Green School and Environmental Education at Junior High School: A Bibliometric Analysis

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ABSTRACT

This study analyzes research on environmental education and the implementation of green school principles at the junior high school level, focusing on trends, challenges, and future directions. A bibliometric approach was applied using Google Scholar as the main database, covering journal articles published between 2013 and 2023. Data were analyzed with VOSviewer to map citation patterns, keyword clusters, and collaboration networks, while PRISMA ensured systematic selection. The findings reveal an increasing number of publications, with three dominant clusters: pedagogical implementation in formal education, the role of geographical and policy contexts, and psychological-behavioral impacts such as environmental awareness, green consumption, and environmental protection. Despite progress, challenges remain, including limited resources, insufficient teacher training, and lack of supportive policies. The study concludes that environmental education at the junior high school level is essential for fostering sustainability awareness and responsible behavior, requiring an integrative approach that combines pedagogy, policy, and psychology. Practical implications emphasize digital learning tools and community-based projects to enhance student engagement and improve green school initiatives.

Keywords: Environmental Education, Green School, Sustainability, Junior High School

INTRODUCTION

Green schools in Environmental education are one of the key elements in creating ecological awareness and forming sustainable behavior among the younger generation (Adnyana et al., 2023). In recent years, the concept of "green schools" has increasingly been implemented in various countries as part of efforts to introduce sustainability principles to students at the secondary education level, especially in junior high schools (Teichmann et al., 2023). Green school is not only a concept that integrates environmentally friendly resource management in the school environment, but also combines an experience-based educational approach that allows students to be directly involved in environmental conservation activities (Altassan, 2023). Green schools encourage students to become responsible agents of change in an effort to maintain natural balance and sustainability in the future (Baierl et al., 2022).

The Green School concept has been applied at various levels of education, from elementary school to university (Wulandari et al., 2025). At the basic education level, this program usually focuses on introducing habits that support environmental sustainability, such as waste management, tree planting and maintaining school gardens. At the secondary level, the application focuses more on collaborative projects, where students are invited

to be involved in addressing environmental issues around them, such as campaigns to reduce plastic waste or save energy. Meanwhile, in higher education, Green Schools are realized through research activities, sustainable technology development, and innovation programs that not only have an impact on the campus, but also society at large. This approach ensures that environmental conservation values are instilled on an ongoing basis, forming individuals who are aware and responsible for environmental sustainability at every level of education (Llopiz-Guerra et al., 2024).

Especially at the junior high school level, green schools function to instill sustainability values that can shape students' thinking patterns and behavior as they develop into individuals who are more aware of existing environmental challenges](Hoque et al., 2022). Green Schools play an important role in environmental education by not only providing an understanding of environmental issues, but also encouraging students to play an active role in preserving nature (Barron et al, 2022). This program can be implemented through project-based learning methods as well as various other practical activities. Through this approach, students are invited to face real challenges that exist around them, such as waste management, energy savings, and conserving water resources (Tsai, 2022).

The implementation of green schools is widely discussed in scientific literature. Based on previous studies, implementing environmental education in schools can increase students' awareness and understanding of environmental issues and encourage them to play an active role in activities that support sustainability (Kalla et al., 2022). In addition, the integration of sustainability principles into the school curriculum and management of school operations also has the potential to increase student participation in environmentally friendly projects (Vare, 2021). A study shows that environmental education programs that involve students in recycling activities and the use of renewable energy at school can increase their involvement in environmental conservation actions, even outside school (Ardoin et al., 2020).

Environmental education in junior high schools faces significant challenges, including limited resources, lack of supporting facilities, and low levels of training for educators in teaching material related to sustainability (Wijayanti et al., 2024). Another problem is the lack of education policies that support the implementation of green schools at the national and regional levels (Yuan et al., 2024). Although there are various initiatives aimed at supporting the implementation of environmental education in schools, existing policies often do not provide sufficient incentives for schools to invest in environmentally friendly facilities and develop sustainability-based curricula (Zhou, 2024). This causes the implementation of the green school concept to be limited, especially in developing countries which have budget and resource challenges (Kuswati et al., 2024).

This bibliometric study aims to explore research developments related to environmental education and green schools at junior high school level in the last five years. This analysis will provide an overview of the main trends in environmental education literature, the dominant topics in current research, and the challenges faced in its implementation. By using a bibliometric approach, this research will also identify collaboration between researchers and institutions, as well as the contribution of various countries to research on green schools (T. Li & Zhou, 2022). It is hoped that the results of this analysis can provide new insights into the development of environmental education and support efforts to improve the quality of sustainable education at the junior high school level.

Several recent studies show that green schools have a positive impact on student character development in terms of social responsibility and concern for the environment (Khuluqo, 2019). Studies revealed that students involved in green school programs show increased understanding of sustainability issues and are more proactive in taking action to preserve their environment (Fernández et al., 2023). Despite the many benefits of implementing environmental education in schools, factors such as budget constraints and lack of policy support often hinder wider implementation of such programs at the secondary school level (Ramírez Suárez et al., 2023).

One important factor that is a challenge in implementing green schools is the role of teachers in transforming a sustainability-based curriculum into interesting and effective activities for students (Hamwy et al., 2023). Various studies show the importance of teacher training in integrating sustainability concepts into teaching. Without adequate training, teachers may face difficulties in presenting relevant material in a way that is easily understood by students. This, in turn, can reduce the effectiveness of implemented environmental education (Teresa et al., 2022).

This bibliometric study will provide a comprehensive analysis of the research topics most widely discussed in the literature related to environmental education and green schools, as well as illustrate the direction of research development in this field. Thus, this research not only contributes to the understanding of current research trends, but also serves as a reference for designing more effective green school implementation policies and strategies at the junior high school level.

LITERATURE REVIEW

The concept of green school and environmental education has been widely discussed in the last two decades as an essential strategy to address the global challenges of sustainability and climate change (Altassan, 2023). According to (Shutaleva, 2023), schools are not only institutions for academic knowledge transfer but also key arenas for cultivating ecological values, sustainable lifestyles, and responsible citizenship among young learners. Previous studies indicate that integrating environmental education into school curricula can significantly enhance students' awareness, attitudes, and behaviors toward environmental protection (van de Wetering et al., 2022).

At the junior high school level, research has shown that project-based learning, outdoor activities, and experiential approaches (Chen, Xiang, & Fan, 2024) foster deeper connections between students and their natural environment. Furthermore, the green school framework has been linked with the achievement of the Sustainable Development Goals (SDGs), particularly Goal 4 on Quality Education and Goal 13 on Climate Action (UNESCO, 2014)(Y. Li, Liao, & Li, 2023). However, scholars also highlight critical challenges such as limited teacher training, inadequate resources, and inconsistent policy support, which hinder the effectiveness of environmental education programs in many contexts (Zhou, 2024).

Bibliometric studies in this field have mapped research trends showing a shift from pedagogical perspectives toward psychological, behavioral, and policy-oriented dimensions of environmental education (Rueda et al., 2023). This suggests that the discourse is moving beyond classroom practice to embrace wider societal impacts, policy frameworks, and community-based engagement. Thus, reviewing existing literature not only provides a comprehensive understanding of how green school initiatives have evolved but also reveals the gaps and opportunities for future research in strengthening environmental education at the junior high school level.

METHODOLOGY

This research uses a bibliometric approach to analyze literature related to environmental education and green schools at the junior high school level. The bibliometric approach was chosen because it can provide a clear picture of trends, dominant topics, and collaboration between researchers in this field (Palupiningtyas & Pahrijal, 2023). The analysis process begins with identifying relevant articles through the Google Scholar database.

The first step in the research process was searching for articles using the keywords "environmental education", "green school", "junior high school", and "sustainability education". Once relevant articles are found, data from articles that meet the inclusion criteria will be collected and analyzed using bibliometric analysis software such as VOSviewers or Bibliometric. The data analyzed includes information such as number of publications, authors, institutions, journals, and most frequently occurring keywords.

Next, analysis will be carried out to identify patterns in current research, such as emerging topic trends, international collaborations, and the contribution of each country to this topic. Using citation analysis, this research will also explore the influence of certain articles in shaping research directions in the field of environmental education (Rueda et al., 2023). The results of this bibliometric analysis will provide insight into the challenges and opportunities in developing environmental education in green schools, as well as provide recommendations for further research in this area (Onyeaka & Akinsemolu, 2024).

DATA COLLECTION AND ANALYSIS

Data Collection

The data selection strategy in this bibliometric research focuses on selecting articles that are relevant to the topic of environmental education and green schools at the junior high school level. Article selection was carried out through systematic searches in leading academic databases, such as Google Scholar. Keywords used in the search included "environmental education", "green school", "junior high school", "sustainability education", and "ecological education". To ensure completeness and relevance of the data, selected articles had to meet several inclusion criteria, namely being published within the last ten years (2013–2023).

In selecting articles, this research adopted selection principles based on the relevance of the content and the quality of the information source. Articles intended for inclusion must have a clear focus on environmental education or the application of green school concepts in junior high schools. Apart from that, the articles taken must also be published in reputable journals that are indexed in international databases, to ensure the quality and validity of the data used. As additional references, articles with a high citation rate or those from leading researchers in the field of environmental education are prioritized for further analysis. Article selection was carried out with the help of bibliometric analysis software such as VOSviewer and Bibliometric to ensure the selection of the most representative articles (Guevara-Herrero, Bravo-Torija, & Pérez-Martín, 2024).

Using a rigorous selection strategy, this research aims to identify relevant literature and provide in-depth insight into the latest developments in research on environmental education and green schools at junior high school level.

Data Analysis

To analyze bibliometric data, this study used VOSviewer software, which is an effective tool for visualization and analysis of bibliometric networks, including relationships between authors, institutions, and keywords. By using this program, researchers can identify international collaboration patterns, topic trends, and the development of concepts commonly discussed in articles related to environmental education and green schools. Application of this tool produces comprehensive visualizations and detailed data, helping to identify relationships between key factors in the environmental education literature. In addition, this tool also facilitates the discovery of less explored areas in environmental education research, providing a broader picture of research developments in the field.

Data Cleansing

Prisma Method

Based on data from the PRISMA flow diagram, the systematic review process goes through several important stages in screening and selection. Initially, a total of 570 records were identified from various databases. After removing duplicates (n = 5), the remaining 565 records were declared eligible by the automation tool, and an additional 15 records were excluded for other reasons, which reduced the number of records to 550. These 550 records were then screened for compliance with the review criteria. Of the 550 records screened, only 5 were excluded after this initial screening stage, indicating a fairly rigorous selection process to ensure only relevant studies were selected. After that, 545 reports were requested to be retrieved, with only 5 reports not being successfully retrieved. This indicates successful efforts in obtaining documents necessary for further evaluation.

The final stage in the process involved assessing the suitability of the 540 retrieved reports. After a thorough assessment, all 540 reports were included in the review, meaning no further exclusions were carried out at this stage. This brings the total number of studies included in the review to 540, reflecting a strong inclusion rate and an effective screening process of the most relevant studies for the research. This process complies with the PRISMA methodological principles, which aim to provide transparency and reduce bias in the systematic review process by clearly documenting each stage of study inclusion and exclusion. The PRISMA guidelines have been widely recognized as an important tool for researchers to ensure comprehensive, reproducible, and bias-free reviews. Additionally, the clarity of this process ensures that readers and researchers can trust the findings of this review, as it demonstrates a rigorous and methodologically based approach to data collection and analysis.

This systematic review, with its clear separation from the study selection process, serves as a model for how PRISMA can be applied to synthesize research in a transparent and systematic manner. By including only studies that meet certain eligibility criteria and excluding those that do not, this review minimizes the risk of including irrelevant or low-quality studies, thereby strengthening the reliability of the results. Such rigorous screening is essential to ensure that the conclusions drawn from this review are based on the highest quality evidence available.
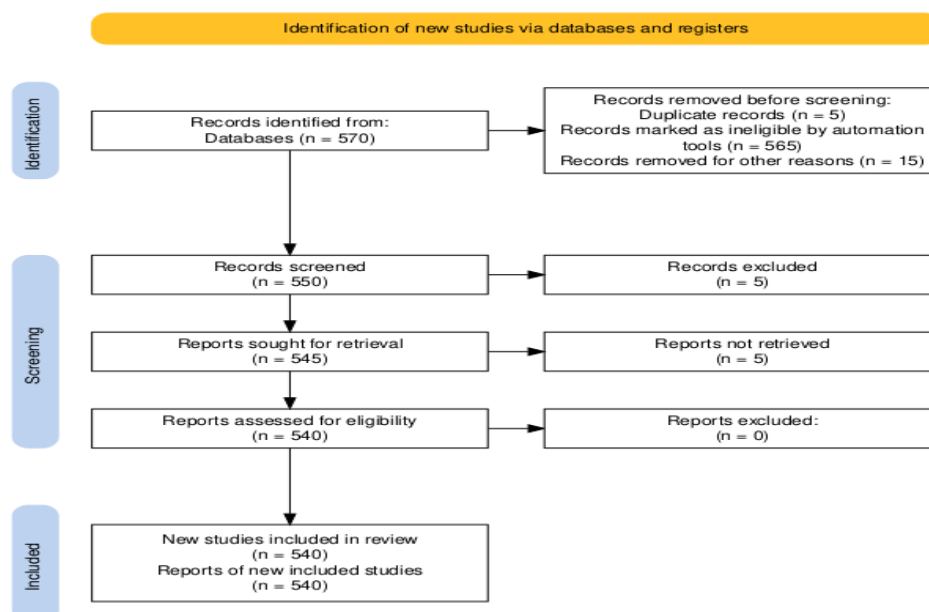

Figure 1. PRISMA Flow Diagram.

The PRISMA flowchart presented here provides a transparent and structured approach to study selection, highlighting the importance of careful screening and eligibility assessment in systematic reviews. This methodological approach helped ensure that the review process was reproducible and bias-free, in accordance with standards set by leading research publications in this field.

RESULTS AND FINDINGS

Data Collection

Citation patterns of articles published between 2013 and 2023 were analyzed. This analysis includes total citations (Cites), average citations per year (CitesPerYear), and average citations per author (CitesPerAuthor) for each article published each year. Through an overall review of this data, several conclusions can be drawn regarding the impact and influence of scientific articles published throughout this period. The resulting citation data shows interesting trends in academic publications between 2013 and 2023, with significant fluctuations seen in Total Cites, average Cites per Year, and average Cites per Author. These findings provide important insights into how these articles contributed to the development of science and their impact on the academic community during the period analyzed.
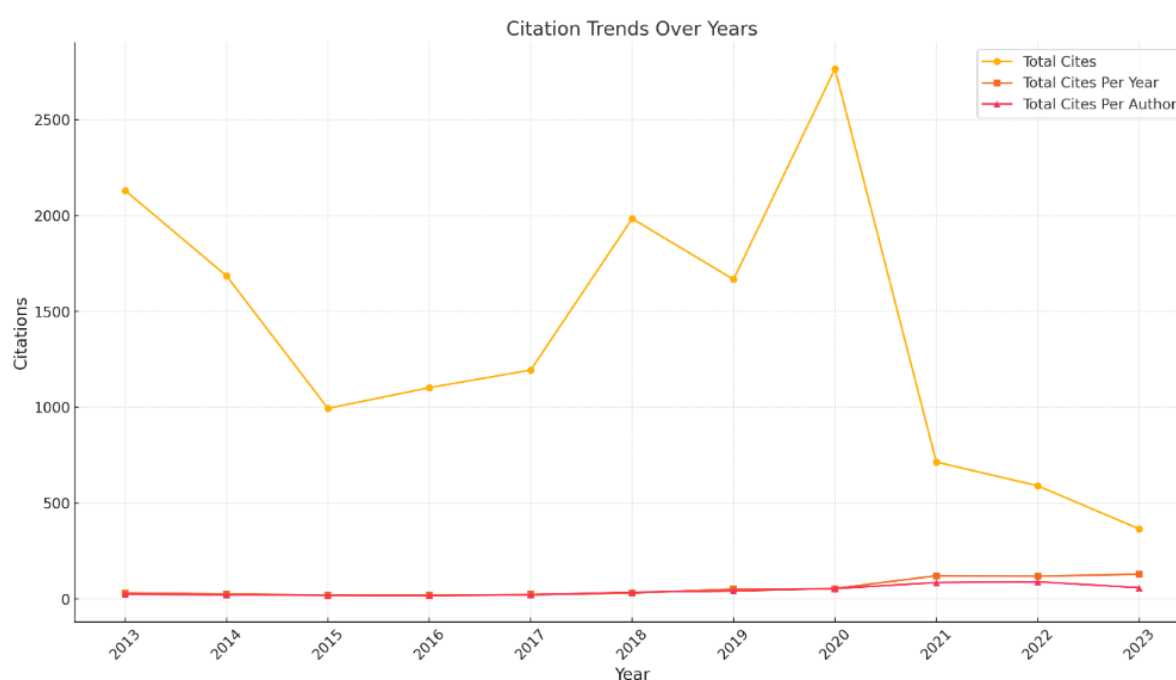
Figure 2. Citation Trend over Years.

Year 2020 recorded the highest Total Cites (2766), which seems to indicate a productive year for research. However, after that there was a sharp decline in 2021, where Total Cites fell to 714, indicating the potential impact of changes in research pathways or developing academic discussions. Although Total Cites decreased in subsequent years, Total Cites Per Year actually increased, reaching a peak in 2023 at 128.56. This indicates that although the total volume of citations is declining, the quality or relevance of published articles may be increasing, with academics more likely to cite work that is considered more substantial and influential.

In addition, Total Cites Per Author shows an upward trend until 2022, reaching 89.12, before decreasing again to 58.39 in 2023. This increase shows that there are authors or groups of authors who produce high-quality research during this period. However, a decline may also signal difficulty in maintaining a level of quality or interest in an ever-changing academic context. In light of this data, it is important to further explore factors that may influence this trend, such as collaboration between researchers, changes in research focus, as well as broader academic dynamics. More in-depth research can help identify problems and opportunities that need to be addressed in today's academic world.
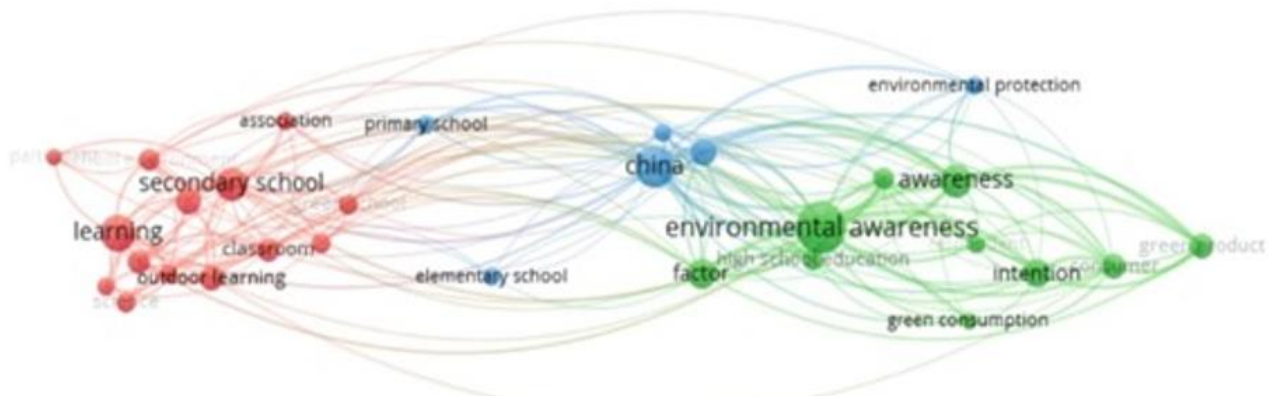
Bibliometric Visualization of Three Main Clusters

Figure 3. Bibliometric Variables Clustering.

First Cluster (Red)

The first cluster (red) focuses on formal education in schools, especially at the primary and secondary levels, with keywords such as secondary school, primary school, outdoor learning, and classroom, which reflect the integration of environmental education in the curriculum through a practice-based learning approach.

Second Cluster (Blue)

The second cluster (blue) refers to the geographical context, with the main keywords China, indicating the research focus on the implementation of environmental education policies and green schools in this region, indicating the role of local policies in promoting educational sustainability.

Third Cluster (Green)

The third cluster (green) highlights psychological and behavioral aspects, with keywords such as environmental awareness, green consumption, and environmental protection, which describe the impact of environmental education on increasing students' awareness and changing environmentally friendly behavior. The relationship between clusters shows the close connection between formal education, environmental awareness, and geographical context, where environmental education programs in schools contribute to the formation of sustainable behavior in society. This study confirms the importance of multidisciplinary approaches that integrate pedagogy, policy, and psychology in environmental education, while highlighting the need for cross-national research to understand variations in implementation and impact globally.
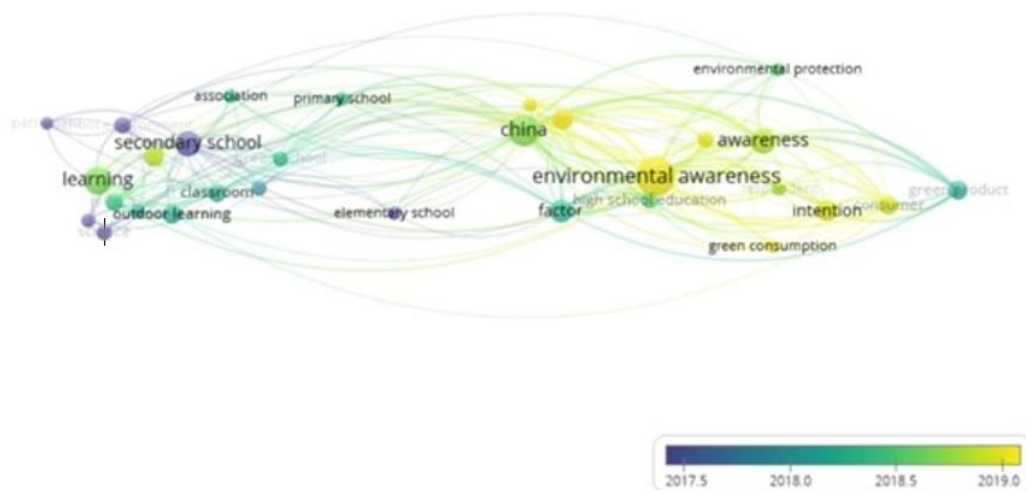
Bibliometric Visualization in the Time Dimension

Figure 4. Bibliometric in the time dimension visualization.

This VOSviewer-based bibliometric analysis reveals the evolution of research related to environmental education, green schools, and lower secondary schools during the 2017–2019 period, by exploiting the temporal dimension to identify thematic trends. The results show three main clusters that develop temporally. The first cluster focuses on formal education in schools with themes such as secondary school, primary school, classroom, and outdoor learning, which were more dominant in the early period (2017–2018), reflecting attention to pedagogical approaches in implementing environmental education.

The second cluster highlights the geographical context, with the keyword China becoming increasingly relevant in subsequent years (2018–2019), reflecting the role of local policy and implementation in supporting environmental education.

The third cluster, which dominates in the most recent period (2018–2019), focuses on the impact of education on environmental awareness and sustainable behavior, with keywords such as environmental awareness, green consumption, and environmental protection.

This evolution represents a shift in research focus from pedagogical implementation towards evaluating social and psychological impacts, along with increasing attention to sustainability and the Sustainable Development Goals (SDGs).

This research highlights the importance of a multidisciplinary approach to integrating policy, pedagogy, and behavior in environmental education to strengthen its positive impact globally.

DISCUSSION

The results of this bibliometric analysis provide significant insight into the thematic distribution in environmental education research, identifying three main clusters that are interconnected and contribute to a holistic understanding of the implementation and impact of environmental education (Lasekan et al., 2024). The first cluster (red) shows a focus on formal education in schools, especially at the primary and secondary levels, through the integration of environmental education concepts into the formal curriculum. Keywords such as secondary school, primary school, outdoor learning, and classroom illustrate how environmental education has become an important element in student development in formal schools (Ardoin et al., 2022).

The practice-based approach reflected in outdoor learning indicates innovation in pedagogy to provide students with direct experiences, such as exploration of the natural environment, which aims to strengthen their understanding of global environmental issues (Hutson et al., 2024). In addition, the focus on the classroom as one of the main elements shows the importance of theory-based learning which involves discussion, problem solving, and integrating environmental material into main subjects such as science, geography, and moral education.

Education at the primary and secondary levels acts as an initial foundation for instilling sustainability values in students from an early age, building their environmental awareness, and encouraging them to become agents of change in the future. This also shows the significant role of schools as institutions capable of influencing student behavior towards environmental issues, with curricula designed to encourage student involvement in activities such as school greening, recycling and environmental awareness campaigns.

The second cluster (blue) underlines the importance of geographical context in the implementation of environmental education, with main keywords such as China. This focus reflects how local policies and national initiatives influence the success of environmental education programs. China, as one of the countries that contributes the most to research in this domain, has utilized environmental education as part of its national sustainability strategy. Policies such as the development of green schools, greening campaigns, and integrating sustainability education in the national curriculum show how the government plays a key role in shaping education policies that are responsive to environmental needs.

This cluster emphasizes the importance of policy-based approaches that consider local challenges and opportunities, such as levels of urbanization, population pressures and environmental degradation. Additionally, research focusing on China also indicates the need for cross-cultural studies to understand variations in policy implementation across geographic contexts. For example, the top-down approach often applied in China shows success in creating a structured framework, but may have different results when applied in countries with more decentralized education systems. As such, this cluster provides insight into how local policies can effectively influence environmental education, while demonstrating the challenges in adopting similar approaches at a global level.

The third cluster (green) focuses on psychological and behavioral aspects, with keywords such as environmental awareness, green consumption, and environmental protection. This cluster illustrates how environmental education not only improves students' cognitive understanding of sustainability issues but also impacts changes in their behavior. Environmental education aims to build students' environmental awareness through interactive and experience-based approaches, such as participation in sustainability projects, environmental policy simulations, and discussions about the impact of everyday behavior on the environment.

The keyword green consumption shows that environmental education also includes economic aspects, by encouraging students to adopt environmentally friendly consumption habits, such as reducing plastic use, choosing products that can be recycled, and supporting local, sustainable products. Additionally, environmental protection reflects the commitment expected of students to engage in activities such as natural resource conservation, carbon emission reduction, and sustainability advocacy. This cluster also underscores the importance of a multidisciplinary approach that combines psychology, pedagogy, and social sciences to maximize the impact of environmental education on student behavior. By using behavioral theories such as the Theory of Planned Behavior (TPB), research in this cluster shows that factors such as social norms, attitudes, and intentions have an important role in determining whether environmental education can influence student behavior effectively.

The relationship between these three clusters shows the close connection between formal education, environmental awareness, and geographic context. Environmental education programs in formal schools, as described in the first cluster, not only aim to provide knowledge but also become a platform for facilitating behavior change as described in the third cluster. In this context, local and national policies, as reflected by the second cluster, play an important role in creating an environment conducive to supporting effective environmental education. For example, the implementation of green schools in China not only strengthens environmental education in schools but also increases community participation in sustainability initiatives, creating a positive cycle between education and community action. This relationship also shows that the success of environmental education is highly dependent on collaboration between various stakeholders, including government, educational institutions, and society.

This research confirms the importance of a multidisciplinary approach in environmental education, which integrates pedagogy, policy, and psychology to create holistic and sustainable impact. Additionally, cross-national research is needed to understand variations in the implementation and impact of environmental education, especially in different cultural and geographic contexts. Future studies could explore how factors such as economic level, educational infrastructure, and level of public awareness influence the success of environmental education programs.

Data-driven approaches such as bibliometric analysis can also be used to identify research gaps and direct academic attention towards themes that are less explored but have the potential for great impact, such as the relationship between environmental education and green technology innovation.

In conclusion, the three clusters identified in this analysis provide comprehensive insight into the dynamics of environmental education research, from pedagogical implementation in formal schools to its impact on individual awareness and behavior, as well as the importance of local policies in supporting educational sustainability. This research not only shows the evolution of research themes but also provides directions for future research to address global challenges through effective and inclusive environmental education.

CONCLUSION

These results confirm that effective environmental education requires the collaboration of various stakeholders, including educational institutions, government, and communities. Successful implementation relies on an integrative approach that combines innovative pedagogy, evidence-based policy, and a deep understanding of the psychological factors that influence individual behavior. Additionally, cross-national research is needed to understand differences in implementation across cultural and geographic contexts.

These findings confirm that advancing education for sustainability requires collaboration among multiple stakeholders, including schools, government agencies, and local communities. Its successful implementation depends on an integrative strategy that combines innovative pedagogy, evidence-based policy, and a strong grasp of the psychological factors influencing individual behavior.

Furthermore, cross-national studies are essential to capture variations in practice across different cultural and geographic contexts. As a recommendation, sustainability-oriented learning should utilize digital technology, such as virtual simulations, to enhance the learning experience. Future research should also examine social innovations, such as student participation in community-based projects that promote sustainable living.

Through a multidisciplinary framework and global cooperation, this field of education can remain a powerful instrument for raising ecological awareness, fostering pro-sustainability behavior, and addressing worldwide challenges related to the environment.

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