

Research Trends Environmental Awareness in Science Learning to Support Sustainable Development Goals (SDGs) Through Bibliometric Analysis

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Abstract. This study aims to analyze the research trend of Environmental Awareness in Science Learning (EA_SL) to Support SDGs through bibliometric analysis. Based on the Scopus database with the keywords "environmental awareness" AND "science learning", 668 documents were obtained. Then, limitations were made using specific criteria so that 44 documents/articles were analyzed. The United States ranks first as the most productive country on this topic. Publications on this topic are increasing every year. Seven clusters were obtained for this keyword. Some of the findings can be used as references for subsequent research in order to achieve the SDGs.

1 Introduction

Environmental awareness (EA) has become important in solving problems caused by environmental degradation. EA includes understanding environmental challenges, recognizing the relationship between human activities and nature, and motivation to engage in sustainable behavior. The EA that is formed will give rise to a sense of responsibility and action in preserving the environment. Therefore, EA is important among students who will be the next generation in the future [1,2]. People who are aware of environmental damage tend to act pro-environmentally [3,4].

Students' awareness can be enhanced through instructional approaches, such as encouraging students to engage in debates on socio-scientific issues. This allows students to connect theoretical knowledge with existing environmental challenges. According to previous studies, including environmental education in the curriculum can increase awareness of environmental issues. Educational institutions are an important medium for spreading awareness of environmental issues and encouraging students to take action. [5,6].

EA is a concept that has two dimensions: cognitive understanding and emotional engagement with environmental issues [7]. Students’ environmental awareness (EA) can be trained through environmental education. Environmental education requires a multidisciplinary approach, where collaboration between several fields can deepen students’ understanding of the complex issues facing our world. This will produce a more environmentally conscious generation [8].

Several studies on EA have been carried out, such as in agriculture [9], technology [10], business [11], and education [12]. However, discussions about EA in bibliometric form have not been widely discussed, especially in science learning. This study aims to analyze research trends on EA in science learning and its relationship with the SDGs. This study will use bibliometric analysis to find trends and possibilities in the existing body of literature. It is envisaged that this method would offer more profound understandings of how science education may help raise environmental consciousness and promote sustainable behavior in society.

2 Methods

The research uses bibliometric analysis using the Scopus database [13–15]. Data mining will be carried out on October 29, 2024. The following bibliometric steps on environmental awareness in science learning (EA-SL) are shown in Figure 1.

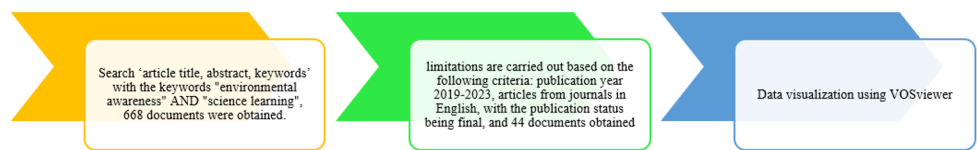


Fig 1. Bibliometric Steps in EA-SL Topics

3 Result and Discussion

The publication of EA-SL topic is depicted in Figure 2.

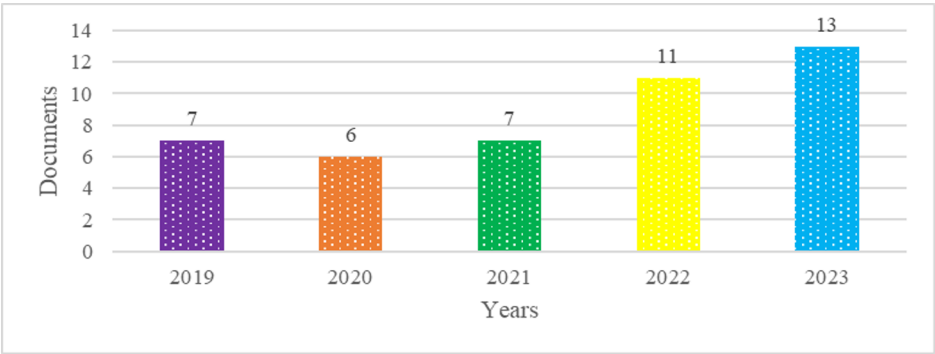


Fig 2. The number of EA-SL publications

Figure 2 shows that the number of publications has generally increased yearly except in 2020, there will be a big increase, which shows that research on environmental awareness is increasingly encouraged. This is in accordance with several studies, such as ecology and conservation [16] and biodiversity conservation [17].

The top 10 sources on EA-SL are provided in Figure 3.

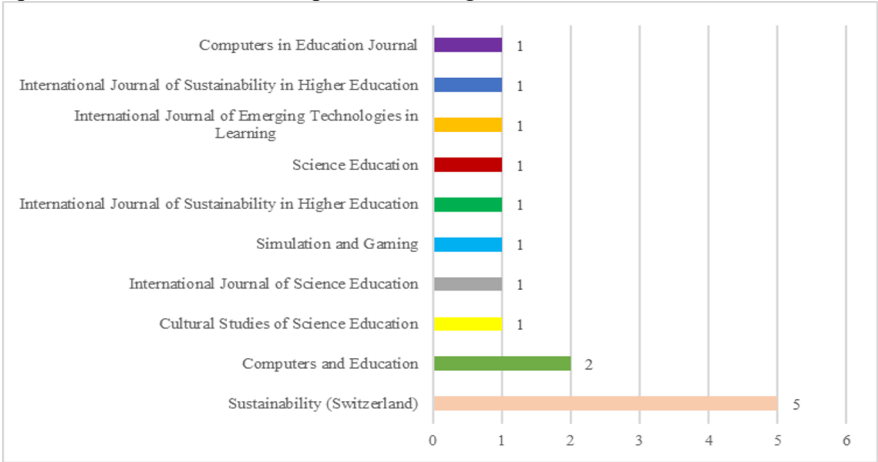


Fig. 3. Top 10 sources of EA-SL topic

Figure 3 shows that the journals that publish a lot of articles on this topic are Sustainability (Switzerland). Several research findings published in this journal state that AR-based learning for natural science inquiry activities can increase students' awareness of environmental protection [18], and service learning as a teaching strategy for Education for Sustainable Development (ESD) makes learners aware of the societal implications of preserving the environment [19]. The majority of journals published on this topic come from Scopus indexed journals [20,21]. The top 10 countries of EA-SL topic are listed in Figure 4.

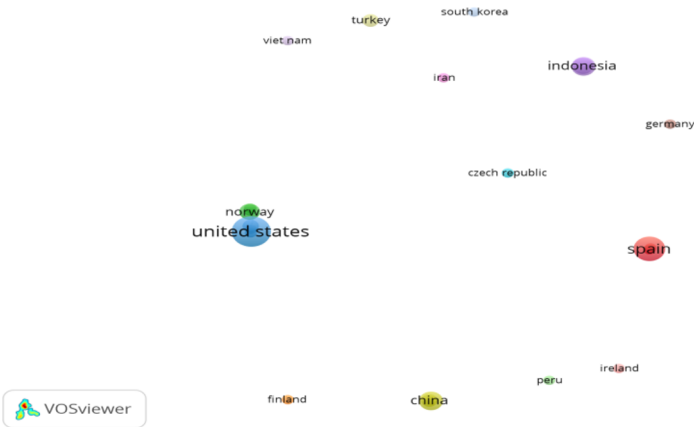


Fig. 4. Top 10 countries of EA-SL topic

Figure 4 shows that the United States (US) ranks first in publications on this topic. This is in line with the top 10 authors, mainly from the US, such as [22], who stated that environmental sustainability education combined with digital games results in changes in students' attitudes towards awareness of environmental sustainability issues, Macalalag [23] and Orr [24].

Top 10 authors researching EA-SL topics listed in Table 1.

Table 1. Top ten authors on the EA-SL topic.

Authors	Source title/Quatile/SJR	Cited by	Abstract
Chang et al. [25]	Computers and Education/ Q1/ 3.651	125	VR design activities based on peer assessment learning approaches can encourage students to learn more and reflect. Students will pay more attention to EA.
Janakiraman et al. [22]	Computers and Education/ Q1/ 3.651	37	Environmental Sustainability Education combined with digital games results in changes in students' attitudes towards awareness of environmental sustainability issues.
Lo et al. [18]	Sustainability (Switzerland) /Q1/ 0.672	33	By studying environmental ecology, we can increase understanding of the importance of the environment and awareness of environmental protection.
Macalalag et al. [23]	Cultural Studies of Science Education/Q1/ 0.725	20	Through socioscientific instruction, teachers can situate experiences in culturally familiar (local) and unfamiliar (international) environments, thereby providing a richer perspective. This is to meet students' STEM learning needs.
Martín-Sánchez et al. [19]	Sustainability (Switzerland)/ Q1/0.672	20	Service Learning as a Teaching Strategy for ESD makes learners aware of the societal implications of preserving the environment and generating benefits for the entire community.
Mork et al. [26]	International Journal of Science Education/Q1/ 0.965	19	The Norwegian science curriculum has a history of emphasizing the values of human dignity, cultural identity and diversity, and respect for nature EA. Findings show that the dominant aspects of the science curriculum are scientific practices and social values.
Agusdinata & Lukosch [27]	Simulation and Gaming/Q1/ 0.586	14	Transdisciplinary approaches have shown the potential to raise EA issues and influence behaviour toward more sustainable practices.
List et al. [28]	Sustainability (Switzerland)/ Q1/0.672	14	Investigating EA in PISA studies can have important implications for ESD.
Orr et al. [24]	International Journal of Sustainability in Higher Education/ Q1/ 0.830	14	Given the importance of issues related to environmental degradation and climate change, university students need to study courses on environmental issues.
Radišić et al. [29]	Science Education/Q1/ 1.543	14	This is anThis is an investigation into students' attributes in relation to science and how these attributes are associated with science achievement. The results indicate that the profiles differ across the covariates and show different patterns relative to achievement and EA.

Table 1 shows authors with many citations from articles published in reputable international journals [30–32].
Figure 5 lists the network visualization on the EA-SL topic.

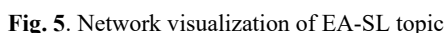


Figure 6 lists the overlay visualization of EA-SL topic.

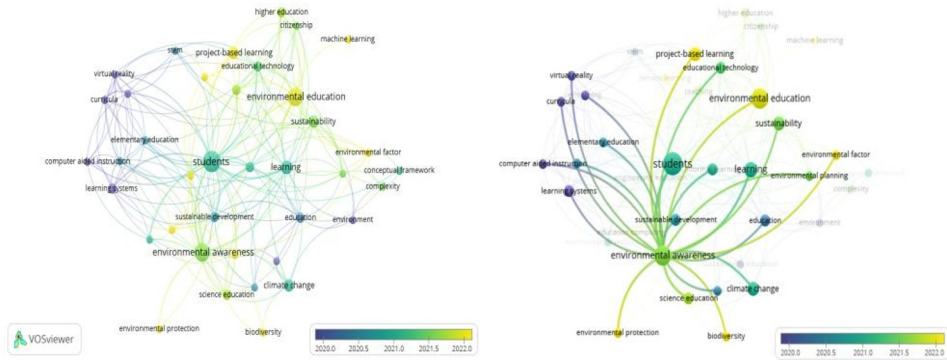


Fig. 6. Overlay visualization of EA-SL topic

Figure 6 shows that EA has been mostly associated with biodiversity, environmental protection, environmental education, environmental factors, and PJBL in the last two years. Increased environmental awareness among students can encourage sustainable behaviour change. By strengthening students' understanding and emotional involvement with environmental issues, it is hoped that students can become agents of change in their communities. A curriculum that integrates environmental awareness will more effectively shape pro-environmental attitudes and behaviours than traditional approaches that focus only on theory.

4 Conclusion

In general, publications on this topic have increased every year. The US as the most productive country on this topic. It is also supported by most of the top ten authors coming from the US. The journal that published an article on this topic is from Q1. Based on the co-occurrence analysis, 7 clusters were obtained. Bibliometric analysis will provide a broader picture of research trends and issues that need to be addressed in the context of environmental education. By exploring the existing literature, this research will identify knowledge gaps that need to be filled and formulate recommendations for educators and policymakers to create a learning environment that is more supportive of environmental awareness and sustainability.

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