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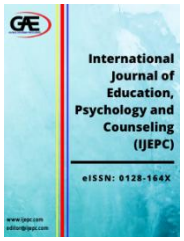

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TRENDS AND DEVELOPMENT OF ENVIRONMENTAL EDUCATION RESEARCH IN HIGHER EDUCATION: A BIBLIOMETRIC PERSPECTIVE (2016-2026)

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Abstract:

This study examines the trends and development of environmental education research within higher education. This field has gained increasing importance in response to global sustainability challenges and policy agendas. Despite the increasing volume of research, a thorough understanding of publication patterns, thematic evolution, influential contributions as well as international collaboration remains limited. To address this gap, a bibliometric analysis was conducted to systematically map the field's intellectual structure and research dynamics. Data were retrieved from the Scopus database utilising an advanced search strategy based on four core keywords: *Environmental Sustainability*, *Sustainability Education*, *Environmental Education*, and *Higher Education*. The dataset was refined and standardized using OpenRefine, while Scopus Analyzer and VOSviewer were employed for quantitative analysis and visualization of publication trends, keyword co-occurrence networks, and country-level co-authorship patterns. The final dataset comprised 1,446 peer-reviewed journal articles published between 2016 and April 2026. The findings reveal a strong upward trend in scholarly output, with notable acceleration after 2021 and a peak in 2025, indicating increasing academic interest and institutional commitment to sustainability in higher education. Keyword analysis demonstrates a dominant focus on sustainability, higher education, and environmental education. This includes emerging themes such as climate change, transformative learning, digital transformation, and pro-environmental behavior. Citation analysis highlights that highly influential publications are predominantly interdisciplinary and policy-oriented, linking higher education to

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broader sustainability and societal transitions. Furthermore, co-authorship analysis indicates that research collaboration is concentrated in developed regions, particularly the United States and Europe, while participation from emerging economies is growing, though it remains less integrated. Overall, the study demonstrates the field's maturation and diversification and gives valuable insights for researchers, institutions, and policymakers seeking to advance sustainability-oriented research and collaboration in higher education.

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Keyword:

Environmental Sustainability, Sustainability Education, Environmental Education, Higher Education

Introduction

Environmental sustainability has become central to national development agendas, and higher education is a key driver in preparing graduates to address complex environmental, social as well as economic challenges. Notably, Malaysian universities are increasingly expected to equip undergraduates with green skills, sustainability mindsets, and the capacity to support the transition to greener economies and workplaces (da Costa et al., 2025; Fuchs, 2024; Saleem et al., 2022). Concurrently, employers worldwide signal an increasing demand for sustainability-oriented competencies, while also highlighting gaps between university learning outcomes and labor market needs (da Costa et al., 2025; McCarthy & Eagle, 2021; Nikolajenko-Skarbalė et al., 2021). Within this context, examining environmental sustainability education for workforce-ready undergraduates in Malaysia is both timely and necessary.

Malaysian studies highlighted generally positive attitudes and perceptions toward sustainability among undergraduates, suggesting a receptive foundation for deeper environmental education. Following this, surveys at several Malaysian universities report that students hold positive views toward environmental dimensions of sustainable development and feel a sense of responsibility toward sustainability, though attitudes to economic and some social issues are weaker (Azhar et al., 2022; Balakrishnan et al., 2024; Thian et al., 2025). A large multi-university study observed that holistic and pluralistic Education for Sustainable Development (ESD) approaches are widely practiced, and are significantly associated with students' sustainability "knowingness," attitudes, and behavior (Saleem et al., 2022). However, first-semester students at a private Malaysian university mainly frame sustainability in social and, to a lesser degree, economic terms. On the other hand, explicit commitment to environmental sustainability is relatively limited in their life-purpose statements. This underscores the need to strengthen environmental themes across disciplines from an early stage (Thian et al., 2025).

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International research provides conceptual clarity on the types of competencies and green skills graduates need to become workforce-ready in a sustainability-oriented economy. The literature on "green skills" highlights their central role in sustainability transitions, while also noting conceptual ambiguity and inconsistent implementation in education and training (Fuchs, 2024; Wegenberger & Ponocny, 2025). Recent work proposes distinguishing general sustainability competences, cross-sectional competences as well as specific green skills, with personal values and interests as critical foundations (Wegenberger & Ponocny, 2025). On a similar note, complementary frameworks on key competencies in sustainability are refined through international expert consensus. It emphasizes systems thinking, anticipatory, normative, strategic, and collaboration competencies as core outcomes for sustainability programs and employability (Brundiers et al., 2021). Studies of employers in green and conventional sectors indicate that graduates often lack the technical, problem-solving, and interdisciplinary skills required for green jobs, as well as experience and the capability to work independently and in teams (da Costa et al., 2025; McCarthy & Eagle, 2021; Nikolajenko-Skarbalė et al., 2021). Competency standards for "Green Citizen Skills" further stress understanding sustainability principles, environmental management, resource efficiency, and engagement in green community initiatives as critical to green job readiness (Surono, 2025).

Around the world, universities are experimenting with curriculum models and pedagogies to better integrate sustainability and align graduate attributes with workforce expectations. A range of studies stresses that higher education institutions (HIEs) must extend beyond adding isolated environmental courses. Instead, they must embed sustainability across programs through interdisciplinary or transdisciplinary approaches, often linked to industry needs (Boarin & Martinez-Molina, 2022; Obrecht et al., 2022). Following this, project-based and experiential learning has been proven to increase students' sustainability awareness and their confidence in applying modern management and environmental tools to real-life problems, thereby enhancing job readiness (Boarin & Martinez-Molina, 2022; da Costa et al., 2025). Reviews of engineering and architectural programs highlight a shift from focusing mainly on "what" content to also addressing "how" sustainability is taught, with growing attention to active engagement, assessment of learning, and alignment with professional practice (Boarin & Martinez-Molina, 2022). Systematic mapping of curricula to the Sustainable Development Goals (SDGs) reveals that many subjects can link to multiple SDGs. However, important gaps and weak linkages remain, especially in technical disciplines, suggesting further room to broaden sustainability integration (Abo-Khalil, 2024; Obrecht et al., 2022).

Within Malaysia, emerging evidence connects sustainability education more directly to employability and entrepreneurial outcomes. Research on green curriculum exposure among Malaysian university students implies that exposure to green content and greater sustainability awareness significantly enhance students' self-efficacy, which, in turn, increases green entrepreneurial intention (Chan et al., 2025). This suggests that well-designed sustainability curricula extend beyond mere knowledge-building. They also foster the confidence to pursue sustainability-oriented careers and ventures. At the same time, local and international employer surveys indicate that, while sustainability is integral for business success, it is not always strongly reflected in recruitment criteria. Likewise, fresh graduates are often perceived as lacking the specific technical and transversal competences needed in green sectors (da Costa et al., 2025; McCarthy & Eagle, 2021; Nikolajenko-Skarbalė et al., 2021). Consequently, these contradictions highlight the significance of closer university–industry collaboration in co-developing curricula, expanding internship opportunities, and enhancing practice-based experiences. It also signals sustainability competences more clearly to employers (Boarin &

Martinez-Molina, 2022; da Costa et al., 2025; McCarthy & Eagle, 2021; Nikolajenko-Skarbalė et al., 2021; Obrecht et al., 2022).

In conclusion, the literature indicates that Malaysian undergraduates generally possess positive orientations toward sustainability. Furthermore, ESD practices are present and beneficial in local universities, but environmental dimensions and economic-social linkages require further strengthening (Azhar et al., 2022; Balakrishnan et al., 2021; Saleem et al., 2022; Thian et al., 2025). International research clarifies the spectrum of sustainability competences and green skills required for workforce readiness, yet also reveals gaps between conceptual frameworks, curricular practice, and employer expectations (Brundiers et al., 2021; Fuchs, 2024; McCarthy & Eagle, 2021; Nikolajenko-Skarbalė et al., 2021; Wegenberger & Ponocny, 2025). In addition, effective responses emphasize transdisciplinary curriculum integration, experiential and project-based learning, and stronger partnerships with industry and communities to align graduate capabilities with real-world sustainability challenges (Abo-Khalil, 2024; Boarin & Martinez-Molina, 2022; da Costa et al., 2025; Obrecht et al., 2022; Tasdemir & Gazo, 2020). In Malaysia, enhancing environmental sustainability education across disciplines, deepening action-oriented pedagogies, and systematically embedding recognized sustainability competencies can help produce workforce-ready graduates capable of driving green transitions at the national and regional levels.

Research Questions

RQ1: How has scholarly output on environmental education in higher education evolved over time?

RQ2: Which publications exert the greatest scholarly influence in environmental education research within higher education, as reflected by citation metrics?

RQ3: What are the prevailing and emerging thematic research patterns in environmental education within higher education, as revealed through keyword co-occurrence analysis?

RQ4: What international collaboration patterns emerge in environmental education research within higher education based on country-level co-authorship networks?

Methodology

Bibliometric analysis comprises the systematic collection, organization as well as evaluation of bibliographic data derived from scholarly publications (Balakrishnan et al., 2021; McCarthy & Eagle, 2021; Nikolajenko-Skarbalė et al., 2021). Beyond basic descriptive indicators, for example, identifying publication outlets, temporal publication trends, and influential authors (Azhar et al., 2022), bibliometric methods also comprise advanced analytical techniques, including document co-citation analysis. A rigorous literature review relies on an iterative, methodical process that includes careful selection of search keywords, comprehensive database retrieval, and detailed analytical assessment. Correspondingly, this structured approach facilitates the construction of a robust bibliographic foundation and improves the reliability and validity of the research findings (Balakrishnan et al., 2024). Concurrently, the current study concentrates on high-impact publications, as such works provide crucial insights into the theoretical underpinnings of the research domain. To ensure data accuracy and consistency, Scopus was employed as the primary source for data extraction (Surono, 2025; Thian et al.,

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2025; Wegenberger & Ponocny, 2025). Furthermore, to maintain scholarly rigor, only peer-reviewed journal articles were included, while books and lecture notes were deliberately excluded (Tasdemir & Gazo, 2020). Thus, utilizing Elsevier's Scopus database, broadly recognized for its detailed coverage, relevant publications published between 2016 and April 2026 were retrieved for subsequent analysis.

Data Search Strategy

The bibliographic data for this study were obtained from Elsevier's Scopus database using a structured and systematic search strategy designed to capture scholarly publications at the intersection of environmental sustainability and higher education. In particular, the search query (as shown in Table 1) was applied to the **TITLE-ABS-KEY** fields to ensure comprehensive coverage of relevant concepts, combining the terms *environmental sustainability*, *higher education*, and *sustainability education*. To reflect recent and contemporary scholarly developments, the publication timeframe was limited to works published between **2016 and 2026**. At the same time, subject area filters were applied to refine disciplinary relevance, limiting results to **Social Sciences (SOCI), Business, Management, and Accounting (BUSI), and Environmental Science (ENVI)**. Additionally, to maintain accessibility and consistency in analysis, only publications written in **English** were included.

Further refinement was achieved by applying **exact keyword filters**, including *Sustainability*, *Higher Education*, *Sustainable Development*, *Environmental Education*, *Environmental Sustainability*, *Sustainable Development Goals*, *Education for Sustainable Development*, and *Sustainable Development Goal*. These filters ensured conceptual alignment with the study's research focus while minimizing irrelevant records. To uphold academic rigor and bibliometric comparability, the analysis was restricted to **peer-reviewed journal articles** by limiting the source type to journals (**SRCTYPE = "j"**) and the document type to research articles (**DOCTYPE = "ar"**). However, it excludes reviews, conference papers, books, and other non-article materials. After applying all inclusion and exclusion criteria (presented in Table 2), the final dataset comprised **1,446 journal articles**, which served as the basis for subsequent bibliometric mapping, trend analysis, and network visualization.

Table 1: The Search String

Scopus	(TITLE-ABS-KEY (environmental AND sustainability) AND TITLE-ABS-KEY (higher AND education) AND TITLE-ABS-KEY (sustainability AND education)) AND PUBYEAR > 2015 AND PUBYEAR < 2027 AND (LIMIT-TO (SUBJAREA , "SOCI") OR LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "ENVI")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "Sustainability") OR LIMIT-TO (EXACTKEYWORD , "Higher Education") OR LIMIT-TO (EXACTKEYWORD , "Sustainable Development") OR LIMIT-TO (EXACTKEYWORD , "Environmental Education") OR LIMIT-TO (EXACTKEYWORD , "Environmental Sustainability") OR LIMIT-TO (EXACTKEYWORD , "Sustainable Development Goals") OR LIMIT-TO (EXACTKEYWORD , "Education For Sustainable Development") OR LIMIT-TO (EXACTKEYWORD , "Sustainable Development Goal")) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (DOCTYPE , "ar"))

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Table 2: The Selection Criterion is Searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Subject	Social Sciences, Environmental Science, Business, Management, and Accounting	Others
Timeline	2016-2026	<2016

Data Analysis

VOSviewer is a broadly adopted and user-friendly bibliometric analysis software established by Nees Jan van Eck and Ludo Waltman at Leiden University, the Netherlands (Boarin & Martinez-Molina, 2022; Dmochowski et al., 2016). The software is specifically designed for the visualization and quantitative analysis of scientific literature. It offers advanced functionalities for constructing network visualizations, clustering related entities, and generating density maps. Furthermore, its methodological flexibility enables the examination of multiple bibliometric relationships, including co-authorship, co-citation, as well as keyword co-occurrence networks. This facilitates a detailed exploration of research structures and intellectual landscapes. Supported by an interactive graphical interface and continuous software updates, VOSviewer enables dynamic and efficient analysis of large-scale bibliometric datasets. In line with this, its ability to compute bibliometric indicators, customize visual representations, and integrate data from multiple sources enhances its value as a robust analytical tool for scholarly research.

A key strength of VOSviewer lies in its capability to transform complex bibliometric data into clear, interpretable visual maps. The software demonstrates particular strength in network-based analyses, including the clustering of related items, identification of keyword co-occurrence patterns, and generation of density visualizations. Additionally, its intuitive interface enables both novice as well as experienced researchers to navigate and interpret research trends effectively. Nonetheless, continuous software development ensures that VOSviewer remains at the forefront of bibliometric visualization, offering adaptable analytical functions across diverse data types, which include authorship and citation networks.

In this research, datasets comprising publication year, article title, author names, source journals, citation counts, and keywords were retrieved in PlainText format from the Scopus database, covering publications from 2016 to 2026, and analyzed utilising VOSviewer version 1.6.20. By applying VOS mapping and clustering techniques, the software assisted the construction and systematic examination of bibliometric maps. As an alternative to the Multidimensional Scaling (MDS) approach, VOSviewer emphasizes positioning items in a low-dimensional space such that the distance between any two items accurately reflects their degree of relatedness (Dmochowski et al., 2016). Although conceptually similar to MDS (Rajabifard et al., 2021), the VOS approach differs methodologically by employing normalization techniques that are better suited for co-occurrence data, such as the Association Strength (AS_ij) calculated as follows (Van Eck & Waltman, 2007).

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$$AS_{ij} = \frac{C_{ij}}{W_i W_j},$$

which is expressed as being proportional to the ratio between the observed number of co-occurrences of *i* and *j*. Meanwhile, the expected number of co-occurrences of *i* and *j* under the assumption that their co-occurrence is statistically independent (Van Eck & Waltman, 2007).

Result and Discussions

Four research questions are discussed in this section.

RQ1: How Has Scholarly Output on Environmental Education in Higher Education Evolved Over Time?

As shown in Figure 1 and Table 3, the trajectory of scholarly output on environmental education in higher education from 2016 to April 2026 indicates a clear shift from an emerging research focus to a more established, globally recognized field. The steady increment in publications, from 51 in 2016 to 117 in 2021, reflects the gradual institutionalization of sustainability within higher education discourse. This development has been strongly influenced by international policy frameworks, particularly ESD. This includes the growing pressure on universities to integrate sustainability competencies into curricula and governance structures (Leal Filho et al., 2018; Pedro & Galán, 2022). During this period, environmental education evolved from a marginal topic into an interdisciplinary domain, drawing attention from education, environmental science, and policy-related fields. However, this growth should be interpreted with caution, as it may also be partly attributable to the expansion of academic publishing systems, increased journal indexing, and rising pressure on academics to publish. This is as opposed to purely reflecting substantive intellectual advancement.

Furthermore, the sharp acceleration in publication output after 2021, culminating in a peak in 2025, suggests a phase of rapid expansion driven by structural and contextual factors. Notably, the transformation of higher education in the post-pandemic environment, coupled with increased funding for sustainability-related research and the global push toward climate action and the SDGs, has significantly intensified scholarly activity in this area (Shulla & Leal Filho, 2023). These conditions have encouraged interdisciplinary collaboration and innovation, positioning environmental education as a key mechanism for institutional and societal transformation. However, this rapid growth also raises critical concerns with regard to the potential topic saturation and duplication, in which similar issues are repeatedly examined without substantial theoretical contribution. Such patterns may indicate that expansion in publication volume does not necessarily correspond to deeper conceptual development.

The apparent decline in 2026 should not be misinterpreted as a downward trend, as it reflects limitations in initial publication coverage. Nevertheless, it may also signal a transition toward stabilization. This phase of normalization is characteristic of maturing research fields, where emphasis gradually shifts from rapid output growth to more specialized, rigorous, and impact-oriented studies. While this suggests greater maturity, it also introduces the risk of fragmentation into narrowly defined subfields, potentially limiting integrative and holistic perspectives essential to addressing complex environmental challenges.

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In addition, the evolution of research trends is closely shaped by funding dynamics. Financial support has a significant role in driving the expansion of sustainability research, particularly through alignment with global agendas such as the SDGs (OECD, 2023; Shulla & Leal Filho, 2023). Nonetheless, reliance on funding priorities may introduce structural imbalances, privilege globally visible themes while marginalizing context-specific or locally relevant issues (Pedro & Galán, 2022). As a result, future progress in this field depends on sustained research investment and maintaining diversity, theoretical depth, and practical relevance in scholarly contributions.

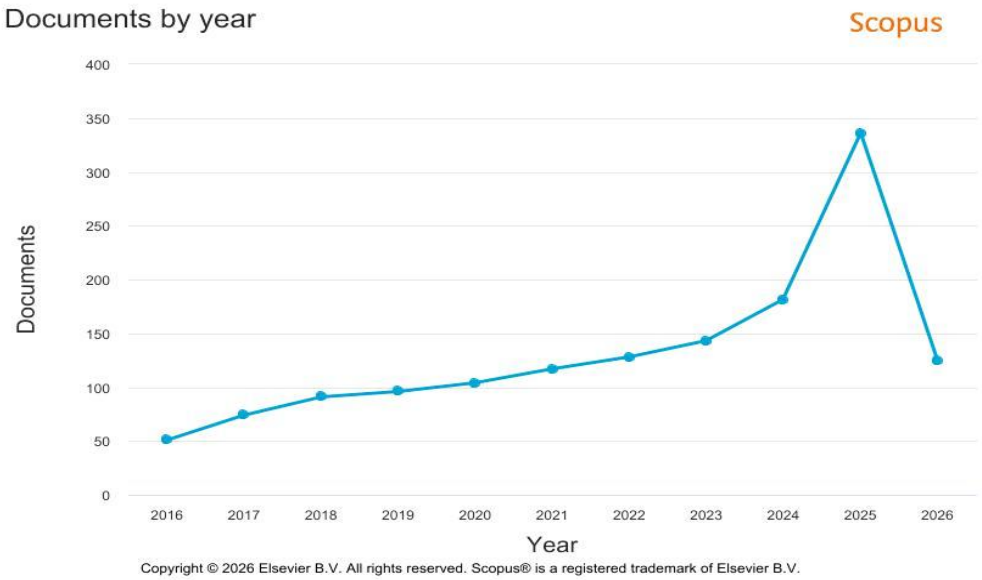

Figure 1: Trend Of Research on Environmental Education in Higher Education from 2016 to 2026 (April).

Table 3: Number of Publications on Environmental Education in Higher Education from 2016 to 2026 (April).

YEAR	Number of Publications	Percentage
2026	125	9%
2025	336	23%
2024	181	13%
2023	143	10%
2022	128	9%
2021	117	8%
2020	104	7%
2019	96	7%
2018	91	6%
2017	74	5%
2016	51	4%
Total	**1446**	**100%**

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RQ2: Which Publications Have the Most Scholarly Influence in Environmental Education Research Within Higher Education, As Reflected by Citation Metrics?

The identification of highly influential publications in environmental education research within higher education, as reflected by citation metrics, indicates that scholarly impact is largely associated with studies that engage with systemic, cross-sectoral, and policy-oriented dimensions of sustainability. As presented in Table 4, the most cited works focus on themes that extend beyond classroom pedagogy to address institutional transformation, governance structures, and alignment with global sustainability agendas. For example, research on integrating the SDGs into sustainability reporting demonstrates strong citation performance due to its relevance across education, policy, and management domains (Rosati & Faria, 2019). Similarly, studies emphasizing transformational learning and institutional frameworks for sustainability have attracted substantial attention, as they address broader structural challenges faced by HIEs (Aleixo et al., 2018; Leal Filho et al., 2018). Thus, the prominence of interdisciplinary journals further highlights that influence in this field is closely tied to research that bridges multiple domains rather than remaining confined to discipline-specific discourse.

In addition, highly cited publications often embed environmental education within wider socio-economic, technological, and organizational contexts, thereby enhancing their applicability and global relevance. Contributions examining digital transformation in higher education, sustainability-oriented institutional models such as living labs, and competency-based education frameworks demonstrate strong citation impact. This can be achieved by providing scalable models adaptable across diverse educational systems (Abad-Segura et al., 2020; Lozano et al., 2019; Purcell et al., 2019). Building on this, the inclusion of themes such as climate vulnerability, green labor markets, and innovation systems suggests that influential research increasingly connects higher education with broader sustainability transitions and economic restructuring (Consoli et al., 2016; He et al., 2021; Pandey et al., 2017).

Nevertheless, reliance on citation metrics as a measure of influence requires critical consideration. For example, citation counts are often shaped by factors such as publication age, journal reputation, and language visibility, rather than solely reflecting theoretical originality or empirical significance (Bornmann & Haunschild, 2018; OECD, 2023). From an alternative perspective, citation patterns may also reinforce dominant research paradigms, privileging widely accepted or policy-aligned topics. On the other hand, it marginalizes emerging, context-specific, or critical approaches that challenge mainstream assumptions. Therefore, while citation metrics provide a useful proxy for scholarly influence, they should be complemented with qualitative evaluation. This aims to capture the full diversity and depth of intellectual contributions within environmental education research in higher education.

Table 4: Most Cited Author

No	Authors	Title	Year	Source title	Cited by
1	Rosati & Faria (2019)	Addressing the SDGs in sustainability reports: The relationship with institutional factors	2019	Journal of Cleaner Production	552

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2	Leal Filho et al. (2018)	The role of transformation in learning and education for sustainability	2018	Journal of Cleaner Production	459
3	Abad-Segura et al. (2020)	Sustainable management of digital transformation in higher education: Global research trends	2020	Sustainability (Switzerland)	389
4	Aleixo et al. (2018)	Conceptualization of sustainable HIEs, roles, barriers, and challenges for sustainability: An exploratory study in Portugal	2018	Journal of Cleaner Production	381
5	Purcell et al. (2019)	Universities as the engine of transformational sustainability toward delivering the sustainable development goals: "Living labs" for sustainability	2019	International Journal of Sustainability in Higher Education	351
6	Pandey et al. (2017)	Sustainable livelihood framework-based indicators for assessing climate change vulnerability and adaptation for Himalayan communities	2017	Ecological Indicators	285
7	Consoli et al. (2016)	Do green jobs differ from non-green jobs in terms of skills and human capital?	2016	Research Policy	284
8	Henderson & Loreau (2023)	A model of Sustainable Development Goals: Challenges and opportunities in promoting human well-being and environmental sustainability	2023	Ecological Modelling	278
9	Lozano et al. (2019)	Teaching sustainability in European HIEs: Assessing the connections between competences and pedagogical approaches	2019	Sustainability (Switzerland)	250
10	He et al. (2021)	Senior management's academic experience and corporate green innovation	2021	Technological Forecasting and Social Change	246

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RQ3: What Are the Prevailing and Emerging Thematic Research Patterns in Environmental Education Within Higher Education, As Revealed Through Keyword Co-Occurrence Analysis?

Figure 2 illustrates a highly centralized and dense keyword co-occurrence network, where *sustainability* (984 occurrences; total link strength = 2,298), *higher education* (568; 1,478), and *environmental education* (473; 1,170) form the dominant conceptual core. This strong clustering indicates that research in this domain is firmly anchored around the institutional role of universities in advancing sustainability agendas. Closely related keywords such as *education for sustainable development*, the *SDGs*, and *climate change* further suggest that the field is strongly shaped by global policy frameworks and international sustainability discourse. The prominence of these interconnected terms reflects the growing alignment of academic research with global initiatives such as the 2030 Agenda and climate education priorities (Shulla & Leal Filho, 2023). However, an alternative interpretation is that this high centralization indicates conceptual convergence, in which research repeatedly emphasizes similar frameworks, potentially limiting theoretical diversity and innovation within the field.

Beyond the dominant cluster, Figure 2 reveals several secondary thematic clusters, indicating the diversification and maturity of the research landscape. Keywords such as *transformative learning*, *pro-environmental behavior*, *competencies*, and *experiential learning* highlight a strong pedagogical orientation, focusing on behavioral change and student-centered learning. At the same time, applied themes such as *ecological footprint*, *carbon footprint*, *circular economy*, and *green campus* indicate an increasing emphasis on operationalizing sustainability within HIEs. Likewise, these patterns suggest that research has moved from conceptual discussions to practical implementation and measurement of sustainability outcomes, consistent with recent trends emphasizing impact-driven education (Lozano et al., 2019; Shulla & Leal Filho, 2023). Nevertheless, a critical perspective may question whether the coexistence of diverse themes leads to genuine interdisciplinary integration or merely to fragmented subfields operating in parallel, lacking sufficient theoretical coherence.

Figure 2 also highlights emerging and evolving topics such as *artificial intelligence*, *digital transformation*, *social justice*, and *global citizenship*, which signal the expansion of environmental education into new technological and socio-cultural domains. These emerging keywords suggest that the field is adapting to contemporary challenges, including digitalization and equity considerations in sustainability education. Despite this, their relatively lower frequency compared to core themes indicates that these areas are still developing and have not yet achieved mainstream prominence. From a critical standpoint, the uneven distribution of keyword occurrences may reflect broader structural influences, including funding priorities and publication trends that favor established topics over emerging or locally relevant issues (OECD, 2023; Pedro & Galán, 2022). Consequently, while Figure 2 demonstrates a mature and expanding research field, it also underscores the need for greater balance between established paradigms and emerging perspectives. This ensures a more inclusive and innovative trajectory of knowledge development.

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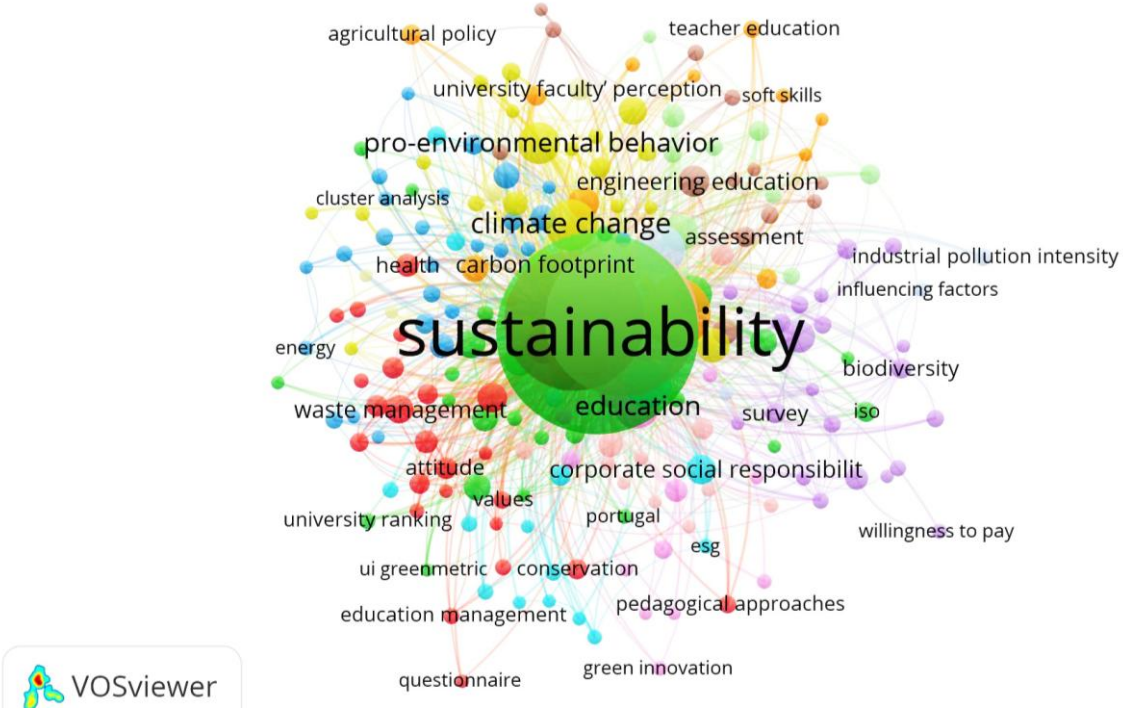

Figure 2: Network Visualization Map of Keywords' Co-Occurrence

RQ4: What International Collaboration Patterns Emerge in Environmental Education Research Within Higher Education Based on Country-Level Co-Authorship Networks?

Figure 3 presents a complex country-level co-authorship network that reflects both the global reach and the structural asymmetries of environmental education research within higher education. The visualization illustrates several central hubs, with the United States (215 documents, link strength = 122), the United Kingdom (129, 203), and Spain (170, 137) being the most notable, occupying dominant and highly connected positions. Specifically, the United Kingdom demonstrates the highest total link strength (203), indicating strong international collaboration intensity despite having fewer publications than the United States. Meanwhile, European countries such as Spain, Germany, and Portugal also display strong connectivity, suggesting a highly integrated regional research network. This pattern can be justified by established research infrastructures, access to funding mechanisms such as cross-border collaborative programs, and policy alignment with sustainability agendas (OECD, 2023; Pedro & Galán, 2022). However, an alternative perspective suggests that such centralization may reinforce academic dominance by a few regions, potentially limiting the diversity of perspectives and marginalizing contributions from less-connected regions.

Figure 3 also highlights the active yet relatively uneven participation of emerging economies in the global research network. Countries such as China (133 documents, link strength = 115), Brazil (92, 99), Malaysia (51, 65), and South Africa (38, 57) demonstrate increasing research productivity and moderate collaboration intensity. China's position indicates strong output with growing international partnerships, although its collaboration density remains less extensive than that of leading Western countries. Similarly, countries in Asia, the Middle East, and Latin America demonstrate expanding involvement, though they remain positioned more peripherally in the network. This imbalance can be explained by differences in research funding, institutional capacity, language barriers, and access to international collaboration

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platforms (Daltro-Oliveira et al., 2025; Pedro & Galán, 2022). Nevertheless, a counterargument suggests that lower collaboration strength does not necessarily indicate weaker research quality. Instead, some regions may prioritize locally relevant research agendas that do not require extensive international co-authorship.

Furthermore, Figure 3 reveals that international collaboration is strongly linked to research visibility and citation impact, as highly connected countries tend to accumulate higher citation counts. This pattern aligns with the idea that collaborative networks facilitate knowledge exchange, resource sharing, and broader dissemination of research findings (OECD, 2023). At the same time, the presence of smaller clusters involving countries such as Indonesia, Vietnam, and several African and Middle Eastern nations indicates emerging participation that has yet to achieve significant global integration. From a critical standpoint, this uneven distribution may reflect systemic inequalities in the global research ecosystem, where collaboration opportunities are concentrated among well-funded institutions. Additionally, collaboration networks may sometimes be driven by strategic incentives, such as funding requirements or publication performance metrics, rather than genuine intellectual exchange. In general, Figure 3 suggests that while environmental education research in higher education has developed into a globally distributed field, its collaborative structure remains uneven. This ultimately highlights the need for more inclusive and equitable international research partnerships.

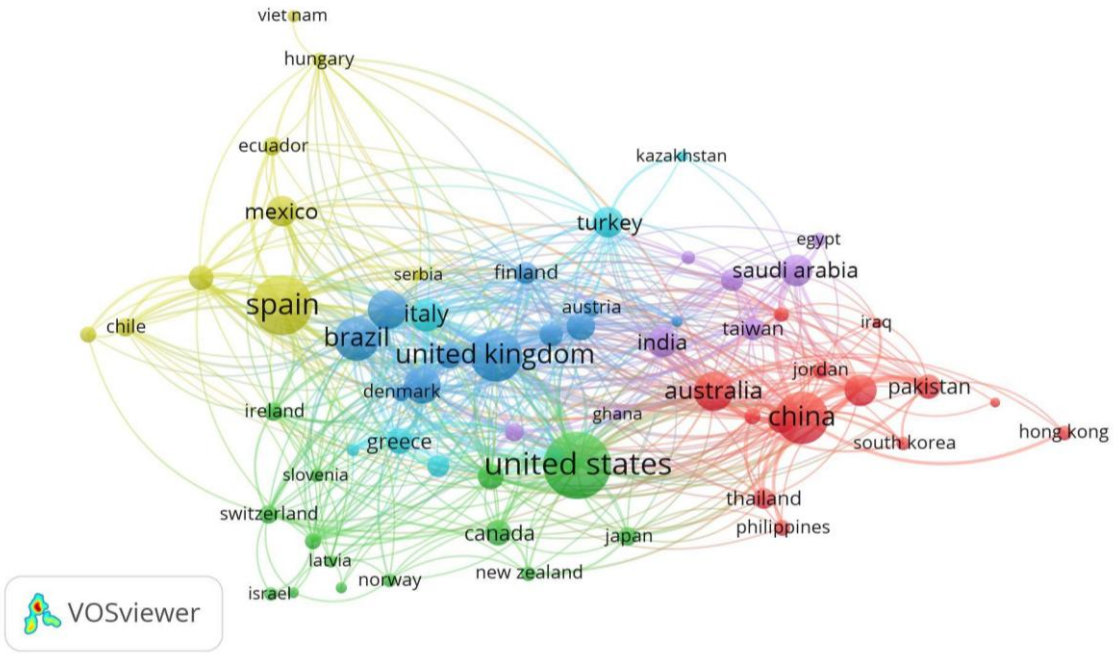

Figure 3: Network Visualization Map of Countries' Co-Occurrence

Conclusion

This study examined trends and developments in environmental education research in higher education from 2016 to 2026 using a bibliometric approach. The main objective was to analyze the evolution of publication output, identify influential research contributions, explore dominant and emerging thematic patterns, and examine international collaboration structures. Correspondingly, these research questions provided a structured understanding of how the

research progress has evolved, where scholarly influence is concentrated, and how knowledge production is globally distributed.

The findings indicate a consistent growth in publication output, with a notable increase after 2021, suggesting that environmental education has become a well-established and actively expanding research domain. Influential publications were primarily interdisciplinary and conceptual, focusing on sustainability integration, institutional transformation, and broader societal relevance rather than on narrow pedagogical topics. Furthermore, the keyword co-occurrence analysis revealed a strong core centered on sustainability, higher education, and environmental education. It also highlights emerging themes such as climate change, transformative learning, digital transformation, and pro-environmental behavior. In addition, country-level co-authorship patterns presented that research output and collaboration are concentrated in a limited number of developed countries. That is, participation from emerging regions continues to grow, though it remains less integrated.

This study contributes to academia by providing a comprehensive overview of its intellectual structure and research dynamics over 10 years. At the same time, the analysis offers useful insights for scholars in identifying key research areas, influential topics, and collaboration opportunities, while also supporting institutions and policymakers in strengthening sustainability-focused research strategies. The results further underscore the significance of interdisciplinary approaches and global cooperation in advancing environmental education within higher education.

Nonetheless, certain limitations should be acknowledged, including the reliance on a single database, language restrictions, and the descriptive nature of bibliometric methods, which do not directly evaluate research quality or real-world impact. In response, future research may extend this analysis using multiple data sources, incorporating qualitative approaches, or exploring institutional and regional comparisons in greater depth. Overall, this study highlights the importance of bibliometric analysis in understanding research development. It also offers a valuable foundation for guiding future scholarship and promoting a more balanced and inclusive advancement of environmental education research in higher education.

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References

Abad-Segura, E., González-Zamar, M.-D., Infante-Moro, J. C., & García, G. R. (2020). Sustainable management of digital transformation in higher education: Global research trends. *Sustainability (Switzerland)*, *12*(5). https://doi.org/10.3390/su12052107

Abo-Khalil, A. (2024). Integrating sustainability into higher education challenges and opportunities for universities worldwide. *Heliyon*, *10*. https://doi.org/10.1016/j.heliyon.2024.e29946

Aleixo, A. M., Leal, S., & Azeiteiro, U. M. (2018). Conceptualization of sustainable higher education institutions, roles, barriers, and challenges for sustainability: An exploratory study in Portugal. *Journal of Cleaner Production*, *172*, 1664–1673. https://doi.org/10.1016/j.jclepro.2016.11.010

Azhar, S. N. F. S., Akib, N. A. M., Sibly, S., & Mohd, S. (2022). Students' Attitude and Perception towards Sustainability: The Case of Universiti Sains Malaysia. *Sustainability (Switzerland)*, *14*(7). https://doi.org/10.3390/su14073925

Balakrishnan, B., Fedorova, N., & Ugap, C. (2024). Sustainability and sustainable development values in creative practices among design undergraduates of Russia and Malaysia. *International Journal of Sustainability in Higher Education*. https://doi.org/10.1108/ijshe-10-2023-0511

Balakrishnan, B., Tochinai, F., Kanemitsu, H., & Al-Talbe, A. (2021). Education for sustainable development in Japan and Malaysia: a comparative study among engineering undergraduates. *International Journal of Sustainability in Higher Education*, *22*(4), 891–908. https://doi.org/10.1108/IJSHE-08-2020-0301

Boarin, P., & Martinez-Molina, A. (2022). Integration of environmental sustainability considerations within architectural programmes in higher education: A review of teaching and implementation approaches. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2022.130989

Bornmann, L., & Haunschild, R. (2018). Plots for visualizing paper impact and journal impact of single researchers in a single graph. *Scientometrics*, *115*(1), 385–394. https://doi.org/10.1007/s11192-018-2658-1

Brundiers, K., Barth, M., Cebrián, G., Cohen, M., Diaz, L., Doucette-Remington, S., Dripps, W., Habron, G., Harré, N., Jarchow, M., Losch, K., Michel, J., Mochizuki, Y., Rieckmann, M., Parnell, R., Walker, P., & Zint, M. (2021). Key competencies in sustainability in higher education—toward an agreed-upon reference framework. *Sustainability Science*, *16*(1), 13–29. https://doi.org/10.1007/s11625-020-00838-2

Chan, M. S., Tan, C. H., Thee, C. C., & Tan, B. C. (2025). Impacts of green curriculum exposure and sustainability awareness on green entrepreneurship intention among Malaysian university students: The mediating role of self-efficacy. *Industry and Higher Education*, *39*(4), 379–394. https://doi.org/10.1177/09504222251354885

Consoli, D., Marin, G., Marzucchi, A., & Vona, F. (2016). Do green jobs differ from non-green jobs in terms of skills and human capital? *Research Policy*, *45*(5), 1046–1060. https://doi.org/10.1016/j.respol.2016.02.007

da Costa, T., Aranda Lopez, L. I., Perussello, C., Quinn, F., Crowley, Q. G., McMahon, H., & Holden, N. M. (2025). Addressing the Demand for Green Skills: Bridging the Gap Between University Outcomes and Industry Requirements. *Sustainability (Switzerland)*, *17*(6). https://doi.org/10.3390/su17062732

Daltro-Oliveira, R., Quintairos, A., Santos, L. I. O., Amado, F., Salluh, J. I. F., & Nassar, A. P. (2025). Global disparities in scientific publications: A 5-year analysis of 10 critical care journals. *Critical Care and Resuscitation*, *27*(4), 100137. https://doi.org/10.1016/j.ccrj.2025.100137

Dmochowski, J., Garofalo, D., Fisher, S., Greene, A., & Gambogi, D. (2016). Integrating Sustainability across the University Curriculum. *International Journal of Sustainability in Higher Education*, *17*, 652–670. https://doi.org/10.1108/ijshe-10-2014-0154

Fuchs, M. (2024). Green Skills for Sustainability Transitions. *Geography Compass 18*(10). https://doi.org/10.1111/gec3.70003

He, K., Chen, W., & Zhang, L. (2021). Senior management's academic experience and corporate green innovation. *Technological Forecasting and Social Change*, *166*. https://doi.org/10.1016/j.techfore.2021.120664

Henderson, K., & Loreau, M. (2023). A model of Sustainable Development Goals: Challenges and opportunities in promoting human well-being and environmental sustainability. *Ecological Modelling*, *475*. https://doi.org/10.1016/j.ecolmodel.2022.110164

Leal Filho, W., Raath, S., Lazzarini, B., Vargas, V. R., de Souza, L., Anholon, R., Quelhas, O. L. G., Haddad, R., Klavins, M., & Orlovic, V. L. (2018). The role of transformation in learning and education for sustainability. *Journal of Cleaner Production*, *199*, 286–295. https://doi.org/10.1016/j.jclepro.2018.07.017

Lozano, R., Barreiro-Gen, M., Lozano, F. J., & Sammalisto, K. (2019). Teaching sustainability in European higher education institutions: Assessing the connections between competences and pedagogical approaches. *Sustainability (Switzerland)*, *11*(6). https://doi.org/10.3390/su11061602

McCarthy, B., & Eagle, L. (2021). Are the sustainability-oriented skills and competencies of business graduates meeting or missing employers' needs? Perspectives of regional employers. *Australian Journal of Environmental Education*, *37*(3), 326–343. https://doi.org/10.1017/aee.2021.11

Nikolajenko-Skarbalė, J., Viederytė, R., & Sneideriene, A. (2021). The Significance of "Green" Skills and Competencies Making the Transition Towards the "Greener" Economy. *Rural Sustainability Research*, *46*, 53–65. https://doi.org/10.2478/plua-2021-0017

Obrecht, M., Feodorova, Z., & Rosi, M. (2022). Assessment of environmental sustainability integration into higher education for future experts and leaders. *Journal of Environmental Management*, *316*, 115223. https://doi.org/10.1016/j.jenvman.2022.115223

OECD. (2023). Enabling Transitions in Times of Disruption. In *OECD Science, Technology and Innovation Outlook*. https://www.oecd.org/en/publications/oecd-science-technology-and-innovation-outlook-2023_0b55736e-en.html

Pandey, R., Jha, S. K., Alatalo, J. M., Archie, K. M., & Gupta, A. K. (2017). Sustainable livelihood framework-based indicators for assessing climate change vulnerability and adaptation for Himalayan communities. *Ecological Indicators*, *79*, 338–346. https://doi.org/10.1016/j.ecolind.2017.03.047

Pedro, F., & Galán, V. (2022). International Cooperation to Enhance Synergies. *World Higher Education Conference 18- 20 May 2022*.

Purcell, W. M., Henriksen, H., & Spengler, J. D. (2019). Universities as the engine of transformational sustainability toward delivering the sustainable development goals: "Living labs" for sustainability. *International Journal of Sustainability in Higher Education*, *20*(8), 1343–1357. https://doi.org/10.1108/IJSHE-02-2019-0103

Rajabifard, A., Kahalimoghadam, M., Lumantarna, E., Herath, N., Hui, F., & Assarkhaniki, Z. (2021). Applying SDGs as a systematic approach for incorporating sustainability in higher education. *International Journal of Sustainability in Higher Education*. https://doi.org/10.1108/ijshe-10-2020-0418

Rosati, F., & Faria, L. G. D. (2019). Addressing the SDGs in sustainability reports: The relationship with institutional factors. *Journal of Cleaner Production*, *215*, 1312–1326. https://doi.org/10.1016/j.jclepro.2018.12.107

Saleem, A., Aslam, S., Sang, G., Dare, P. S., & Zhang, T. (2022). Education for sustainable development and sustainability consciousness: evidence from Malaysian universities. *International Journal of Sustainability in Higher Education*, *24*(1), 193–211. https://doi.org/10.1108/IJSHE-05-2021-0198

Shulla, K., & Leal Filho, W. (2023). Achieving the UN Agenda 2030: Overall actions for the successful implementation of the Sustainable Development Goals before and after the 2030 deadline Requested by the DEVE committee DIRECTORATE-GENERAL FOR EXTERNAL POLICIES POLICY DEPARTMENT. *European Union Parliament*, 64. https://www.agenda-2030.fr/IMG/pdf/expo_ida_2022_702576_en.pdf

Surono, S. (2025). Establishing Competency Standards of Implementing Green Citizen Skills To Strengthen Employability of Green Jobs. *Asian Journal of Social and Humanities*. https://doi.org/10.59888/ajosh.v3i5.499

Tasdemir, C., & Gazo, R. (2020). Integrating sustainability into higher education curriculum through a transdisciplinary perspective. *Journal of Cleaner Production*, *265*, 121759. https://doi.org/10.1016/J.JCLEPRO.2020.121759

Thian, L. B., Chang, Y. H., Raman, N., & Ng, V. (2025). Sustainability as a life purpose among first-semester students at a private university in Malaysia. *Discover Sustainability*, *6*. https://doi.org/10.1007/s43621-025-02012-z

Van Eck, N. J., & Waltman, L. (2007). Bibliometric mapping of the computational intelligence field. *International Journal of Uncertainty, Fuzziness and Knowldege-Based Systems*, *15*(5), 625–645. https://doi.org/10.1142/S0218488507004911

Wegenberger, O., & Ponocny, I. (2025). Green Skills Are Not Enough: Three Levels of Competences from an Applied Perspective. *Sustainability*. https://doi.org/10.3390/su17010327