A Bibliometric Review of Environmental Education and Literacy from 2010 to 2021

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Abstract—One's literacy ability is something that should be considered in the era of revolution society 5.0. Environmental literacy is part of basic literacy that is needed so that everyone has the ability to understand and feel that they are part of the solution to environmental problems. This research is a systematic mapping in the topic of 'environmental literacy' based on bibliometric analysis. This study aims to determine the development of citations, core journal publications, number of authors, language statistics, publication trends, author collaboration, trend terms keywords, and country statistics on environmental literacy articles in 2010-2021. Data collection through the software used is Publish or Perish (PoP) to search for bibliographies as initial database on Google Scholar. Meanwhile, the country's statistical data were analyzed using the Vos Viewer. The results showed that the highest number of citations was 761 citations. In the publication trend, the most publications occurred in 2011 with 120 articles. The most widely used keyword term is 'environmental literacy' with a frequency of more than 100.

Keywords: Bibliometrics, environmental literacy, Publish or Perish (PoP), and VosViewer

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1. INTRODUCTION

The world is currently starting to develop towards a revolution in the era of society 5.0 with the emergence of digital media, information technology, increasing connectivity, interaction of communication systems, artificial intelligence, and virtual media. One's literacy ability is something that should be considered in the era of revolution society 5.0. This happens because a person's literacy ability has an influence on how broad a person's knowledge and insight is which in turn will have an influence on a person's performance. Based on air quality index (AQI) data, air pollution and air pollution in the world, including Indonesia occupies the highest country with being in 9th position in the world for air pollution levels (IQAir Visual, 2019). Environmental literacy is needed by everyone so that they can understand that they are part of the solution related to handling and preventing environmental problems such as pollution or pollution (NEEF, 2015). An understanding of the environment is needed to create a society that is environmentally sound, aware of the meaning of ecology and the environment for human life.

According to environmental literacy of students is still low (Nasution, 2016). Therefore, the younger generation in this case needs to get adequate environmental education, because education will provide knowledge and influence attitudes and behavior towards the environment. Environmental literacy provides knowledge in order to be able to use knowledge to make the right decisions about environmental problems (Hollweg et al., 2011). Environmental literacy is a conscious attitude to keep the environment in balance (Kusumaningrum, 2018). Environmental literacy is part of basic literacy that is needed so that everyone has the ability to understand and feel that they are part of the solution to environmental problems (NEEF, 2015). According to

environmental literacy as information and individual understanding of the viewpoints that shape the climate, the rules that occur in the climate and have the choice to act according to the qualities of nature that are applied in everyday life (Haske & Wulan, 2015).

Bibliometric analysis or method (bibliometrics) also known as scientometrics is important for the exploration assessment approach and from an assortment of writing that has been created, and permits bibliometric analysis to be carried out using its own method (Ellegaard & Wallin, 2015). The bibliometric technique is an estimation strategy for the writing utilizing a measurable methodology with the goal that it incorporates the utilization of quantitative examination (Pendlebury, 2008). Several research studies discussing the growth of literature have been carried out by Hallinger and Chatpinyakoop (2018), Lopera-perez et al. (2021), and Syahmani et al. (2021). They both discussed the growth of the 'environmental education' literature using bibliometric studies but only until 2018 and 2019. Based on the novelty of the research compiled through the method used in the form of bibliometric analysis by knowing how much and how far the development of the literature from the 2010-2021 period on environmental literacy. Research utilizing bibliometric techniques can uncover the way that there are not very many exploration results that are not refered to following quite a long while, considering that references mirror the effect of examination that has been completed, the outcomes show that these diaries have done well in choosing research results that significant, in this manner analysts are relied upon to think about these qualities (López-Robles et al., 2019).

The research questions posed are:

1) How is the development of the productivity of scientific publications on environmental literacy by year?
2) How is the development of core journals that publish about environmental literacy?
3) How is the development of the number of writers on productive environmental literacy?
4) How is the development of the highest number of citations of scientific publications on environmental literacy?
5) How is the development of scientific publications on environmental literacy by country?
6) How is the development map of scientific publications on environmental literacy based on keyword clustering?
7) How is the development map of scientific publications on environmental literacy based on clustering collaboration and influential authors?
8) How is the development of scientific publications on environmental literacy based on language?

2. METHODS

2.1 Research Design

This research is a bibliometric literature review that uses an explicit method of systematics (Garza-Reyes, 2015). Research is classified as a concept mapping method for making exploratory boundary maps (Tranfield, 2003) and similar studies have been carried out by (Hudha et al., 2020).

2.2 Procedure

In the first research determine the search keywords. The literature search was conducted based on the 2010-2021 time span with the keywords 'environmental literacy, sustainable development, environmental education'. The Google Scholar information

base was picked for this review to guarantee that analysts can get however much writing as could reasonably be expected, as it is right now the biggest data set of scientific articles (Baneyx, 2008). This Google Scholar provides complete and free information services to find references. In addition, in Google Scholar there is a new source, namely Citations or quotes with the Citation having the potential to assist in writing scientific papers (Dekeyser & Watson, 2006). Research using Publish or Perish is used to systematically search and filter journal articles from Google Scholar. The keywords used in the PoP software are 'environmental literacy or environmental literacies, sustainable development, environmental education'. The underlying query items on this pursuit were explicitly for 'journal', just 'title words', and in 2010-2021 935 articles were found in the underlying inquiry. The outcomes are traded from the product in the Research Information Format System (RIS) to incorporate article data, for example, paper title, author, abstract, keywords, and references. The RIS file of the PoP software is imported into the vos viewer. Assembling introductory information insights, After all the diary articles reasonable for this review were accumulated from the past advance, the writers checked the total parts of the journal article (year of distribution, volume, number, pages, etc.). Information investigation is done so that articles can be ordered by year. These progressions have been saved and turn into the principle data set that will be utilized as the data set for process representation in the VOSViewer Software. Information investigation through bibliometric examination in this review utilized PoP programming and RIS record design which was then brought into VOS Viewer. Break down and imagine bibliometric networks utilizing VOSviewer programming (Shukla et al., 2020). VOSviewer is utilized on the grounds that it can give representation of bibliometric information, to be specific distribution maps, creator guides, or diary maps dependent on co-reference organizations or in light of watchword maps dependent on shared organizations (Van Eck & Waltman, 2010).

2.3 Variable

The bibliometric analysis of environmental literacy in this study involves several variables, namely the distribution and trend of published article titles, keyword trends in articles, collaboration of authors and authors who have the most influence on the article, the number of authors in the article, the country that has the most influence on the article, and the language that has the most influence on the article. articles, core journals of environmental literacy scientific publications, and the highest number of citations on environmental literacy scientific publications. Bibliometrics is a study that reveals the magnitude of a field of science in scientific publications in certain institutions with the application of theories such as author analysis, keyword analysis, citations, number of publications, author collaboration (Tupan et al., 2018).

3. RESULTS AND DISCUSSION

3.1 Publication Trend Analysis

Measuring the productivity of authors is carried out with the aim of knowing the amount of research produced by researchers and productive writers in scientific journals and a certain period of time (Rahayu & Saleh, 2017). Based on Figure 1, it can be seen that the year of publication of documents revealing an increase in production over the 10 years is analyzed, as only 62 documents were published in 2010 while 93 were issued in 2021. This increase is consistent over the years starting from 2010 to 2021. and obtained a linear model.

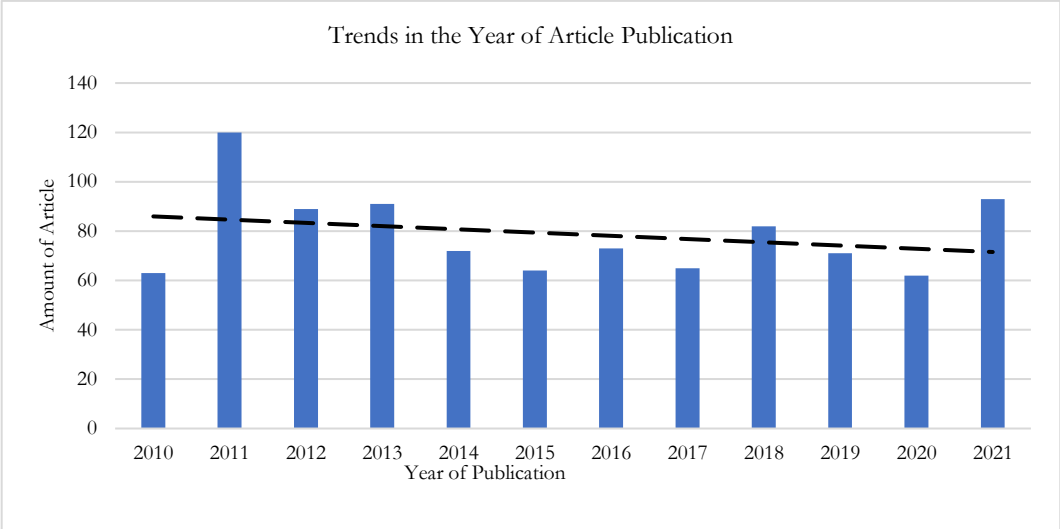

Figure 3. Publication of Environmental Literacy Articles from 2010-2021

3.2 Highest Citation Count Analysis

It can be seen that the number of citations from 935 documents revealed that the most citations were 761 citations in journals with the title 'Environmental, institutional, and demographic predictors of environmental literacy among middle school children' by the author KT Stevenson, MN Peterson, HD Bondell, AG Mertig The increase in citations over the 10 years analyzed comes from the publisher journals.plos.org and is the Public Library of Science which is a peer-looked into open access logical diary distributed by the Public Library of Science starting around 2006. This journal covers key exploration from all disciplines in science and medication beginning from the USA.

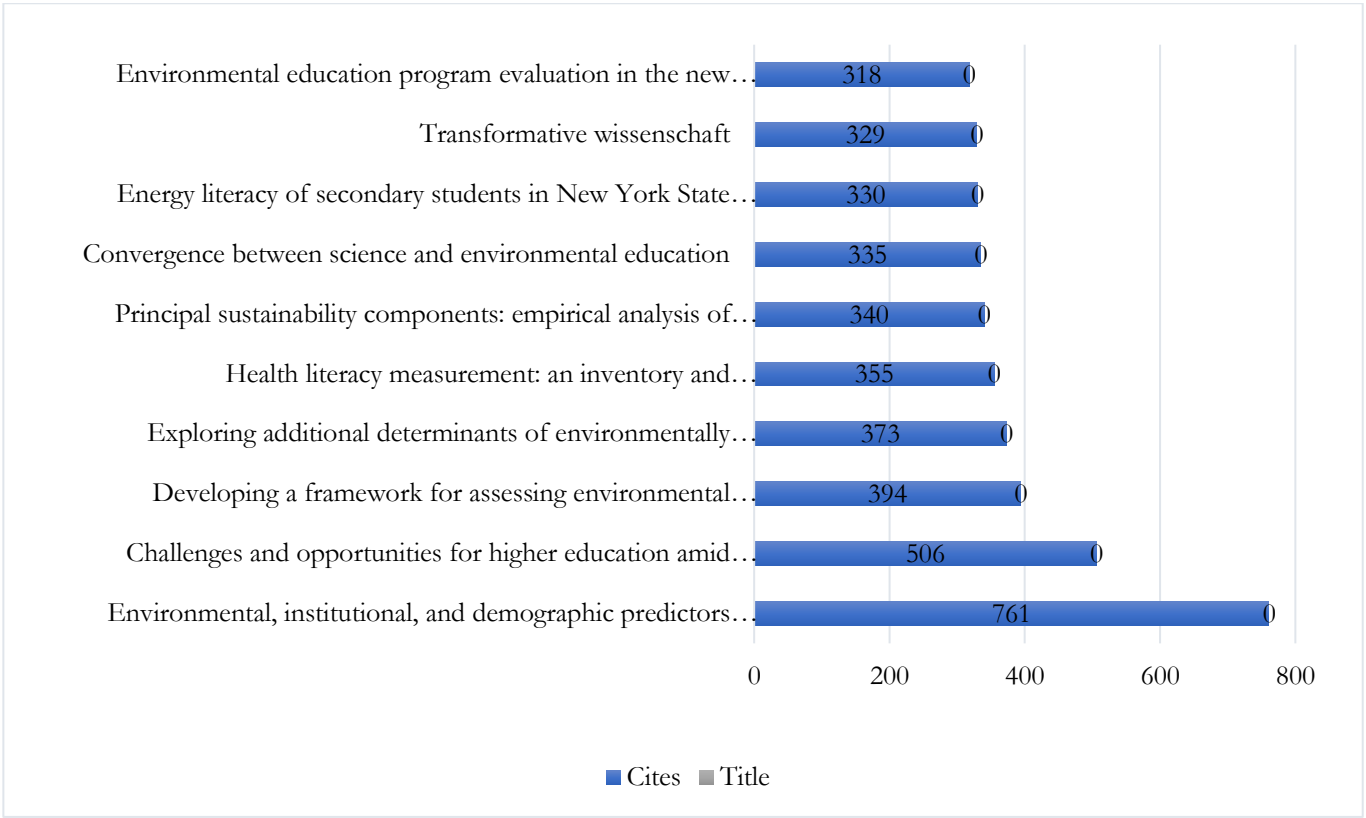

Figure 3. The highest number of citations in environmental literacy articles

3.3 Trend Analysis Keywords

This investigation plans to break down the substance, examples and patterns of an assortment of records by estimating the strength of terms and to count the quantity of catchphrases from an exploration archive that show up all the while in the articles under study (Chen, 2003; Russell & Rousseau, 2015). The descriptor whose frequency is more than 100 is "environmental literacy" which appears in 51.4% of all documents, and for the other frequencies it appears 'environmental education' and 'sustainable development'. To find out about the descriptors that are straightforwardly identified with ecological proficiency, extra catchphrases acquired in the information were sifted utilizing truncation on the right hand side with "environment" so that 935 documents were obtained. In addition, co-occurrence maps of these filtered descriptors are generated and to have a more concrete view in the analyzed documents, they are grouped by groups consisting of at least several themes.

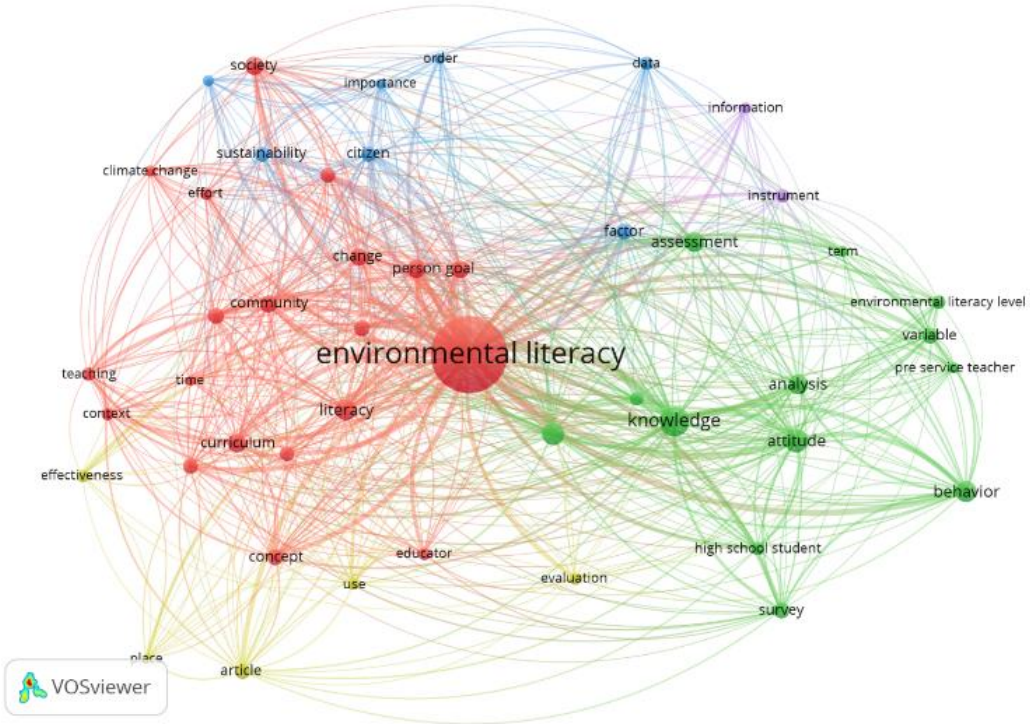

Figure 4. Visualization of keywords in the title of environmental literacy articles

3.4 Author Collaboration Analysis

With regards to explore, cooperation recorded as a hard copy is required, taking into account that exploration isn't constantly done independently (Rohanda & Winoto, 2019). Because of this, collaboration between researchers and between agencies is needed both in terms of ideas or ideas, funding, facilities and equipment as well as the opportunity to share knowledge, expertise, and certain techniques in a science (Widuri, 2018). In this study, out of 942 authors, 21 authors had a strong association. Each author in each of the different link groups. The author with the most links is Fang, Wt.

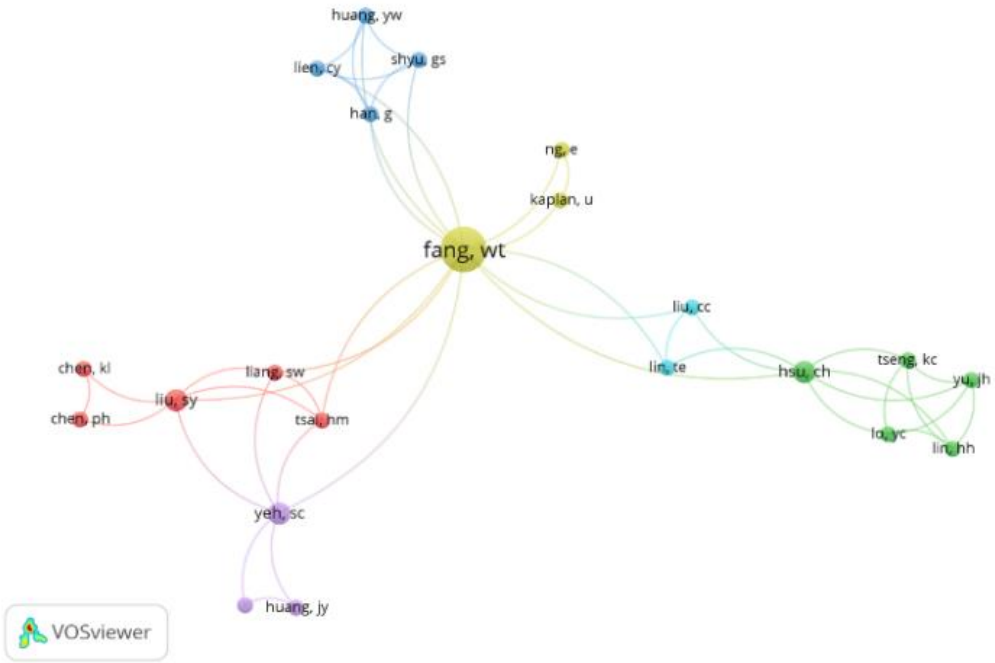

Figure 5. Visualization of Author Collaboration

3.5 Analysis of the Number of Publications by Country

This investigation is completed by examining individually diary in the PoP data set, it tends to be recognized that the writers of 'natural education' articles are spread across different nations and landmasses. The nations that distribute the most articles on 'environmental education' are the USA with 301 articles, Indonesia with 126 articles, and Turkey with 79 articles. This is in accordance with the study of Himawanto (2016) which states that the United States recorded a collaboration value of 82.31% in productive publications.

Table 1. Number of Publications by Country

Country	*N* of Articles
USA	301
Indonesia	126
Turkey	79
Iran	42
UK	28
Chinese Taipei	27
Australia	26
Germany	25
Canada	24
China	24

3.6 Analysis of the Number of Authors

Based on the charts of the analysis of 935 documents with 942 authors, it was found that the number of collaborating authors on each document with the keywords

(environmental literacy or environmental literacy), sustainable development (sustainable development), environmental education (environment education) there are only up to four collaborating authors and the largest number of authors is on one author with a total of 728, two authors with a total of 96, three authors with a total of 80, and four authors with a total of 38 authors.

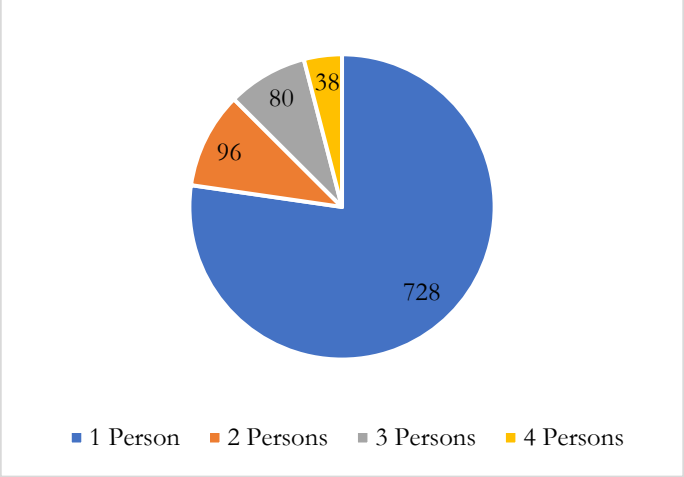

Figure 5. Number of authors of environmental literacy articles

3.7 Analysis of the Number of Publications by Language

Based on the analysis of 935 documents, there are 17 languages used in articles on 'environmental literacy'. From the results of the document analysis, it was found that the three most common languages were English with 912 articles, Persian with 21 articles, and Indonesian with 16 articles. Moreover, the outcomes acquired show that the greater part of the reports are written in English and come fundamentally from nations like USA, Turkey, and UK. In accordance with research (Lopera-perez et al., 2021) which expresses 'the outcomes got show that most reports are written in English (96.73%) and they come primarily from nations like the United States of America, Australia, the United Kingdom and Canada. This uncovers Anglo-Saxon's authority in talks in WoS and the more modest presence of other examination settings like Latin America'.

Table 2. Number of Environmental Literacy Articles by Language

Language	*N* of Articles
English	912
Persian	21
Indonesia	16
Turkish	8
Korean	8
German	6
Arabic	4
Russia	3
Portuguese	3
Thai	3

4. CONCLUSION

Environmental education aims to build an environmentally literate population, and environmental literacy is a necessary condition for maintaining and improving environmental quality. Many researchers obviously reported that the environmental literacy of students and students such as Chen et al. (2020) showed a positive relation between environment education, literacy, and learning outcomes (Curdt-Christiansen, 2021) examines to reflection on children's awareness and environmental issue (López-Alcarria et al., 2021). Environmental literacy is a scientific attitude to protect the environment to be part of the solution to environmental problems. The publication of environmental literacy articles throughout the year has changed over the last decade. Based on the Google Scholar data base, the results of document searches revealed an increase in production over the past 10 years. The analysis found that there were 62 documents issued in 2020 while 93 were published in 2021, this is a significant increase. The most prolific writers are KT Stevenson, MN Peterson, HD Bondell, AG Mertig with 935 documents and the highest number of citations, namely 761 with the title 'Environmental, institutional, and demographic predictors of environmental literacy among middle school children'. This article is widely cited, because the article provides reliable data on environmental literacy and the article provides discussing environmental literacy in middle schools.

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