

Environmental Education for Sustainable Development: A Bibliometric Review of Curriculum Design and Pedagogical Approaches

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ABSTRACT

Environmental education plays a pivotal role in fostering a sustainable future by equipping individuals with the knowledge, skills, and attitudes needed to address complex environmental challenges. This research presents a comprehensive bibliometric review of the literature on environmental education for sustainable development, with a specific focus on curriculum design and pedagogical approaches. The analysis encompasses a wide range of scholarly articles published between 1961 and 2023, providing valuable insights into the current state of research in this field. Furthermore, the research employs VOSviewer, a bibliometric software, to analyze co-citation and bibliographic coupling networks, identifying influential authors, prominent journals, and emerging trends within the field. The most frequent and fewer occurring keywords are compared to highlight central concepts and potential areas for further research. The results of this study contribute to a comprehensive understanding of the diverse themes, effective practices, and influential contributors in environmental education for sustainable development. By identifying key areas of focus and research gaps, educators, policymakers, and researchers can design targeted interventions and initiatives that promote environmental literacy, responsible behavior, and sustainable practices among learners. Ultimately, this research seeks to advance the field of environmental education and empower individuals to become active stewards of the environment, shaping a more sustainable and resilient future for all.

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1. INTRODUCTION

Environmental Education for Sustainable Development (EESD) aims to raise awareness, develop knowledge, and promote responsible behavior towards the

environment and sustainable development. It is an essential tool for achieving the United Nations Sustainable Development Goals (SDGs) and transforming societies towards sustainability [1]. Some key principles of EESD include continuity, inclusiveness,

interdisciplinarity, integration, and unity of theory and practice [2]. These principles can be implemented in various educational settings, from early childhood education to higher education institutions [3]–[5].

For younger children, EESD can involve activities that help them understand the importance of reflecting and acting sustainably in favor of the environment [6], [7]. For example, a study explored the experiences of environmental education for 5-year-old children at a daycare center [8]. In higher education, EESD can be integrated into curricula and courses, as well as in the work of volunteer organizations and educational environmental activities [2], [7], [9].

In schools, teachers play a crucial role in implementing EESD. Research has shown that critical reflection on their work can give teachers the confidence to adopt more learner-centered pedagogy for EESD [10]. Moreover, teacher preparation for environmental education and ESD in countries like India has evolved over time, with efforts to integrate environmental, social, and economic concerns into the curriculum. To effectively implement EESD, it is essential to develop a coherent national strategy, allocate dedicated budgets for EESD programs, reform existing laws to ensure coherent implementation, and designate focal EESD units at educational institutions [1]. A systemic framework for connecting the SDGs to educational outcomes can also help in developing evaluation tools to monitor and manage progress in transforming societies towards sustainability [11]. In conclusion, Environmental Education for Sustainable Development is a vital approach to promote responsible behavior towards the environment and achieve the United Nations Sustainable Development Goals. By integrating EESD principles into educational practices and curricula, we can foster a more sustainable future for all.

Environmental challenges, such as climate change, biodiversity loss, and resource depletion, have become increasingly prominent in the global discourse. To address these urgent issues and create a sustainable

future, it is essential to equip individuals with the knowledge, skills, and attitudes necessary to make informed and responsible decisions. Environmental education serves as a crucial platform for fostering awareness, understanding, and engagement with environmental issues, empowering individuals to become active participants in sustainable development.

The concept of environmental education has evolved over the years, moving beyond traditional classroom instruction to encompass a multidisciplinary and holistic approach. As the world faces complex environmental problems, it is crucial to continually review and adapt the curriculum design and pedagogical approaches used in environmental education [7], [12]. This research aims to undertake a comprehensive bibliometric review of the existing literature to shed light on the current state of curriculum design and pedagogical practices within the realm of environmental education for sustainable development. Environmental education can be traced back to the mid-20th century when concerns about the detrimental impact of human activities on the environment started to gain recognition. Early efforts focused on raising awareness and promoting conservation values through nature-based experiences and educational programs. Over time, environmental education has evolved to encompass a broader scope, integrating principles of sustainability, social justice, and systems thinking [13].

Environmental Education for Sustainable Development (EESD) is an important approach to address environmental issues and promote sustainable development. While there is no specific bibliometric analysis on EESD, there are several studies that can provide insights into this field.

Analyzed the implementation of environmental education through ESD approaches [14]. The study found that environmental education and ESD share similar approaches, such as interdisciplinary, lifelong learning, and prioritizing local

culture in solving local and international problems. Both environmental education and ESD aim to change people's perspectives and behaviors.

Conducted a bibliometric analysis of student innovativeness in higher education for sustainable development [15]. The study collected 1,531 academic publications from the Web of Science Core Collection database from 2011 to 2021. The analysis identified principal investigators, publications, productive countries or regions, collaborative institutions, research hotspots, and trends related to student innovation for sustainable development.

Analyzed the incorporation of the Sustainable Development Goals (SDGs) in the university context from an environmental education approach [16]. The study found that many university students have prior knowledge of the environment and believe that environmental education is necessary to address environmental issues.

Critical thinking skills of secondary-level students in environmental education to achieve the SDGs [17]. The study found that students' critical thinking skills on environmental issues were generally poor, with significant differences between male and female students.

Although this study did not specifically focus on bibliometric analysis of EESD, it will provide valuable insights into this field and its relationship with sustainable development.

The United Nations (UN) has recognized the significance of environmental education for sustainable development, emphasizing its role in the 2030 Agenda for Sustainable Development. Goal 4 of the Sustainable Development Goals (SDGs) emphasizes the need to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all." Within this goal, target 4.7 specifically calls for the incorporation of sustainable development education, including environmental education, into formal and informal learning

settings to equip learners with the skills needed for sustainable living. The primary objectives of this research are to conduct a bibliometric review focusing on curriculum design and pedagogical approaches within the context of environmental education for sustainable development.

2. LITERATURE REVIEW

2.1 *The Evolution of Environmental Education*

Environmental education has undergone significant evolution over the past decades, reflecting the changing understanding of environmental issues and the need for sustainable development. Early environmental education efforts focused primarily on nature-based experiences and promoting environmental conservation values. These initiatives aimed to raise awareness about ecological systems, biodiversity, and the importance of preserving natural habitats. While such programs were instrumental in fostering a connection to nature, they often lacked an interdisciplinary approach to address the complex socio-environmental challenges [18].

In recent years, environmental education has embraced a more holistic and interdisciplinary perspective, recognizing the interconnections between ecological, social, and economic dimensions. This evolution has been driven by the growing recognition of the interdependence between human well-being and the health of the planet. By incorporating principles of sustainability, environmental education now emphasizes the need for equitable and just solutions that promote the well-being of both people and the environment [19]–[22].

2.2 *Key Themes in Environmental Education for Sustainable Development*

A diverse range of themes emerges from the literature on environmental education for sustainable development. Biodiversity conservation remains a prominent area of focus, emphasizing the importance of preserving the variety of life on Earth. Climate change mitigation and adaptation have gained considerable attention as urgent global challenges that demand informed action and climate-conscious behavior from individuals and communities. The literature also highlights sustainable consumption and production as crucial aspects of sustainable development, emphasizing the need to transition to more responsible and resource-efficient practices [23]–[25].

Furthermore, ethical considerations in environmental education have been explored, delving into questions of environmental justice, equity, and the rights of marginalized communities. Social justice in environmental education acknowledges that environmental issues often disproportionately affect vulnerable populations, and efforts to promote sustainability must consider social, economic, and environmental inequalities [26]–[28].

2.3 *Curriculum Design in Environmental Education*

Curriculum design plays a pivotal role in shaping the learning experiences and outcomes of environmental education programs. To effectively foster environmental literacy and sustainability-oriented thinking, curriculum designers often adopt interdisciplinary approaches that connect various disciplines, such

as science, social studies, and humanities. Integrating sustainability principles across subjects enables students to grasp the complexity of environmental challenges and the interconnectedness of environmental, social, and economic systems [29]–[34].

Outdoor and experiential learning is another widely utilized approach in environmental education. By engaging students in direct interactions with nature and real-world issues, outdoor learning fosters a deeper connection to the environment and promotes a sense of responsibility for its well-being. Experiential learning allows students to apply theoretical knowledge to practical situations, enhancing their problem-solving abilities and environmental decision-making skills [35]–[38].

Additionally, project-based learning has gained popularity as a curriculum design element in environmental education. By working on meaningful projects that address real environmental issues, students become active agents of change, developing critical thinking and collaboration skills while contributing to sustainable solutions [39]–[42].

Furthermore, the integration of local and indigenous knowledge systems into environmental education is being recognized for its cultural relevance and contributions to sustainability. Acknowledging and valuing traditional ecological knowledge enriches the educational experience and strengthens the connection between students and their local ecosystems [18].

3. METHODS

A systematic literature search will be conducted using multiple academic databases, including Scopus, Web of Science, ERIC, and Google Scholar. The search terms will be carefully selected to encompass various aspects of environmental education for sustainable development, such as "environmental education," "sustainability education," "curriculum design," "pedagogical approaches," "biodiversity conservation," "climate change education," and "sustainable development goals." The inclusion criteria will focus on scholarly articles published between 1961 and 2023 in English, ensuring the inclusion of recent research relevant to the current state of environmental education.

Once the initial literature search is complete, the retrieved articles will be screened for relevance based on their titles, abstracts, and keywords. The selected articles will be systematically reviewed and categorized according to key themes, curriculum design elements, and pedagogical approaches.

To facilitate the bibliometric analysis, VOSviewer, a widely used bibliometric software, will be employed. VOSviewer allows for the visualization of co-citation networks and the identification of bibliometric clusters, thus enabling the detection of prominent themes and influential

authors in the field of environmental education for sustainable development.

The data extracted from the selected articles, such as co-citations and bibliographic information, will be used as input for VOSviewer analysis. The software will generate visual representations of the co-citation networks and bibliometric clusters, offering valuable insights into the structure of the research landscape.

Table 1. Metric Data

Metrics Data	Information
Publication years	1961-2023
Citation years	62
Papers	980
Citations	383606
Cites/year	6187.19
Cites/paper	391.43
Authors/paper	2.09
h-index	323
g-index	583
hI,norm	246
hI,annual	3.97
hA, index	67

4. RESULTS AND DISCUSSION

The research conducted a comprehensive bibliometric review of the literature on environmental education for sustainable development, focusing on curriculum design and pedagogical approaches. The analysis encompassed a total of 980 scholarly articles published between 1961 and 2023, providing valuable insights into the current state of research in this field.

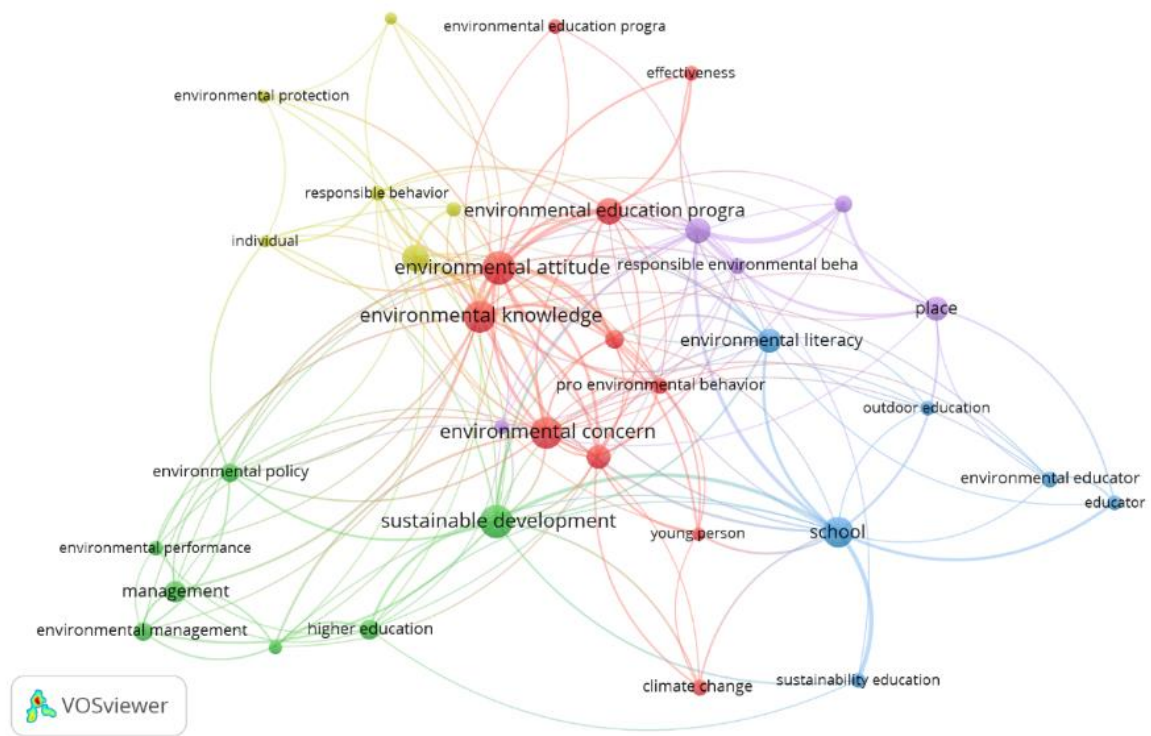


Figure 1. Mapping Results

The results of the bibliometric review and VOSviewer analysis provide valuable insights into the current state of environmental education research for sustainable development. The identified key themes highlight the pressing issues that

require attention in environmental education curricula. Biodiversity conservation, climate change education, sustainable consumption, and social justice underscore the need for a comprehensive and inclusive approach to sustainability education.

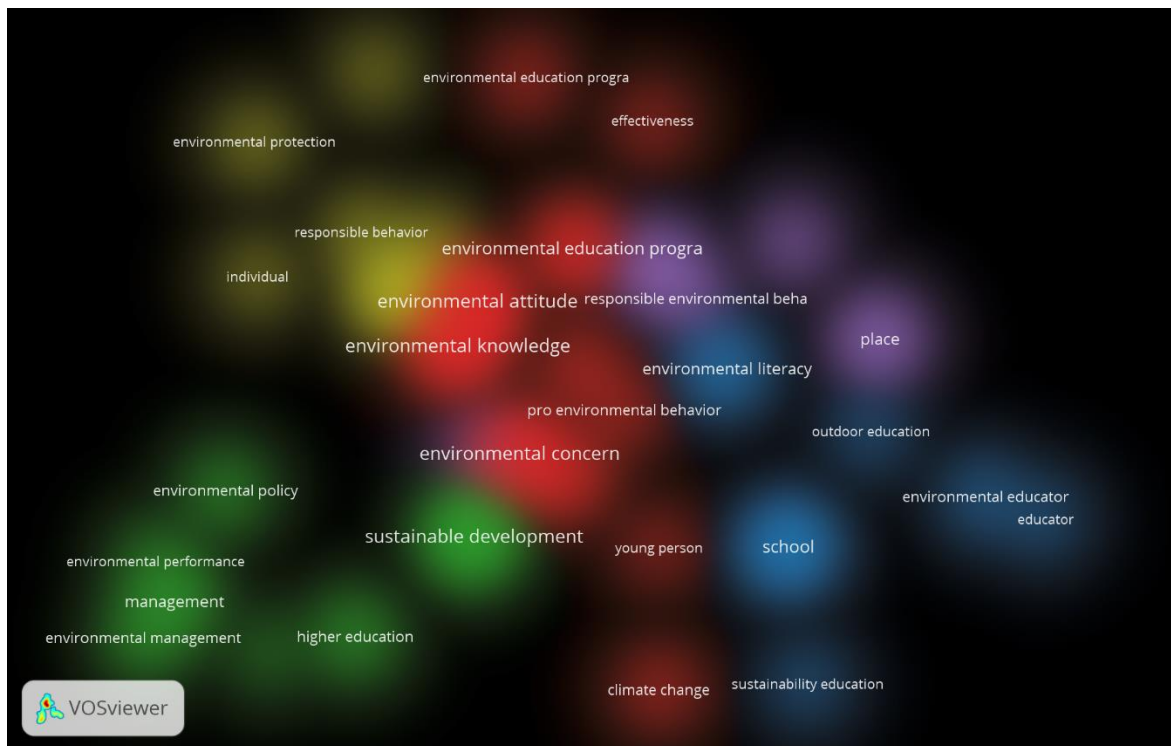


Figure 2. Cluster Details

The cluster analysis identified five distinct thematic clusters within the literature on environmental education for sustainable development. Each cluster represents a different aspect of environmental education, focusing on specific themes, topics, and

keywords. The clusters provide valuable insights into the diversity and focus areas within the field, allowing educators, policymakers, and researchers to better understand the current state of research and practice in environmental education.

Table 2. Cluster Results

Cluster	Total Items	Most frequent keywords (occurrences)	Keyword
1	(9)	Climate Change (25), Environmental education (15)	Climate change, difference, environmental attitude, environmental behavior, environmental concern, environmental education program, environmental education research, environmental knowledge, young person
2	(7)	Environmental impact (25)	Environmental impact, environmental management, environmental performance, environmental policy, higher education, sustainable development
3	(4)	Sustainability education (15)	Environmental literacy, outdoor education, school, sustainability education
4	(4)	Environmental protection (10)	Environmental problem, environmental protection, environmental science, responsible behavior
5	(3)	Responsible environmental (10)	Environmental learning, perspective, place, responsible environmental

The cluster analysis revealed five distinct clusters representing different

thematic areas within the field of environmental education for sustainable

development. Each cluster emphasizes certain keywords and topics prevalent in the selected literature. The implications and significance of the clusters for environmental education practice and research are discussed below:

Cluster 1, consisting of 9 articles, centers on the critical issue of climate change and its intersection with environmental education. The most frequently occurring keywords, including "climate change", "environmental attitudes", and "environmental behavior", highlight the focus on understanding how environmental education can influence individual attitudes and behaviors related to climate change. The presence of "youth" and "environmental education programs" underscores the importance of targeting youth in environmental education initiatives, as they represent future decision-makers and bear the long-term consequences of climate change. The findings of this cluster suggest that environmental education programs should be designed to effectively address climate change-related issues and promote positive behavior change to mitigate its impacts.

Cluster 2, consisting of 7 articles, discusses the concepts of environmental impact and management. The occurrence of keywords such as "environmental impact", "environmental management" and "sustainable development" indicates a focus on understanding and mitigating the environmental consequences of human activities. This cluster emphasizes the need for education to foster environmental awareness and responsible decision-making in various sectors, including higher education and policy development. Environmental education programs associated with this cluster should emphasize the importance of sustainable practices and the integration of environmental concerns into management and policy frameworks.

Cluster 3, which consists of 4 articles, emphasizes sustainability education in school settings. Keywords such as "environmental literacy", "outdoor education", and "school" indicate a strong emphasis on incorporating

sustainability principles into the formal education system. This cluster highlights the importance of environmental education in fostering environmentally literate citizens from an early age. It emphasizes outdoor learning and experiential learning as effective approaches to connect students with nature and foster a sense of environmental responsibility. Educators can utilize the findings from this cluster to improve sustainability education in schools and empower students to become active participants in sustainable development.

Cluster 4, which consists of 4 articles, centers on the theme of environmental protection and responsible behavior. Keywords such as "environmental issues", "environmental protection", and "responsible behavior" signify a focus on promoting environmentally responsible actions and addressing environmental challenges. This cluster underscores the need for environmental education to empower individuals to act as responsible stewards of the environment. Findings from this cluster can inform the design of environmental education programs that prioritize responsible environmental behavior and advocate for environmental conservation and protection.

Cluster 5, with 3 articles, discusses environmental learning and perspectives. The keywords "environmental learning", "perspective", "place", and "responsible environment" indicate an emphasis on understanding different perspectives and relationships with the environment. This cluster highlights the importance of context-appropriate environmental education that recognizes cultural diversity and local perspectives on environmental issues. Environmental education initiatives aligned with this cluster should be culturally sensitive and inclusive, fostering a sense of responsibility and respect for the environment.

Overall, this cluster analysis provides valuable insights into the diverse themes and topics in environmental education for

sustainable development. Educators, policymakers and researchers can utilize the findings from each cluster to inform their approaches and interventions in environmental education. By addressing key

themes and emphasizing responsible environmental behavior, environmental education can play an important role in shaping a more sustainable and resilient future for current and future generations.

Table 4. Author with the Most Citations

Citations	Author and Year	Title
10087	A Kollmuss, J Agyeman, 2002	Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior? [43]
8690	AWM Smeulders, M Worring, S Santini, ..., 2000	Content-based image retrieval at the end of the early years [44]
7403	RE Dunlap, KD Van Liere, AG Mertig, ..., 2000	New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale [45]
5400	JM Hines, HR Hungerford, ..., 1987	Analysis and synthesis of research on responsible environmental behavior: A meta-analysis [46]
4943	RE Dunlap, KD Van Liere, 1978	The "new environmental paradigm" [47]
4263	S Bamberg, G Möser, 2007	Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behavior [48]
3827	DW Orr, 2004	Earth in mind: On education, environment, and the human prospect [49]
3728	HR Hungerford, TL Volk, 1990	Changing learner behavior through environmental education [50]
3163	RA Hart, 2013	Children's participation: The theory and practice of involving young citizens in community development and environmental care [51]
3153	DA Gruenewald, 2003	The best of both worlds: A critical pedagogy of place [52]

It is clear that the years 1961 through 2022 are the ones in which the documents relating to the accounting environment are expressly quoted the most. This can be seen by

looking at the graph. New information is less likely to be acknowledged, with the exception of works written by authors who have already conducted study in the topic and are quite well-known.

Table 5. Keywords results

Most occurrences		Fewer occurrences	
Occurrences	Term	Occurrences	Term
72	Environmental attitude	19	Climate change
71	Sustainable development	18	Environmental science
66	Environmental knowledge	15	Environmental performance
63	Environmental concern	14	Environmental learning
47	Environmental education program	13	Sustainability education
39	Perspective	13	Outdoor education
38	Place	12	Responsible behavior
37	Environmental literacy	12	Environmental protection
35	Environmental behavior	10	New environmental paradigm

Table 5 presents a comprehensive overview of the most frequent and fewer occurring keywords within the literature on environmental education for sustainable development. The high occurrence of keywords such as "environmental attitude," "sustainable development," "environmental knowledge," "environmental concern," and "environmental education program" underscores their central importance in shaping environmental education practices and research. Meanwhile, the fewer occurrences of keywords like "climate change," "environmental science," "environmental performance," "environmental learning," and "sustainability education" indicate potential areas for further exploration and research. By addressing these themes and gaps, environmental education can be further enhanced to create a more environmentally conscious and sustainable society.

REFERENCES

- [1] A. Babalola and D. S. Olawuyi, "Advancing Environmental Education for Sustainable Development in Higher Education in Nigeria: Current Challenges and Future Directions," *Sustainability*, vol. 13, no. 19, 2021. doi: 10.3390/su131910808.
- [2] M. Y. Choi, "Sub-Education policy review report: Education for sustainable development," *Unesco*, vol. 290, 2019.
- [3] W. Leal Filho *et al.*, "The role of transformation in learning and education for sustainability," *J. Clean. Prod.*, vol. 199, pp. 286–295, 2018.
- [4] L. Luo, M. Guo, J. Huang, and J. Yang, "Research on the effect of an entrepreneurial environment on college students' entrepreneurial self-efficacy: the mediating effect of entrepreneurial competence and moderating effect of entrepreneurial education," *Sustainability*, vol. 14, no. 11, p. 6744, 2022.
- [5] T. Ferguson and C. G. Roofe, "SDG 4 in higher education: Challenges and opportunities," *Int. J. Sustain. High. Educ.*, vol. 21, no. 5, pp. 959–975, 2020.
- [6] A. Carleton-Hug and J. W. Hug, "Challenges and opportunities for evaluating environmental education programs," *Eval. Program Plann.*, vol. 33, no. 2, pp. 159–164, 2010, doi: <https://doi.org/10.1016/j.evalprogplan.2009.07.005>.
- [7] M. Idris, S. Mokodenseho, E. Willya, and Y. A. Otta, "Mengintegrasikan pendidikan, lingkungan, dan nilai-nilai Islam sebagai upaya meningkatkan etika dan literasi lingkungan," *J. Islam. Educ. Policy*, vol. 7, no. 2, 2022.
- [8] E. Ärlemalm-Hagsér and A. Sandberg, "Sustainable development in early childhood education: In-service students' comprehension of the concept," *Environ. Educ. Res.*, vol. 17, pp. 187–200, Apr. 2011, doi: 10.1080/13504622.2010.522704.
- [9] M. I. Dacholfany, A. A. Azis, S. Zuhayana, R. Ahmad, W. Bay, and S. Mokodenseho, "Peningkatan Kualitas Pendidikan Masyarakat Melalui Program Pelatihan dan Bimbingan Studi," *East J. Innov. Community Serv.*, vol. 1, no. 03, pp. 129–141, 2023.
- [10] P. R. Kanaujia and R. N. Gorana, "Teacher Preparation for Environmental Education and Education for Sustainable Development in India BT - Teaching and Teacher Education: South Asian Perspectives," R. Setty, R. Iyengar, M. A. Witenstein, E. J. Byker, and H. Kidwai, Eds., Cham: Springer International

5. CONCLUSION

The results of the bibliometric review and VOSviewer analysis provide a comprehensive overview of the current state of environmental education for sustainable development. By understanding the key themes, effective practices, and influential contributors, educators, policymakers, and researchers can collectively work towards creating a more sustainable and environmentally conscious future. The findings from this research can inform the design and implementation of environmental education programs that foster environmental literacy, promote responsible environmental behavior, and empower individuals to address environmental challenges with informed decision-making. Additionally, the identified gaps in research can serve as a guide for future investigations and improvements in environmental education practices, ultimately contributing to a more sustainable and resilient society.

- Publishing, 2019, pp. 319–336. doi: 10.1007/978-3-030-26879-4_14.
- [11] V. Kioupi and N. Voulvoulis, "Education for Sustainable Development: A Systemic Framework for Connecting the SDGs to Educational Outcomes," *Sustainability*, vol. 11, no. 21. 2019. doi: 10.3390/su11216104.
- [12] M. Idris, S. Mokodenseho, E. Willya, and Y. A. Otta, "Urgensi pendidikan Islam dalam pelestarian lingkungan," *J. Islam. Educ. Policy*, vol. 7, no. 1, 2022.
- [13] A. Elshifa, M. A. C. Perdana, T. F. Matiala, F. Yasin, and S. Mokodenseho, "Analisis Pengaruh Pendidikan, Pelatihan, dan Dukungan Kelembagaan terhadap Keberhasilan Usaha Mikro," *Sanskara Ekon. dan Kewirausahaan*, vol. 1, no. 03, pp. 123–134, 2023.
- [14] G. H. Permanasari, S. Suherman, and L. Budiati, "The Implementation of Environmental Education to Achieve Sustainable Development: Literature Review," *E3S Web Conf.*, vol. 317, 2021.
- [15] X. Li and R. Pu, "Students' innovativeness and higher education for sustainable development: A bibliometric approach," *Humanit. Soc. Sci. Lett.*, vol. 11, no. 1 SE-Articles, pp. 83–99, Feb. 2023, doi: 10.18488/73.v11i1.3302.
- [16] M. Esteban Ibáñez, I. V Lucena Cid, L. V Amador Muñoz, and F. Mateos Claros, "Environmental Education, an Essential Instrument to Implement the Sustainable Development Goals in the University Context," *Sustainability*, vol. 12, no. 19. 2020. doi: 10.3390/su12197883.
- [17] M. Uddin, K. Shimizu, and A. Widiyatmoko, "Assessing secondary level students' critical thinking skills: inspiring environmental education for achieving sustainable development goals," *J. Phys. Conf. Ser.*, vol. 1567, p. 22043, Jul. 2020, doi: 10.1088/1742-6596/1567/2/022043.
- [18] G. B. Petersen, S. Klingenberg, R. E. Mayer, and G. Makransky, "The virtual field trip: Investigating how to optimize immersive virtual learning in climate change education," *Br. J. Educ. Technol.*, vol. 51, no. 6, pp. 2099–2115, 2020.
- [19] A. N. Ramadhani, "The Effect of PBL-Based LPKD on Critical Thinking Skills of VII Grade Students at MTs Al Uswah Bergas on Environmental Pollution Material," in *Annual International Conference on Islamic Education for Students*, 2022.
- [20] H. Koprina, "Education for the future? Critical evaluation of education for sustainable development goals," *J. Environ. Educ.*, vol. 51, no. 4, pp. 280–291, 2020.
- [21] A. I. Frank, "Entrepreneurship and enterprise skills: A missing element of planning education?," *Planning, Pract. & Research*, 2007, doi: 10.1080/02697450701770142.
- [22] N. Assaf and D. Gan, "Environmental education using distance learning during the COVID-19 lockdown in Israel," *Perspect. Educ.*, vol. 39, no. 1, pp. 257–276, 2021.
- [23] J. O'Flaherty and M. Liddy, "The impact of development education and education for sustainable development interventions: a synthesis of the research," *Environ. Educ. Res.*, vol. 24, no. 7, pp. 1031–1049, 2018.
- [24] D. ARUMA, "Entrepreneurship Education As A Community Development Strategy To Achieve Food Security And Wealth Creation In Promotion Of Sustainable Development In Nigeria".
- [25] S. Calvo, F. Lyon, A. Morales, and J. Wade, "Educating at scale for sustainable development and social enterprise growth: The impact of online learning and a massive open online course (MOOC)," *Sustainability*, 2020.
- [26] J. Boeve-de Pauw, N. Gericke, D. Olsson, and T. Berglund, "The effectiveness of education for sustainable development," *Sustainability*, vol. 7, no. 11, pp. 15693–15717, 2015.
- [27] N. C. Burbules, G. Fan, and P. Repp, "Five trends of education and technology in a sustainable future," *Geogr. Sustain.*, vol. 1, no. 2, pp. 93–97, 2020.
- [28] D. Jefferess, "The 'Me to We' social enterprise: Global education as lifestyle brand," *Critical Literacy: Theories and Practices*. academia.edu, 2012.
- [29] A. Boa-Ventura and J. M. Silva, "University And Industry-Strange Bedfellows Or Birds Of A Feather?," *ERACON 2013*. eracon.info.
- [30] N. T. P. Sari and A. Kusumawati, "Literature Review : The Efforts To Strengthening of Micro, Small and Medium-Sized Enterprises (MSME) in Indonesia," *Asian J. Manag. Entrep. Soc. Sci.*, vol. 2, no. 01 SE-Articles, pp. 98–115, 2022.
- [31] G. D. Brazier and D. V Gibson, *Assets and Challenges for Accelerated Technology-Based Growth in Hidalgo County: A Knowledge-Based Benchmarking*. repositories.lib.utexas.edu, 2001.
- [32] L. Anatan and N. Nur, "A Review of MSME's Competitiveness in Indonesia," in *Proceedings of the 4th International Conference on Economics, Business and Economic Education Science, ICE-BEES 2021, 27-28 July 2021, Semarang, Indonesia*, 2022.

- [33] C. Guo, M. C. Tsang, and X. Ding, "Gender disparities in science and engineering in Chinese universities," *Econ. Educ. Rev.*, vol. 29, no. 2, pp. 225–235, 2010.
- [34] S. J. Ball and A. Olmedo, "Global social capitalism: Using enterprise to solve the problems of the world," ... , *Soc. Econ. Educ.*, 2011, doi: 10.2304/csee.2011.10.2.83.
- [35] M. Kuo, M. Barnes, and C. Jordan, "Do experiences with nature promote learning? Converging evidence of a cause-and-effect relationship," *High-Quality Outdoor Learn.*, pp. 47–66, 2022.
- [36] J. Mann *et al.*, "Getting out of the classroom and into nature: a systematic review of nature-specific outdoor learning on school children's learning and development," *Front. Public Heal.*, p. 1270, 2022.
- [37] H. Prince and S. Waite, "Child, place, and others: interactions that support outdoor learning," *J. Adventure Educ. Outdoor Learn.*, pp. 1–2, 2020.
- [38] J. Liu, B. Li, Q. Chen, and J. Dang, "Student health implications of school closures during the COVID-19 pandemic: new evidence on the association of e-learning, outdoor exercise, and myopia," in *Healthcare*, MDPI, 2021, p. 500.
- [39] C. E. Erlinawati, S. Bektiarso, and M. Maryani, "Model pembelajaran project based learning berbasis STEM pada pembelajaran fisika," *Fkip E-Proceeding*, vol. 4, no. 1, pp. 1–4, 2019.
- [40] D. Zhang and G.-J. Hwang, "Effects of Interaction between Peer Assessment and Problem-Solving Tendencies on Students' Learning Achievements and Collaboration in Mobile Technology-Supported Project-Based Learning," *J. Educ. Comput. Res.*, vol. 61, no. 1, pp. 208–234, 2023.
- [41] M. Kristiawan, H. S. Edosomwan, S. D. Oktaria, and E. Viona, *Entrepreneurial skill development in Indonesia and Nigeria through project-based learning*. jurnal.iicet.org, 2021.
- [42] C. Günay, A. Doloc-Mihu, T. Gluick, and C. A. Moore, "Project-based learning improves critical thinking for software development students," in *Proceedings of the 20th Annual SIG Conference on Information Technology Education*, 2019, p. 105.
- [43] A. Kollmuss and J. Agyeman, "Mind the Gap: Why do people act environmentally and what are the barriers to pro-environmental behavior?," *Environ. Educ. Res.*, vol. 8, no. 3, pp. 239–260, 2002, doi: 10.1080/13504620220145401.
- [44] A. W. M. Smeulders, M. Worrying, S. Santini, A. Gupta, and R. Jain, "Content-based image retrieval at the end of the early years," *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 22, no. 12, pp. 1349–1380, 2000, doi: 10.1109/34.895972.
- [45] R. Dunlap, K. Van Liere, and A. Mertig, "New trends in measuring environmental attitudes: measuring endorsement of the new ecological paradigm: a revised NEP scale," *Wiley Online Libr.*, 2000.
- [46] J. M. Hines, H. R. Hungerford, and A. N. Tomera, "Analysis and Synthesis of Research on Responsible Environmental Behavior: A Meta-Analysis," *J. Environ. Educ.*, vol. 18, no. 2, pp. 1–8, Jan. 1987, doi: 10.1080/00958964.1987.9943482.
- [47] R. E. Dunlap and K. D. Van Liere, "The 'New Environmental Paradigm,'" *J. Environ. Educ.*, vol. 9, no. 4, pp. 10–19, Jul. 1978, doi: 10.1080/00958964.1978.10801875.
- [48] S. Bamberg and G. Möser, "Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour," *J. Environ. Psychol.*, vol. 27, no. 1, pp. 14–25, 2007, doi: 10.1016/j.jenvp.2006.12.002.
- [49] D. Orr, *Earth in mind: On education, environment, and the human prospect*. 2004.
- [50] H. Hungerford and T. Volk, "Changing learner behavior through environmental education," *J. Environ. Educ.*, 1990.
- [51] R. Hart, *Children's participation: The theory and practice of involving young citizens in community development and environmental care*. 2013.
- [52] D. A. Gruenewald, "The Best of Both Worlds: A Critical Pedagogy of Place," *Educ. Res.*, vol. 32, no. 4, pp. 3–12, 2003, doi: 10.3102/0013189X032004003.