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Current status and future research directions of business intelligence and analytics education: a bibliometric analysis

Hengchao Zhang[1], Mohamed Asmy Mohd Thas Thaker[2], Zarinah Hamid[2], Hassanudin Mohd Thas Thaker[2]
[1]School of Graduate and Professional Studies, International Center for Education in Islamic Finance (INCEIF University), Kuala Lumpur, Malaysia
[2]Department of Economics, Kulliyyah of Economics and Management Sciences, International Islamic University Malaysia, Kuala Lumpur, Malaysia

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ABSTRACT

The growing demand for analytics-skilled professionals in today's digital economy has led higher education institutions (HEIs) worldwide to offer business intelligence and analytics (BI/BA) programs. However, BI/BA education is still in its early stages, with noticeable curriculum structure and pedagogical methods discrepancies. Thus, this study seeks to comprehensively evaluate BI/BA education research and unveil its evolving intellectual framework. Guided by the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines, it employs a bibliometric analysis of Scopus-indexed BI/BA education research published between 2005 and 2023. Utilizing both VOSviewer and Biblioshiny, the findings revealed that BI/BA education research has surged dramatically since 2018. Researchers based in the United States have been instrumental in advancing this research domain and fostering international research collaborations. Our findings underscored two key emerging research trends: i) Integrating BI/BA knowledge into business and IT programs and ii) Incorporating industry 4.0 (IR4.0) technologies into the BI/BA curriculum. The findings call for more research collaborations with leading BI/BA institutes in the United States and China to leverage their rich knowledge and expertise. Furthermore, HEIs and future researchers shall focus on aligning curricula with the advancing digital technologies to ensure graduates possess a holistic and current skill set.

Corresponding Author:

Hengchao Zhang
School of Graduate and Professional Studies,
International Center for Education in Islamic Finance (INCEIF University)
50480 Kuala Lumpur, Malaysia
Email: zhang@inceif.edu.my

1. INTRODUCTION

The rise of industry 4.0 (IR4.0) and the convergence of new technologies have resulted in an explosion of data [1]. As a result, our digitalized economy faces unprecedented volume, velocity, variety, and veracity of data (commonly known as Big Data) generated from the ubiquity of connected devices, including the internet of thing (IoT), smartphones, and social media [2]. To overcome this challenge, companies need to have adequate business analytics (BA) capabilities to obtain competitive advantages in this digitalized era [3].

To meet the growing demand for business intelligence and analytics (BI/BA) talent, higher education institutions (HEIs) worldwide increasingly offer BI/BA courses and programs at undergraduate and

postgraduate schools [4]. For example, approximately 9% of the United States HEIs offered data analytics programs in 2016 [5]. Since then, data analytics programs have significantly increased, offering certificates, training camps, and degrees at various levels. [2]. While most of these programs are offered in graduate schools, they are rarely offered at the undergraduate level [6]. Nevertheless, many universities have begun restructuring their undergraduate curricula to include BI/BA programs [5].

At present, most BI/BA programs in HEIs are still nascent, while advancements in the industrial applications of BI/BA have far outpaced the corresponding curriculum development. This gap has heightened the demand for BI/BA skill training. According to the 2023 Future of Jobs Report, BA training has been championed as the top priority of skill training required between 2023-2027 [7]. Existing research has identified key barriers to effective BI/BA education, including the absence of a standardized curriculum model [5], inadequate pedagogical methods, and a shortage of qualified faculty with the required expertise [8]. These factors have hampered the effective delivery of BI/BA programs and have undermined their overall quality and sustainability.

Given the rapidly evolving of the BI/BA industry and the pressing need for comprehensive and future-proof solutions [9], [10], a bibliometric study on BI/BA education research is essential for a holistic understanding of the field [11]. Unlike traditional review studies, which primarily synthesize past research [12], bibliometric studies leverage quantitative techniques, such as performance and network analysis, to systematically examine scholarly contributions in a domain [13]. Applying this approach across the full spectrum of BI/BA education research can: i) Uncover critical themes, trends, and gaps [14]; ii) Facilitate the development of standardized curricula and innovative pedagogical strategies [15]; and iii) Provide insights to guide faculty capacity building [16].

Before this study, only a dearth of studies systematically surveyed extant scholarly works in BI/BA education over the past two decades [17]. Table 1 summarizes the selected review studies in the research domain. These studies have only focused on a specific sub-theme, for instance, the educational application of BI/BA, its importance for tertiary education, readiness, and key success factors for applying BI/BA in education. None has covered the full spectrum of the intellectual structure underlying BI/BA education research. Thus, our study is among the first to employ bibliometric analysis to systematically examine BI/BA education research. The objectives of this study are two-fold. First, it seeks to deliver a thorough performance evaluation of the development trajectory of BI/BA education research. Thus, researchers and practitioners can identify seminal studies and focal research constituents in the field, paving the way for future research and academic collaboration [18]. Second, it seeks to reveal the evolving intellectual structure of research on BI/BA education. This will help researchers and practitioners gauge research trends, identify knowledge gaps, and prioritize future research areas [14]. Ultimately, these research findings are expected to guide educators and policymakers in developing BI/BA program curricula that nurture data-savvy human capital, thereby fostering the sustainable development of our increasingly digitalized economy [19].

This study is comprised of four parts. Following the introduction, this study's research methods and procedures are elaborated upon. Subsequently, we discuss the findings of the bibliometric analysis. Finally, we summarize this study and offer suggestions for future research on BI/BA education.

Table 1. Summary of selected review studies in BI/BA education

Study	Scope of study	Review method
[20]	Application of BI/BA methods in the education sector	Systematic review
[21]	The importance of BI/BA in tertiary education	Narrative review
[22]	The readiness factors for effective implementation of BI/BA in colleges and universities	Systematic review
[23]	Critical success factors for Big Data and analytics adoption in tertiary education settings	Narrative review
[24]	Determinants for successfully implementing BI/BA	Systematic review
[25]	Application of BI in an educational institution	Narrative review
[26]	Development of BI/BA maturity models for colleges and university	Systematic review
[27]	BI/BA education research related to Information Systems	Hermeneutic review
[17]	The essential knowledge, competencies, and skill set for graduates in BI/BA	Systematic review

2. METHOD

Having discussed the growing significance of BI/BA education and the escalating research interest in this domain over the last two decades, it is imperative to comprehensively understand the present status of BI/BA education research. Given the distinctive features of bibliometric analysis for delineating the comprehensive knowledge structure and its temporal evolution within a research field [11], our study employed this approach to quantitatively investigate bibliometric data on BI/BA education research. To this end, we adopted the 5-phrase methodology [28]. These phrases and their descriptions are listed:

- Study design: define the research questions and select appropriate bibliometric methods to address them.

- Data consolidation: retrieve relevant research from the Scopus database, exclude non-related studies, and aggregate metadata of the selected publications.
- Bibliometric analysis: apply various bibliometric methods to tackle research inquiries.
- Visualization: using software to visualize findings derived in step 3.
- Discussion: analyze and explain the results.

2.1. Study design

Considering the novelty of this research domain, this study examines scholarly publications between 2005-2023. Bearing in mind that this research endeavors to evaluate the performance of scientific output and unveil the intellectual structure of BI/BA education research. This study was designed to answer four research questions:

- How has BI/BA educational research been developed between 2005 and 2023?
- What were the performance metrics and collaboration patterns in the BI/BA education research during this period?
- Which themes profoundly influenced BI/BA education research during this timeframe?
- How has the intellectual structure of BI/BA education research evolved and what areas have emerged as priorities for further research?

2.2. Data consolidation

An extensive search of the Scopus database was conducted in July 2023 to collect scholarly work on BI/BA education. Our rationale for selecting the Scopus database for gathering bibliometric metadata is based on the following considerations: i) Scopus provides a wide range of research content and employs a rigorous quality control process, making it a dependable source for extensive bibliometric analyses [29]; ii) Its advanced operational functions, including detailed information on authors, their affiliations, and other publication metadata, facilitate the sorting of documents using different criteria, thereby enhancing insights from bibliometric analysis [30]; iii) The performance metrics of scholar outputs from the Scopus and Web of Science databases are comparable [31]; and iv) As a unified platform, Scopus provides accessible content, making it an ideal resource for research focusing on review and synthesis [32].

To ensure the completeness and validity of the publication metadata collected, our study adhered to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines adapted from previous research [33], [34] for conducting article searches and screening. Figure 1 illustrates the augmented PRISMA research flow used in this research. We began identifying relevant articles by using specific keywords commonly found in past BI/BA educational studies. These terms are used along with wildcard symbols like "*" and logical operators like "AND" and "OR" to refine the search based on the metadata contained in article titles, abstracts, and author keywords. Next, we filtered out research published as journal and conference papers, published between 2005 and 2023, and written in English. Subsequently, we removed seven unusable entries, including five duplicates and two incomplete records. The final dataset included 1932 articles, which were then exported into CSV format for further analysis.

The dataset was carefully examined to eliminate articles unrelated to BI/BA education. These excluded entries either discuss applying BI/BA tools or techniques to improve the operational management of educational institutions or adopting BI/BA as an instrumental tool in the classroom to enhance students' learning experience. We closely examined titles and abstracts during the exclusion process whenever the study's relevance was unclear. Ultimately, our final dataset was narrowed down to 547 articles.

2.3. Analysis and visualization of data

This study used performance and network analysis to investigate the consolidated research metadata. The former assessed the scholarly impact within a research field through metrics like the number of publications and the average (or total) citation count [13]. The latter presented the connections among researchers, affiliated institutions and their respective countries, and keywords in a given research field. Techniques such as the co-citations, co-authorships, and keyword co-occurrences were employed to achieve this [13]. Furthermore, through the application of clustering (i.e., bibliographic coupling) and visualization (i.e., temporal overlaying) methods, the bibliometric trend and conceptual framework of the domain were effectively displayed [28].

Table 2 provides a summary of the analysis methods and tools used in this study. It details which analysis tool was performed for each analysis method in relation to the corresponding research question. In particular, we employed R's Bibliometrix package to unravel the performance of the research constituents and their development over time. Furthermore, we used VOSviewer to depict the connections within BI/BA education research landscape. This integrated approach enabled in-depth and visually appealing investigation of the research metadata in this field.

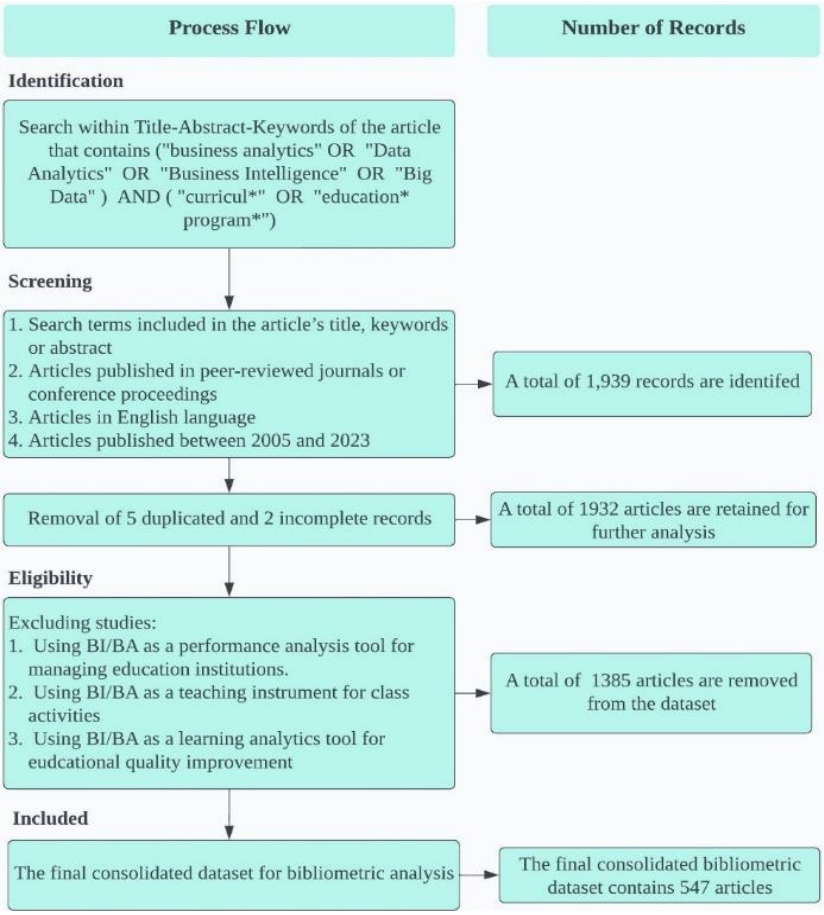

Figure 1. Workflow of data search and screening for bibliometric analysis

Table 2. Bibliometric analysis methods and tools

Analysis method	Research tool	Research questions (RQ)
Descriptive analysis	R's Bibliometric package	RQ1: research development trends between 2005-2023
Performance analysis	R's Bibliometric package	RQ2: performance metrics of research constituents
Collaboration analysis	R's Bibliometric package	RQ2: the network of research co-authorship
Keywords analysis	R's Bibliometric package	RQ3: main research themes
Citation analysis	VOSviewer	RQ3: the influential authors and studies in this field
Bibliographic coupling	VOSviewer	RQ4: the intellectual structure of BI/BA education research
Co-word analysis	VOSviewer	RQ4: the research trends in BI/BA Education

3. RESULTS AND DISCUSSION

3.1. Research development (addressing RQ1)

Table 3 presents a comprehensive overview of the consolidated bibliometric data on BI/BA education research. The table depicts four noticeable trajectories. Firest, scientific outputs in this field have experienced notable growth, averaging an annual increase of 20% over the last two decades. This trend is illustrated in Figure 2. As the figure demonstrates, BI/BA education research began to intensify in 2014. With accelerated research development in 2018, scholarly contributions peaked in 2021 with approximately 100 publications. The rapid expansion of scholarly output in this field mirrors the growing recognition of the industry's heightened need for competent BI/BA professionals [5].

Secondly, most scholarly output (58%) was published as conference papers. One plausible reason for this is that researchers often present their research ideas and preliminary research findings at conferences and subsequently incorporate feedback received to refine their reports before submitting them to journals [35]. This trend reaffirms the fact that BI/BA education is a young and rapidly evolving research discipline [36]. Similar trends can be observed in fields such as physics and computer science [37].

Third, collaborative efforts among researchers in this field primarily occur domestically, with an average of 3.12 co-authors per publication. Despite a strong tendency towards collaboration, only about 14%

of these studies involve international researchers. This signifies that most research partnerships remain within domestic boundaries. This trend reflects the current state of BI/BA education research, which predominantly focuses on developing curricula or pedagogical frameworks tailored to specific countries, such as the United States [38], [39].

Lastly, the sampled BI/BA educational research was of good quality. An average citation rate of 7.28 per document indicates that research outputs in the sampled collection have received 7.28 citations each. As citation counts are commonly employed as indicators of a research work's quality and influence [40], these average citation statistics reinforce the esteemed quality of the BI/BA education research collection.

Table 3. Overview of the extracted bibliometric data

Classification	Attributes	Findings
Main information	Timespan	2005:2023
	Journal articles	232
	Conference paper	315
	Annual growth rate (%)	19.84
	Mean citations per article	7.28
	Aggregate reference count	12633
	Aggregate author keyword count	1365
Author	Number of authors	1495
	Single-author document contributors	114
	Average co-authors per article	3.12
	Percentage of International co-authorship	13.71

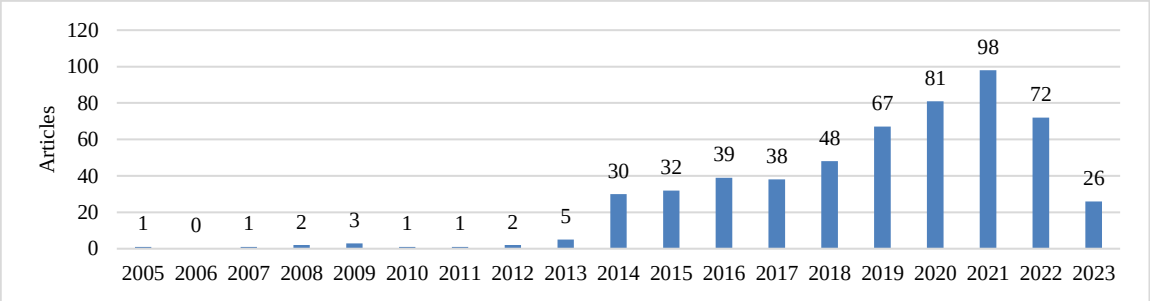

Figure 2. Total annual scientific production

3.2. Research performance (addressing RQ2)

Our performance analysis offered descriptive statistics on BI/BA education research, encompassing the research productivity of authors, countries, and affiliated institutions, as well as publication counts in leading publication avenues. The top 10 performers in each category are reported in this study. If multiple observations share the same count value as the 10th-ranked one, they are included in the top 10 performers.

Table 4 presents the authors who published the most, including full and fractionalized articles. For the former, an author receives one count regardless of whether the article is single-authored or multiple-authored. In contrast, the fractionalized article count allocates a portion of the credit to every co-author [41]. Both counting methods identified Demchenko Y as the most productive author, with 13 total counts or 4.31 fractionalized counts. This was followed by Wiktorski T with nine 9 or 2.06 fractionalized counts. Among these, only Belloum A, Brewer S, and Goul M had fractionalized counts of less than 1. Our findings highlight a significant disparity between the full and fictionalized counts by the top 10 authors in the publication volume. This implies the prevalence of co-authorship practices in BI/BA education research.

Table 5 presents a summary of the leading nations in BI/BA educational research. The data is categorized into several columns: "country" represents the affiliated nation of the corresponding author; "articles" represents the total number of publications from a country; "freq" indicate the frequency of each country's contribution to the total research corpus; "single country publications (SCP)" counts the publications authored by individuals from the same country; and "multi-country publications (MCP)" reflects the number of publications produced from international collaborations. Notably, the U.S. emerged as the most prolific contributor with 110 articles. Among these, SCP was predominant, with 101 articles, compared to nine with MCP. This was followed by China, which published 62 articles. In addition, there is a significant inclination towards SCP in China. The table effectively underscores the dominant influence of the U.S. and China in this research field.

We have compiled a list of 10 major publication avenues for BI/BA education research, as shown in Table 6. These avenues are ranked based on their total publication counts. The table provides two insights. Firstly, conference proceedings serve as the primary avenue for publishing BI/BA educational research, with the ACM International Conference Proceeding Series (ICPS) leading the field with 27 publications. Secondly, these prominent publication avenues can be categorized into two main groups based on their focus area: i) Those emphasizing computing and information systems such as Advances in Intelligent Systems and Computing (AISC) and ii) Those centered on information systems, like Journal of Information Systems Education (JISE) or business education, such as Journal of Accounting Education (JAEd).

Table 4. Top productive authors

Authors	Articles	Articles fractionalized
Demchenko Y	13	4.31
Wiktorski T	9	2.06
Kang JW	6	1.70
Li L	6	1.75
Yu Q	6	1.70
Holden EP	5	1.37
Li X	5	1.43
Belloum A	4	0.85
Brewer S	4	0.72
Deb D	4	1.67
Gottipati S	4	1.67
Goul M	4	0.77
Liu M	4	1.42
Zheng G	4	1.17
Zhu Y	4	1.42

Table 5. Top productive countries

Nation	Article counts	Relative freq	SCP	MCP
USA	110	0.201	101	9
China	62	0.113	61	1
Australia	10	0.018	9	1
India	9	0.016	9	0
UK	8	0.015	6	2
Germany	6	0.011	3	3
Korea	6	0.011	6	0
South Africa	6	0.011	5	1
Malaysia	4	0.007	4	0
Philippines	4	0.007	4	0
Turkey	4	0.007	4	0

Table 6. Most relevant publication avenues

Sources	Articles
ACM International Conference Proceeding Series	27
Journal of Information Systems Education (JISE)	16
ASEE Annual Conference and Exposition, Conference Proceedings	15
Proceedings-Frontiers in Education Conference	15
IEEE Global Engineering Education Conference	11
Communications of the Association for Information Systems	10
Advances in Intelligent Systems and Computing (AISC)	9
Communications in Computer and Information Science	9
Journal of Physics: Conference Series	9
Decision Sciences Journal of Innovative Education	8
Journal of Accounting Education (JAED)	8
Journal of Education for Business	8

3.3. Collaboration analysis (addressing RQ2)

Collaboration analysis examines the key attributes of authors, such as affiliated institutions and countries, is a commonly used method for evaluating research collaboration [13]. Given the growing complexity of research in BI/BA education, research partnerships play a vital role in facilitating the international exchange of resources, technologies, and knowledge. Additionally, co-authorship networks provide valuable insights into potential research collaboration. By leveraging this information, researchers can gain access to a vast pool of advanced expertise and promising collaborative opportunities, further driving progress in this research domain [42].

In this study, collaboration analysis was conducted at the national level. It used the Louvain algorithm to cluster multi-level collaboration networks (i.e., nodes) [43]. As illustrated in Figure 3, the connection nodes, represented by rectangle boxes, indicate corresponding authors' affiliated countries. The size of each node reflects the volume of publications contributed by that country, while the thickness of the connecting lines signifies the number of co-authored publications. Given this study's large sample of authors, the collaboration analysis is limited to 50 nodes (or countries). Consequently, countries with fewer than two co-authorship connections were excluded. Our results reveal three major observations: first, three distinct collaboration clusters emerged, including U.S.-dominated (red), Europe-centered (blue), and ASEAN-focused (orange); second, research institutions in the U.S. play a pivotal role in fostering international research collaborations globally; and third, the most robust cross-country research partnerships were observed between the U.S. and Canada as well as Norway and the Netherlands.

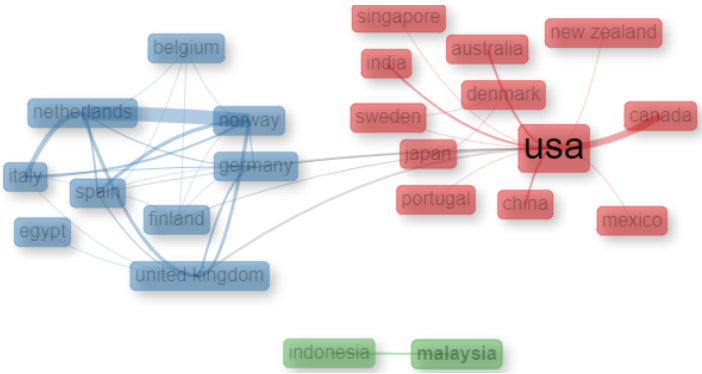

Figure 3. Analysis of research collaboration

3.4. Citation and keyword analysis (addressing RQ3)

The influence of a researcher is typically measured by either total citation (TC) counts or H-index score. The former provides a simple and straightforward measure of an author's impact in a research domain based on the total number of citations since its publication, while the latter balances both the number of publications and the TC each publication receives. Table 7 lists the top ten most influential BI/BA education researchers based on these two metrics. Notably, the authors' rankings differ based on these two metrics. This divergence in ranking can be attributed to the advantages of the H-index in addressing the issue of assigning equal contributions to each co-author [44]. Despite these differences, Demchenko Y, Goul M, Wiktorski T, and Ariyachandra T remain the most influential authors in this field.

Table 7. Top researchers in BI/BA education

Author	H-index	TC
Demchenko Y.	5	104
Goul M.	4	303
Wiktorski T.	4	83
Ariyachandra T.	3	209
Brewer S.	3	59
Deb D.	3	18
Eckroth J.	3	44
Fuad M.	3	16
Holden E. P.	3	20
Johnson M. E.	3	15
Kang J. W.	3	22
Manieri A.	3	63
Yu Q.	3	22

To disentangle the key research themes within BI/BA education, a word cloud analysis was conducted on keywords retrieved from the compiled research metadata. This analysis highlights the fifty most frequently used keywords, as illustrated in Figure 4. The keywords "curricula", "Big Data", "data analytics", and "students" are notably larger than the other terms, underscoring their significance in BI/BA education research. Moreover, the prominence of "students" suggests the critical role of learner engagement

and the educational experience in this field. Additionally, terms like “teaching”, “engineering education”, and “information systems” are interwoven, suggesting an interdisciplinary approach that merges technological expertise with instructional strategies. Minor yet notable keywords, including “artificial intelligence”, “information management”, and “data science”, reflect the integration of cutting-edge technologies into curriculum development.

Figure 4. Keywords word cloud analysis

3.5. Bibliographic coupling (addressing RQ3)

We applied VOSviewer to analyze bibliographic coupling of references and to visualize research clusters in BI/BA education. Bibliographic coupling assesses the similarity between two publications based on their shared references [28]. Articles that share more common references indicate a stronger shared research interest and are subsequently grouped into the same cluster [45]. Figure 5 illustrates the bibliographic coupling analysis, where box-shaped nodes represent the clustering network. The color of each node denotes its corresponding research cluster, while its size reflects the TC received by the publication [42]. This study included publications with at least 30 citations in the analysis. Subsequently, 23 articles are featured in the coupling network.

The BI/BA education publications were grouped into four clusters based on the node color: red, green, blue, and yellow. The red and green clusters are relatively larger, each comprising seven publications, while the blue and yellow clusters consist of six and four articles, respectively. A closer examination of the research themes within each cluster revealed that these are related research areas, each focusing on different sub-themes. Specifically, the green cluster focused on integrating BI/BA into the accounting curriculum. The blue cluster concentrated on developing curricula and pedagogical approaches for BI/BA education, and the red cluster delved into the BI/BA knowledge and skill sets required for graduates to meet market demands. The yellow nodes centered on transforming existing statistics education into a data-driven program by incorporating BI/BA knowledge.

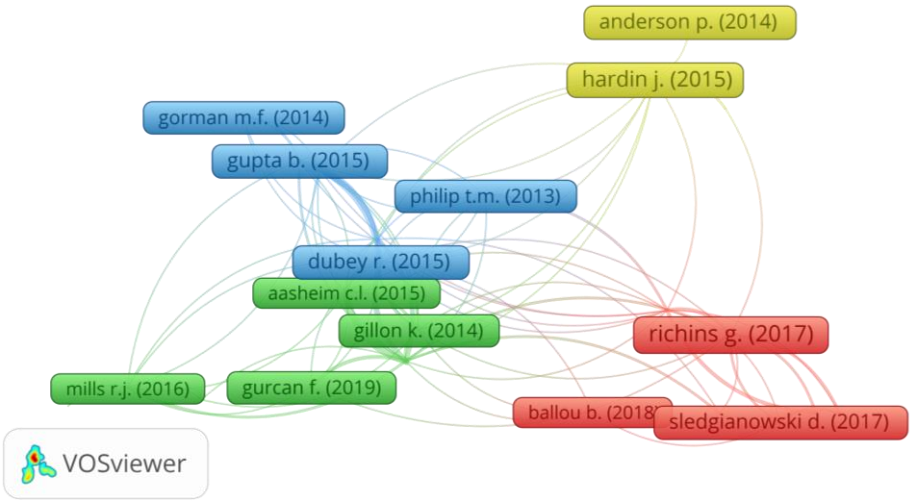

Figure 5. Bibliographic coupling analysis

3.6. Keywords co-occurrence (addressing RQ4)

To explore the evolution of intellectual structure in BI/BA education research, we employed a keyword co-occurrence analysis. We presented the findings via an overlay visualization network generated using VOSviewer. This analysis examined the similarity of two keywords based on the frequency of their co-occurrence in the sampled publications. Terms that frequently co-occur are deemed highly similar, as indicated by the shorter links connecting the nodes. In our analysis, 1,408 author keywords were considered. We set a minimum frequency threshold of ten to identify the pivotal building blocks of the keyword co-occurrence. Subsequently, 19 keywords were retained in the co-occurrence network mapping.

Furthermore, to reveal the temporal evolution of intellectual structure in BI/BA education research, network mapping employed an overlay visualization method, as shown in Figure 6. In this overlay network visualization, the color of an item is determined by its similarity score, accounting for metadata such as the publication year of the documents and citation counts. Furthermore, the color spectrum ranges from blue to yellow, indicating past and present research trends, respectively [46]. The node size indicates the frequency of occurrence, and the thickness of the lines connecting two nodes indicates the strength of the association between keywords [47].

Figure 6 reveals two notable observations. First, four clusters emerged from the underlying keyword network, each focusing on a distinct theme. Detailed information on these themes and their associated keywords is listed in Table 8. Second, the temporal overlaying network depicts a shift in the research focus in BI/BA education. Initially, the focus was on general curriculum and pedagogical development. It then evolved to integrate the latest technologies such as machine learning and cloud computing into BI/BA education. This shift will cater to the growing industry demand for IR4.0 competent graduates. Lastly, an emerging trend reveals that future BI/BA education research should focus on integrating artificial intelligence (AI) into traditional business programs, such as accounting.

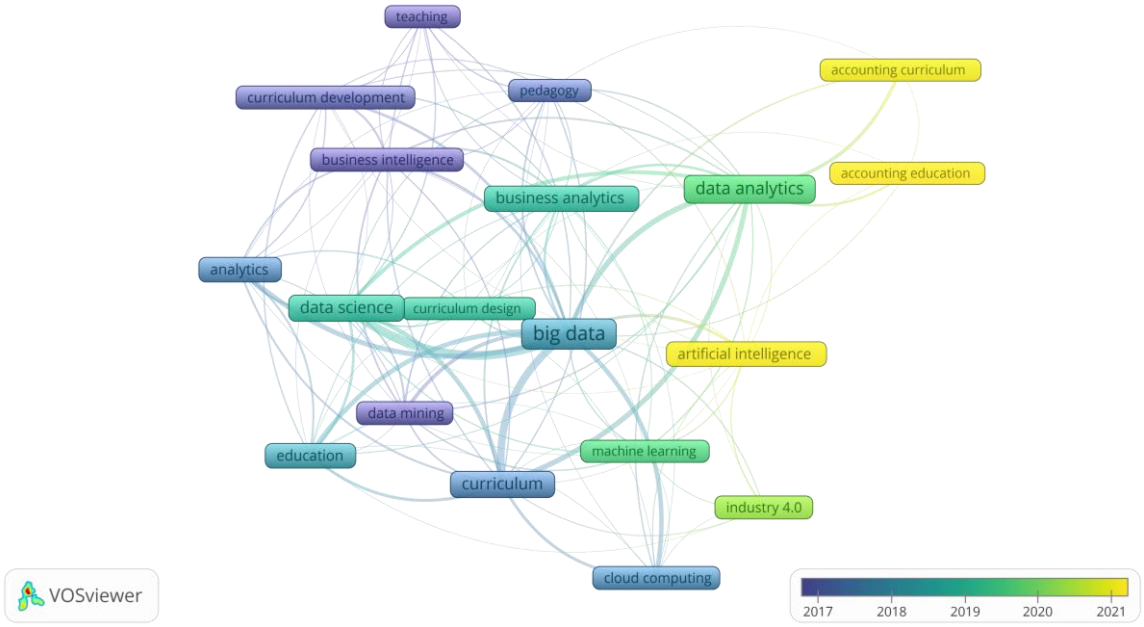

Figure 6. Keywords overlay network

Table 8. Keywords co-occurrence clusters

Cluster no.	Co-occurring keywords	Derived theme
1	Analytics, Big Data, curriculum design, data mining, data science, education	Educational development in data science and analytics
2	Cloud computing, curriculum, IR4.0, machine learning	Incorporating advanced IR4.0 technologies into BI/BA education
3	BA, BI, curriculum development, pedagogy, teaching	Developing teaching strategies and curriculum for BI/BA education
4	Accounting curriculum, accounting education, AI	Integration of AI into accounting education and curriculum design

3.7. Discussion

The present study contributes to the understanding of the evolution of BI/BA education by analyzing key trends and identifying gaps in this research domain. Our findings reveal that research on BI/BA education has surged dramatically since 2018. This echoes the growing market demand for skilled BI/BA professionals to sustain the growth of our increasingly digitalized economy [48]. We observed that the U.S. and China dominate this field, highlighting the urgent need for other countries, especially developing ones, to advance BI/BA education. This claim is supported by previous studies [49], [50], both of which underscore the significant workforce skill gap in transforming Big Data into actionable strategic insights. To address this challenge, our study recommends that HEIs in developing countries collaborate with leading entities in the U.S. and China to benefit from their knowledge and expertise.

Furthermore, the results show that BI/BA education research is evolving to emphasize its integration into existing business and information technology programs. This trend aligns with the growing efforts to blend BI/BA skillsets into marketing [51] and accounting [52] programs, which aim to nurture graduates with a balanced combination of analytical and technical skills. Another emerging trend identified in this study is incorporating IR4.0, such as AI, into BI/BA education. This supports the advocacy of Silva *et al.* [53], highlighting the urgency of integrating the latest technological advancements into those programs. Such integration equips BI/BA graduates with comprehensive and up-to-date knowledge, enabling them to analyze large datasets for actionable business insights, make strategic decisions, and foster competitive advantages and sustainable growth for their companies.

However, the present study had two main limitations. First, it relies only on the Scopus database to retrieve bibliometric data on BI/BA educational research. Second, it includes only journal articles, conference papers, and book chapters written in English. To address these constraints, future bibliometric research should expand the data collection to cover more databases and include documents written in different languages with a broader range of document types. Ultimately, this will lead to more encompassing BI/BA education research perspectives.

4. CONCLUSION

This study applied a bibliometric analysis of BI/BA education research published in the Scopus database between 2005-2023. Our performance and network analyses revealed four main findings. First, BI/BA education research has rapidly escalated since 2018, primarily through conference proceedings. Furthermore, the U.S. and China have led this research field over the last two decades. Although research collaborations have mainly been confined to the domestic level, the U.S. is the focal point for fostering international collaboration. Our analysis also indicates that the existing BI/BA education research has focused on integrating IR4.0 technologies into the BI/BA curriculum and improving learner engagement and education experience. Finally, the research focus has gradually evolved from curriculum and pedagogical development to incorporating advanced Industry 4.0-related technologies such as AI, machine learning, and cloud computing into BI/BA education and traditional business disciplines such as accounting.

Our research findings suggest that future BI/BA education research, especially in the context of HEIs in developing countries, should prioritize partnerships with leading institutions in the U.S. and China to harness their knowledge and expertise. This enables emerging nations to design comprehensive curricula and to adopt best practices tailored to local market needs. Furthermore, future research should emphasize a multidisciplinary and dynamic approach for developing BI/BA curricula. On one hand, it involves integrating BI/BA content into traditional business and IT programs. On the other hand, it incorporates up-to-date technological skills, such as AI, to align with evolving industrial needs. These measures ensure that BI/BA graduates possess future-ready knowledge and enable them to transform Big Data into strategic business insights. Additionally, future research should explore innovative pedagogical approaches and global best practices to refine BI/BA education continuously. These efforts will address the growing demand for competent analytics professionals, foster innovation, and lead to the worldwide development of data-driven economies.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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Hengchao Zhang	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓
Mohamed Asmy Mohd Thas Thaker	✓						✓			✓				
Zarinah Hamid	✓				✓		✓			✓				
Hassanudin Mohd Thas Thaker	✓						✓			✓				

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author [HZ], upon reasonable request.

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BIOGRAPHIES OF AUTHORS

Hengchao Zhang is an assistant professor at the INCEIF University, Malaysia. Prior to this, he served as an assistant professor in the Department of Economics at the Kulliyyah of Economics and Management Sciences, International Islamic University Malaysia (IIUM) until 2023. His research interests encompass various topics, including financial economics, education economics, financial technologies, sustainable economic development, and Islamic capital market. He can be contacted at email: zhang@inceif.edu.my.

Mohamed Asmy Mohd Thas Thaker is an associate professor of Economics at International Islamic University Malaysia. He specializes in economic development, Islamic economics, and waqf. He has published numerous articles in top-ranked journals and received various awards for his research. He can be contacted at email: asmy@iium.edu.my.

Zarinah Hamid was a professor of Economics at the International Islamic University Malaysia. She specializes in economic development, financial integration, and applied economics. She can be contacted at email: inahumkc@gmail.com.

Hassanudin Mohd Thas Thaker is an associate professor of Economics at International Islamic University Malaysia. He specializes in applied economics and international finance. He can be contacted at email: hassanudin@iium.edu.my.