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Bibliometric Analysis of Computational Thinking in Islamic Studies

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ABSTRACT

This research focuses on a review of articles, book chapters and proceedings based on the topics of computational thinking in Islamic studies. Past studies reveal all discussions of these topics separately either only the concept of computational thinking or the practice of computational thinking generally in teaching and learning without emphasizing Islamic studies precisely. The review of articles in this research focused on parallels in the manner in which computational thinking could be conceptualized in the context of Islamic studies. This review seeks an alignment between computational thinking of being a professional engaged in educational research as general to Islamic studies based on one's belief, which takes a holistic notion of life. As an add-on, to facilitate an understanding of computational thinking in Islamic studies, as viewed from the framework of the Qur'ān, Hadith, and Islamic education, it will elaborate the characteristics of this new way of thinking in the teaching and learning of Islamic subjects and other subjects in the Islamic schools and institution. Hence, through the study of computational thinking in Western studies, a comparison can be made with the application of computational thinking in Islamic studies, especially in terms of its advantages and disadvantages.

1. Introduction

Computational thinking has transformed several disciplines by changing the paradigm of research and analysis. Computational thinking is how problems are maintained, such as algorithmic thinking, data analysis, and logical structuring, which form the crux of contemporary scholarship in the digital humanities. It, therefore, takes on a different dimension if applied to Islamic studies, an area of scholarship characterised by classical and historical texts, legal documents, and theological discussions [9]. An overview of how computational thinking has been applied in the background of any Islamic Studies research environment is hardly found. Through recourse to a bibliometric analysis, this study intends to bridge this gap by giving insights into trends, key contributors, and

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evolution in this newly created and produced interdisciplinary approach. Despite these potential benefits, computational thinking in the context of Islamic Studies has rarely been examined with any degree of rigor. Specifically, to date, there has not been any comprehensive bibliometric study; this could make scholars, practitioners, and policymakers less familiar with the current situation, trends, and impact that computational methods have on this area of research. This gap will make it difficult to release potential energies for collaboration, financing, or other developmental undertakings of more focused educational and research initiatives.

Over the last decade, computational thinking has been increasingly applied to Islamic Studies, a fact that reflects the emergence of a new trend: interdisciplinarity. The introduction of computational thinking in the space of Islamic Studies has been very vibrant and exciting. It shows several trends in education and technology. Over the last couple of years, computational thinking has gained greater recognition for the presentation of an essential problem-solving process and skills such as algorithmic thinking and pattern recognition up to abstraction for all academic domains, including the humanities [33]. This multidisciplinary methodology serves to strengthen an analyst's and an interpreter's grain for the scholars working on Islamic Studies to allow them new ways of thinking and relating to the ancient writings and modern issues [20,23,30].

Themes and trends in computational thinking in Islamic Studies. Much work focuses on the ability to reach the understanding of Islamic texts, in particular the Quran and Hadith, using text mining methods and digital humanities techniques in these early works. The strength of employing computational methods in discovering meaningful patterns and insight that is likely not otherwise apparent in traditional scholarship approaches is perhaps best presented in these studies. The mentioned studies, therefore, present the strength of employing computational methods in discovering meaningful patterns and insight that is likely not apparent in traditional scholarship approaches. Recent research has broadened to look at the subject use of computational thinking in Islamic education as a medium of inculcating critical and problem-solving skills of the students. For instance, Ibrahim A. Shogar [15] and Amrizaldi *et al*., [4] show that when computing thinking is incorporated into the syllabus, students can understand difficult religious concepts and remain engaged in the material.

In addition, the infusion of computational thinking into the study of Islamic knowledge has been said to give rise to larger educational and societal goals, such as digital literacy and preparing students for the 21st-century workforce [6,18]. These researchers claimed that this type of interdisciplinary approach can bridge the gap between the former religious education and contemporary technological achievement and that it can lead the way for a more holistic and relevant type of education. The field of Islamic studies has benefited from this bibliometric analysis by highlighting important features with critical details, showing the author, institution, and journal works that significantly contributed to the development of computational thinking within Islamic studies in the face of growing interest and impact this interdisciplinary approach had begun to make in the field [11,21,31,39].

In sum, incorporating computational thinking in the discipline of Islamic Studies is an area of research in development and growth. Interdisciplinary approaches and computational methods employed expand scholarly analysis capabilities, open up new findings, and help solve existing problems in the field. Future research efforts would need to be undertaken to determine the potential of computational thinking in Islamic Studies for innovative educational practices and interstate discipline characterization [2,10,12,14,17].

2. Methods

The desired methodology section consists of the research objective and data set extraction.

Formulation of Research Questions

The main aim of this study is to examine a bibliometric analysis of computational thinking in Islamic studies indexed in Scopus, ResearchGate, Semantic Scholar, Mendeley, Google Scholar, Academia, and Scribd databases. To accomplish this objective, some research questions have been set out to answer. These questions and their significance are given in Table 1.

Table 1
Research questions with their significance

Research Questions	Significance
In what countries is the literature on computational thinking in Islamic studies or discipline published, and what is the balance of the contribution of those nations?	It will help to determine the countries where the relevant research publications for computational thinking in Islamic studies were published.
In what countries do the authors who contribute to computational thinking in Islamic studies literature work, and what is the balance of the contribution of those nations?	It will help to determine the countries where the authors published relevant research publications on computational thinking in Islamic studies.
What languages are most used in publications on computational thinking in Islamic studies research?	It will help to summarize the languages that are most used in research publications on computational thinking in Islamic studies.
How are words used in publication, and what patterns describe their use?	It would benefit to broaden the intellectual context in which computational thinking in Islamic studies situated.
What type of information sources (book chapters, articles, proceedings, etc.) are most important to computational thinking in Islamic studies?	It would benefit to analyse the type of information sources/documents within the publications for computational thinking in Islamic studies.

Data Extraction

For effective data extraction, selecting the appropriate search engines is crucial. Therefore, Scopus, ResearchGate, Semantic Scholar, Mendeley, Google Scholar, Academia, and Scribd have been chosen for this task. This selection is based on the following reasons:

1) Access to Full-Text Articles: Offers a wide collection of full-text research articles shared by authors.
2) Citation Graphs: Offers advanced citation analysis, helping to visualize research trends and the influence of papers.
3) Reference Management: Excellent for managing and organizing references, which is key for bibliometric analysis.
4) Comprehensive Coverage: Indexes a vast number of academic publications across disciplines, providing a broad range of data.
5) Social Networking for Researchers: Facilitates interaction between researchers and provides insights into current trends in various fields.

Harzing's Publish or Perish is the software used for data extraction purposes. Most of the publications are attained using the Harzing's Publish or Perish through the mentioned databases. Figure 1 shows a few examples of the articles obtained by Publish and Perish as its source.

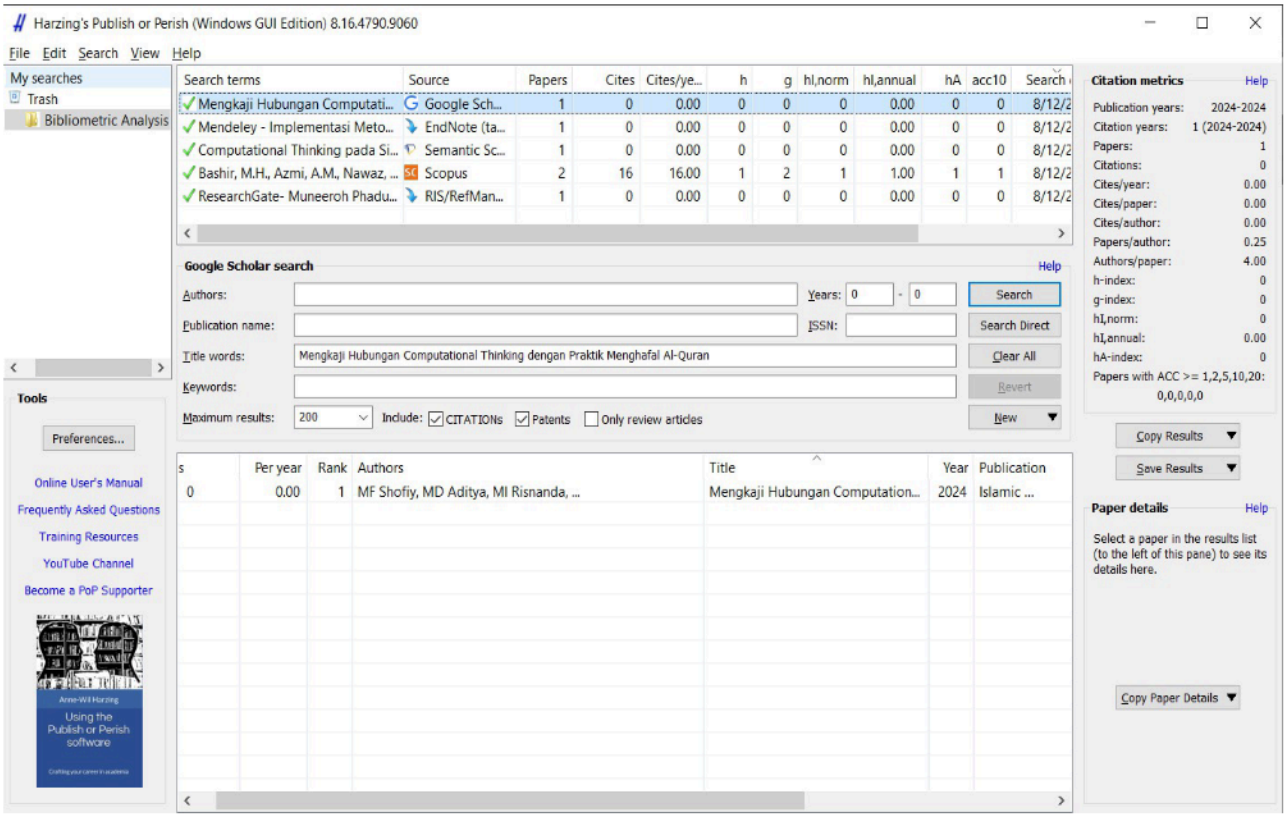

Fig. 1. Articles obtained by publish and perish

3. Results

In this section, the bibliometric analysis of the Scopus database is presented. The analysis is carried out in such a way that it will answer all the formatted research questions.

Distribution of Research Countries Trend

The "Distribution of Research Countries Trend for the Analysis of Computational Thinking in Islamic Studies" provides a comprehensive view of how research related to computational thinking in the context of Islamic studies is geographically distributed across the globe. This trend involves mapping out the contributions of different countries to the scholarly work in this niche academic area. By examining the distribution of research output, we can understand which nations are actively involved in exploring the intersection of computational thinking and Islamic studies and which regions may be underrepresented or emerging in this field. Computational thinking is defined as a problem-solving process that includes several key components: decomposition, pattern recognition, abstraction, and algorithmic thinking. It is increasingly recognized as a vital skill in the 21st century, essential for navigating the complexities of modern life and education. In the case of Islamic studies, this integration involves using computational tools to explore and analyse Islamic texts,

traditions, and educational methods. The study of how computational thinking is applied within Islamic studies offers valuable insights into how modern technology and traditional religious scholarship can work together.

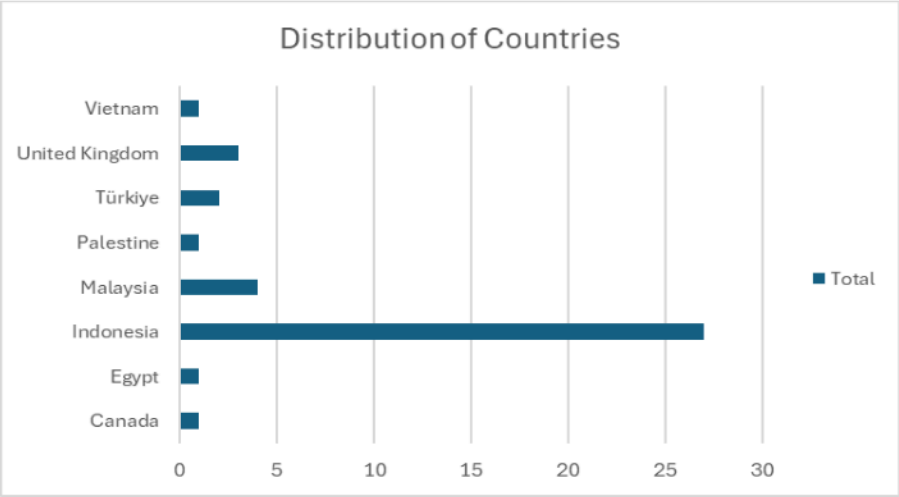

Fig. 2. Distribution of research countries

Distribution of Countries Where Authors Work Trend

The global distribution of countries involved in computational thinking within Islamic studies is varied and extensive, with significant contributions from both Western and non-Western regions. Western nations such as the U.S., UK, and Germany are at the forefront of incorporating technology into Islamic studies, utilizing advanced tools like artificial intelligence, machine learning, and natural language processing to analyze Islamic texts, history, and culture. Meanwhile, countries in the MENA region, Southeast Asia, and South Asia, including Saudi Arabia, Qatar, Malaysia, Indonesia, Pakistan, and India, are also making notable contributions, particularly in the digitization of Islamic heritage, preservation of historical texts, and applying computational methods to explore Islamic law, philosophy, and practices. This growing international collaboration underscores the potential of interdisciplinary research, driving innovation and providing fresh perspectives in Islamic studies through computational techniques.

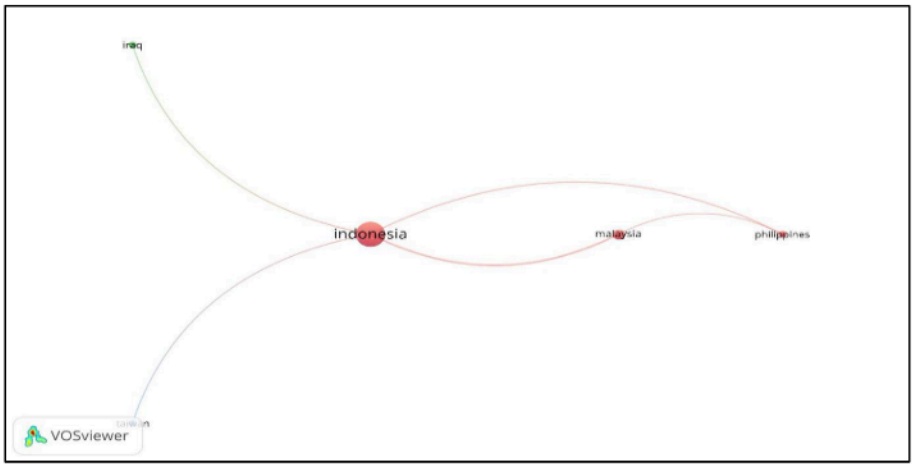

Fig. 3. Network visualization map of co-authorship by country

Distribution of Languages Trend

The distribution of languages in computational thinking in Islamic studies reflects the global and interdisciplinary nature of the field. Arabic remains central, as it is the original language of key Islamic texts, and computational tools like natural language processing (NLP) are extensively used to analyze Quranic verses, Hadith, and historical documents. English serves as a bridge for international collaboration, with many studies and tools available in this language. Additionally, languages such as Turkish, Persian, Urdu, and others like Indonesian, Malay, and Swahili, contribute significantly to research, particularly in regions with rich Islamic histories. This linguistic diversity in computational Islamic studies highlights the global reach of the field and emphasizes the importance of cross-cultural collaboration in using technology to explore Islamic scholarship.

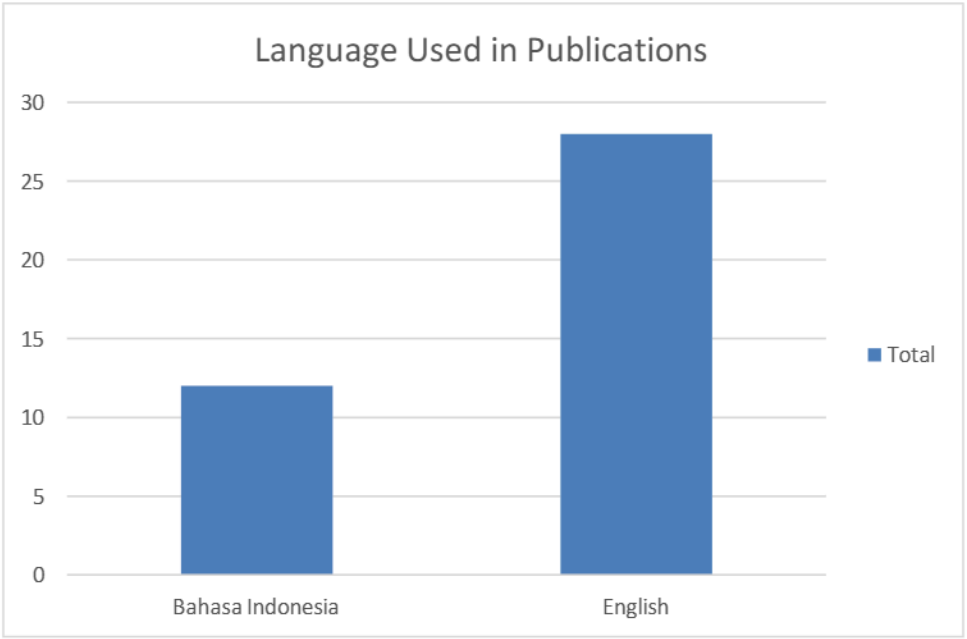

Fig. 4. Distribution of language used trend

Distribution of Keywords Used Trend

The distribution of keywords used in computational thinking in Islamic studies reflects the key themes, methodologies, and areas of focus within the field. Keywords related to digital tools and computational methods, such as artificial intelligence (AI), machine learning, natural language processing (NLP), and data mining, are prevalent, indicating a growing reliance on technology to analyze Islamic texts, history, and culture. Additionally, terms like Quranic analysis, Islamic law, Fiqh, and Hadith highlight the focus on applying computational techniques to traditional Islamic scholarship. Other prominent keywords include digitization, text mining, semantic analysis, and digital archives, reflecting efforts to preserve and study Islamic heritage through digital means. The use of such keywords shows the intersection of technology with Islamic studies, emphasizing the increasing role of computational methods in expanding and innovating research in this field.

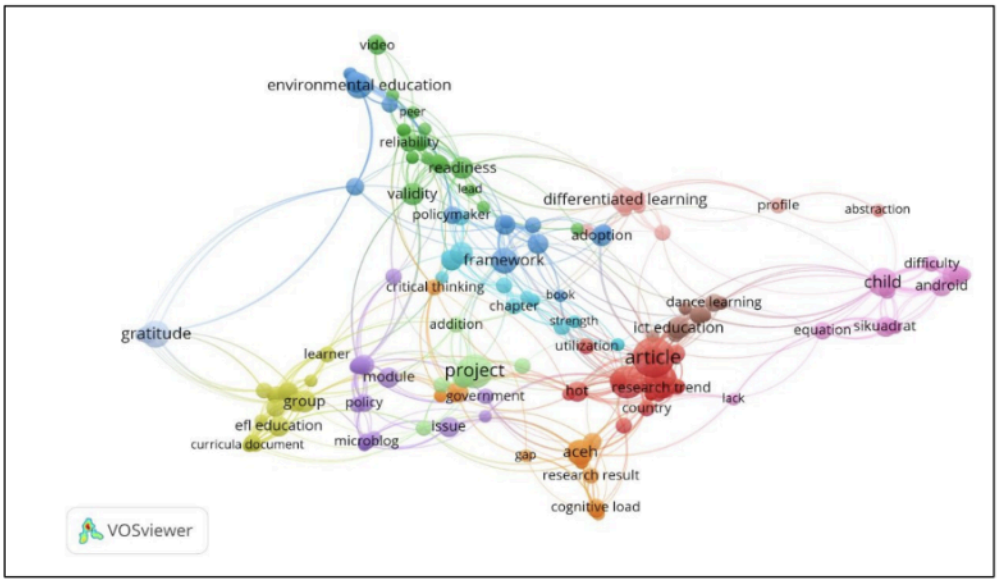

Fig. 5. Distribution of keyword used trend

Distribution of Information Sources Type Trend

The distribution of information source types in computational thinking in Islamic studies reflects a variety of academic and research outputs. The most common information source types include research articles and conference papers, which often present new methodologies, tools, and findings in applying computational techniques to Islamic studies. Books and book chapters also play a crucial role, offering comprehensive theoretical frameworks and in-depth discussions on the intersection of technology and Islamic scholarship. Theses and dissertations are significant, as they often explore novel topics and contribute to the development of the field, especially in higher education settings. Additionally, technical reports and working papers are used to document the development of computational tools and models tailored for analyzing Islamic texts and heritage. This trend demonstrates the growing diversity of document types and the increasing importance of digital and interdisciplinary research in the field of computational Islamic studies.

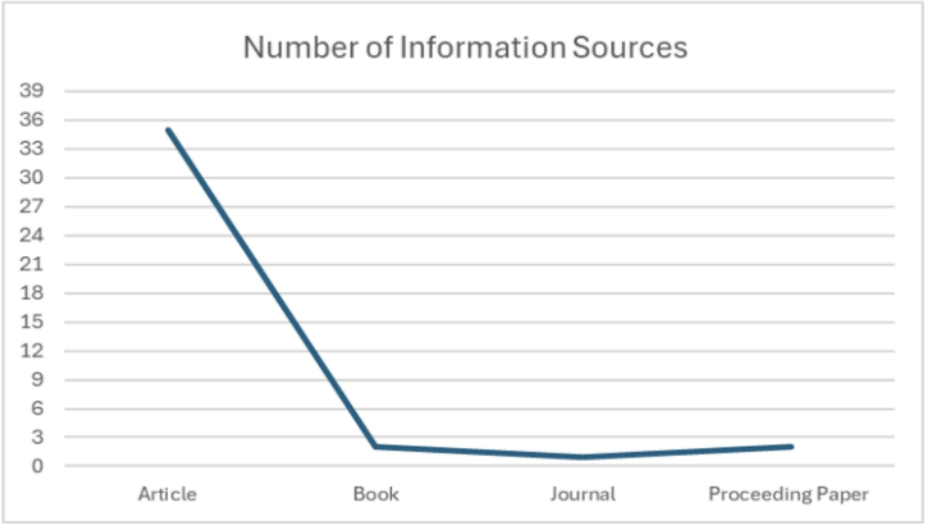

Fig. 6. Distribution of information sources

4. Discussion

In the discussion section, answers to research questions formulated in the methodology section are discussed.

RQ1: In what countries is the literature on computational thinking in Islamic studies or disciplines published, and what is the balance of the contribution of those nations?

The bibliometric analysis represented through the bar chart in Figure 2 highlights the integration of computational thinking in Islamic studies, showcasing contributions from various countries. Indonesia emerges as the dominant contributor, which can be attributed to its large Muslim population, robust institutional support from Islamic universities, and growing awareness of computational tools for enhancing Islamic research. The government's initiatives to digitize education and address community needs, such as the digitization of religious texts, further solidify its leadership. Malaysia follows as a significant contributor, reflecting its emphasis on blending Islamic traditions with technological innovation. Institutions like the International Islamic University Malaysia (IIUM) and strategic government policies have fostered advancements in this area. However, other countries, such as the United Kingdom, Türkiye, Palestine, Egypt, Vietnam, and Canada, show minimal contributions. The disparity in contributions underscores the need for increased international collaboration, capacity building, and resource-sharing to promote the integration of computational tools in Islamic studies globally. By addressing these challenges, fostering partnerships, and encouraging governments and institutions to prioritize this interdisciplinary field, the global development of computational thinking in Islamic studies can be significantly enhanced.

RQ2: In what countries do the authors who contribute to a particular subject literature work, and what is the balance of the contribution of those nations?

The network visualization shown in Figure 3 highlights Indonesia as the central hub in the field of computational thinking within Islamic studies, showcasing its dominant role and extensive contributions. Strong connections with Malaysia and the Philippines suggest active regional

collaboration, likely driven by shared cultural, academic, and geographical ties, as well as mutual efforts to integrate computational methods into Islamic research. Indonesia's leadership can be attributed to its large Muslim population, institutional support, and government initiatives promoting the modernization of Islamic studies through technology. Malaysia's connection reflects its commitment to blending Islamic knowledge with computational tools, while the Philippines shows growing engagement in this field. In contrast, weaker links to countries like Iraq and Taiwan indicate emerging or limited collaboration, likely due to resource constraints or less institutional focus. These disparities emphasize the importance of fostering international partnerships and capacity-building efforts to enable underrepresented nations to contribute more effectively, creating a more balanced and inclusive global network for advancing computational Islamic studies.

RQ3: What languages are most used in publications on computational thinking in Islamic studies research?

The bibliometric analysis of computational thinking in Islamic studies represented in Figure 4 reveals a significant disparity in the language of publications, with English dominating over bahasa Indonesia or Indonesia language. Approximately 27 publications are in English, compared to around 13 in bahasa Indonesia. This suggests a preference for English, likely due to its status as the global lingua franca, enabling researchers to reach a wider international audience and enhance the visibility of their work. Conversely, publications in bahasa Indonesia may cater to a localized audience, emphasizing regional dissemination. The dominance of English also reflects the integration of computational thinking in Islamic studies into broader global academic discourse, where English serves as the primary medium for collaboration and knowledge exchange. The lower number of publications in bahasa Indonesia may indicate either limited engagement with the topic in Indonesian academic circles or a strategic decision by researchers to prioritize international impact over regional communication.

RQ4: How are words used in the publication, and what patterns describe their use?

The keyword distribution map for computational thinking in Islamic studies, visualized using VOS viewer as represented in Figure 5, reveals various clusters representing interconnected research themes. Each cluster highlights a specific focus area in the field, with keywords grouped based on their co-occurrence and relevance.

4.1 Central Themes (Red Cluster)

The largest and most interconnected cluster is centered around keywords like "article," "research trend," and "country." This suggests a focus on identifying and analyzing key trends in computational thinking within Islamic studies, emphasizing its adoption and utilization across different regions.

4.2 Differentiated Learning and Education (Pink Cluster)

This cluster includes keywords such as "child," "difficulty," and "android." It points to research emphasizing educational methods tailored to different learning needs, particularly in relation to technology and younger learners.

4.3 Framework and Readiness (Blue Cluster)

Keywords such as "framework," "readiness," and "validity" in this cluster suggest studies exploring theoretical foundations and practical frameworks for integrating computational thinking into Islamic studies, as well as measuring readiness and reliability.

4.4 Environmental and Educational Policy (Green Cluster)

This group includes terms like "environmental education," "readiness," and "policymaker," indicating a focus on the broader implications of computational thinking in Islamic studies, particularly in shaping education policies and environmental awareness.

4.5 Gratitude and Group Learning (Yellow Cluster)

Keywords such as "gratitude," "group," and "efl education" highlight collaborative learning and the inclusion of emotional or psychological factors in computational thinking research, particularly in English as a Foreign Language (EFL) contexts.

4.6 Research Gaps and Cognitive Load (Orange Cluster)

This cluster includes terms like "Aceh," "gap," and "cognitive load," pointing to regional studies (e.g., Aceh) and challenges like cognitive load in computational thinking implementation.

4.7 Specialized Topics and Critical Thinking (Purple Cluster)

Terms like "module," "policy," and "critical thinking" reflect a focus on curriculum development, policy integration, and the enhancement of critical thinking skills in the context of computational thinking.

Overall, the map demonstrates a multidimensional approach to computational thinking in Islamic studies, integrating educational methodologies, theoretical frameworks, and policy discussions while addressing region-specific challenges and broader global trends.

RQ5: What type of information sources (book chapters, articles, proceedings, etc.) are most important to computational thinking in Islamic studies?

The distribution of information sources for computational thinking in Islamic studies, as depicted in the chart in Figure 6, demonstrates a significant reliance on articles as the primary source of information. With approximately 40 sources, articles dominate the landscape, reflecting their importance in disseminating research and ideas in this field. In contrast, books, journals, and proceeding papers are used far less frequently, with each contributing only a minimal number of sources. This disparity suggests that articles are the preferred medium for researchers, likely due to their concise nature and quicker publication timelines, which facilitate timely dissemination of findings. The limited use of books and journals may indicate a lack of comprehensive or long-form studies on this topic, while the low count of proceeding papers suggests that conference contributions in this area remain relatively sparse. Overall, the chart highlights the centrality of articles as the dominant source of knowledge in computational thinking within Islamic studies.

5. Conclusion

The bibliometric analysis of computational thinking in Islamic studies highlights a field at the intersection of tradition and modernity, where computational methodologies are increasingly being employed to enhance scholarly inquiry. The analysis reveals a preference for English-language publications, which dominate over those in bahasa Indonesia, reflecting an effort by researchers to engage with a global audience and contribute to international academic discourse. This trend underscores the importance of computational thinking as a tool to modernize Islamic studies and broaden its reach beyond regional contexts.

The distribution of keywords reveals diverse research themes, including frameworks for computational thinking, educational policies, differentiated learning, environmental education, and the emotional and psychological aspects of learning. These clusters indicate a multidimensional approach, blending theoretical foundations with practical applications to address challenges in education, policy-making, and regional development. Notable gaps, such as cognitive load challenges and regional research limitations, present opportunities for further exploration.

In terms of information sources, the dominance of articles suggests a strong preference for this format due to its accessibility and rapid dissemination. However, the limited use of books, journals, and conference proceedings points to a need for more comprehensive and long-term studies, as well as greater engagement in academic conferences to foster collaboration and idea exchange.

Overall, this bibliometric analysis reflects a growing recognition of computational thinking as a transformative tool in Islamic studies, offering new ways to analyse, interpret, and apply knowledge. The findings emphasize the need for continued interdisciplinary collaboration, the development of robust theoretical frameworks, and increased efforts to address regional and global challenges. By integrating computational thinking, Islamic studies can further its relevance in addressing contemporary issues while preserving its rich scholarly heritage.

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