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A SCIENTOMETRIC ANALYSIS OF RESEARCH ON ENVIRONMENTAL EDUCATION

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INTRODUCTION :

The environment is causing us more and more anxiety, not just for ourselves but also for the next generation and all of humanity. Children are the nation's most precious resource and are vital to civilization's existence, it was decided. In the last two decades, environmental education (E.E.) initiatives have increased dramatically. Many curriculums, extracurricular activities, and literary works have been produced as a result. The aim is to revive humanity's passion for environmental protection, enhancement, and preservation before it's too late and irreversible. The perception of EE varies among educationalists and intellectuals. Their aims, the means by which they are accomplished, and the activities and resources involved are different. Because of the area's size and diversity, understanding all of its facets holistically is necessary. With this, we will be able to weigh its benefits and drawbacks and use that information to inform our future choices. Reviewing the circumstances in this setting, looking at the various roles that E.E plays at the school level, and determining how these are fulfilled are the goals. It's also interesting to observe how E.E is shaped by various environments, such as those found in a variety of industrialized and developing nations. The term "environmental education" is frequently used interchangeably. The definitions of EE in our context must be stated, at least briefly, in order to prevent ambiguity and promote clarity. This is where we'll start. People can become more environmentally aware, concerned, and informed through the technique of environmental education. For the benefit of present and future generations, they are able to understand how to apply this knowledge to preserve, protect, and use the environment responsibly. To attain sustainability, one must have the motivation to take personal initiative and engage in social activities. In order to build relevant environmental related abilities, it is meant for all sorts of learners, including students, out-of-school kids, community leaders, policy makers, and the general public.

Environmental education covers topics such as the functioning of the natural environment and appropriate human behavior for maintaining the ecosystem. It offers the

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know-how and abilities required to meet the related difficulties. The primary goals of environmental education are to impart knowledge, raise consciousness, foster concern for the environment, and offer the skills needed to deal with environmental issues. Following the 1972 UNESCO-organized Stockholm Conference on the Human Environment, environmental education became increasingly significant on a global scale. UNESCO introduced the International Environmental Education Programme (IEEP) shortly after the conference. Different term combinations, like Environmental Education (EE). Environmental approach (E.A.) and environmental study (E.S.) are words used in the literature in relation to the environment and education. Despite having distinct meanings in the strict sense of the words, E.E., E.S., and E.A., according to word semantics, are frequently used synonymously and interchangeably. Here, we examine the implications of E.E., E.S., and E.A. and determine which contexts they are pertinent to, how significant they are, and how they connect to teacher preparation programs.

This study aims to analyze this corpus of information in order to comprehend the evolution of this field of study. We use citation patterns, publication trends, and theme developments to map the intellectual terrain of EE research. Our analysis makes use of quantitative approaches to evaluate the quantity and significance of EE research.

OBJECTIVES

Examining academic publications and research trends in the subject of Environmental Education (EE) is the purpose of this study. The main study is to recognize major contributors, institutional and geographical patterns, and the overall impact and dissemination of EE research by looking at the distribution of records by document types, languages, institutions, and countries as well as citation metrics like Total Local Citation Score (TLCS) and Total Global Citation Score (TGCS). This thorough investigation will throw light on the present, highlight notable publications and emerging topics, and give suggestions for future directions in this vital field of study.

REVIEW OF LITERATURE

Hallinger and Nguyen(2020) examined the bibliometrics of 1,842 ESD articles using VOS viewer. For sustainable thinking, they emphasized the importance of Dewey's democratic education and experiential learning ideas.Zhang and Wang (2021) examined 58,588 cited references in 1778 publications pertaining to ESD using the reference publication year spectroscopy technique. They found that the earliest known mention to ESD was made in 1732. Lozano and Wals have authored the most of the 50 most cited references, which has promoted the growth of studies on education for sustainable development.IanYongli et al., 2024 They surveyed the Web of Science core collection database for publications on environmental education published between 2013 and 2022. There were 1851 papers in the

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final study. Time view was used to create pertinent maps, while Cite Space was used to visualize and analyze environmental education researchers, keyword co-occurrences, and keyword clustering. Five primary areas of interest in environmental education research were determined by the analysis: environmental literacy and awareness, theories in environmental education, modes and methods of delivery, environmental education developments and implementation, and the relationship between environmental justice and climate change.Zaman.u (2024). Between 1966 and 2023, they examined 3850 full-text research articles on sustainable and regenerative tourism that were published in Web of Science. These included 7052 studies from 132 different nations. The results of this investigation provide a current scientometric analysis that covers. It lists top nations, areas of study, funding sources, and associations in the subject of regenerative and sustainable tourism, along with renowned scholars and well-known travel publications.

MATERIALS AND METHODS

The scientometric analysis employs Web of Science as a database.We gathered information from studies published between 2019 and 2024 that dealt with environmental education. A comprehensive review that incorporates scientometric analysis is used to assess and illustrate the co-authorship, co citation, and co-occurrence analyses of countries, organizations, authors, references, and keywords in this discipline. We displayed the data in Microsoft Excel and conducted a more in-depth analysis using the Hist Cite tool.

RESULTS

Table1: Authors Research Productivity on Environmental Education

S. No	Authors	Records	Percentage	H-index	TGCS
1	Zhang Y	23	0.2	8	182
2	Lee J	22	0.2	9	249
3	Bogner FX	21	0.2	9	176
4	Wang Y	20	0.2	8	216
5	Kim J	17	0.1	6	136
6	Chen Y	16	0.1	6	119
7	Li L	16	0.1	7	400
8	Li Y	16	0.1	7	270

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9	Gericke N	15	0.1	9	381
10	Liu Y	15	0.1	6	314
11	Sun Y	15	0.1	7	170
12	Wang X	15	0.1	7	114
13	Li J	14	0.1	6	122
14	Wang J	14	0.1	6	304
15	Zhang L	14	0.1	7	237

Table 1 presents a summary of the scholarly contributions made by different authors, as indicated by metrics such the quantity of records, percentage of overall contributions, H-Index, overall Global Citation Score (TGCS) and TGCS/t (the total number of citations each year). Zhang Y and Li L are notable for their outstanding research output and impact in the field. with the most records (23) and TGCS (400). Although Lee.J and Bognar FX have slightly fewer total records than Zhang Y (22 and 21, respectively), they are nevertheless important contributors. Authors differ in their H-Index, a metric that evaluates their productivity as well as their impact on citations. The three authors with the highest H-Index (9), Lee J., Bogner FX, and Gericke N., indicate a constant degree of influential research. Authors like as Gericke N, nevertheless, have remarkable influence with each release. The significance of both quantity and quality in contributions to academic research is emphasized by this approach.

Table 2: Year wise Distribution publications in Environmental Education

S. No	Year	Records	Percentage	NA	TLCS	TGCS
1	2019	1529	13.2	7693	790	30349
2	2020	1963	16.9	9092	567	29533
3	2021	2380	20.5	11788	309	25442
4	2022	2732	23.6	13057	164	16208
5	2023	2781	24	13751	108	7492
6	2024	208	1.8	998	7	376
Total		**11593**	**100**	**56379**	**1945**	**109400**

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Table 2 gives a six-year summary of research production from 2019 to 2024, including trends in author contributions, publication volume, and citation indicators the overall number of records published increased considerably between 2019 and 2023, from 1529 to 2781, demonstrating a distinct upward trend in research effort. The year 2023 (2781) had the most publications, accounting for 23.6% of all records. This indicates a steady rise in research output and points to the field's increasing activity. In 2023, there will be 13751 authors working on publications, up from 7693 in 2019. This rise suggests that research collaboration is becoming more widespread; in 2021, there will be a notable increase to 11788 authors, indicating a larger research community. The research community seems to be growing, and more collaborative efforts could increase the influence and exposure of upcoming articles.

Table 3: Language wise Distribution on Environmental Education

S. No	Languages	Records	Percentage	TLCS	TGCS
1	English	10797	93.1	1877	108634
2	Spanish	331	2.9	36	410
3	Portuguese	321	2.8	24	168
4	Russian	39	0.3	4	48
5	Turkish	29	0.3	2	25
6	German	14	0.1	0	24
7	French	13	0.1	0	17
8	Chinese	8	0.1	0	31
9	Korean	6	0.1	0	5
10	Indonesian	5	0	0	2
11	Unspecified	5	0	0	6
12	Malay	4	0	2	4
13	Polish	4	0	0	11
14	Ukrainian	4	0	0	6
15	Hungarian	3	0	0	2

Table 3 depicts the distribution of records by language in a dataset, indicating the dominance of English (10797) in scholarly publications. With a significant Total Local Citation Score

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(TLCS) of 1877 and a Total Global Citation Score (TGCS) of 108634, English makes up 93.1% of the records, highlighting its leading position in academic communication and research influence. Spanish (331) Records with (2.9%) is the second one. Less than 1% of the total data are in other languages, including Russian, Turkish, German, French, Chinese, and Korean. These languages are hardly represented. These languages have much lower global and local citation counts, which suggests limited use in the larger research community. Interestingly, Polish has a comparatively higher TGCS of 11 than other less-represented languages, even though it only has four recordings. Overall, English's overwhelming prevalence highlights how crucial a role it plays in the global dissemination and citation of scholarly work.

Table 4: Country wise Distribution on Environmental Education

S.No	Country	Records	Percentage	NA	TLCS	TGCS
1	USA	2592	22.4	18090	648	33609
2	UK	1354	11.7	9002	506	20084
3	Peoples R China	1249	10.8	5467	50	14146
4	Spain	823	7.1	2344	144	8922
5	Brazil	764	6.6	4231	140	3930
6	Australia	735	6.3	4231	283	10739
7	Germany	565	4.9	4839	156	8836
8	Canada	553	4.8	4369	156	5869
9	Italy	388	3.3	1731	48	5707
10	Netherlands	376	3.2	2471	97	6391
11	Sweden	305	2.6	3123	273	5013
12	France	275	2.4	829	100	4901
13	South Africa	267	2.3	1291	34	2576
14	India	263	2.3	860	19	3899
15	Portugal	261	2.3	1675	54	2970

Table 4 shows the breakdown of records by nation, total local citation score (TLCS), total global citation score (TGCS), and number of authors. The USA has the most published in the dataset (2,592 records, or 22.4%), then the UK (1,354 records, or 11.7%). Both countries have considerable citation ratings, reflecting their important contributions to the dataset. Brazil, Spain, and China all produce a lot of research. TLCS (648) is highest in the USA. Canada, Germany, and Australia are mid-level providers with a variety of citation impacts and a sizable number of records. Notably, in comparison to their record counts, Germany

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and Canada have lower citation ratings. About 3-3.5% of the records are contributed by Italy and the Netherlands, the latter of which has a comparatively high TGCS (6391). Portugal, South Africa, India, Sweden, and France, together accounting for 2.4-2.6 percent of the records, complete the list. The worldwide scope of research contributions is highlighted by this distribution.

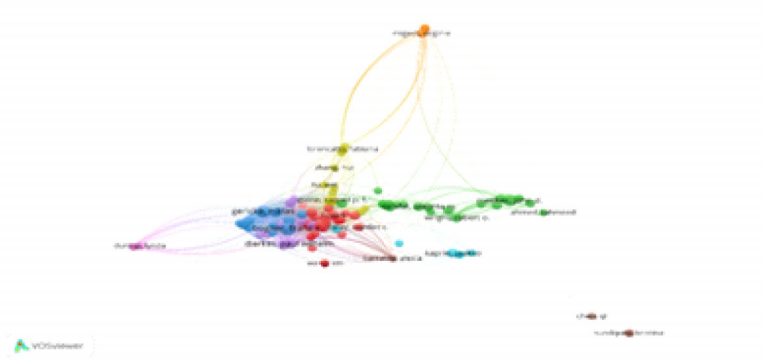

Figure:2 Bibliographic Coupling of Authors

As can be seen in Figure 2, if any of the 46798 authors fulfill the least quantity of authors and citations of 5, Each of the 116 authors will have their overall bibliographic coupling links with other authors assessed. The author with the greatest cumulative link count will be chosen. There are 11 authorship clusters derived from bibliographic coupling out of the 116 authors that will be chosen. There are a lot of papers or authors in this Cluster 1 (27) that show high co-citation or co-authorship ties. In the field of EE, it could stand for a well-known study topic or a well linked group. Despite being smaller than Cluster 1, However, a significant proportion of publications or authors in Cluster 2 (22) have co-citation or co-authorship trends.

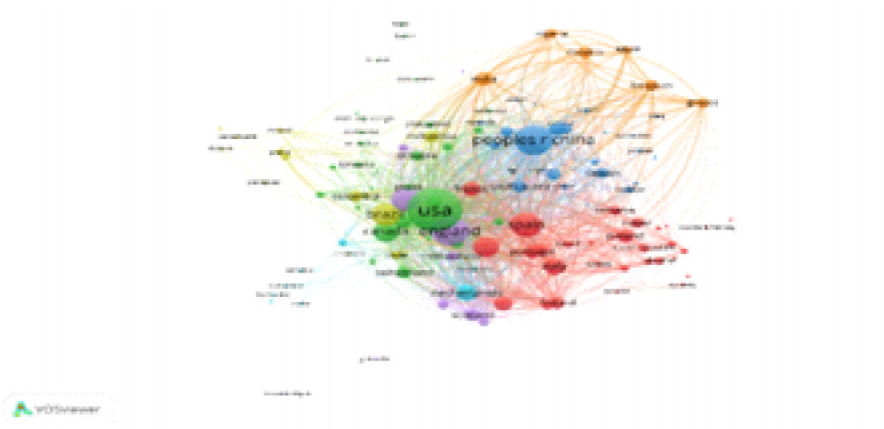

Figure:3 Bibliographic Coupling of Country

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Figure 3 illustrates that out of the 177 countries, a country must have a minimum of 5 papers and a minimum of 5 citations. If 122 countries satisfy the requirements, The total strength of the bibliographic coupling relationships with other nations will be determined for each of the 122 nations. The nations having the most connections overall will be chosen. There are seven groups of countries based on bibliographic coupling out of the 122 countries that need to be chosen. Group 1 (30) A cluster of nations with close co-authorship ties is represented by this group. These nations most likely together closely in the field of EE, demonstrating a significant amount of cooperation in research. A sizable portion of the nations in Cluster 2 (29) display co-authorship tendencies. These countries may have created cooperative networks and partnerships that represent common EE research objectives or cooperative projects. A moderate number of nations having co-authorship ties are represented by Cluster 3 (26). These nations might collaborate regularly and contribute to the body of studies conducted in the area of EE. There are fewer countries in Clusters 4 (13) and 5 (10) than in the preceding clusters. These nations might collaborate on co-authorship projects to some extent, perhaps concentrating on particular EE research topics. Compared to Cluster 6 (8) and Cluster (6), fewer nations are included. Compared to the larger clusters, these nations may participate in co-authorship collaborations, but not as much.

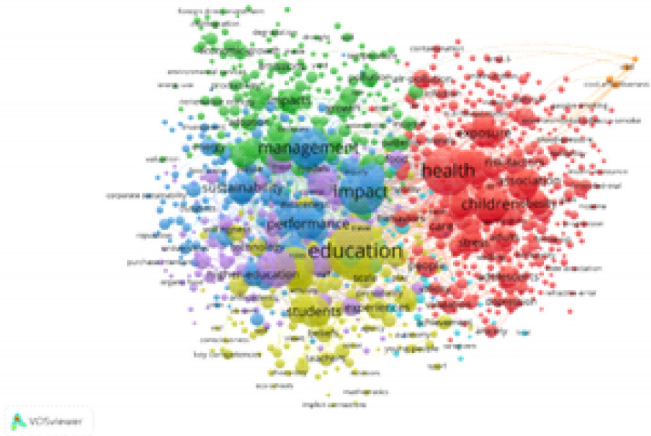

Figure: 4 Co-occurrence of Keywords plus

Figure 4 illustrates how the co-occurrence analysis of keywords used in the research can identify important subjects for the articles as well as the hotspots and frontiers of the field as a whole. Of the 13381 keywords, a keyword must appear at least five times. Of those, 1817 fulfill the criteria, and for each of the 1817 keywords, the total strength of the co-occurring linkages with other keywords will be determined. The keywords with the most links overall will be selected. Out of the 1000 keywords that must be selected, there are

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seven clusters of keywords that co-occur.

CONCLUSION

These days, the focus of environmental education is shifting from the natural world to a more all-encompassing framework that considers social, political, and economic factors. One constant source of innovation in international environmental education research is the integration of new social challenges, such public science and the green economy, into the existing environmental education system. Future environmental education will place more emphasis on creative teaching approaches that speak to the values, beliefs, and skills and knowledge of the educated public. It will explore how situational activities, social practice, and classroom instruction can naturally coordinate and balance to promote the successful development of sustainable development concepts and emotional construction in environmental education practice. To achieve objectives like encouraging a sense of personal social responsibility and environmental conservation motivation, environmental education will increasingly incorporate perspectives from disciplines like economics and law in the future. From a scientometric standpoint, this work makes a novel contribution to the scientometric analysis of EE research output, primarily because most scientometric studies have used a single source database for their analytical goals.

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