

## Research Article

# Education for Sustainable Development in Secondary School: A Review and Bibliometric Analysis

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## Abstract.

Education for sustainable development (ESD) should be implemented at all levels of education, including secondary schools. This article aimed to give a thorough bibliometric assessment of the literature on “education for sustainable development in secondary schools.” The article was discovered in the Scopus database. The Scopus database reviewed in this study yielded 100 papers from 1998 to 2022. The VOS viewer software was then used to organize, classify, and visualize the selected references. Overall, this evaluation serves as a good starting point for more research into secondary school “education for sustainable development.”

**Keywords:** education for sustainable development, secondary school. a review, bibliometric analysis

## 1. INTRODUCTION

Education for sustainable development (ESD) is founded on the idea of encouraging individuals to contribute to sustainable development and to be able to evaluate various activities today and in the future based on social, economic, and environmental elements from a local to global perspective [1]. The concept of ESD must be used at many levels at the school level; ESD implemented in schools is considered as good in creating awareness of the current generation so that future generations can respect the environment [2]. As a result, teachers should play a significant role as change agents in the implementation of educational ideas for long-term sustainability [3]. Learning

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activities paired with sustainable development goals is one method of putting the ESD concept into practice.

ESD enables people to gain the knowledge, values, and abilities necessary to participate in decisions about how to conduct work individually and in groups that will improve the quality of life both locally and internationally; this has been the subject of extensive research and is well-documented. From the definition of ESD [4–8], policy [9–11], curriculum [12–15], and theory [16–19] to the present day.

This bibliometric analysis is a research project that examines the scientific output on the topic in order to determine a research path and strategy for the future. There have been a few bibliometric studies on ESD in higher education [20–23] but there has been little research on ESD in secondary schools. Until present, no bibliometric analysis of ESD has been conducted in secondary schools.

Due to the aforementioned reasons, the purpose of this paper is to address a research gap by providing a full bibliometric analysis of the literature on ESD in secondary schools. Bibliometric analysis is a way for analysing research in the literature and summarizing them using certain indicators[24–27]. Numerical information about the increase in publications from year to year, the list of people who contributed the most (authors, institutions, nations), collaboration between authors/institutions, and the percentage of references per article may all be calculated using the bibliometric method.

## 2. RESEARCH METHOD

This study is a systematic quantitative literature review. This bibliometric analysis assessed journal publications on ESD in secondary schools by article title, journal title, author, nation, and institutional affiliation of the author [10, 24, 36, 28–35]. To access as many ESD published articles as feasible, an appropriate database should be used for the investigation. There are multiple stages to this process, including:

### 2.1. Source Identification and Search Criteria

For this review, the writers used the Scopus database as the source material. Scopus was chosen because it selects documents for inclusion in its index based on uniform criteria. Furthermore, for research reviews in education and the social sciences, this component offers a larger document coverage than Web of Science. Scopus also has more advanced features for exporting bibliographic data than Google Scholar.

Journal articles, books, book chapters, and conference proceedings can all be found on Scopus. Scopus contains documentation from 1998 through 2022. The review's subject area is "education for sustainable development in secondary schools." We searched using a broad word (for example, "education for sustainable development"). The following keywords were used in the Scopus search: TITLE-ABS-KEY ("education for sustainable development" ) AND TITLE-ABS-KEY ( "secondary school" ) AND NOT TITLE-ABS-KEY ( "higher education" ) AND NOT TITLE-ABS-KEY ( university ).

## 2.2. The Initial Search Results

Scopus discovered 461 documents in its initial search. We update keywords and remove documents that aren't appropriate. Following this screening, we looked at each document's title and abstract to see if it was relevant, then enlarged the document to 100 articles.

## 2.3. Data analysis

Scopus exports metadata from ESD documents in high school to an Excel master file. The descriptive statistical analysis in Excel was utilized to document ESD in secondary schools. VOS viewer, a bibliometric software application used for science mapping, is then used to load the data from the primary spreadsheet file. Author and document citation analysis, as well as co-author citation analysis, are all part of VOS viewer's bibliometric analysis. VOS viewer can also build publication maps, author maps, and journal maps based on shared citation networks, as well as keyword maps.

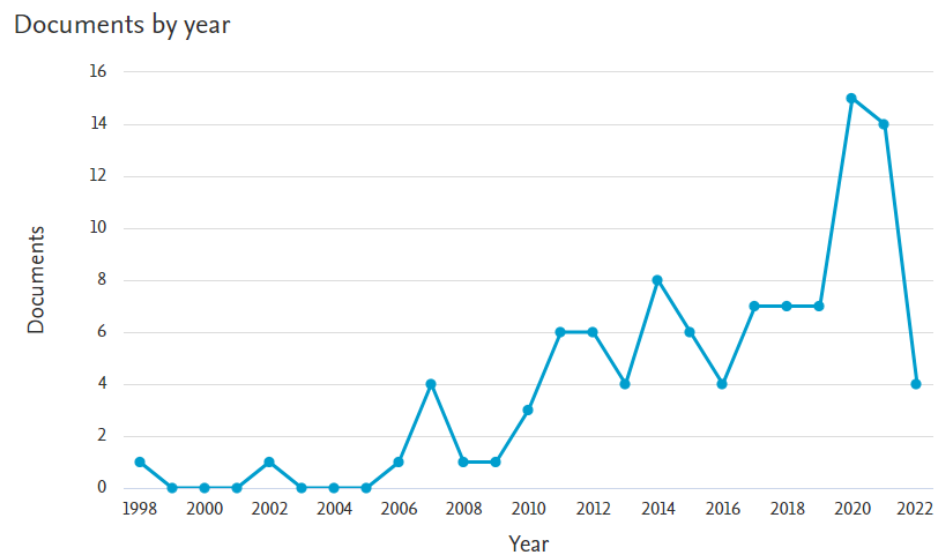
## 3. RESULTS AND DISCUSSION

The journal articles published on ESD in secondary schools between 1998 and 2022 are included in this section of the articles. The following are the findings of the bibliometric analysis:

Scopus indexed papers from 1998 to 2022 include 85 journal articles, 6 book chapters, 4 conference articles, 4 reviews, and 1 data document. Social sciences 51.5 percent, Environmental Science 15.4 percent, Energy 10.7%, Earth and Planetary Science 3.6 percent, Engineering 3.0 percent, Computer Science 2.4 percent, Psychology 2 percent, Chemistry 1.8 percent, Economics, Econometrics and Finance 1.8 percent,

Physics and Astronomy 1.8 percent, and Other 5.9% were among the subject areas studied.

Beginning in 1998, ESD materials in Scopus-indexed secondary schools were published as a single article, and the trend in scientific publishing maintained until 2022, as illustrated in Figure 1 below:



**Figure 1:** Growth trajectory of the literature on education for sustainable development in secondary school, 1998-2022 (n = 100).

Following that, we looked at the geographic distribution of the ESD literature (Figure 2), which revealed that it has become a global literature. Sweden (25), Germany (18), the United Kingdom (13), Norway (5), Portugal (5), Austria (4), Finland (4), Hong Kong (3), Japan (3), and the Russian Federation (3) are the top donors to the ESD knowledge base in secondary schools (3).

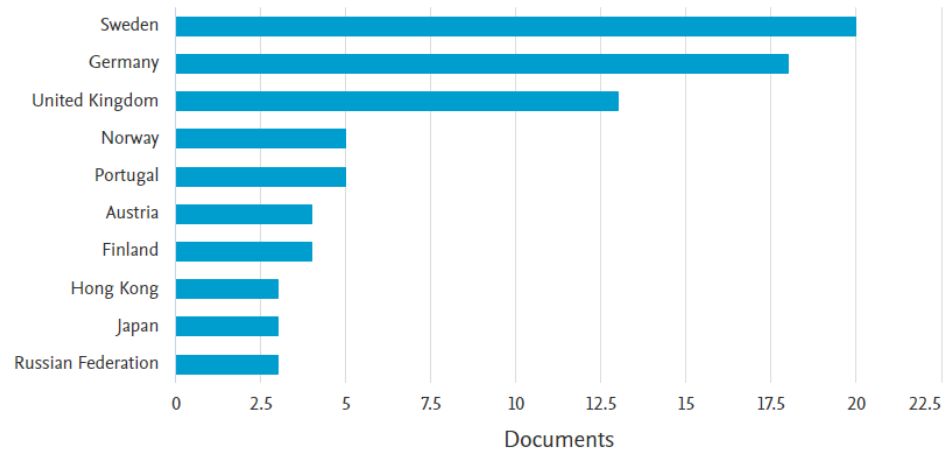
Table 1 shows the results of the researcher's attempt to offer the 5 papers with the highest citation value (the first 5 cited articles).

According to the table above, articles on ESD in secondary schools received the most citations from other researchers during the years 2010-2012. Figure 3 shows the data mesh visualization image of ESD-related Scopus data in the search refined secondary school keyword after analysis with the VOS viewer, while Figure 4 shows the overlay visualization and Figure 5 shows the density visualization.

The results reveal clusters of diverse study themes with ESD in secondary schools based on keywords in the title and abstract. The relationships between the themes are depicted in Figure 3. There were a total of 427 words, but see Figure 6 for the themes with the highest ESD in secondary schools:

### Documents by country or territory

Compare the document counts for up to 15 countries/territories.



**Figure 2:** Global distribution of literature on Education for Sustainable Development (ESD) in secondary school, 1998-2022 (n = 100).

**TABLE 1:** Top 5 cited articles.

No	Year	Author	Title	Journal	citation	Publisher
1	2012	Borg C., Gericke N., Höglund H.-O., Bergman E.	The barriers encountered by teachers implementing education for sustainable development: Discipline bound differences and teaching traditions	Research in Science and Technological Education	91	Routledge
2	2010	Rudsberg K., Öhman J.	Pluralism in practice - experiences from Swedish evaluation, school development and research	Environmental Education Research	90	Routledge
3	2010	Riess W., Mischo C.	Promoting systems thinking through biology lessons	International Journal of Science Education	70	Elsevier
4	2011	Uitto A., Juuti K., Lavonen J., Byman R., Meisalo V.	Secondary school students' interests, attitudes and values concerning school science related to environmental issues in Finland	Environmental Education Research	62	Routledge
5	2012	Burmeister M., Eilks I.	An example of learning about plastics and their evaluation as a contribution to Education for Sustainable Development in secondary school chemistry teaching	Chemistry Education Research and Practice	60	Elsevier



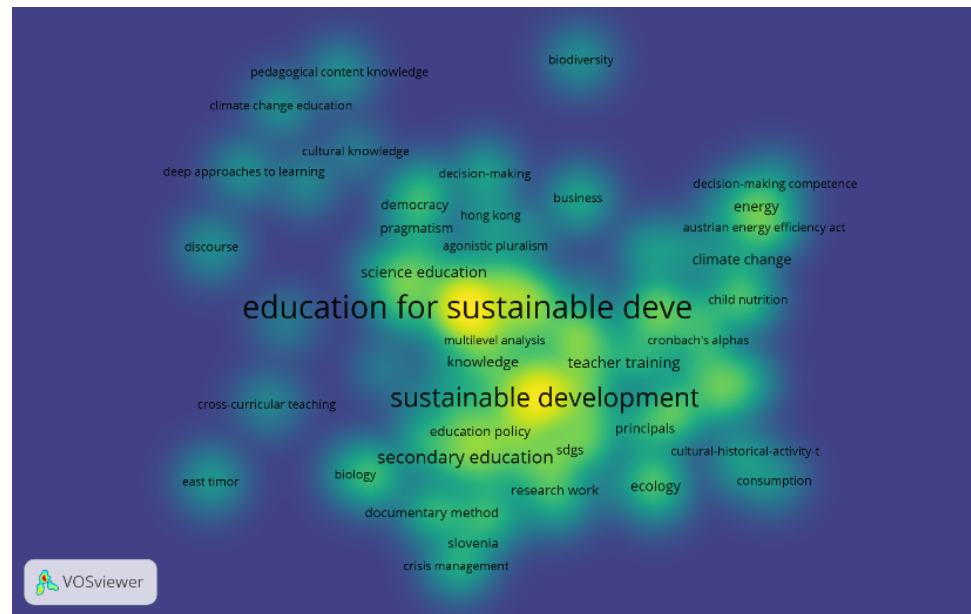


Figure 5: Visualization topic area using VOS viewer using density visualization.

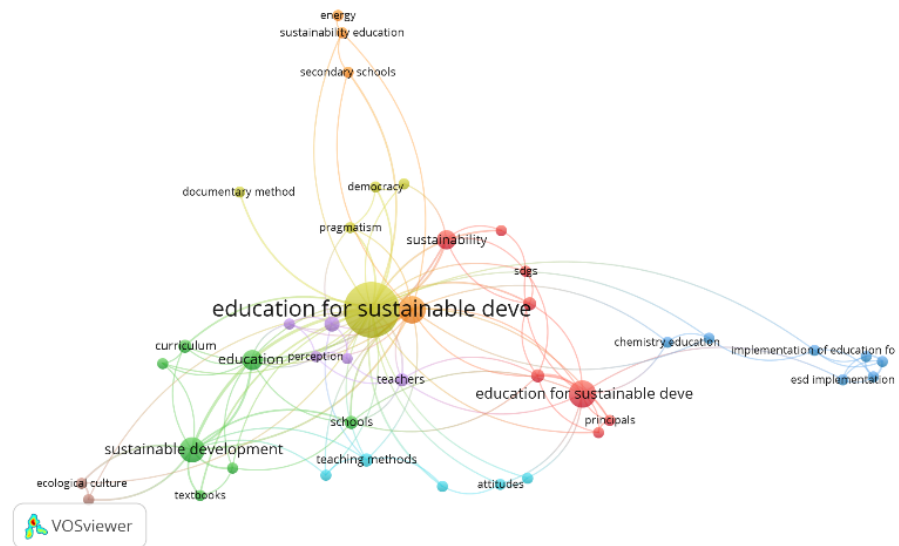


Figure 6: Visualization topic area using VOS viewer in ESD secondary school.

## 4. CONCLUSION

Based on the aforementioned findings and discussion, it can be stated that the development of Sustainable Development Education research in secondary schools has fluctuated from 1998 to 2022. With 15 papers, 2020 has the most publications on this topic; nonetheless, there is still room for more research on this topic. In terms of document formats, 85 articles on the topic of ESD research in secondary schools were published between 1998 and 2022. This article uses bibliometric analysis to visualize

diverse literatures in order to discover essential themes in each study or setting. The VOS viewer identified eight clusters describing eight research issues connected to the application of ESD in secondary schools based on the findings of this study.

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