan Kemanusiaan*, vol. 21, no. 1, pp. 79–98, Jun. 2021, doi: 10.18326/ijtihad.v21i1.79-98.

[8] M. A. I. AlJahsh, "Science and Islamic ethics: Navigating artificial womb technology through Quranic principles," *Heliyon*, vol. 10, no. 17, p. e36793, Sep. 2024, doi: 10.1016/j.heliyon.2024.e36793.

[9] K. Kardi, H. Basri, A. Suhartini, and F. Meliani, "Challenges of Online Boarding Schools In The Digital Era," *At-tadzkir*, vol. 2, no. 1, pp. 37–51, Mar. 2023, doi: 10.59373/attadzkir.v2i1.11.

[10] M. Elbanna and Muthoifin, "Islamic Education Models: A Bibliometric Analysis of Challenges and Prospects," *SUJIEM*, vol. 3, no. 01, pp. 11–26, Dec. 2024, doi: 10.61455/sujiem.v3i01.231.

[11] Z. Mustafa, Azizan Baharuddin, and Shaikh Mohd Saifuddeen, "Islam, Science and Education: Delving into the Progress, Collaboration and Biases," *JITC*, vol. 11, no. 2, Sep. 2021, doi: 10.32350/jitc.112.03.

[12] S. Inganah, N. Rizki, C. Choirudin, S. M. Y. Farooq, and N. Susanti, "Integration of Islamic Values, Mathematics, and Career Readiness Competencies of Prospective Teachers in Islamic Universities," *DPJPM*, vol. 1, no. 1, pp. 11–14, Apr. 2023, doi: 10.61650/dpjpm.v1i1.31.

[13] D. Mohammed, Q. Aini, D. Supriyanti, S. Sulistiawati, and M. Anggraeni, "Assimilate The Qur'an's View with Science and Technology Perspectives," *att*, vol. 3, no. 1, pp. 42–47, Mar. 2021, doi: 10.34306/att.v3i1.141.

[14] M. Mahmudulhassan, M. Abuzar, S. U. A. Khondoker, and J. Khanom, "The Integration of Islamic Epistemology in Ethical and Multicultural Education: Pedagogical Strategies and Challenges," *mier*, vol. 2, no. 2, Feb. 2025, doi: 10.23917/mier.v2i2.7612.

[15] R. Aulia, A. Prastowo, F. Fathunnajih, and D. A. Saputri, "Implementing moral education through al-ghazali's perspective in islamic studies: a case study at elementary school in yogyakarta," *Lentera Pendidikan : Jurnal Ilmu Tarbiyah dan Keguruan*, vol. 27, no. 1, pp. 243–259, Jun. 2024, doi: 10.24252/lp.2024v27n1i15.

[16] F. Mardatillah, R. M. Gumilang, M. A. Wahyudi, M. Rawanita, and M. Muhammad, "Epistemological Reconstruction of Islamic Education: Developing a Transformative Pedagogical Model to Foster Creativity," *jip*, vol. 13, no. 2, pp. 1071–1094, May 2025, doi: 10.26811/peuradeun.v13i2.2200.

[17] R. Aulia, I. H. D. Alfani, M. R. Haririe, D. Iswanto, and N. Hannah, "Social Egg Freezing in Islamic Law: Conditional Permissibility through a Maqāṣid al-Sharī'ah and Gender Justice Perspective," *Mawaddah: Jurnal Hukum Keluarga Islam*, vol. 3, no. 2, pp. 546–578, Nov. 2025, doi: 10.52496/mjhki.v3i2.81.

[18] Hayadin Hayadin, K. Niam, Munawiroh, and R. Lukens-Bull, "Contemporary Changes in Islamic Higher Education in Indonesia: Dynamic Encounter Between Modernisation and Tradition," *JAT*, vol. 20, no. 1, pp. 189–200, May 2025, doi: 10.22452/JAT.vol20no1.14.

[19] M. Ibrahim, S. Islam, O. Zohriah, and M. Azid, "Addressing contemporary ethical and moral issues through islamic education," *jois*, vol. 1, no. 1, pp. 36–51, Jun. 2024, doi: 10.35335/kbbzar83.

[20] H. R'boul, O. Z. Barnawi, and B. Saidi, "Islamic Ethics As Alternative Epistemology In Intercultural Education: Educators' Situated Knowledges," *British Journal of Educational Studies*, vol. 72, no. 2, pp. 199–217, Mar. 2024, doi: 10.1080/00071005.2023.2254373.

[21] U. J. Mirza, "Islamic Scientific Critical Consciousness as a theoretical framework for Muslim science educators," *London Review of Education*, vol. 22, no. 1, Mar. 2024, doi: 10.14324/LRE.22.1.09.

[22] J. Sjöström, "Vision III of scientific literacy and science education: an alternative vision for science education emphasising the ethico-socio-political and relational-existential," *Studies in Science Education*, vol. 61, no. 2, pp. 239–274, Jul. 2025, doi: 10.1080/03057267.2024.2405229.

Electronic ISSN : 2656-3088
Homepage: https://www.journal-jps.com

[23] N. R. Sholehah, "Islamic Education Based On Integration Of Science," *hjie*, vol. 1, no. 2, pp. 227–244, Aug. 2025, doi: 10.61630/hjie.v1i2.17.

[24] N. A. Salim, M. Zaibi, M. Brantasari, M. Ikhsan, and A. Aslindah, "Islamic Boarding School Leadership Innovation: From Traditional to Modernization of Education," *Munaddhomah*, vol. 5, no. 4, pp. 447–460, Jan. 2025, doi: 10.31538/munaddhomah.v5i4.1392.

[25] S. Sunarti and B. Rahman, "Islamic Education Management in Axiological Studies: The Integration of Scientific and Moral Values in Learning," *Wawasan: J. Kediklatan Balai Diklat Keagamaan Jakarta*, vol. 6, no. 1, pp. 55–67, Jun. 2025, doi: 10.53800/a0bvsw05.

[26] A. Mubaidilah, S. Sabihis, and H. Huda Yana, "Strengthening Islamic Literacy in Education: A Literature Review for Cultivating Intelligent Muslims in the Modern Era:," *EDUSOSHUM*, vol. 5, no. 1, pp. 96–103, Mar. 2025, doi: 10.52366/edusoshum.v5i1.139.

[27] R. Aulia, S. Nazilla, M. Ghifari, M. Susanto, and A. Prasetiya, "The Triangulation Blueprint: Bridging the Gap Between Rhetoric and Reality in Islamic Religious Education," *Bustanul Ulum Journal of Islamic Education*, vol. 4, pp. 94–114, May 2026, doi: 10.62448/bujie.v4i1.573.

[28] F. Fakhrurrazi, N. Wasilah, and H. Jaya, "Islam and Knowledge: Harmony between Sciences and Faith," *J. Mod. Islam. Stud. Civiliz.*, vol. 2, no. 01, pp. 45–57, Dec. 2023, doi: 10.59653/jmisc.v2i01.416.

[29] A. D. Ikmah, M. R. Al-Am, I. Setiawati, M. Thoriqul Islam, and D. Novitasari, "Recontextualizing Islamic Education in the 21st Century, A Study on the Thought of KH. Ahmad Dahlan," *jier*, vol. 6, no. 2, pp. 179–196, Apr. 2025, doi: 10.35719/jier.v6i2.477.

[30] B. Syafaruddin, "Modernization and Renewal Islamic Education in the Era of Society 5.0: A Systematic Review," *IJRER*, vol. 3, no. 3, pp. 105–117, Jun. 2024, doi: 10.51574/ijrer.v3i3.1802.

[31] F. Mokhtar, N. F. Abdullah@Abdul Aziz, and M. A. Tumiran, "Bridging Traditions and Innovations of Islamic Education in the Modern Era," *qjssh*, vol. 6, no. 2, pp. 297–307, Apr. 2025, doi: 10.55197/qjssh.v6i2.640.

[32] S. Sunardi, S. Solechan, U. Ubaidillah, R. Waenasae, and A. N. Kamali, "The Essence of Islamic Education: The Paradigm of Knowledge, Faith, and Action," *Ngaos*, vol. 3, no. 2, pp. 84–101, Aug. 2025, doi: 10.59373/ngaos.v3i2.220.

[33] N. Chotisarn and T. Phuthong, "A bibliometric analysis insights into the intellectual dynamics of artificial intelligence for the micro, small, and medium enterprises," *Cogent Business & Management*, vol. 12, no. 1, p. 2491684, Dec. 2025, doi: 10.1080/23311975.2025.2491684.

[34] E. Nurhidin, M. Habibah, and M. R. M. Nor, "Islamic Education in Schools and Madrasas: Research Trend and Issues Based on Bibliometric Evidence," *Nadwa J. Pendidik. Islam*, vol. 19, no. 2, pp. 214–242, Dec. 2025, doi: 10.21580/nw.2025.19.2.29271.

[35] G. Marzi, M. Balzano, A. Caputo, and M. M. Pellegrini, "Guidelines for Bibliometric-Systematic Literature Reviews: 10 steps to combine analysis, synthesis and theory development," *Int J Management Reviews*, vol. 27, no. 1, pp. 81–103, Jan. 2025, doi: 10.1111/ijmr.12381.

[36] J. Baas, M. Schotten, A. Plume, G. Côté, and R. Karimi, "Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies," *Quantitative Science Studies*, vol. 1, no. 1, pp. 377–386, Feb. 2020, doi: 10.1162/qss_a_00019.

[37] R. Pranckutė, "Web of Science (WoS) and Scopus: The Titans of Bibliographic Information in Today's Academic World," *Publications*, vol. 9, no. 1, p. 12, Mar. 2021, doi: 10.3390/publications9010012.

[38] O. Öztürk, R. Kocaman, and D. K. Kanbach, "How to design bibliometric research: an overview and a framework proposal," *Rev Manag Sci*, vol. 18, no. 11, pp. 3333–3361, Nov. 2024, doi: 10.1007/s11846-024-00738-0.

[39] M. K. A. Faiz, A. Hasan, M. Z. Azani, and A. N. AN, "Bibliometric Trends in Research on Islam and Morality: Contextualizing Findings Within Qur'anic Thought," *Iseedu Journal of Islamic Educational Thoughts and Practices*, vol. 9, no. 2, pp. 168–184, 2025, doi: 10.23917/iseedu.v9i2.13913.

[40] M. Ghaly, *Islamic Ethics and the Genome Question*. BRILL, 2019. doi: 10.1163/9789004392137.

[41] A. Sachedina, "Islamic Ethics and the Genome Question," *Journal of Islamic Studies*, vol. 32, no. 1, pp. 153–156, 2020, doi: 10.1093/jis/etaa034.

[42] L. Amin, S. F. Sujak, S. N. S. Ramlee, A. L. Samian, M. S. Haron, and M. N. Mohamad, "Educating the Ummah by introducing Islamic bioethics in genetics and modern biotechnology," *Procedia - Social and Behavioral Sciences*, vol. 15, pp. 3399–3403, 2011, doi: 10.1016/j.sbspro.2011.04.308.

Electronic ISSN : 2656-3088
Homepage: https://www.journal-jps.com

[43] E. Juliyanti, I. Iskandar, L. Rahmi, and F. Zohra, "A Literature Review on Reconstructing Islamic Educational Philosophy in the Digital Age: Between Classical Wisdom and AI Ethics," *DIAJAR Jurnal Pendidikan Dan Pembelajaran*, vol. 5, no. 1, pp. 193–203, 2026, doi: 10.54259/diajar.v5i1.6781.

[44] N. Khoiriah and D. Hude, "Teknologi dan Inovasi dalam Pendidikan Islam: Perspektif Etika Islam dan Tantangan Globalisasi di Era Digital," *Irsyaduna Jurnal Studi Kemahasiswaan*, vol. 5, no. 3, pp. 647–657, 2026, doi: 10.54437/irsyaduna.v5i3.2785.

[45] J. S. Mawejje, "Aasim I. Padela, ed. Medicine and Sharia: A Dialogue in Islamic Bioethics," *İslâm Araştırmaları Dergisi*, vol. 53, pp. 199–203, 2025, doi: 10.26570/isad.1500571.

[46] A. I. Padela, "Maqāṣidī Models for an 'Islamic' Medical Ethics," *American Journal of Islam and Society*, vol. 39, pp. 72–114, 2022, doi: 10.35632/ajis.v39i1-2.3069.

[47] D. B. Siddique and U. F. A. Rauf, "Artificial intelligence, bioethics, and islamic law: a cross-disciplinary study for the modern age," *Journal of Applied Linguistics and TESOL (JALT)*, vol. 8, no. 3, pp. 78–88, 2025, doi: 10.63878/jalt1034.

[48] A. Mardani, A. Parsapoor, F. Asghari, and E. Shamsi Gooshki, "The scientific productions in Iranian biomedical ethics: A combined study of bibliometrics and social network analysis," *Developing World Bioethics*, vol. 22, no. 3, pp. 126–139, Sep. 2021, doi: 10.1111/dewb.12306.

[49] E. Jr. Baguio, T. H. Baguio, and N. R. Sali, "Mapping the Landscape of Islamic Education Scholarship: A Bibliometric Study," *IJFMR*, vol. 7, no. 3, p. 48829, Jun. 2025, doi: 10.36948/ijfmr.2025.v07i03.48829.

[50] L. Kopelman, "Contemporary Issues in Bioethics," *Arch Pediatr Adolesc Med*, vol. 133, no. 6, p. 662, Jun. 1979, doi: 10.1001/archpedi.1979.02130060102036.

[51] A. Woodman, K. B. Waheed, M. Rasheed, and S. Ahmad, "Current state of ethical challenges reported in Saudi Arabia: a systematic review & bibliometric analysis from 2010 to 2021," *BMC Med Ethics*, vol. 23, no. 1, p. 82, Aug. 2022, doi: 10.1186/s12910-022-00816-6.

[52] L. Judijanto, "Evolution of Islamic Education Research Through a Comprehensive Bibliometric Review 2000–2024," *WSiSS*, vol. 4, no. 01, Jan. 2026, doi: 10.58812/wsiss.v4i01.2624.

[53] "Contemporary Issues in Bioethics.," *Ann Intern Med*, vol. 89, no. 4, pp. 581–581, Oct. 1978, doi: 10.7326/0003-4819-89-4-581_1.

[54] A. Padela, "Methodological and Discursive Considerations for Islamic Bioethics Research and Writing," *TAFHIM*, vol. 16, no. 1, pp. 1–34, Jun. 2023, doi: 10.56389/tafhim.vol16no1.2.

[55] A. Shabana, "Bioethics in Islamic Thought," *Religion Compass*, vol. 8, no. 11, pp. 337–346, Nov. 2014, doi: 10.1111/rec3.12137.

[56] R. Aulia *et al.*, *Dasar Ilmu Pendidikan: Menemukan Metode Pembelajaran yang Tepat*. PT. Nawala Gama Education, 2025.

[57] P. A. Clark, Ed., *Contemporary Issues in Bioethics*. InTech, 2012. doi: 10.5772/2179.

[58] A. Pourabbasi, M. T. Bina, and M. Sanjari, "The necessity of observing ethical liability in bioethics: Instruction of the principles of bioethics should be launched from school," *J Med Ethics Hist Med*, vol. 3, p. 7, 2010.

[59] M. Noroozi, P. Salari, and B. Larijani, "A quantitative analysis of publication trends in Iranian medical ethics and a comparison with EMRO countries," *IJME*, vol. 9, no. 2, pp. 94–100, Apr. 2024, doi: 10.20529/IJME.2024.008.

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