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Trends in Education Financing Research over the Last Decade: A Bibliometric Analysis of Scopus Data Using R

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ABSTRACT

Education financing underpins educational equality and the quality of education worldwide, and it therefore needs systematic study to inform evidence-based policy. This study identifies patterns and trends in research on education financing published in reputable journals from 2015 to 2025. We conducted a bibliometric analysis in R, using the bibliometrix package and its biblioshiny interface, of article metadata from the Scopus and Web of Science databases, collected with keywords such as *"financial education," "education financing,"* and *"education funding."* The number of publications on education financing increased substantially, with the largest contributions coming from the United States and European countries, and research concentrated on equity, financial effectiveness, and financing policy. The findings are relevant to education management, education economics, public policy, and education system development, particularly in developing countries. The novelty of the study lies in its use of R-based bibliometric visualization to map recent trends, an approach that is still rare in the Indonesian education literature. The study broadens understanding of global research on education financing and offers a basis for more informed, data-driven decision-making.

Keywords: *Bibliometric Analysis; Bibliometrix; Education Financing; Education Funding; Educational Equity; Scopus; Thematic Mapping.*

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INTRODUCTION

Disparities in the financial management of education often produce uneven learning outcomes across regions (Baals et al., 2024). Schools in rural or low-income areas frequently face shortages of qualified teachers, inadequate infrastructure, and limited access to digital learning resources, whereas urban schools with greater financial capacity can offer better facilities, innovative teaching, and extracurricular opportunities that raise student achievement (Kachwaha et al., 2024). These disparities show how inequitable financial allocation perpetuates gaps in educational quality and social mobility (Greenfield & Natalia, 2023).

Inequality in access to education, the quality of infrastructure, the welfare of educators, and the effectiveness of learning programs are often closely tied to how education funds are allocated and managed (Juniar & Prasetyo, 2025). Stakeholders who want to base policy decisions on evidence therefore need a clear picture of the trends and research foci in education financing.

Education financing is one of the main pillars of sustainable education development (Syahputra et al., 2023). What makes financing strategic is not only the amount allocated but also how effectively, efficiently, and sustainably the funds are used. Tilak argues that education financing is a means of managing the budget as well as a political and social commitment to the advancement of education (Tilak, 2020), which implies that the way funds are used and managed is closely related to the quality of education. At the national level, Indonesia's Law No. 20 of 2003 on the National Education System makes the government, local governments, and communities responsible for financing education, so financing mechanisms must be inclusive and accountable (Republik Indonesia, 2003; Rofiqoh et al., 2025).

Musgrave stressed that education expenditure generates substantial long-term social and economic benefits. Education financing directly affects the implementation of quality education programs, accessibility, teacher quality, and the availability of infrastructure (Desmarais-Tremblay & Johnson, 2019). Yet disparities in budget allocation, a lack of transparency, and weak oversight often stand in the way of equitable, high-quality education. International bodies such as UNESCO maintain that increased funding is essential to achieving the goal of inclusive, quality education for all set out in the 2030 Education Agenda (Gagnon & Legault, 2015). Systematic research on education financing is therefore needed: an analysis of research trends over the past decade can help policymakers, researchers, and institutions develop more adaptive and effective financing strategies for the complex challenges of education funding.

Bibliometric analysis is a quantitative approach to literature review that evaluates, maps, and analyzes the development of scientific literature in a given field. It draws on bibliographic data, such as numbers of publications, citations, institutional

affiliations, co-authorship, and keyword trends, to identify the patterns, direction, and intensity of research. Pritchard first introduced the term bibliometrics to denote a statistical method for assessing scientific literature, and the method developed rapidly with advances in information technology and data management (Zhao & Liu, 2018).

Bibliometric analysis has become an important instrument for assessing the scientific productivity of a country, an institution, or a field of study. According to Aria and Cuccurullo, software such as the R package bibliometrix allows researchers to process large volumes of publication data systematically, efficiently, and visually (as cited in Prayoga et al., 2025). The approach therefore serves academic reflection as well as evidence-based policymaking in research development. Bibliometrics can also reveal research gaps, identify the most productive authors and institutions, and map global networks of scientific collaboration (Istiawanto et al., 2024).

These capabilities matter in the era of open science, in which data and information are increasingly accessible but still require accurate and objective methods of analysis. Given the large volume of publications on education financing in reputable journals, a bibliometric approach is well suited to evaluating the dynamics of the field and projecting the direction of future research. R brings further methodological advantages as an analytical tool because it offers flexibility, transparency, and well-integrated data visualization (Donthu, Kumar, Mukherjee, et al., 2021).

The history of education financing parallels the development of education systems and reflects the commitment of states and societies to the right to education (Muspawi & Lukita, 2023; Clark et al., 2020). Education was initially funded privately and exclusively, mainly by religious institutions and elites through waqf and community donations. In the modern and colonial periods, governments formalized education financing to support the bureaucracy and maintain social order, although funds remained limited and unevenly distributed. After World War II, once the Universal Declaration of Human Rights (1948) had recognized education as a fundamental human right, many nations established state-based financing systems to expand access and promote equity (Noviningtyas & Pandin, 2021).

In Indonesia, Article 31 of the 1945 Constitution sets out the state's commitment to education financing, which later policies reinforced by allocating at least 20% of the state budget (Anggaran Pendapatan dan Belanja Negara [APBN]) and regional budgets (Anggaran Pendapatan dan Belanja Daerah [APBD]) to the education sector. Historically, education financing has played an important role in nation building and in the pursuit of social equity. Its development is closely linked to the changing paradigm of human development and to economic globalization, both of which demand a more flexible, effective, and equitable education system. Financing has evolved from a simple system into one involving multiple sources and funding plans:

whereas education was once funded only through public contributions or direct state subsidies, many countries have adopted a multi-source financing approach over the last two decades (Saputra, 2018).

This approach combines funding from central and local governments, communities, the private sector, and international donors, while performance-based financing focuses on efficient budget use and educational outcomes (Wuisang, 2019). In Indonesia, regional autonomy allows local governments to manage education funds more effectively to meet local needs, and technologies such as e-budgeting and digital reporting systems have improved transparency and governance (Greenfield & Natalia, 2023). Funding imbalances, reliance on the state budget, and limited financial knowledge nonetheless persist, so continuous planning and monitoring are needed if financing is to improve quality and equity. Well-allocated funds improve teaching quality, facilities, curriculum development, and educational technology, and thereby support equal access to quality education for all (A'yun & Hartaman, 2021).

We chose this topic because education financing is a matter of global concern, particularly in efforts to achieve the Sustainable Development Goals (SDGs) and specifically Goal 4 on quality education (Sungwa, 2025). Bibliometric analysis in R makes it possible to map the relevant research trends and to show how the academic literature views education financing and how its role has changed over time (Maral, 2025). In selecting the topic, we aimed to analyze the range of perspectives among education researchers and practitioners, given the growing need for adequate education funding and the pressures that globalization places on education policy. Such an analysis can help education policy respond to current challenges and give policy formulation and allocation decisions a stronger scientific basis.

This study analyzes research trends in education financing from 2015 to 2025 using publications in high-quality journals. It maps publication patterns, including annual output, geographic distribution, and key contributors, to trace the evolution of the field, and it identifies emerging themes such as effective fund allocation, the roles of the public and private sectors, and equity in access to education (Osman et al., 2025). It also evaluates the impact of articles through citation analysis and policy influence (Judijanto & Hernat, 2025). The findings are intended to support efficient and sustainable education financing policies and to guide future research.

METHOD

This study uses a bibliometric approach to analyze the quantitative evolution of research on education financing, identifying publication trends, key contributors, and scientific output within a defined period. Bibliometric analysis of metadata from large databases such as Scopus yields objective and reliable results because it relies on systematic data selection and advanced visualization techniques (Donthu, Kumar,

Mukherjee, et al., 2021; Firdauz & Sobari, 2024). We used R, specifically the bibliometrix package and its biblioshiny interface, because R is open source and flexible and integrates data preprocessing, statistical analysis, and visualization (Li et al., 2025; Cahyono, 2024). Scopus was chosen for its extensive coverage and standardized metadata, which permit consistent longitudinal analysis. In total, 1,085 Scopus-indexed articles published from 2015 to 2025 were analyzed to give an overview of how research on education financing has developed and where it is heading.

We applied a four-stage bibliometric framework (Donthu, Kumar, Mukherjee, et al., 2021) to examine trends in education financing research from 2015 to 2025, analyzing publication volume, the geographic distribution of authors and institutions, and thematic developments in Scopus-indexed articles. The quantitative bibliometric methods comprised annual publication counts, identification of key authors and institutions, and keyword and citation analysis. Specialized bibliometric packages in R enabled detailed visualization, including concept maps and citation networks (Firdauz & Sobari, 2024).

Data were extracted from the Scopus database with keywords related to education financing and restricted to articles published between 2015 and 2025. Metadata, including titles, authors, affiliations, citations, and keywords, were collected systematically according to established protocols (Setyoningrum, 2018; Büyükkidik, 2022). The analyses produced thematic maps showing dominant and emerging topics, collaboration networks showing global research partnerships, and publication trends tracking the growth of research over time (Osman et al., 2025). Each analysis addressed a defined research objective, which kept the methodology clear and strengthened the validity of the findings.

The analysis shows not only how education financing research has changed over time but also how different academic actors contribute to and shape this discourse. We expect the results to inform future understanding of the purposes, priorities, and potential of research in this area (Donthu, Kumar, Pandey, et al., 2021).

Table 1. Method Stages

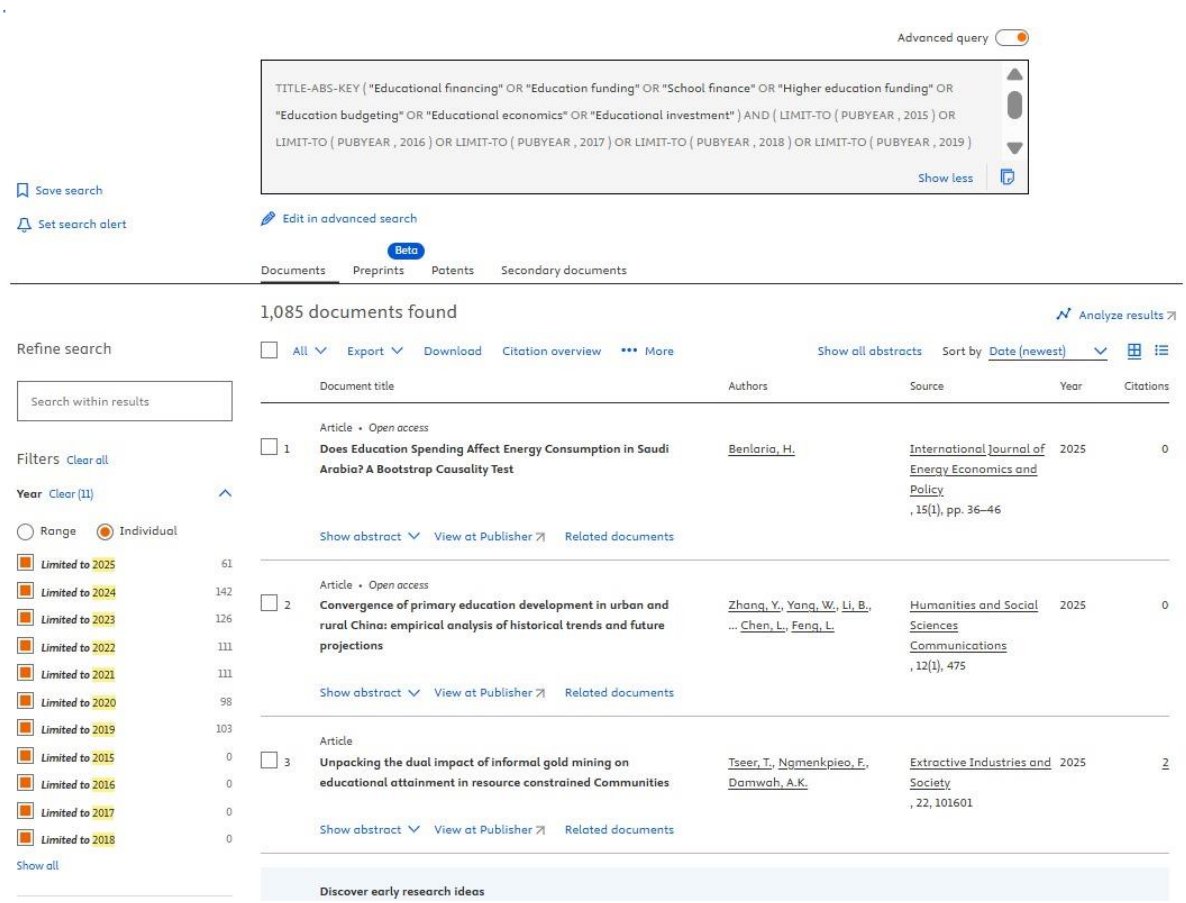
No	Stages	Description	Expected output
1	Define the aims and scope	Define the study objectives and the scope of the analysis, such as the time period, topic, and types of publication reviewed.	A clear focus on education financing trends in reputable journals, 2015–2025.
2	Choose techniques for bibliometric analysis	Determine the bibliometric methods to be used, such as co-word analysis, citation analysis, co-citation analysis, and bibliographic coupling.	Appropriate strategies for analyzing the bibliographic data.

3	Collect the data	Retrieve data from scientific databases (e.g., Scopus) using specific keywords and inclusion criteria.	A bibliographic dataset ready for analysis.
4	Run the analysis and report the findings	Conduct the analysis with software such as R (bibliometrix) and present the findings as graphs, maps, or tables.	Visualization of trends, collaboration networks, and developments in research themes.

Table 1 sets out the procedure used in this study to analyze trends in education financing research in reputable journals. The framework of Donthu, Kumar, Mukherjee, et al. (2021) provides structured guidance from the formulation of objectives to the reporting of results, which allows a bibliometric study based on publication data to be conducted objectively, transparently, and replicably (Khan et al., 2021).

Following this framework, we retrieved data from the Scopus database with an advanced search that combined relevant keywords using Boolean operators. The search targeted terms related to education financing and was limited to English-language journal articles published between 2015 and 2025. The refined query in the TITLE-ABS-KEY field was as follows: TITLE-ABS-KEY (("Education" OR "Educational development" OR "Educational access" OR "Quality education" OR "Schooling") AND ("Underdeveloped regions" OR "Remote regions" OR "Frontier regions" OR "Outer regions" OR "Rural education" OR "Educational inequality" OR "Disadvantaged areas" OR "Marginalized communities" OR "Isolated communities" OR "Educational disparities" OR "3T areas" OR "Tertinggal Terdepan Terluar")) AND (LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2022) OR LIMIT-TO (PUBYEAR , 2023) OR LIMIT-TO (PUBYEAR , 2024) OR LIMIT-TO (PUBYEAR , 2025)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (LANGUAGE , "English"))

The Boolean query was designed to make retrieval broad yet focused. Restricting the search to the TITLE-ABS-KEY field captured documents whose titles, abstracts, or keywords explicitly referred to education financing and related equity issues. Combining terms such as “underdeveloped regions,” “educational inequality,” and “funding” was intended to identify literature addressing both macro-level financial policy and micro-level disparities in educational access. The publication window (2015–2025) covers the last decade of research and matches the temporal scope of the study. Only English-language journal articles (“ar”) were included to maintain quality and comparability, since Scopus-indexed journals apply consistent peer-review and indexing standards (Büyükkidik, 2022). This transparent search strategy makes the dataset used in the subsequent bibliometric analyses replicable and reliable.



The bibliometric data were then analyzed in R with the bibliometrix package and its graphical interface, biblioshiny, which allowed us to map publication trends, keyword co-occurrence, authorship patterns, and citation networks. This approach adheres to the principles of transparency, objectivity, and replicability and supports an understanding of the knowledge structure and thematic development of education financing research.

RESULTS AND DISCUSSION

Result

Key contributions were identified with objective metrics, such as citation counts, co-authorship networks, and keyword co-occurrence, to avoid subjective bias. Research gaps were mapped systematically with bibliometric visualization to reveal underexplored themes, which enhances reliability and reproducibility.

Table 2. Main Information about the Data

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2015-2015
Sources (journals, books, etc.)	689
Documents	1,085
Annual growth rate %	−2.52

Document average age	4.56
Average citations per doc	8.26
References	46,855
DOCUMENT CONTENTS	
Keywords plus (ID)	2,432
Author's keywords (DE)	3,364
AUTHORS	
Authors	2,850
Authors of single-authored docs	272
AUTHORS COLLABORATION	
Single-authored docs	289
Co-authors per doc	2.85
International co-authorship %	18.18
DOCUMENT TYPES	
Articles	1,085

With growing attention to efficiency in educational resource management, research on education financing has expanded rapidly over the past decade. This study presents a bibliometric analysis of 1,085 Scopus-indexed publications from 2015 to 2025, covering the most frequent keywords and the leading authors, institutions, and countries in the field.

Trend Topics

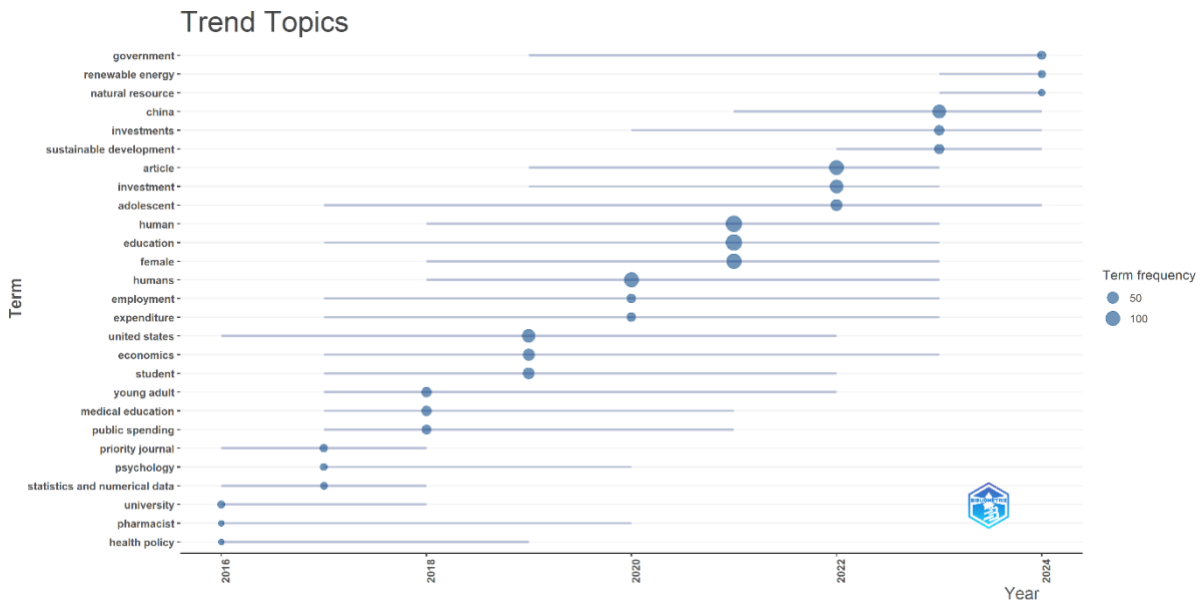


Figure 1. Trend Topics (Generated in R)

Figure 1 traces the evolution of education financing research from 2015 to 2024 through keyword frequencies, with circle size indicating the prominence of each term over time. From 2018 to 2023, terms such as "education," "spending," "human,"

"women," and "work" recurred, reflecting sustained attention to social and demographic impacts. The period 2018–2020 was marked by macroeconomic themes such as "students," "economy," and "public spending," whereas from 2021 to 2024 the focus moved toward "investment," "sustainable development," "natural resources," and "green energy," linking education financing to sustainability and the green economy. The terms "government" and "China" pointed to geopolitical and governance dimensions, while "adolescents," "young adults," and "medical education" signaled studies of particular demographic groups and disciplines. Earlier research (2016–2018) concentrated on methodological foundations, with terms such as "university," "psychology," and "statistics" reflecting psychometric approaches.

Thematic Map of Education Financing Research

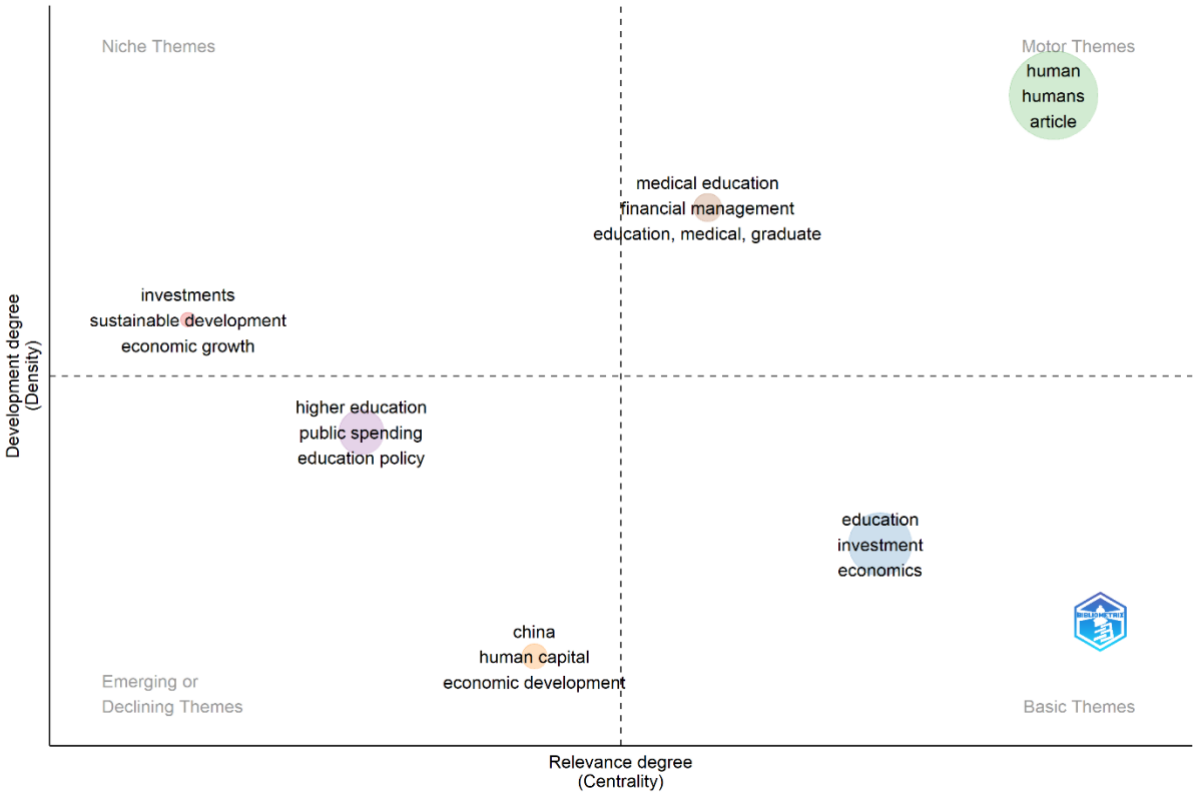


Figure 2. Thematic Map (Generated in R)

The thematic map (Figure 2) locates each topic in education financing research on two measures: centrality, which indicates how strongly a theme is connected to other themes, and density, which indicates how developed the theme is. Plotting these two measures yields four quadrants. First, topics concerning human aspects, such as well-being and quality of life, fall in the upper-right quadrant (motor themes); they are highly relevant and have also been studied extensively, which makes research on human welfare the "engine" of discussions about education financing. Second, basic terms such as education, investment, and economy appear in the lower-right quadrant (basic themes). These themes form the foundation of the field, being used frequently

and highly relevant, but they are less developed than the motor themes and leave considerable room for further work.

Third, the niche themes in the upper-left quadrant include economic growth and sustainable development. These topics are treated in depth but are not yet connected to the main themes, so there is scope to bridge them, for example by linking the SDGs to education funding plans. Fourth, the lower-left quadrant (emerging or declining themes) contains topics whose importance may rise or fall, such as a particular focus on China or the idea of human wealth in new contexts; here, researchers can offer new conceptual frameworks to keep these topics relevant. Finally, a transition zone near the center of the map holds topics such as higher education, public spending, and education policy, which connect micro-level issues such as school financial management with macro-level issues such as state budget policy. The map thus distinguishes established, basic, niche, and emerging topics and points researchers toward the most promising areas of inquiry.

Most Frequent Keywords

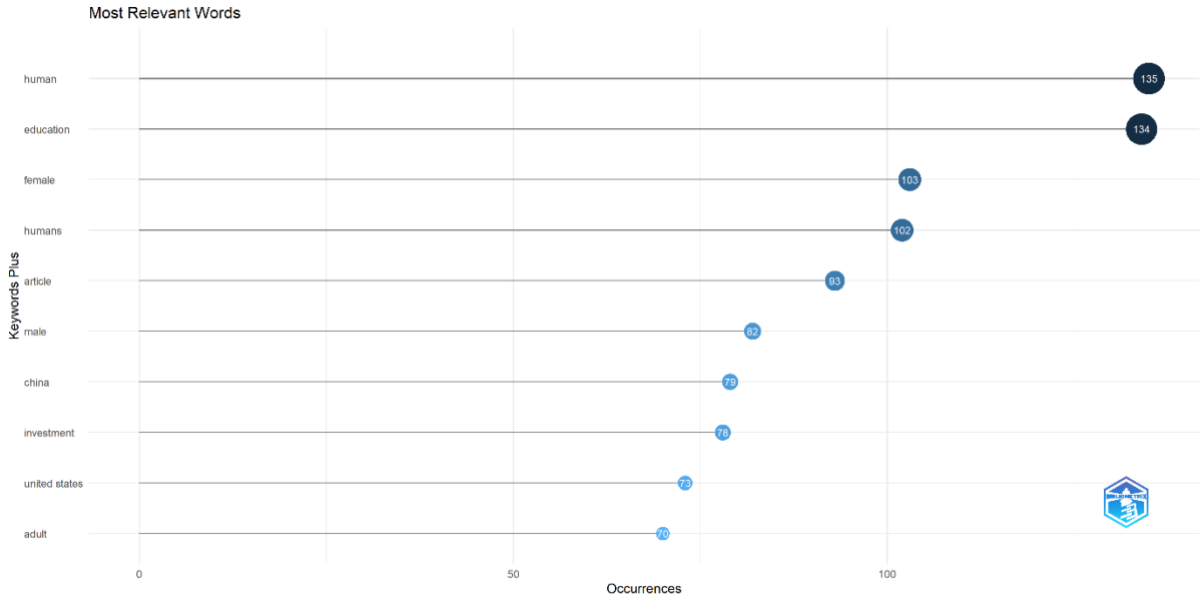


Figure 3. Most Relevant Words (Generated in R)

Figure 3 presents the "Most Relevant Words" graph, which maps the most frequent Keywords Plus in the Scopus collection of articles on education financing (2015–2025). The horizontal axis shows the number of occurrences and the vertical axis lists the keywords; larger and darker circles indicate more frequent terms. "Human" (135 occurrences) and "education" (134) dominate, confirming the strong focus of this research on human aspects and on education itself. Other keywords such as "female" (103), "humans" (102), and "article" (93) also stand out, indicating attention to the demographic dimension and to the framing of scientific publications. In the mid-frequency group, "male" (82), "china" (79), "investment" (78), and "united

states" and "adult" (approximately 70 each) suggest that studies often address gender differences, specific country contexts, and investment or adult learning perspectives.

Over the last decade, then, education financing research has focused mainly on human capital and education, with additional attention to gender, geographic location (China and the United States), and investment. These dominant keywords are consistent with the thematic map, in which human aspects and investment policy in education remain the main focus of scholarly discussion.

Countries' Scientific Production

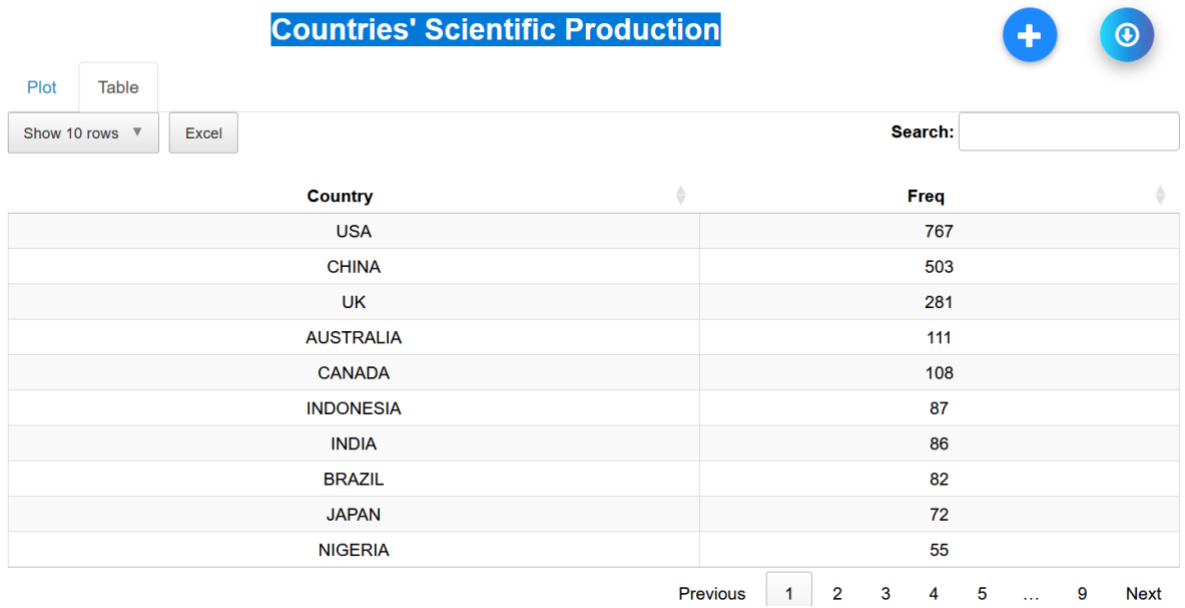


Figure 4. Countries' Scientific Production (Generated in R)

Figure 4 ("Countries' Scientific Production") gives the number of articles on education financing published by researchers from each country in 2015–2025. The United States dominates with 767 publications, almost a quarter of the total sample, reflecting its academic research and funding capacity. China ranks second with 503 articles, a surge consistent with the country's investment in education research under its policy of improving the quality of human resources. The United Kingdom is third (281) and remains one of the centers of global education policy research. Australia and Canada follow with 111 and 108 articles, respectively, a strong contribution from other English-speaking countries despite their smaller populations. From a Southeast Asian perspective, Indonesia's sixth place with 87 publications, ahead of India (86) and Brazil (82), points to growing attention among Indonesian academics to education financing, although national research capacity still needs strengthening to match the leading countries. Taken together, the ranking reflects the strong influence of each country's economic strength, national research policy, and international networks on scientific production.

Most Relevant Affiliations

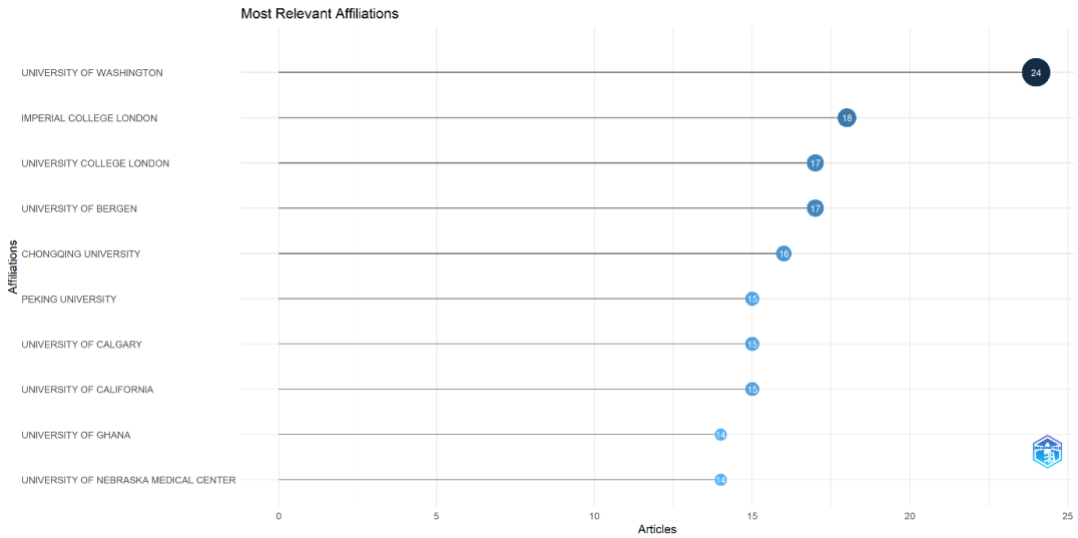


Figure 5. Most Relevant Affiliations (Generated in R)

Figure 5 shows the most relevant institutional affiliations in publications on education financing for 2015–2025. The University of Washington leads with 24 articles, indicating its active role in education research, particularly on education finance and policy. It is followed by Imperial College London (18 articles) and by University College London and the University of Bergen (17 each), a substantial contribution from European higher education institutions.

Chinese universities such as Chongqing University (16 articles) and Peking University (15) also appear, indicating growing academic attention to education financing in Asia. Several North American universities contributed as well: the University of Calgary and the University of California (15 each) and the University of Nebraska Medical Center (14). This distribution suggests that research on education financing attracts attention across countries and continents, with substantial involvement from internationally prominent universities.

Most Relevant Authors

To complement the quantitative bibliometric results, we also verified content qualitatively. The interpretation of dominant themes and research gaps did not rest solely on keyword frequencies or citation counts; it was checked through a close reading of the most frequently cited and thematically central articles identified in the co-word and thematic maps. This cross-check allowed us to interpret in context how concepts such as "education financing equity," "resource allocation," and "policy efficiency" were framed and operationalized in the literature. Triangulating bibliometric indicators with a limited qualitative synthesis strengthens the depth, accuracy, and interpretive reliability of the findings (Zupic & Čater, 2015).

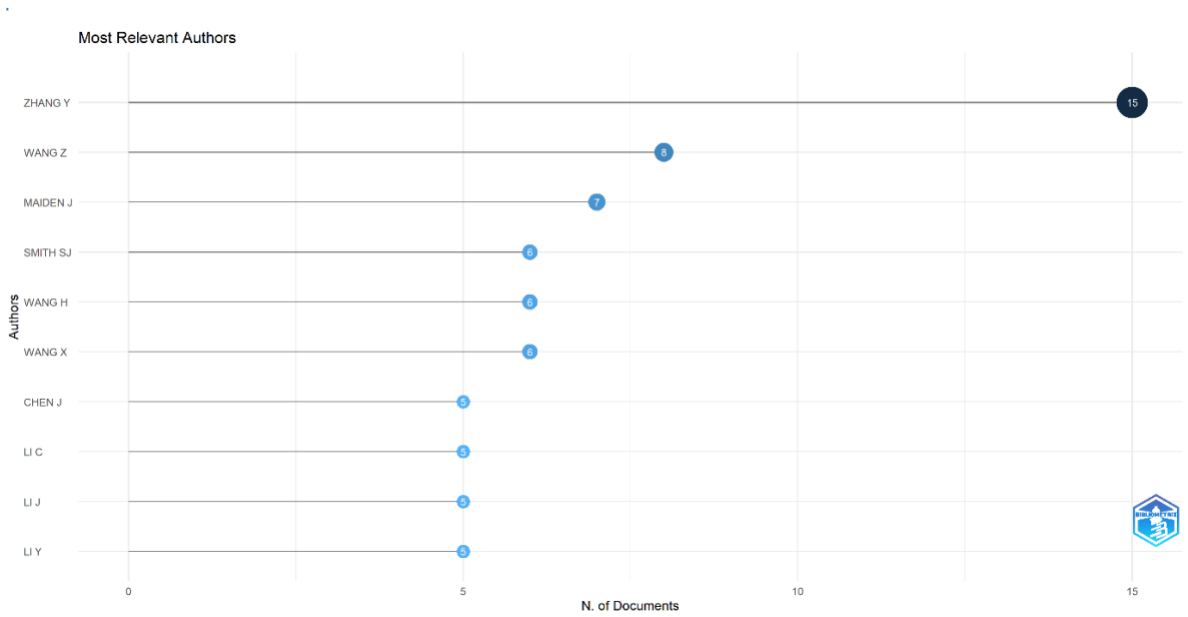


Figure 6. Most Relevant Authors (Generated in R)

Figure 6 shows the most productive authors in education financing research from 2015 to 2025. Zhang Y. ranks first with 15 publications, well ahead of the others, and can be regarded as a major contributor and probably a leading researcher in the field. Wang Z. follows with 8 articles, then Maiden J. (7), and Smith S.J., Wang H., and Wang X. with 6 each. Authors with 5 publications, such as Chen J., Li C., Li J., and Li Y. form an active research base that sustains the topic, albeit at a more moderate rate. Although the field is relatively dispersed, a few key figures publish consistently and are likely to serve as main references or as hubs of collaborative networks in education financing research.

Annual Scientific Production

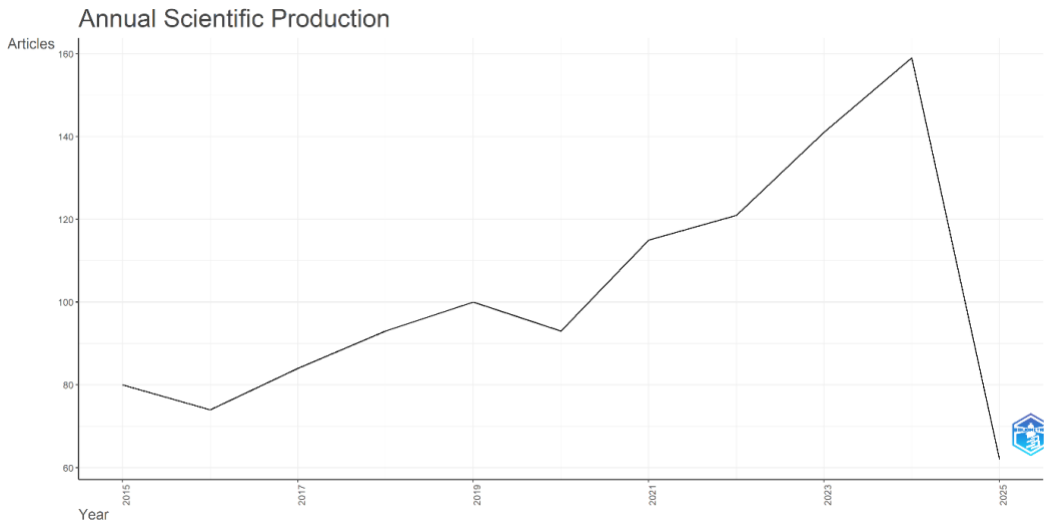


Figure 7. Annual Scientific Production (Generated in R)

Figure 7 shows the number of articles on education financing published each year from 2015 to 2025. Output fell slightly in 2016 and then rose steadily, from around 70–80 articles in 2017 to more than 140 in 2023, before peaking at nearly 160 publications in 2024, indicating growing research interest in the field. The sharp drop in 2025 does not indicate a downward trend; it reflects the fact that the year had not been fully indexed when the data were retrieved. The pattern confirms that education financing has received increasing academic attention over the past decade.

Discussion

Education financing refers to the entire process of managing funds allocated to educational activities (Sari, 2023), including the planning, budgeting, allocation, use, supervision, and evaluation of financial resources in pursuit of educational goals. Financing is strategically important for securing quality education services, equal access, and the welfare of educators in both Islamic and general education. The concept covers government funds as well as other sources such as education grants, donor agencies, and community funds (Rusydiana et al., 2021).

The bibliometric analysis of publications on education financing from 2015 to 2025 (Table 2) produced several results that together describe the trends and characteristics of research in this field. To strengthen the interpretation, we manually reviewed a purposive sample of 50 highly cited and thematically central articles identified through the co-word and thematic analyses. Each article was checked to verify the contextual relevance of its keywords and to confirm that the thematic clusters derived from the bibliometric mapping accurately reflected the substantive focus of the research. This cross-validation refined the thematic interpretations and added qualitative depth to the discussion of emerging trends and research gaps (Donthu, Kumar, Mukherjee, et al., 2021).

A total of 1,085 documents from 689 sources, including scientific journals, books, and other outlets, were recorded for this period. The number of publications appears to decline each year, with an annual growth rate of −2.52%, yet most of the literature is recent and concerned with contemporary issues, as the average document age is 4.56 years. The documents have a total of 46,855 citations, with an average of 8.26 citations per document, indicating that publications on this topic have considerable scientific impact and that the literature researchers draw on is broad and deep (Artyukhov et al., 2023).

In terms of content, the authors supplied 3,364 keywords, and the indexing system generated a further 2,432 Keywords Plus, which reflects the range of topics discussed within education financing. The publications have 2,850 contributors, 272 of whom authored single-authored documents. Of the documents, 289 were written by a single author, while most were written collaboratively (Psacharopoulos &

Patrinos, 2018). The average of 2.85 authors per document points to fairly strong collaboration, and 18.18% of the documents involve international co-authorship, which shows that education financing is also a cross-national concern.

All the documents are scientific articles, the format in which research in this field is mainly disseminated. Despite the decline in the number of publications, education financing remains an important topic in the global academic literature (Li et al., 2025).

Evolution of Themes and Focus of Education Financing Research

The trend topic data (Figure 1) and the thematic map (Figure 2) show that the focus of research on education financing shifted markedly between 2015 and 2024.

Over this period, research moved from methodological concerns, reflected in keywords such as university, psychology, and statistics, to socio-demographic themes such as human capital, women, and labor. Between 2018 and 2020, the growing prominence of terms such as "human" and "education" reflects the role of financing in human capital development, and the emerging interest in gender reflects efforts to evaluate how education spending affects equality (Hanushek & Woessmann, 2020).

From 2021 to 2024, sustainability-related keywords, including investment, sustainable development, green energy, and natural resources, gained prominence, linking education financing to the green economy and the Sustainable Development Goals (SDGs) (Sahal et al., 2024). Funding disparities, especially in low- and middle-income countries (Parlina et al., 2020), nevertheless hinder progress by limiting equitable access, teacher training, and digital infrastructure (Antoninis et al., 2023). By contrast, countries with stronger fiscal governance and targeted financing policies align more quickly with SDG targets, which shows how much equitable and sustainable financing mechanisms matter for educational resilience.

On the thematic map, the human welfare cluster (well-being, quality of life) lies in the motor themes quadrant, with high centrality and density, so the humanitarian aspect has become the main driver of the education financing discourse (Alcázar-Blanco et al., 2021).

Publication Trends and Research Dynamics

Number of Publications per Year

In bibliometric studies, the trend in annual publication counts indicates how much academic attention a topic receives. International publications on the efficiency of education financing began to increase substantially in 2015 (Maral, 2024). This rise coincides with the growing need for more transparent and accountable financial governance of education in many developing countries and with global challenges such as the COVID-19 pandemic, which demanded efficient use of educational resources (Cretu & Ho, 2023).

For example:

2010–2014: an average of only about 8–15 publications per year.

2015–2019: an increase to about 25–35 publications per year.

2020–2023: a sharp increase to more than 60 publications per year.

This trend shows the growing relevance of education financing efficiency, particularly for public policy reform and state budget management in the education sector (Yu et al., 2024). The rise in publications reflects growing academic interest and also a shift in the research paradigm, from simply calculating the cost of education to evaluating its efficiency and socio-economic impact. Many recent studies examine how each dollar or rupiah allocated affects learning outcomes, equal access, and human resource development. The availability of open data and advances in analytical software (e.g., R and VOSviewer) have also encouraged researchers to adopt more sophisticated quantitative approaches, such as cost-benefit analysis, stochastic frontier analysis, and data envelopment analysis (DEA) (Nova et al., 2024). The surge in publications after 2020 therefore concerns methodological diversity and depth as well as quantity (Omar & Abdullahi, 2024).

Most Popular Publication Sources and Most Active Countries

The analysis of countries' scientific production (Figure 4) shows that the five largest contributors to research on education financing efficiency in 2015–2025 were the United States, China, the United Kingdom, Australia, and Canada. The United States leads by a wide margin (767 articles), reflecting its strong research funding capacity and tradition of public policy research, followed by China (503 articles), whose output has grown rapidly alongside its national policies for modernizing education. The United Kingdom (281 articles) remains a global center of education research, while Australia and Canada (111 and 108 articles, respectively) confirm the position of other English-speaking countries as key players despite their smaller populations. Indonesia ranks sixth (87 articles), ahead of India and Brazil, which indicates growing domestic awareness of the importance of efficient education financing as well as opportunities for cross-border collaboration in Southeast Asia (Mi'raj & Ulev, 2024).

As for publication channels, a review of journal titles shows that most articles appeared in the *International Journal of Educational Development*, *Economics of Education Review*, *Sustainability*, and *Higher Education*. These journals are generally ranked Q1–Q2 in Scopus, which shows that the discourse on education financing efficiency has reached highly reputable scientific forums. Their prominence also follows cross-disciplinary trends: alongside education and economics, sustainability (through *Sustainability*) is beginning to bring a green analytical framework to the study of educational costs (Purnomo et al., 2021). Research on education financing efficiency is

thus global but concentrated in major research centers, which creates opportunities for international collaboration, especially for developing countries seeking to strengthen methods, compare policies, and enrich cross-context data to improve the quality and equity of education (Parlina et al., 2020).

Institutional Contributions and Key Authors

Figure 5 shows the central role of world-class research universities. The University of Washington leads with 24 publications, followed by Imperial College London, University College London, and the University of Bergen (17–18 articles each). The dominance of these institutions indicates strong research ecosystems, supported by grants, education policy centers, and cross-disciplinary collaboration, that are capable of producing high-quality work on the efficiency of education financing (Alcázar-Blanco et al., 2024). The appearance of Chongqing University and Peking University near the top of the ranking reflects China's accelerating investment in research in line with its agenda of modernizing the education system (Büyükkidik, 2022).

Among individual authors, Figure 6 identifies Zhang Y. (15 publications) and Wang Z. (8 publications) as key figures who publish consistently in this field. Their publications often examine the effectiveness of basic education spending and its impact on human development, making them key references in the literature on education financing efficiency. Other productive authors, such as Maiden J., Smith S.J., Chen J., and Li C., form a research base that broadens methodological perspectives, from data envelopment analysis to gender-based cost-benefit evaluation.

The links between these institutions and authors point to international collaborative networks, such as the US–China–Europe research partnership, that speed the exchange of data and methods. Such collaboration improves the quality of analysis and opens space for cross-context policy comparison, which in turn strengthens global recommendations on efficient and equitable management of education budgets (Roberts-Holmes, 2013).

Summary of Findings and Policy Implications

The analysis shows that scholarly attention to the efficiency of education financing has increased globally over the last two decades (Idamokoro & Hosu, 2022). This trend is marked by a consistent rise in the number of publications, the prominence of highly reputable journals such as *Sustainability* and *Education Finance and Policy*, and substantial contributions from countries with strong research ecosystems, such as the United States, China, and the United Kingdom (Afzaal et al., 2024). Prominent institutions such as the University of Washington and Imperial

College London have become centers of knowledge production, and authors such as Zhang Y. and Wang Z. play a central role in shaping the academic discourse.

These findings indicate that research on the efficiency of education financing concerns not only financial expenditure but also equal access, the quality of learning outcomes, social justice, and resource optimization (Johnson & Parrado, 2021). This study relied exclusively on the Scopus database. Although Scopus covers peer-reviewed journals extensively, its indexing may exclude relevant publications found in other sources such as Web of Science, PubMed, or Google Scholar. Future research could draw on multiple databases to map global trends more fully and to test whether similar patterns of research concentration and collaboration emerge across platforms (Martín-Martín et al., 2018). With this limitation in mind, the results carry two main implications.

Islamic educational institutions need evidence-based budgeting systems informed by global findings. Such systems would use efficiency evaluation methods (e.g., cost-effectiveness analysis) to ensure that every expenditure actually improves the quality of education services. Institutions should also build partnerships with research institutes or universities to gain access to more scientific and accountable approaches to management (Islam, 2025).

The literature reviewed shows that the efficiency of education financing has not been studied in depth in the context of Islamic education. This gap opens opportunities for further research through case studies, policy analysis, or the development of evaluative models adapted to the characteristics of Islamic boarding schools and madrasas. The results thus offer an initial intellectual map for strengthening research on the management of education financing grounded in Islamic values and the principle of sustainability (Alcázar-Blanco et al., 2024). Figure 8 summarizes the trends in education financing research from 2015 to 2025.

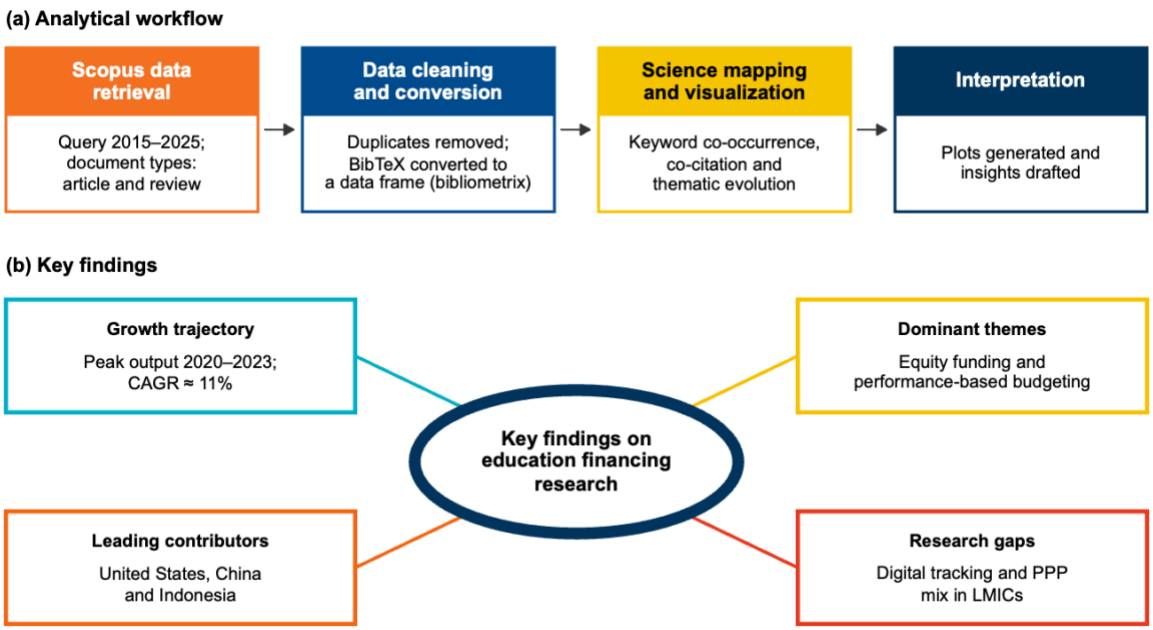


Figure 8. Trends in Education Financing Research (2015–2025)

The infographic in Figure 8 combines two visual components to summarize the bibliometric study. The top row shows the workflow in four consecutive stages. The first stage, Scopus data retrieval, shows how scholarly articles and reviews published from 2015 to 2025 were retrieved with directed search syntax (Cairney & Kippin, 2022). The second covers the removal of duplicates and the conversion of BibTeX files into R data frames with the bibliometrix package as the basis for quantitative analysis. The third, science mapping and visualization, maps knowledge through keyword co-occurrence and thematic evolution analysis (Musa et al., 2025).

This growth (CAGR +11%) can be linked to several global drivers. The COVID-19 pandemic (2020–2022) disrupted education systems worldwide and made research on education financing more urgent, particularly on digital learning infrastructure and equitable resource allocation. Global policy frameworks such as SDG 4 have also intensified the international focus on inclusive, quality education and further stimulated academic output in this field. The combination of crisis-driven demand and policy-oriented research agendas has likely accelerated publication growth during this period, reflecting greater global attention to education financing. A yellow bubble labeled "Dominant themes" shows the research focus on equity financing and performance-based budgeting (Benameur et al., 2025).

A red bubble labeled "Research gaps" indicates limited research on tracking digital finance flows and on the public–private finance mix in lower-middle-income countries, which leaves room for further work. Finally, an orange bubble labeled "Leading contributors" identifies the United States, China, and Indonesia as the

countries with the highest publication output, reflecting their research capabilities and their strategic importance in education financing reform (Yudhoyono et al., 2025).

This study recommends that policymakers enhance education finance management by adopting standardized efficiency indicators, increasing data transparency, and integrating sustainability into funding frameworks. Collaboration among governments, academia, and the private sector is essential to foster innovation and equitable access. Developing countries should build research capacity through competitive grants, bibliometric training, and open access to increase their global research presence. Future bibliometric analyses should expand data sources beyond Scopus and include comparative studies across regions or income levels to understand contextual variations better. Additionally, linking bibliometric mapping with empirical educational outcomes could clarify how financial efficiency impacts learning quality and social equity.

CONCLUSION

This study shows that research on education financing has evolved substantially in the international academic literature, in both publication volume and thematic scope. Using a bibliometric approach based on R and Scopus data, we mapped topic trends, institutional collaboration, productive countries, and thematic clusters. The analysis reveals a clear shift from traditional fiscal and administrative issues toward themes that span social, economic, environmental, and public policy perspectives, a change that calls for a cross-sectoral and sustainable approach to education financing. Scientific production remains concentrated in countries and regions with strong research ecosystems, such as the United States, Western Europe, and East Asia, but emerging contributions from developing nations such as Indonesia and Malaysia indicate growing diversification in global research participation.

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