Review Article

e-ISSN: 2710-2122, p-ISSN: 2710-2114
2026: Vol 8(1), pp 1-14. https://doi.org/10.38140/ijer-2026.vol8.1.06
Interdisciplinary Journal of Education Research

Global Research Trends in Integrating Education for Sustainable Development into School Curricula: A Bibliometric Analysis (2015–2024)

Mzuyanda Percival Mavuso[1]
Kayode Babatunde Olawumi[2*]

AFFILIATIONS

[1&2]Faculty of Education, University of Fort Hare, East London, South Africa.

CORRESPONDENCE

Email: kayode.olawumi1969@gmail.com*

EDITORIAL DATES
Received: 05 October 2025
Revised: 20 January 2026
Accepted: 28 January 2026
Published: 26 February 2026

DOI: 10.38140/ijer-2026.vol8.1.06

Abstract: Education for Sustainable Development (ESD) has become a global priority for promoting environmental, social, and economic sustainability through formal education. However, the pattern of global research output on ESD integration into the school curriculum has remained uneven, with concerns about limited research from developing countries and Africa. This study presents a bibliometric analysis of global research trends on ESD integration from 2015 to 2025. The study adopts a qualitative bibliometric analysis approach, collecting data from the Web of Science (WoS) database due to its high quality and extensive coverage. Articles published between 2015 and 2025 were considered for the study. The analysis reveals an upward trend in ESD publications globally, with a sharp rise from 2019. Research output on ESD is dominated by developing countries, especially the USA, with 315 articles; China, with 229 articles; the UK, with 210 articles; and Australia, with 176 articles. Institutional productivity is also concentrated in the global north, led by Manchester Metropolitan University, the University of California system, and major Australian universities. The most productive journal is Sustainability, which accounts for over 50 percent of the total output. Findings indicate a significant regional disparity in ESD research, with African countries showing lower production output, weak international collaboration, and limited citation impact. Strengthening research capacity, expanding cross-continental collaborations, and improving access to high-impact publication platforms are essential for advancing equitable global engagement in ESD scholarship.

Keywords: Education for sustainable development, Integration, Bibliometric analysis, curriculum, systematic review.

1. Introduction

Increasing environmental issues across the globe are multifaceted and multidimensional. Improved economic activities globally may have contributed to environmental problems such as climate change, biodiversity loss, freshwater scarcity, land degradation, and other environmental concerns (Yang et al., 2023; Khan et al., 2022). In response to these issues, education for sustainable development (ESD) has been embraced worldwide through the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs), which aim to achieve social equity, economic growth, and environmental preservation (Agbedahin, 2019; Shulla, K. et al., 2020). ESD is to be implemented across all disciplines, specifically addressing goals 13 (Climate Action), 14 (Life Below Water), 15 (Life on Land), 4 (Education), and 12 (Responsible Consumption and Production) (Leal Filho et al., 2019; Chou & Wang, 2024). These goals are to be driven by integrating ESD into the school curriculum, developing competencies, values, and transformative behaviours to achieve these interconnected and interrelated objectives.

However, despite an increase in academic interest in bibliometric analysis related to ESD, there is a dearth of research publications focusing on research trends regarding ESD and its integration into

the school curriculum globally. Most bibliometric analyses focus only on specific subject areas (Bazilova et al., 2025) or relevant topics in higher education (Chusniyah et al., 2025; Tao & Tao, 2024; Arifin et al., 2025). Other articles on ESD have concentrated on areas such as curriculum development and pedagogical methods, while paying less attention to the systematic synthesis of global trends in the production of articles on ESD, countries with higher production rates, annual production trends of journals, corresponding authors, and international collaborations among nations. Exploring international regional collaborations enhances research development from developing countries, especially in Africa, and facilitates effective policy formulation and development.

Through the use of bibliometric analysis, this study intends to investigate the patterns of research on the incorporation of ESD into the curriculum through a substantial body of research-related documentation produced between 2015 and 2024. With the advent of tools like Gephi, Leximancer, and VOS Viewer, as well as scientific databases like Scopus and WoS, bibliometric analysis has gained international attention in business research (Donthu et al., 2020b; Khan et al., 2021). Additionally, bibliometric analysis is valued for its ability to handle vast amounts of scientific data while generating research insights. According to studies, researchers employ bibliometric analysis to examine the intellectual structure of a particular domain within the existing literature, as well as to identify new trends in article and journal performance, collaboration patterns, and research constituents (Donthu et al., 2021; Verma & Gustafsson, 2020; Donthu et al., 2021). Well-executed bibliometric studies can provide a solid groundwork for expanding a topic in new and significant ways by offering researchers a comprehensive overview, identifying knowledge gaps, generating new research ideas, and positioning their intended contributions to the field. The following questions were addressed by the study:

- What is the current trend in the annual distribution of Education for Sustainable Development globally from 2015 to 2024?
- What is the current state of the distribution of academic research on Education for Sustainable Development globally from 2015 to 2024?
- Which country and institution have the highest affiliation with ESD research from 2015 to 2024?
- By analysing highly cited literature on ESD, which country and author have the highest citations that can be identified from 2015 to 2024?

2. Materials and Methods

According to Kumar et al. (2023), Donthu et al. (2021), and Donthu et al. (2020), bibliometric analysis is a quantitative method that employs tools to analyse and characterise published papers for scientific review. This approach identifies connections and correlations between words by mining previous publications, enabling the examination of the geographical and chronological distribution of publications across various academic domains. This systematic review methodology reduces the possibility of errors associated with manual and qualitative assessments when working with large datasets, providing thorough, dependable, and replicable procedures (Klarin, 2024). Additionally, this method assists in establishing research goals, determining research coverage, and identifying inconsistencies that require further study. Research trends are visualised through graphic analysis, which incorporates data such as article titles, author information, publication locations, and keywords. The authors analyse publication patterns, productive nations, contributing institutions, and countries that integrate ESD into the curriculum using a scientific methodological approach. Using the biblioshiny function, part of the bibliometrix package in the RStudio programme designed for text mining analysis, we conducted citation analysis, co-citation analysis, and collaboration analysis.

2.1 Eligibility criteria

We examine the various concepts and methodologies that illustrate the significance of education for sustainable development in this bibliometric review. Our work incorporates research publications

from 2015 to 2024. These articles are peer-reviewed and focused on ESD, meaning that conference papers, books from databases other than WoS, and book chapters are excluded from the selection. We also consider only articles published in English; those published in other languages were rejected. Additionally, the selection includes articles from the Social Science Citation Index (SSCI) and the Social Science Index Expanded (SSIE). The authors also take into account the categorisation of the following WoS categories in their selection process: education, educational research, green sustainable science technology, education scientific discipline, and social sciences interdisciplinary.

The data were extracted from the WoS database on February 8, 2025. We adopted the WoS database for data collection due to its wide coverage and reliability, as well as the fact that high-quality journals are indexed in it. We consider only WoS papers; Scopus-published articles were not included in the selection because they are also indexed in WoS. The analysis was conducted using Biblioshiny in R version 4.5.1. To validate the research and its relevance, the authors subjected the data collection, analysis, and interpretation to expert review. The search strings were also subjected to expert review; after the search results were obtained, they were assessed for validity and reliability purposes.

Table 1: *Inclusion and exclusion criteria*

Inclusion Criteria	**Exclusion Criteria**
Peer-reviewed articles were selected for the study.	Non-peer-reviewed articles were rejected for this study
Only articles published between 2015 and 2024 were selected for review	Articles published outside of the 2015 and 2024 were excluded from the study.
Articles published in the English language were considered for inclusion	Articles published in languages other than English speakers were excluded from the study.
The authors also considered only articles that focus on ESD and curriculum.	Articles that focused on Environmental education, climate change, which are not the direct focus of the study, were excluded from study.

2.2 Search strings

Articles were selected from the WoS databases using the following search strings: Education AND sustainable development AND school curriculum. This search resulted in the selection of 2,470 articles.

2.3 Search results and data description

We conducted an investigation into research papers on the integration of Education for Sustainable Development (ESD) into the school curriculum using the Web of Science (WoS) database. The WoS comprises over 100 million documents, focusing on high-quality articles. We searched the WoS database for items related to "Education for Sustainable Development" and "School Curriculum," resulting in the identification of 2,470 articles. We then narrowed our search to articles published from 2015 to 2024, reducing the number to 1,811. Furthermore, we filtered for peer-reviewed articles, which brought the count down to 1,422. We also restricted our search to articles published in English, resulting in 1,378 articles. Additionally, we considered the SSCI and SSIE citation indexes, which led to the selection of 925 articles. Finally, we filtered the search further to include articles from WoS categories such as Educational Research, Green Sustainable Science Technology, Education Scientific Discipline, and Social Sciences Interdisciplinary, resulting in the identification of 630 articles.

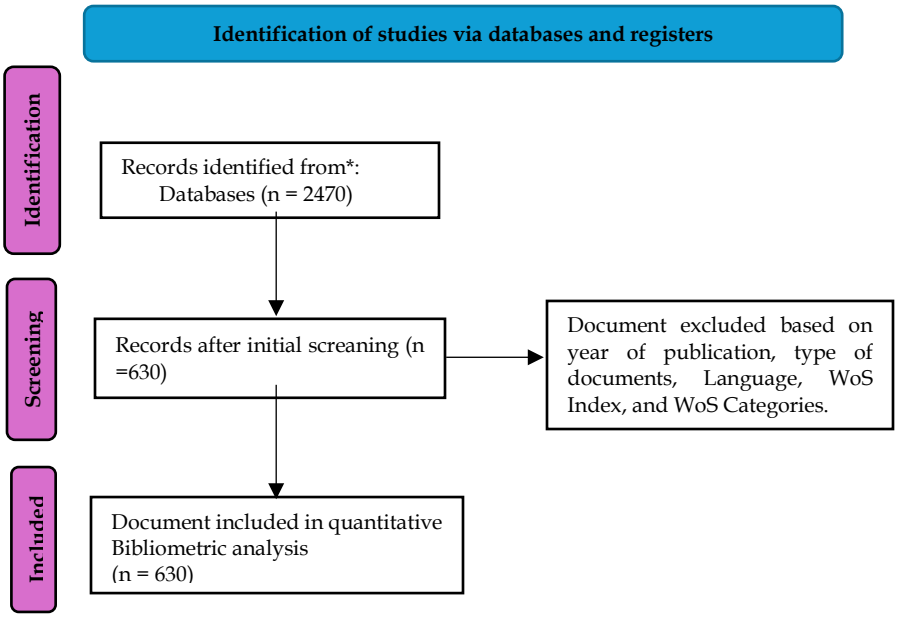

Figure 1: *PRISMA flow diagram describing the process of data collection from the WoS database*

3. Results and Discussions

In this section, we present the findings within the framework of the research purpose. The following findings were obtained from the literature on ESD and are presented in tables and figures.

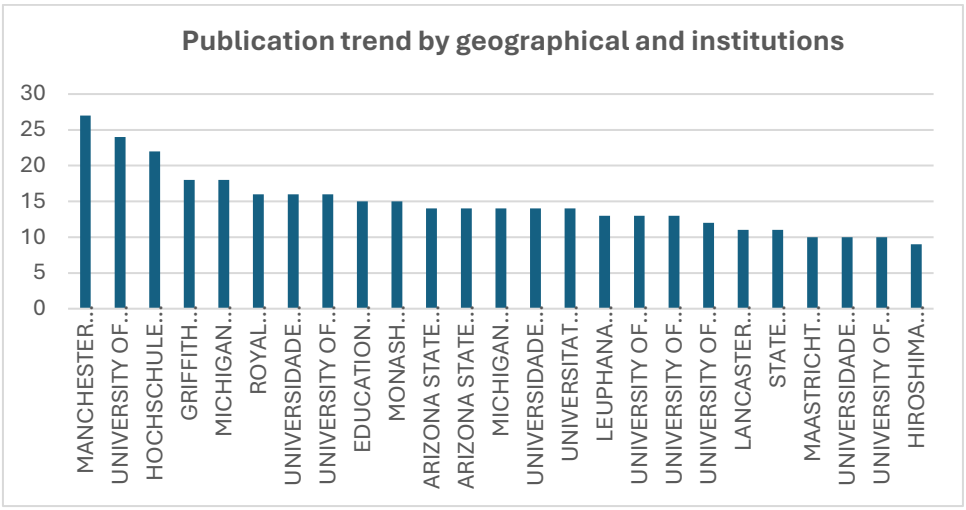

Figure 2: *Publication trend by geographical and institutions*

Figure 2 represents the trends in the publication of articles on ESD by affiliations and countries. Table 1 and Figure 2 display the affiliations of researchers, which include universities or research institutes, as well as the corresponding countries. The data clearly indicate that the majority of publications originate from developed countries. Manchester Metropolitan University (UK), the University of California (USA), and Hochschule Angewandte Wissenschaft Hamburg (Germany) have the highest outputs, with 27 articles, 24 articles, and 22 articles, respectively. The data reveal that developing countries in Africa do not appear on the lists of the top 25 countries with the highest publications on ESD. It is important to note that there is a concentration of articles on ESD in developed countries. In

Africa and other developing regions, little or no research on ESD has been conducted. This is a concerning trend, as the issues of sustainability, climate change, and environmental challenges are particularly pronounced in African countries. Therefore, more research on ESD is needed to find solutions to these problems. This finding underscores the necessity for increased research on ESD in light of environmental degradation, climate change, biodiversity loss, and other environmental issues specific to Africa. Institutions in Africa should enhance the capacity of their academics and students to engage in research on ESD, aiming to be on par with their counterparts in European and other developed countries.

Table 2: *Top 25 Countries by institutions*

S/N	INSTITUTIONS/AFFILIATION	COUNTRY	ARTICLES
1.	Manchester Metropolitan University	UK	27
2.	University of California System	US	24
3	Hochschule Angewandte Wissenschaft Hamburg	Germany	22
4.	Griffith University	Australia	18
5.	Michigan State University	US	18
6.	Royal Melbourne Institute of Technology (RMIT)	Australia	16
7.	Universidade De Passo Fundo	Brazil	16
8.	University Of London	UK	16
9.	Education University of Hong Kong (Eduhk)	Hong Kong	15
10.	Monash University	Australia	15
11.	Arizona State University	US	14
12.	Arizona State University-Tempe	US	14
13.	Michigan State University College of Human Medicine	US	14
14.	Universidade Estadual De Campinas	Brazil	14
15.	Universitat Politecnica De Catalunya	Spain	14
16.	Leuphana University Lüneburg	Germany	13
17.	University of Bristol	UK	13
18.	University of Wollongong	Australia	13
19	University of Pécs	Hungary	12
20.	Lancaster University	UK	11
21.	State University of New York (SUNY) System	US	11
22.	Maastricht University	Netherlands	10
23	Universidade Federal Fluminense	Brazil	10
24.	University of Salamanca	Spain	10
25.	Hiroshima University	Japan	9

Table 2 shows the affiliations and production trends by country. The top three countries with the highest production of articles on ESD are Manchester Metropolitan University, UK (27 articles), University of California System, US (24 articles), and Hochschule Angewandte Wissenschaft Hamburg, Germany (22 articles). Figure 3 presents the global output of articles on ESD by countries from Africa, Asia, Australia, Europe, North America, and South America. The map also illustrates the global output of ESD articles by country.

3.2. Country scientific production

This section presents country-specific research outputs on ESD on a country-by-country basis. Contributions from each country are represented on maps showcasing the 88 most productive countries in the world in ESD research.

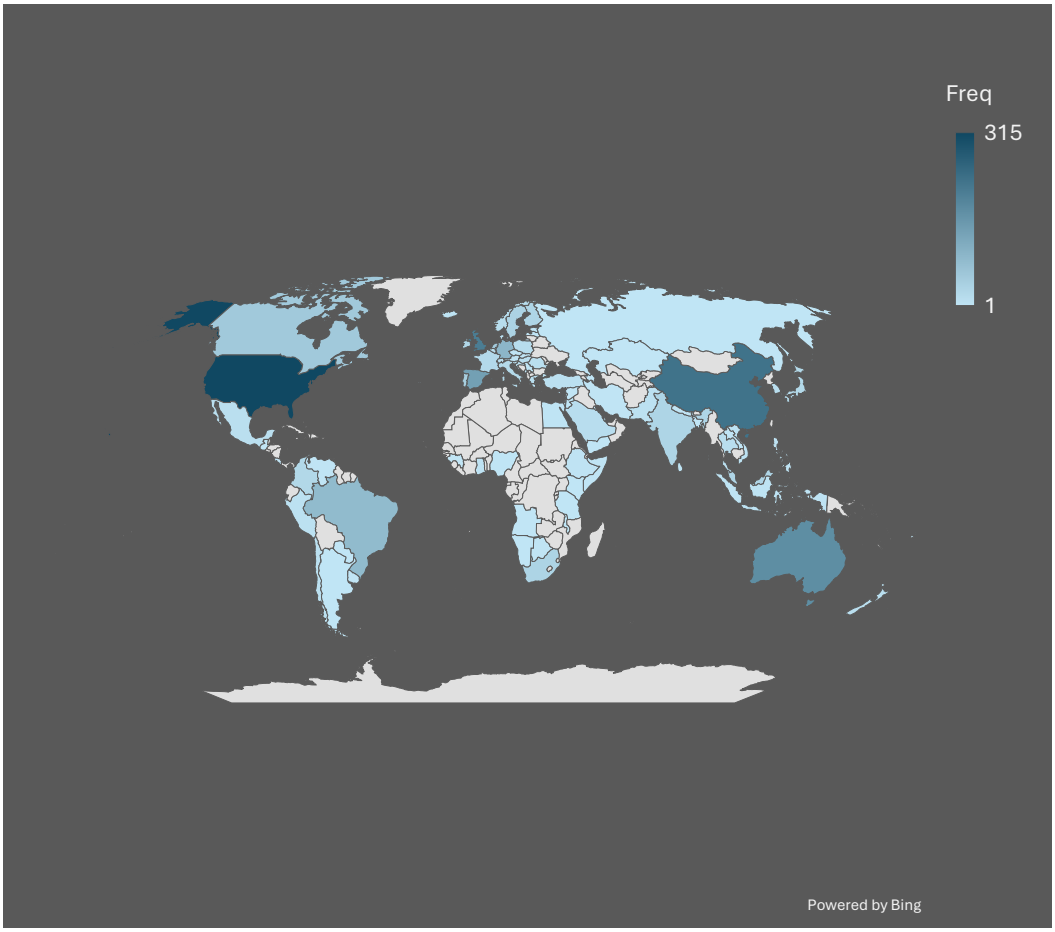

Figure 3: Country Scientific production

Figure 3 presents the research outputs based on the contributions of the top 88 countries to research on ESD. The ten countries with the highest number of publications are the USA (315 articles), China (229), the UK (210), Australia (176), Spain (140), Germany (95), Brazil (86), Canada (57), the Netherlands (55), Portugal (45), and Sweden (38). Notably, African countries are absent from this list, indicating that research on ESD is concentrated in developed nations. Of the 2,122 articles published on ESD, only 70—representing 3.3%—were published in Africa between 2015 and 2025. The results reveal the distribution of research on ESD across continents, although the contributions of countries vary. Countries that publish a higher number of articles on ESD include those from South America, Asia, Australia, and Europe. The first twelve countries with the highest publication counts are all developed nations, while African countries are falling behind. This situation should not be allowed to persist, and urgent attention must be directed towards increasing the production of research on ESD in high-impact journals. Table 3 and Figure 4 illustrate the annual production trends of ESD articles by the top five journals between 2015 and 2024, depicting the patterns of ESD article production by these journals.

3.3. Annual Production Trends by journals

Table 3 below shows the annual production trend of ESD on a journal-by-journal basis. Five productive journals focusing on ESD outputs from 2015 to 2024 are analysed on a yearly basis to determine the production trends in ESD research. The table also displays the ranking of the five most productive journals in ESD research.

Table 3: *Annual production trend*

Year	Sustainability	International Journal of Sustainability in Higher Education	Journal of Cleaner Production	Environmental Education Research	International Journal of Management Education	Total
2015	2	2	4	0	0	8
2016	2	6	7	4	0	19
2017	3	8	8	7	7	33
2018	12	15	16	8	7	58
2019	23	20	22	9	8	82
2020	58	26	25	12	9	130
2021	96	37	28	15	12	188
2022	138	44	31	16	14	243
2023	180	51	33	25	17	306
2024	206	63	33	28	19	349
Total	720	272	207	124	93	1416

The production of articles by the top five journals is detailed in Table 3. The analysis reveals that the Sustainability Journal has the highest production of articles between 2015 and 2024, with a total output of 1,416 articles during this period. Of this total, the Sustainability Journal accounts for 720 articles (50.8%), the International Journal of Sustainability in Higher Education has 272 articles (19.2%), the Journal of Cleaner Production has 207 articles (14.6%), Environmental Education Research has 124 articles (8.7%), and the International Journal of Management Education has 93 articles (6.5%). The table also indicates a low output from 2015 to 2019, signifying the early stage when Education for Sustainable Development (ESD) began gaining recognition from researchers globally.

Figure 4 showcases the outputs of the five top journals on ESD articles, comparing the journals and the years of publication.

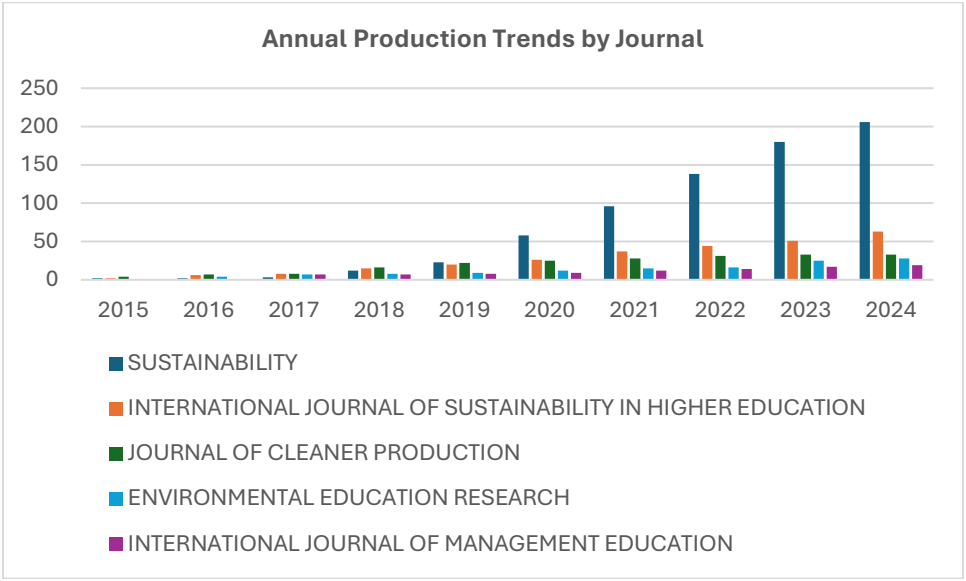

Figure 4: *Annual production trends*

Figure 4: Annual production trend of publications on ESD. This figure represents the publication trends from 2015 to 2024. The data was retrieved from the WoS database in the subject areas of

sustainable development, sustainability, and curriculum. The years 2015 to 2019 experienced low output in the production of publications on ESD. Journal distribution is essential for research in interdisciplinary fields like ESD and helps to identify areas of research. The top five journals with the highest number of publications out of the 88 countries indicate that the Sustainability Journal was ranked as the most productive journal in the analysis, with the highest production of 729 (50.8%) articles on ESD between 2015 and 2024. This was closely followed by the International Journal of Sustainability in Higher Education, with 272 (19.2%) articles published on ESD during the period under review.

The low annual production trends experienced in developing countries, such as those in Africa, are largely due to institutional factors affecting these regions. These factors include inadequate funding from agencies such as the government, non-governmental organisations, and other research institutes that support research of this nature in Africa. This could also be largely attributed to poor infrastructure. Research on ESD has predominantly focused on developed countries, as indicated in the analysis. The results show that developing countries, particularly those in Africa, receive less attention. This assertion aligns with the views of Yang and Xiu (2023) and Grosseck et al. (2019), who note that less attention has been paid to ESD research from Africa and Middle Eastern countries, largely due to cultural differences, a lack of funding, and infrastructural deficiencies.

3.4 Corresponding author's country

Collaborations between authors from different countries have been advocated, particularly between developed and developing nations.

The purpose of this graph is to illustrate the extent of collaboration between authors across countries and continents.

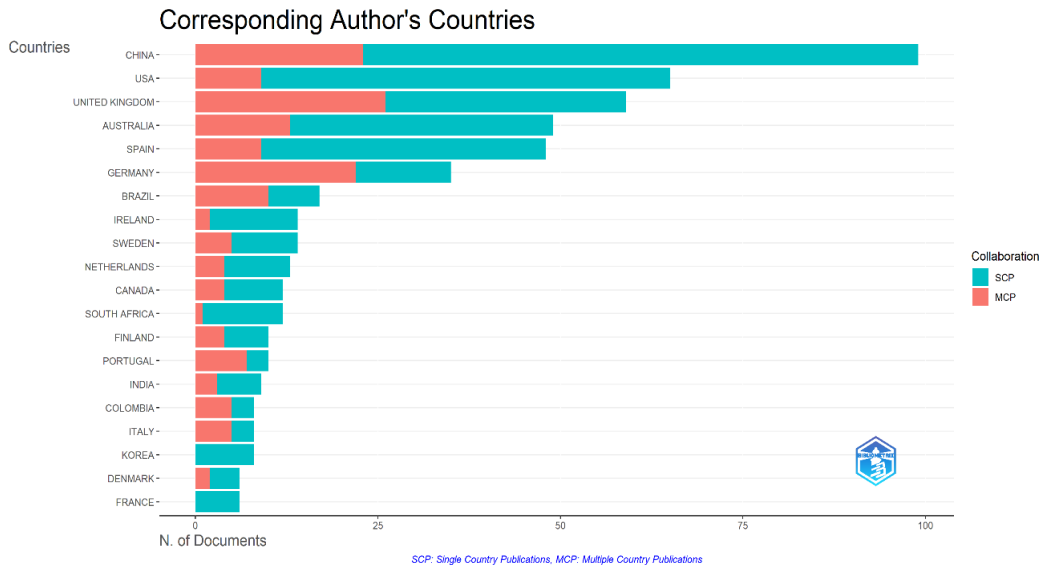

Figure 5: *Corresponding authors' countries*

Figure 5 shows the research outputs of the top 20 countries. The outputs indicate that most developing or emerging countries focus on single-country publications, whereas developed countries concentrate on multi-country production. This suggests strong collaboration among developed countries, while developing and emerging countries demonstrate weak collaboration. Research output from developing countries is low. The only African country on the list, South Africa, has very weak collaboration with authors or institutions from other countries. This indicates that most articles on ESD published in South Africa are classified as single-country publications, as most

collaborations occur within the country. This analysis highlights the importance of multiple-country collaboration to enhance the quality of research on ESD, particularly to encourage cooperation between developed and developing countries, as well as between countries from different continents.

It is important to investigate the pattern of citations by country. Citation metrics reflect the relevance and impact of publications across disciplines. The map in Figure 6 illustrates the global spread of publications on ESD.

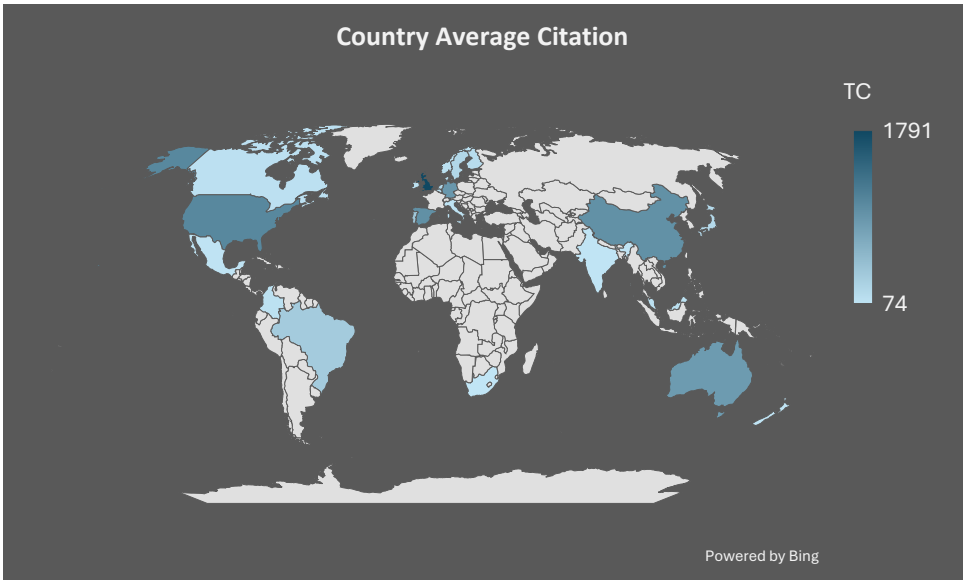

Figure 6: *Country average citation*

The country's annual citations of articles on ESD globally are presented in Table 4 and Figure 6. The citation index is an important metric that showcases the impact of articles and their usability. The average citations indicate that developed countries are the most cited in ESD. The top three most cited countries for ESD articles between 2015 and 2024 are the UK with 1,791 articles, the USA with 1,095, and Spain with 1,003 articles. South Africa ranks 25th on the table with 74 citations.

Table 4: *Average article citations*

S/N.	Country	Total Citations	Average Article Citations
1.	United Kingdom	1791	30.40
2.	USA	1095	16.80
3.	Spain	1003	20.90
4.	China	992	10.00
5.	Germany	927	26.50
6.	Australia	884	18.00
7.	Portugal	400	40.00
8.	Brazil	353	20.80
9.	Sweden	231	16.50
10.	Netherlands	222	17.10
11.	Japan	204	40.80
12.	Finland	167	16.70
13.	Belgium	134	26.80
14.	Denmark	134	22.30
15.	Malaysia	134	22.30
16.	Norway	133	22.20

17.	Canada	125	10.40
18	Ireland	121	8.60
19.	Colombia	118	14.80
20.	Italy	106	13.20
21.	United Arab Emirates	106	35.30
22.	Mexico	98	19.60
23.	India	88	9.80
24.	New Zealand	84	14.00
25.	South Africa	74	6.20

The table shows the average citations for the top 25 countries. The purpose of citation is to measure academic success or excellence, referring to a discrete unit of publication acknowledgement. In this article, we showcase the 25 countries that have attained the highest citations for articles published on ESD between 2015 and 2024. It is important to emphasise that among the 25 countries listed in Fig …, only one African country appears, with 74 citations, while the United Kingdom, USA, Spain, and other European, South American, and developed countries dominate the list of the most cited countries in ESD. This revelation indicates that articles published by African countries attract lower citations. Most African publications on ESD receive limited citations and recognition. It is worth noting that the lower citation of articles on ESD from African countries may not be due to lower output; rather, such articles are often published in low-impact journals that are not indexed in WOS and Scopus.

The findings from this study will assist policymakers responsible for higher education, particularly in African countries, to recognise the need to increase research on ESD. This concerning result, which highlights low output on ESD research in Africa, must be addressed. More funding and infrastructural facilities must be provided to enhance research output on ESD. Policy direction should be tailored to increase the visibility of research on ESD in a global context, showcasing the deficiencies in reporting ESD in developing countries and Africa. Collaborations among countries across continents must be intensified and facilitated through special funding from the African government, so that meaningful partnerships on ESD between developed and developing countries can be established.

4. Discussion of Findings

This paper specifically examines the trends of production regarding the integration of Education for Sustainable Development (ESD) into the school curriculum. The integration of ESD into the school curriculum has been embraced by stakeholders to address environmental challenges. In response to the problem of climate change and the inclusion of sustainable education in the school curriculum, we conducted a bibliometric analysis on ESD and its integration into the curriculum. We collected data from the Web of Science (WoS) database to determine the production trends geographically and institutionally, as well as the annual outputs by journals and institutions. The paper also analyses the patterns of collaboration among authors across geographical boundaries, countries, and continents. Additionally, the study explores the citation index by country to determine the citation trends of articles on ESD.

The findings indicate that ESD research is gaining more attention globally and is concentrated in developed countries such as the UK, USA, Germany, Spain, China, Australia, and other European nations. These significant findings contradict much of the related research (Hallinger & Chatpinyakoop, 2019; Fischer et al., 2022; Prieto-Jiménez et al., 2021). Furthermore, it can be deduced from the findings that less attention has been paid to ESD research by developing countries, including those in Africa and the Middle East. Sustainable development issues and policies must not

be limited to the Global North alone, as sustainability is a global concern. African countries and those in the Global South must recognise the urgent need to prioritise ESD more than ever before. More research on ESD in developing countries must be intensified. Developing countries must urgently improve their research on ESD to correct the disproportionate output compared to their developed counterparts (Yang and Xiu, 2023; Grosseck et al., 2019). African countries need to enhance their efforts to stimulate interest in ESD research by developing their capacity to support researchers in contributing to the global effort on ESD.

The consolidated body of knowledge shows that the ESD output pattern is skewed towards developed countries and journals. In other words, even though Education for Sustainable Development (ESD) is a new area that gained prominence between 2010 and 2015, the output pattern indicates that most of the publications originate from Western countries, with the first 25 countries in this category being developed nations. This finding highlights the divergence in publication volume between Africa and Western developed countries, indicating that developing countries in Africa are not among the most productive in ESD output. This is concerning given that African countries are particularly vulnerable to environmental degradation, climate change, and other related issues.

The data reveal that no developing countries from Africa appear on the lists of the top 25 countries with the highest publications on ESD. It is important to note that there is a concentration of ESD articles in developed countries. In Africa and other developing regions, little to no research on ESD has been conducted. This is a troubling trend, as issues of sustainability, climate change, and environmental challenges are prominent in African countries. Consequently, more research on ESD is necessary to find solutions to these pressing problems. This finding underscores the need for increased research on ESD in the context of environmental degradation, climate change, biodiversity, and other environmental challenges unique to Africa. Institutions in Africa should enhance the capacity of their academics and students to conduct research in ESD to be on par with their counterparts in Europe and other developed nations.

Most of the research institutions involved were universities that served as the research sites for implementing the ESD concept. The three institutions with the highest output were Manchester Metropolitan University, the University of California System, and Hochschule Angewandte Wissenschaft Hamburg. In terms of author collaboration, the findings indicate lower collaboration between authors from different countries, which is particularly prevalent in developing regions like Africa, where authors tend to collaborate with peers from the same country. There is a need for cross-country collaboration, especially between authors from developing and developed countries. This would facilitate the sharing of research information among them and help improve the quality of research.

5. Conclusions and Recommendations

The purpose of this study is to examine the bibliometric analysis of the integration of Education for Sustainable Development (ESD) into the school curriculum. The bibliometric analysis reveals that the production output of African countries, compared to that of developed countries, is very low. This finding also indicates that African authors on ESD are cited less frequently than their counterparts from developed countries outside Africa. The UK, USA, and several Asian countries, along with other developed nations, feature among the 25 most productive countries in this field. The study concludes that most of the publications from these countries are single-country publications, with the exception of Germany, which has the majority of its publications classified as multiple-country publications. It is important to emphasise the need for collaboration among countries on ESD to enhance the quality of research in this area. Collaboration between developed and developing countries, such as those in Africa, can be beneficial in this context. Adequate funding for ESD research must be provided by governments to facilitate increased research output from Africa. Governments

in developing countries should implement policies to address infrastructural gaps that contribute to low research output on ESD, particularly in African nations.

The data for this study were collected from the Web of Science (WoS) database. The primary justification for selecting WoS lies in its extensive coverage, dependability, and its status as the largest repository of high-impact journals. Other databases could also have been used alongside WoS, which was not considered in this study. Additionally, we excluded articles published in languages other than English, which may limit our findings, as relevant articles on ESD may have been omitted. For future research, it is recommended that data be collected from other sources, such as Scopus, Google Scholar, and additional databases.

6. Declarations

Author Contributions: Conceptualisation (K.B.O.); Literature review (K.B.O. &M.P.M.); methodology (K.B.O. & M.P.M.); Data extraction (K.B.O. & M.P.M.); software (N/A); validation (N/A); formal analysis (N/A); investigation (N/A); data curation (N/A); drafting and preparation (K.B.O. & M.P.M.); review and editing (K.B.O. & M.P.M.); supervision (N/A); project administration (N/A); funding acquisition (N.M.). All authors have read and approved the published version of the article.

Funding: The article processing charge (APC) was covered by the Research Partnership and Internalisation (RPI) at the University of Fort Hare, South Africa.

Acknowledgements: The authors declare no acknowledgements.

Conflict of Interest: The authors declare no conflict of interest.

Data Availability: This review is based entirely on publicly available data and information sourced from peer-reviewed articles, reports, and other academic publications cited in the manuscript. No new primary data were generated or analysed during this study. Readers may refer to the cited sources for detailed information.

References

Agbedahin, A. V. (2019). Sustainable development, Education for Sustainable Development, and the 2030 Agenda for Sustainable Development: Emergence, efficacy, eminence, and future. *Sustainable Development*, *27*(4), 669–680. https://doi.org/10.1002/sd.1931

Arifin, Z., Sukarmin, S., & Saputro, S. (2025). Trends and research frontiers in socioscientific issues for sustainable science education: A systematic and bibliometric analysis from 2014 to 2024. *Journal of Pedagogical Research*, *9*(1), 407–434. https://doi.org/10.33902/jpr.202530575

Bazilova, A., Kaimuldinova, K., Shakirova, N., Abdimanapov, B., Aliaskarov, D., & Satybaldieva, A. (2025). Implementation of ESD in school geography: Bibliometric analysis of 2015 to 2024 publications in scientific databases. *EURASIA Journal of Mathematics, Science and Technology Education*, *21*(4), em2614. https://doi.org/10.29333/ejmste/16169

Chou, P. I., & Wang, Y. T. (2024). The representation of sustainable development goals in a national curriculum: A content analysis of Taiwan's 12-Year Basic Education Curriculum Guidelines. *Environmental Education Research*, *30*(4), 591–608. https://doi.org/10.1080/13504622.2023.2273790

Chusniyah, A., Makruf, I., & Supriyanto. (2025). Two decades of sustainable development studies in higher education management: A bibliometric analysis. *International Journal of Sustainability in Higher Education*, *26*(3), 614–632. https://doi.org/10.1108/ijshe-11-2023-0546

Donthu, N., Kumar, S., & Pandey, N. (2021). A retrospective evaluation of *Marketing Intelligence and Planning*: 1983–2019. *Marketing Intelligence & Planning*, *39*(1), 48–73. https://doi.org/10.1108/mip-02-2020-0066

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070

Donthu, N., Kumar, S., Pandey, N., & Lim, W. M. (2021). Research constituents, intellectual structure, and collaboration patterns in *Journal of International Marketing*: An analytical retrospective. *Journal of International Marketing*, *29*(2), 1–25. https://doi.org/10.1177/1069031x211004234

Donthu, N., Kumar, S., & Pattnaik, D. (2020). Forty-five years of Journal of Business Research: A bibliometric analysis. *Journal of Business Research*, *109*, 1–14. https://doi.org/10.1016/j.jbusres.2019.10.039

Fischer, D., King, J., Rieckmann, M., Barth, M., Büssing, A., Hemmer, I., & Lindau-Bank, D. (2022). Teacher education for sustainable development: A review of an emerging research field. *Journal of Teacher Education*, *73*(5), 509–524. https://doi.org/10.1177/00224871221105784

Grosseck, G., Ţîru, L. G., & Bran, R. A. (2019). Education for sustainable development: Evolution and perspectives: A bibliometric review of research, 1992–2018. *Sustainability*, *11*(21), 6136. https://doi.org/10.3390/su11216136

Hallinger, P., & Chatpinyakoop, C. (2019). A bibliometric review of research on higher education for sustainable development, 1998–2018. *Sustainability*, *11*(8), 2401. https://doi.org/10.3390/su11082401

Khan, M. A., Pattnaik, D., Ashraf, R., Ali, I., Kumar, S., & Donthu, N. (2021). Value of special issues in the Journal of Business Research: A bibliometric analysis. *Journal of Business Research*, *125*, 295–313. https://doi.org/10.1016/j.jbusres.2020.12.015

Khan, M. K., Trinh, H. H., Khan, I. U., & Ullah, S. (2022). Sustainable economic activities, climate change, and carbon risk: An international evidence. *Environment, Development and Sustainability*, *24*(7), 9642–9664. https://doi.org/10.1007/s10668-021-01842-x

Klarin, A. (2024). How to conduct a bibliometric content analysis: Guidelines and contributions of content co-occurrence or co-word literature reviews. *International Journal of Consumer Studies*, *48*(2), e13031. https://doi.org/10.1111/ijcs.13031

Kumar, M., George, R. J., & PS, A. (2023). Bibliometric analysis for medical research. *Indian Journal of Psychological Medicine*, *45*(3), 277–282.

Leal Filho, W., Shiel, C., Paço, A., Mifsud, M., Ávila, L. V., Brandli, L. L., ... & Caeiro, S. (2019). Sustainable development goals and sustainability teaching at universities: Falling behind or getting ahead of the pack? *Journal of Cleaner Production*, *232*, 285–294. https://doi.org/10.1016/j.jclepro.2019.05.309

Olawumi, K. B., & Akintolu, M. (2025). Awareness, attitudes, and challenges of pre-service teachers in integrating education for sustainable development (ESD). *Prizren Social Science Journal*, *9*(2), 46-57. https://doi.org/10.32936/pssj.v9i2.663

Olawumi, K. B., & Akintolu, M. (2025b). Education for sustainable development in higher education institutions: A structural equation modelling on pre-service teachers' awareness. *EUREKA: Social and Humanities*, (4), 65-77. https://doi.org/10.21303/2504-5571.2025.003807

Olawumi, K. B., Mavuso, M. P., & Khalo, X. (2024). Integrating environmental ethics in teaching and learning through the use of Ubuntu principles: Review of literature. *Journal of Culture and Values in Education*, *7*(4), 149-171. https://doi.org/10.46303/jcve.2024.46

Olawumi, K. B., & Mavuso, M. P. (2024). In-service teacher training programmes that promote education for sustainable development: A review of emerging literature. *Interdisciplinary Journal of Education Research*, *6*, 1-20. https://doi.org/10.38140/ijer-2024.vol6.35

Prieto-Jiménez, E., López-Catalán, L., López-Catalán, B., & Domínguez-Fernández, G. (2021). Sustainable development goals and education: A bibliometric mapping analysis. *Sustainability*, *13*(4), 2126. https://doi.org/10.3390/su13042126

Shulla, K., Filho, W. L., Lardjane, S., Sommer, J. H., & Borgemeister, C. (2020). Sustainable development education in the context of the 2030 Agenda for sustainable development. *International Journal of Sustainable Development & World Ecology*, *27*(5), 458-468. https://doi.org/10.1080/13504509.2020.1721378

Tao, Y., & Tao, Y. (2024). Integrating aesthetic education in quality education: A bibliometric analysis of sustainable development perspectives. *Sustainability*, *16*(2), 855. https://doi.org/10.3390/su16020855

Verma, S., & Gustafsson, A. (2020). Investigating the emerging COVID-19 research trends in the field of business and management: A bibliometric analysis approach. *Journal of Business Research*, *118*, 253-261. https://doi.org/10.1016/j.jbusres.2020.06.057

Yang, C., & Xiu, Q. (2023). A bibliometric review of education for sustainable development, 1992–2022. *Sustainability*, *15*(14), 10823. https://doi.org/10.3390/su151410823

Yang, M., Chen, L., Wang, J., Msigwa, G., Osman, A. I., Fawzy, S., ... & Yap, P. S. (2023). Circular economy strategies for combating climate change and other environmental issues. *Environmental Chemistry Letters*, *21*(1), 55-80. https://doi.org/10.1007/s10311-022-01499-6