

Research Article

Bibliometric evaluation based on Web of Science database: nature and environmental education

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Abstract

The aim of this study is to present studies on nature and environmental education in related literature from 1977 to the present time by using bibliometric method. Nature and environmental education, which has an increasing popularity especially in the last years, gain a place in so many countries' teaching policy. Thus, increasing number of scientific studies and researches on this field in the related literature draw attention. In this study, publications in nature and environmental education have been examined both bibliometrically and in content, and their distribution by years, institutions, journals, citations and the features of co-works have been presented with descriptive and visual maps. Web of Science (WoS) Core Collection database has been used in obtaining data. "Nature education" and "Environmental education" terms were scanned with the aim of reaching highest number of studies from database. A total of 1312 publications have been included in study through various filtering processes. Bibliometric analysis techniques have been used in data analysis. VOSviewer programme has been used in determining the network analysis of those data obtained. In the study, the distribution of publications by years, the authors with the most publications, the journals, institutions and countries with the most publications have been determined. Besides, those data obtained have been discussed in the light of related literature by forming visual maps together with co-author, co-citation taken together, co-word and co-citation analyses. At the end of the study, some suggestions have been provided in the light of findings obtained.

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Introduction

The notion of nature has a wide of meaning burden that does not have sharp borders thanks to its dynamic structure and that is tried to be identified with so many definition. The notion of nature; was derived from "natura" word which has Latin root, beyond that, from "nasci" word meaning "be born" (Kahyaoğlu & Yetişir, 2015). In general meaning, it is defined as an open system with uncertain borders which shows a great colorfulness and diversity with its living and non-living elements, which affects and to be affected, which can change, which has the ability of renewal and forming, which formed without human effect and can exist without human, which has its own mechanisms and laws, which covers so many different factors, creatures, relationships, interactions and processes (Atasoy, 2005, p.73). The intensity

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of meaning attributed to the notion of nature also affects deeply people's relations towards nature. Some societies center people in their relations with nature; while some societies center nature itself and determine their lifestyles accordingly (Kahyaoglu & Yetişir, 2015). Therefore, the mentality of living together with nature and giving value for it is the common legacy of all humanity. In this regard, the importance of nature education is growing day by day to understand and recognize nature and to leave a livable world to future generations. Nature education aims to know nature in the natural environment and to benefit from what nature offers as educational subjects, materials and tools (Aladağ et al., 2021). On that sense, it is important to use as education materials what nature offers (Keleş, 2011). Nature education is based on the idea of learning by living and doing with the original examples and models offered by nature in order for the learning to be more permanent (Başal, 2003). So, to understand various ways of people's giving value for nature in the interaction of people with nature (Krasny & Tidball 2012) and to create opportunities for more comprehensive evaluations and also to develop cultural interaction have become more and more important (Dendoncker et al., 2013).

Nature enables children to develop their imagination skills and to meet their game needs independently away from the adult world, improves children concentration skills and increases their motivations (Council for Environmental Education [CEE], 2004). Therefore, when in nature which is called out-of-school learning areas, education environment is moved out of a classroom to realize effectively the objectives and achievements of the lesson. Learning environment other than a classroom, provide individuals to be in a more comprehensive learning environment, concretize abstract concepts, have the chance of transferring and applying informations into their life, and develop so many affective skill by making possible for them to meet facts and events in life (Hazelworth & Wilson, 1990; Meredith et al., 1997; Pedretti, 1997; Ramey-Gassert, 1997). The nature which a synthesis product, necessitate knowledge, skill and attitude regarding different disciplines. So, nature education provides valuable contributions in holistic development of individuals and supports healthy development of individuals. In this regard, especially since the mids of 20th century, camp studies on nature education have become important (Garner, 2012). In those camps environmental educations have started to be given based on nature experience and applied (Dresner & Gill, 1994). On the other hand, applied activities in environmental education and first-hand experiences with programmes prepared by UNESCO-UNEP on environmental educations and 1978 Tbilisi Declaration have increased the importance of nature education (Ozner, 2004; Ünal & Dımışkı, 1999). Nature education for children should involve the relationship order of nature; namely the diversity in nature, ecological cycles, the functioning of the food chain, absorbing the coexistence of different species and how important nature is for the individual. In this way, it can be provided for individuals to understand their unity in the nature and their position in this unity by gaining a large scale perspective (Devall, 1994). Thus, out-of-school nature educations and natural area studies show students the relationships of different disciplines with each other, help students participating in those activities to understand well the subjects areas in their curriculum and support developing a better environmental awareness (Heather, 1999). Considering all these benefits, it can be said that nature education is a process that continues from preschool to the end of life and a necessity that is needed in every moment of life. Thus, so many study findings empahsize the importance of ecologic programmes in positive change of individual behaviours towards environment and present the necessity of nature education for the formation of a healthier society perception (Başal, 2003; Bogner, 2002; Bogner & Wiseman, 2004; Çakmak, 2018; Ozner, 2004). Besides, activities done in out-of-school environments helps for students to get information at their own learning pace and courages their learning behaviours (Melber & Abraham, 1999) and supports the education at schools (Gerber et al., 2001).

Environmental education which is often confused with nature education is planned for contributing to individuals' understanding of the natural environment, affecting their values and behaviors positively, and increasing the sensitivity towards environment. The outanding structure in environmental education to gain environmental awareness, sensitivity about protecting and using the natural environment, and responsible behavior towards the environment and to make it sustainable (Erdoğan, 2009; Hungerford & Volk, 1990). Environmental education is an education which enables every level of people to understand the environment, makes them realize their place and role in it, and aimed at being aware of all the factors affecting the environment and being conscious in this context (Özbuğutu et al., 2014). In other words, it is to raise awareness about environmental events and gain desired behaviors for the solution of

environmental problems (Milton et al., 1995). Nature and environment contented education's happening in its natural environment raises the interest for nature, provides to look at life by empathizing with nature and to gain desired behaviours towards natural environment (Atasoy, 2005; Güler, 2009; Phenice & Griffore, 2003; Wells, 2000). Thus, the importance of natural environments is emphasized often for children development and well-beings and it is stated that individuals should increase their interactions with natural environment (Jickling & Wals, 2008; Taylor & Kuo, 2009; Wells, 2000). Although there have been many studies and researches in nature and the environment, issues like the deficiencies in environmental education, why we have not been successful in environmental education and what we should be done to solve these problems still keeps its validity and increase the importance of raising a youth to solve today's and tomorrow's environmental issues (Gigliotti, 1990; Krasny & Tidball, 2012). One of the most important reasons of this situation is that even if individuals have a developed environmental awareness, they do not have the knowledge about actual reasons lying under these environmental problems (Özbuğutu et al., 2014). In this regard, the mentality of contributing in development and progress of environmental education is not just an individual responsibility but also all of the societies' responsibility. Bogner ve Wiseman (2004) who draws attention to this, states that on the one hand students' perceptions on environmental protection increased with nature and environmental education, on the other hand nature education downgraded only "pragmatist" perceptions towards nature. In this regard, quality and accessible nature and environmental education should be planned for educators and children, more studies should be done on course designs and programs that strengthen conceptual knowledge and teaching expertise (Meier & Sisk-Hilton, 2017).

When examining researches regarding the field studies in nature and environmental education, it is seen that there are many studies from the past to the present (Aladağ et al., 2021; Bogner, 2002; Bogner & Wiseman, 2004; Dresner & Gill, 1994; Hazelworth & Wilson, 1990; Jickling & Wals, (2008), Krasny & Tidball, 2012; Kruse & Card, 2004; Wells, 2000). According to Kahyaoglu (2015), In most of the studies in nature education, the effect of nature education on environmental attitudes has been handled. This is respectively followed by views on nature education, environmental knowledge, awareness, cognitive structure and the effect of responsible behaviors. Besides, it is seen that nature and environmental education given in out-of-school learning areas has positive effects on attitudes and behaviors of participant towards nature (Ballantyne & Packer, 2002; Farmer, et al., 2007; Mittelstaedt et al., 1999) and environmental awareness and responsible behavior awareness (Demir & Yalçın, 2014; Dresner & Gill, 1994; Hannaman, 2013; Kruse & Card, 2004). In this regard, examining of those publications in related literature under the nature and environmental education in terms of various features (author, year, journal, institution, country, etc.) is the basis of this study. As stated, meta-analysis and content analysis studies are few, besides the frequently published ones in nature and environmental education, ecology-based education, sustainable nature education in the related literature. It is important to present the general trends, author collaborations or citation networks of publications in nature and environmental education, in terms of lighting future studies in the field. Especially, to identify the fields of study, to see the missing parts and to form a basis for new studies are one of the contributions of bibliometric research to the literature. It is hoped that this study will fill the gap in the literature in terms of using bibliometric method regarding nature and environmental education and handling the features like general trends, author collaborations and cited publications. Thus, the bibliometric analysis method is an important analysis method in terms of showing researchers and readers general trends in any field or subject, and cooperation between authors, institutions and countries. Many studies and the relation of a publication to another can be analyzed deeply via bibliometric analysis method (Du et al., 2015; Grabowska & Saniuk, 2022; Wang et al., 2017). It is an important method in terms of showing the most important publications and authors and presenting the general trends in the field. In this way, bibliometric studies are important in terms of pointing out current issues as well as lighting researchers or readers who want to research on any subject.

Problem of Study

This study answers to the following sub-problems were sought within the scope of the study:

- What is the distribution of studies by years in Nature and Environmental Education?
- What is the distribution of studies by countries in Nature and Environmental Education?

- What is the distribution of studies by institutions in Nature and Environmental Education?
- What is the distribution of studies by journals in Nature and Environmental Education?
- What is the distribution of studies by authors in Nature and Environmental Education?
- What is the distribution of studies by most cited ones in Nature and Environmental Education?
- What is the distribution of studies by co-works in Nature and Environmental Education?
- What is the distribution of studies by citations taken together in Nature and Environmental Education?
- What is the distribution of studies by co-keywords in Nature and Environmental Education?
- What is the distribution of co-citations of studies in Nature and Environmental Education?

Method

Research Model

In this study, content analysis and bibliometric analysis have been used, which enables to be evaluated research results in the literature and scientific findings acquired from researches and to appear them in a comprehensive way. The bibliometric analysis method includes the usage of quantitative data in scientific studies and quantitative indicators of various databases (Du et al., 2015; Wang, et al., 2017). In other words, written documents have been examined with this study to reveal the knowledge structure and the development of research areas. In this regard, bibliometric analysis based on the use of quantitative methods was used (Pritchard, 1969). In the study, systematic literature network analysis has been used as a bibliometric analysis method. Critical trends and problems affecting knowledge development in a particular field are defined as more scientific and objective than descriptive reviews with this approach (Grabowska & Saniuk, 2022). Bibliometric practice, which is used in many disciplines often, is opted with the aim of searching specific qualifications of those scientific studies published in a specific area on the axis of statistical methods (Pritchard, 1969). By this means, feature review of studies on the related field have been done by sticking to the defined frameworks. Bibliometric reviews are seen as a method that subjects defined under the study field have been examined, evaluation and classifications of them have been done, state assessment has been done with realistic analysis in the light of data and efforts have been spent in understanding the details of those scientific studies (Borgman & Furner, 2002). One of the strongest ways of this kind of studies is that it contributes informations recorded to spread the large masses and to be used (Tague-Sutcliffe, 1992). In this regard, document analysis obtained from WoS database has been done within the scope of the study, which was designed depending on the qualitative understanding.

Data Collection and Procedure

Literature review on nature and environmental education has been done by using Web of Science (WoS) Core Collection which is a database from Clarivate Analytics. In this regard, all studies in English have been reviewed. The Web of Science database was used for bibliometric analysis as it is an interdisciplinary research platform that records more than 21,000 internationally accessible high-quality journals and more than 205,000 conferences, including international conferences. This database make possible to search in multiple databases simultaneously using a single interface through Web Science Core Collection. At the same time, Web of Science database is considered one of the most consistent databases of scientific publications (Zhao & Strotmann, 2015). Bibliometric analysis have been done by following the processes of planning the research, forming sub-problems, doing source review, deciding time zone, generating input codes, forming other analysis criteria, collecting and sorting of data, compiling data, comparing final outputs, presenting, defining and interpreting the results obtained (Grabowska & Saniuk, 2022). In this context, studies have been examined by years of publication, countries, institutions, journals, authors, most cited ones, co-works, co-citations taken together, common keywords, and co-citations. At the first step of the study, the review has been done by following the steps of "Search Documents Topic" in Web of Science and using "nature education" or "environmental education" terms and a total of 9212 studies have been reached. This review process was done on 24-25 April 2022. ESCI, SCI-EXPANDED, SSCI, CPCI-SSH, CPCI-S, A&HCI, BKCI-SSH, BKCI-S indexes and all years (1997-2022) have been included in this study. At the second step, the review continued by excluding document types like "letters, retracted publications, meeting abstracts, early access, book reviews, editorial materials, book chapters, review articles and proceedings papers" and ESCI,

CPCI-SSH, CPCI-S, BKCI-SSH, BKCI-S field indexes, 3516 article has been included in data analysis. Coding in reviewing of Web of Science contents is as follows: TS=(“nature* education” or “environment* education”) Refined by: [excluding] Document types: (letters or retracted publications or meeting abstracts or early access or book reviews or editorial materials or book chapters or review articles or proceedings papers) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI” biographical item) Timespan: All years. Indexes: “SCI-EXPANDED, SSCI, A&HCI”. At the other step, the process continued by choosing the category of Education Educational Research (Refined by [including]) from the Web of Science categories and a total of 1312 article has been included in the final evaluation. VOSviewer programme has been used in visualization of network analysis of the obtained data.

Findings

In this part of the research, firstly, the distribution of studies in nature and environmental education by years is given in line with the purpose of the study. Then there are the findings of the first 30 countries, the first 20 institutions, the first 20 journals, the first 20 authors and the first 20 most cited studies in nature and environmental education. Last, informations have been presented on co-author analysis, co-citation analysis, and co-keyword analysis. Accordingly, the graph showing the distribution of studies in nature and environmental education by years is presented below (Figure 1).

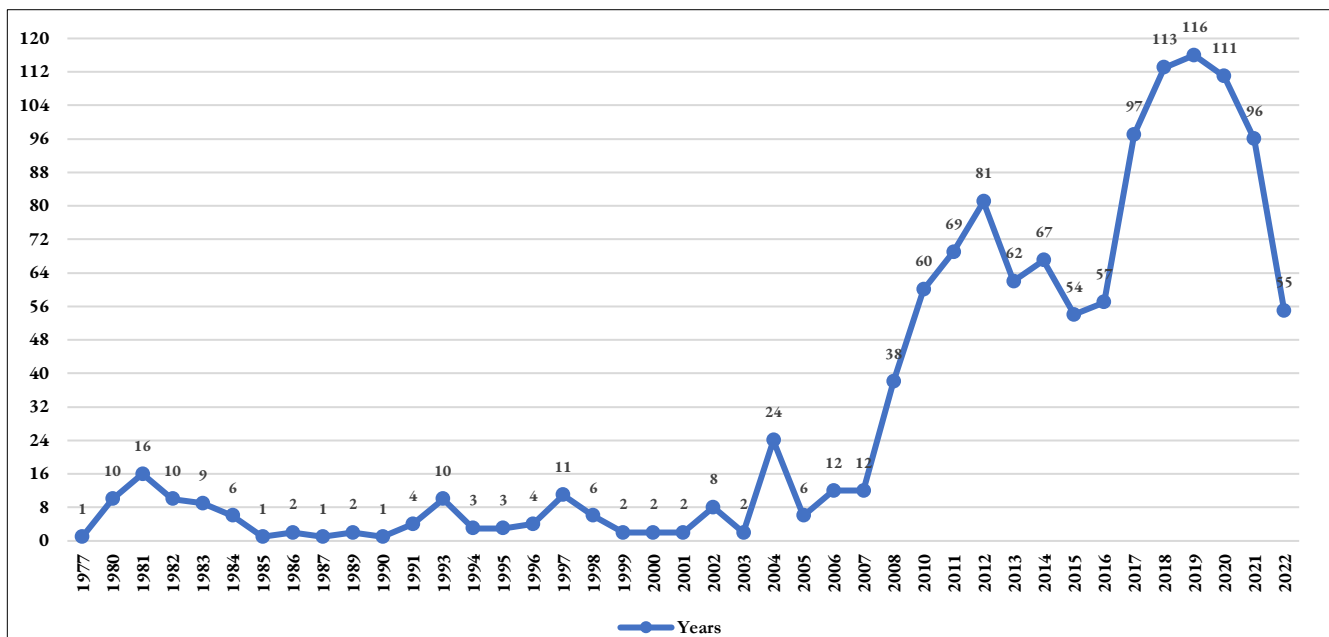


Figure 1. *Distribution of Studies in Nature and Environmental Education by Years*

Looking over Figure 1, a total of 1312 articles have been published between 1977-2022 in Education Educational Research (EER) category. Most articles have been published in 2019 (116), while least articles have been published in 1977, 1985, 1987 and 1990 (1). A growing trend in nature and educational studies draws attention especially in the time period from 2007 to 2020. The number of studies, which was stable between 1977 and 2005, gained momentum after 2005 and this growing trend continued until 2012. The distribution chart of the first 30 countries where the most research done in nature and environmental education is presented below (Figure 2).

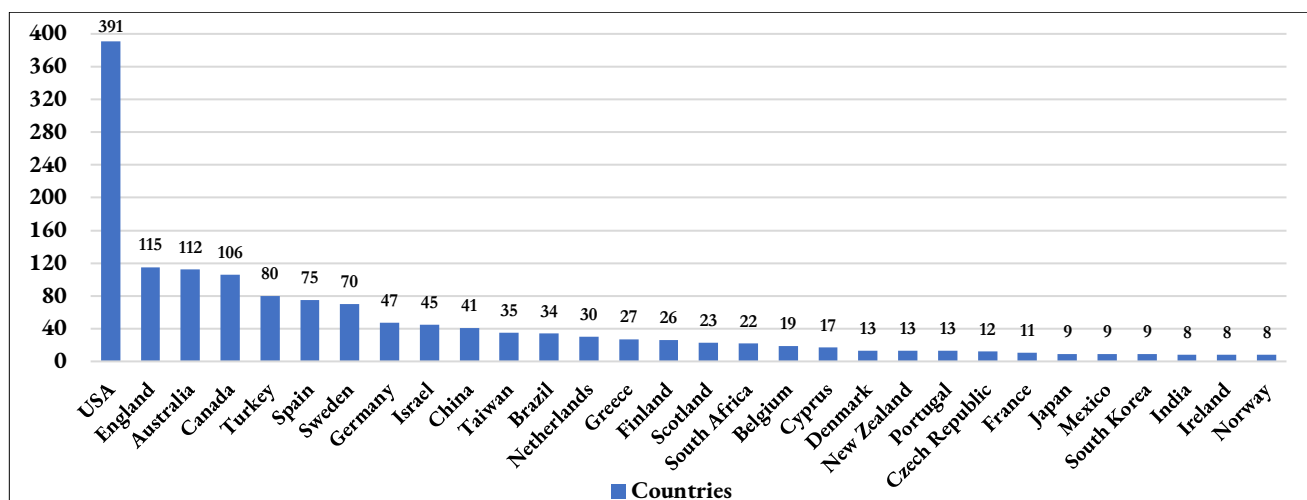


Figure 2. The Distribution of The First 30 Countries Where The Most Research Done in Nature and Environmental Education

Looking over Figure 2, the country where the most research have been done in nature and environmental education is by far the USA (United States of America) (391). It is respectively followed by England (115), Australia (112), Canada (106), Turkey (80), Spain (75), Sweden (70), Germany (47), Israel (45), China (41), Taiwan (35), Brazil (34), Netherlands (30), Greece (27), Finland (26), Scotland (23), South Africa (22), Belgium (19), Cyprus (17), Denmark (13), New Zealand (13), Portugal (13), Czech Republic (12), France (11), Japan (9), Mexico (9), South Korea (9), India (8), Ireland (8), and Norway (8). The distribution chart of the first 20 institutions where the most research done in nature and environmental education is presented below (Table 1).

Table 1. The Distribution of The First 20 Institutions Where The Most Research Done in Nature and Environmental Education

Affiliations	Record Count	%
League of European Research Universities	28	2.13
University of North Carolina	24	1.82
Virginia Polytechnic Institute State University	24	1.82
Monash University	22	1.67
Cornell University	20	1.52
Pennsylvania Commonwealth System of Higher Education	20	1.52
Pennsylvania State University	19	1.44
Stanford University	19	1.44
California State University System	18	1.37
Clemson University	18	1.37
University of London	18	1.37
Deakin University	17	1.29
Pennsylvania State University Park	16	1.22
State University System of Florida	16	1.22
University of California System	16	1.22
University of Wisconsin System	16	1.22
Stockholm University	15	1.14
University of Bath	15	1.14
University of Bayreuth	14	1.06
University of Edinburgh	14	1.06

Looking over Table 1, League of European Research Universities (28) is the institution doing the most research in nature and environmental education. This is respectively followed by the University of North Carolina (24), Virginia Polytechnic Institute State University (24), Monash University (22), Cornell University (20), Pennsylvania Commonwealth System of Higher Education (20), Pennsylvania State University (19), Stanford University (19), California State University System (18), Clemson University (18), University of London (18), Deakin University (17), Pennsylvania State University Park (16), State University System of Florida (16), University of California System (16), University of Wisconsin System (16), Stockholm University (15), University of Bath (15), University of Bayreuth (14) and University of Edinburgh (14). The distribution chart of the first 20 institutions that published the most research in nature and environmental education is presented below (Table 2).

Table 2. *The Distribution of The First 20 Institutions that Published The Most Research in Nature and Environmental Education*

Publication Titles	Record Count	%
Environmental Education Research	495	37.72
Journal of Environmental Education	210	16.00
International Journal of Science Education	58	4.42
International Journal of Sustainability in Higher Education	31	2.36
Journal of Biological Education	27	2.05
Eurasia Journal of Mathematics Science and Technology Education	24	1.82
Research in Science Education	24	1.82
Ensenanza de Las Ciencias	20	1.52
Journal of Philosophy of Education	20	1.52
Chinese Education and Society	17	1.29
Journal of Geography in Higher Education	15	1.14
Journal of Baltic Science Education	14	1.06
Science Education	14	1.06
Cultural Studies of Science Education	13	0.99
Journal of Curriculum Studies	13	0.99
Studies in Educational Evaluation	13	0.99
International Journal of Educational Development	11	0.83
Journal of Research in Science Teaching	11	0.83
Educational Sciences Theory and Practice	11	0.83
Educational Philosophy and Theory	10	0.76

Looking over Table 2, Environmental Education Research (495) is the journal which published the most research in nature and environmental education. This is respectively followed by the Journal of Environmental Education (210), International Journal of Science Education (58), International Journal of Sustainability in Higher Education (31), Journal of Biological Education (27), Eurasia Journal of Mathematics Science and Technology Education (24), Research in Science Education (24), Ensenanza de Las Ciencias (20), Journal of Philosophy of Education (20), Chinese Education and Society (17), Journal of Geography in Higher Education (15), Journal of Baltic Science Education (14), Science Education (14), Cultural Studies of Science Education (13), Journal of Curriculum Studies (13), Studies in Educational Evaluation (13), International Journal of Educational Development (11), Journal of Research in Science Teaching (11), Educational Sciences Theory and Practice (11) and Educational Philosophy and Theory (10). The distribution chart of the first 20 authors who have done the most research in nature and environmental education is presented below (Figure 3).

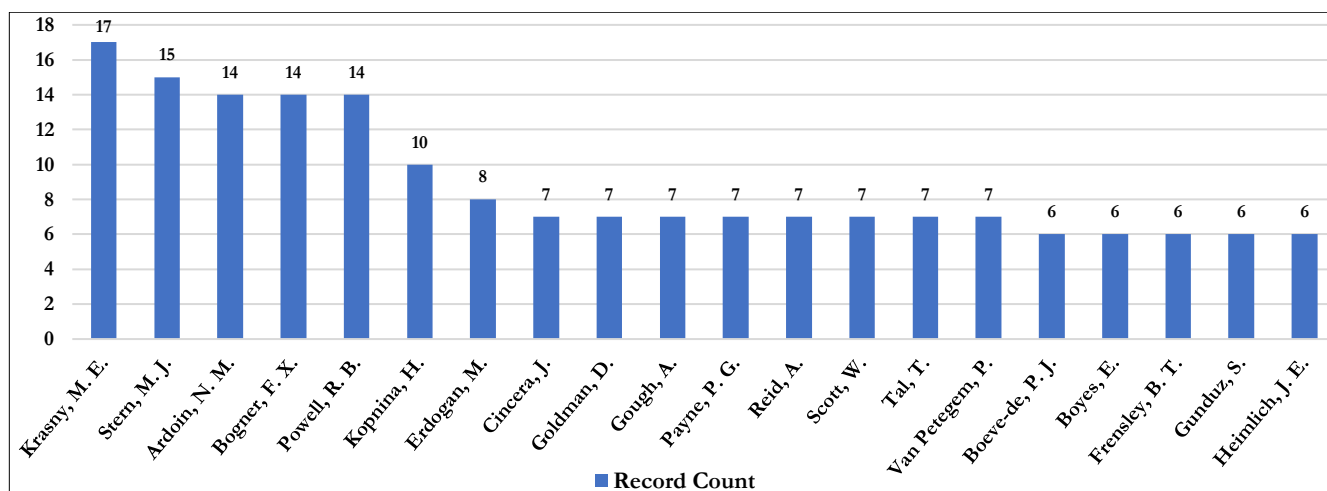


Figure 3. The Distribution of The First 20 Authors Who Have Done The Most Publication in Nature and Environmental Education

Looking over Figure 3, Krasny, M. E. (17) is the author who did the most research in nature and environmental education. This is respectively followed by Stern, M. J. (15), Ardoin, N. M. (14), Bogner, F. X. (14), Powell, R. B. (14), Kopnina, H. (10), Erdogan, M. (8), Cincera, J. (7), Goldman, D. (7), Gough, A. (7), Payne, P. G. (7), Reid, A. (7), Scott, W. (7), Tal, T. (7), Van Petegem, P. (7), Boeve-de, P. J. (6), Boyes, E. (6), Frensley, B. T. (6), Gunduz, S. (6), and Heimlich, J. E. (6). The distribution chart of the first 20 most cited studies in nature and environmental education is presented below (Table 3).

Table 3. The Distribution of The First 20 Most Cited Studies in Nature and Environmental Education

Articles	Number of Citation	Number of Citation/Years
The new environmental paradigm scale: from marginality to worldwide use	452	32.28
Globalization and environmental education: looking beyond sustainable development	313	22.35
The child in the garden: an evaluative review of the benefits of school gardening	228	17.53
Ecomobile: integrating augmented reality and probeware with environmental education field trips	213	23.66
The action competence approach and the “new” discourses of education for sustainable development, competence and quality criteria	195	16.25
Education for sustainable development (ESD): the turn away from 'environment' in environmental education?	186	18.60
Significant life experiences-a new research area in environmental-education	184	4.38
Promoting connectedness with nature through environmental education	173	19.22
Learning for resilience, or the resilient learner? Towards a necessary reconciliation in a paradigm of sustainable education	151	12.58
Sense of place in environmental education	128	12.80
Evaluating the effects of environmental education programming on connectedness to nature	121	11.00
Revealing the research 'hole' of early childhood education for sustainability: a preliminary survey of the literature	119	9.15
The importance of connection to nature in assessing environmental education programs	110	13.75
Outdoor adventure education: applying transformative learning theory to understanding instrumental learning and personal growth in environmental education	108	9.81
Introducing a fifth pedagogy: experience-based strategies for facilitating learning in natural environments	107	8.23

Enhancing learning, communication and public engagement about climate change-some lessons from recent literature	101	12.62
The study on integrating WebQuest with mobile learning for environmental education	98	8.90
Multi-level assessment of scientific content knowledge gains associated with socioscientific issues-based Instruction	98	8.16
Goals for curriculum-development in environmental-education	96	2.28
Beyond stewardship: common world pedagogies for the anthropocene	95	19.00

Looking over Table 3, “the new environmental paradigm scale: from marginality to worldwide use” (452) is the one which most cited research article in nature and environmental education. This is respectively followed by “globalization and environmental education: looking beyond sustainable development” (313), “the child in the garden: an evaluative review of the benefits of school gardening” (228), “ecomobile: integrating augmented reality and probeware with environmental education field”. trips” (213) and “the action competence approach and the “new” discourses of education for sustainable development, competence and quality criteria” (195). When considered by the number of citations and year rate, “the new environmental paradigm scale: from marginality to worldwide use” (32.28) is in the first place, while “ecomobile: integrating augmented reality and probeware with environmental education field trips” (22.35) is in the second place and “globalization and environmental education: looking beyond sustainable development” (22.35) is in the third place. Findings on the co-author analysis of studies in nature and environmental education are presented below (Figure 4).

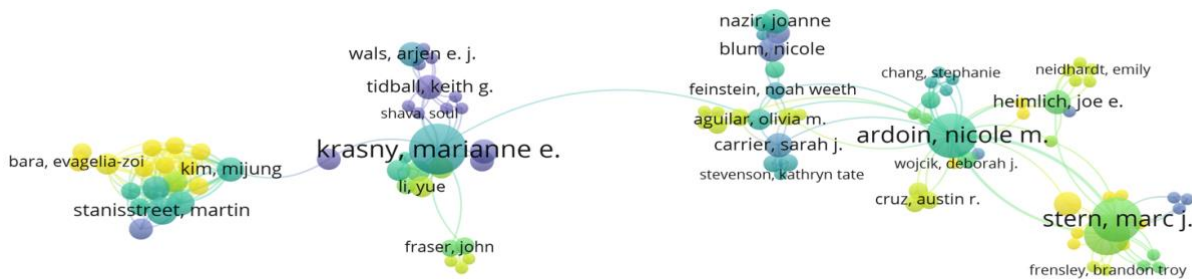


Figure 4. Co-Author Network Analysis of Studies in Nature and Environmental Education

Looking over Figure 4, it is seen that co-publishing authors in the co-analysis of the studies in nature and environmental education usually work separately and in groups. Co-publishing authors were divided into 12 clusters in different colors (items: f=103) under the criterion of having at least one publication. It is seen that the authors publishing on nature education mostly work among themselves and they have different and broad connections. Along with these, even if there has been a decrease in the number of co-author studies in recent years, it can be said that there is an increasing trend in co-work. Especially, it is seen that authors like Krasny, M. E., Stern, M. J, Ardoin, N. M. Stanisstreet, M., and Powell, R. B. form focus networks. The findings on the co-citation analysis of studies in nature and environmental education are presented below (Figure 5).

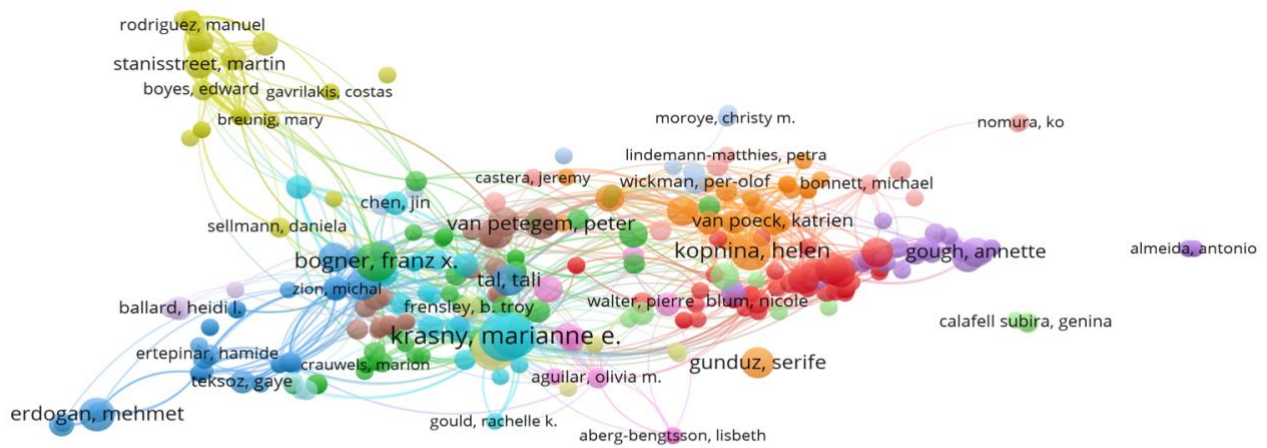


Figure 5. Co-citation Network Analysis of Studies in Nature and Environmental Education

Looking over Figure 5, 2182 links have been obtained in 15 different colored clusters (items: $f=311$, total link strength: 3447) in the co-citation analysis of studies in nature and environmental education. Especially, Krasny, M. E. (17 documents, 612 citations, 197 total link strength), Stern, M. J. (13 documents, 232 citations, 149 total link strength), Ardoin, N. M. (13 documents, 271 citations, 145 total link strength) and Powell, R. B. (11 documents, 203 citations, 137 total link strength) take the lead in co-citation analysis. Other than these, so many focus researchers have been in contact except Krasny, M.E in researches regarding nature while there have been researches which do not have strong connections in co-citation index. Findings on the co-keyword analysis of studies in nature and environmental education are presented below (Figure 6).

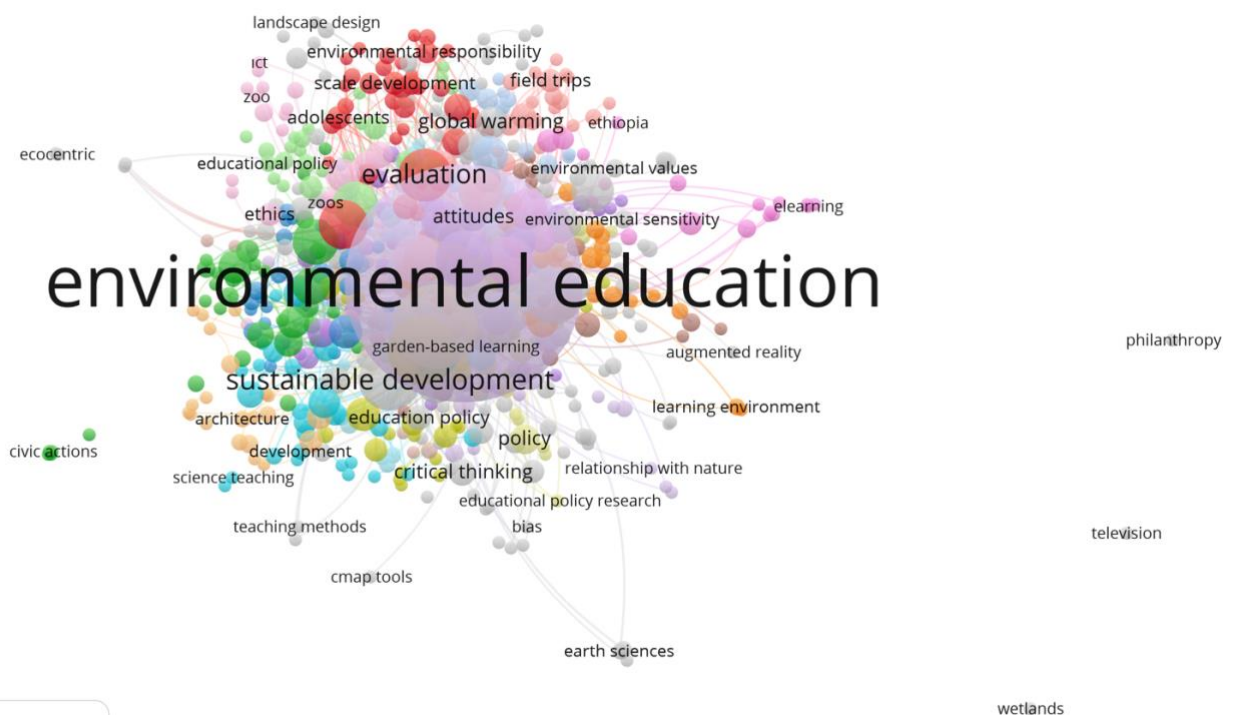


Figure 6. Co-Keyword Network Analysis of Studies in Nature and Environmental Education

Looking over Figure 6, it is seen that 63 different clusters (items: $f=623$) made 3324 connections with each other in the common keyword analysis of studies in nature and environmental education. When breakpoint 2 is taken, outstanding keywords among the links are respectively as follows: environmental education (610 occurrences, 1429 total

link strength), sustainable development (77 occurrences, 214 total link strength), sustainability (51 occurrences, 148 total link strength), higher education (43 occurrences, 105 total link strength), climate change (35 occurrences, 99 total link strength), environmental literacy (42 occurrences, 97 total link strength) and science education (36 occurrences, 93 total link strength). Environmental education keyword, which to be in the focus, has been used often with the words like environmental values, environmental sensitivity, critical thinking, development, evaluation, environmental education, zoo, global warming, garden-based education, attitude, education policy.

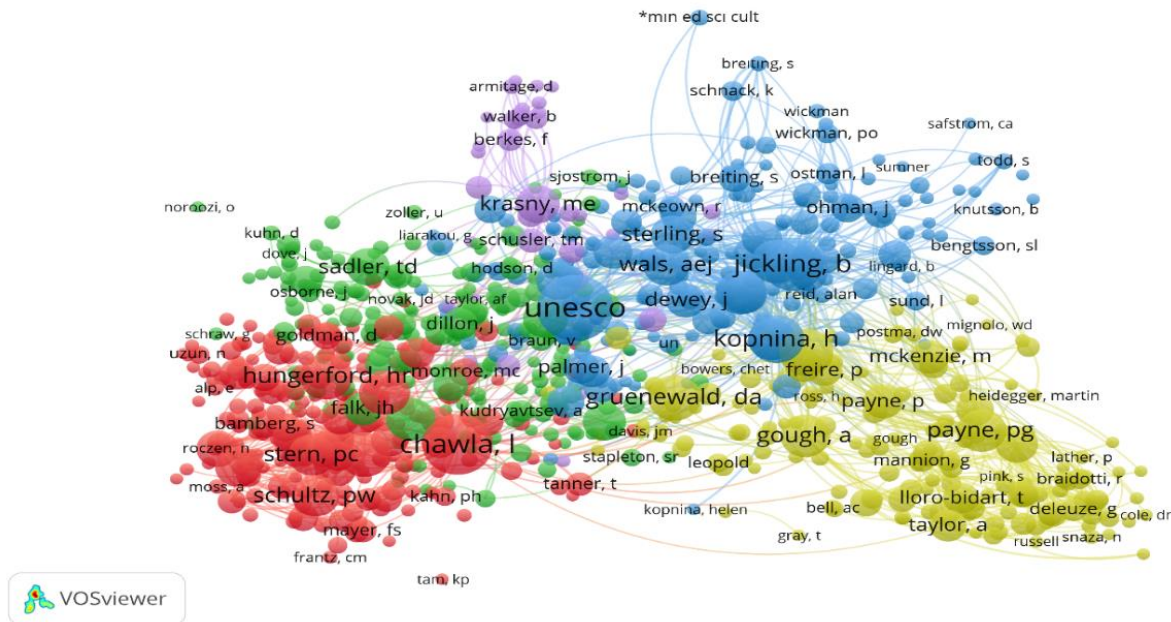


Figure 7. Co-Citation Network Analysis of Studies in Nature and Environmental Education

Looking over Figure 7, it is seen that there are clusters in 5 different colors (items: $f=828$) in the co-citation (breakpoint 10) of studies in nature and environmental education. Besides, it is said that the contact and bond between the authors frequently cited in the publications is quite intense and strong. Co-citation enables authors to reach publications that have a strong impact on related publications in terms of citing two different publications in a scientific study. Therefore, analysis of co-citations which made in related field with a specific publication is important. Especially the number of co-citations are too many in works by Chawla, I. (283 citations, 7043 total link strength), UNESCO (332 citations, 7024 total link strength), Jickling, B. (220 citations, 6550 total link strength) and Kopnina, H. (178 citations, 4773 total link strength). The cluster in blue color covers 732 nodes, the cluster in red color 683, the cluster in yellow color 470, the cluster in green color 336 and the cluster in purple color 139 nodes. Therefore, the cluster blue is the one with the highest knot density.

Discussion and Conclusion

In this study, it is aimed to put studies that was done between 1977-2022 in nature and environmental education with bibliometric method. In this regard, first of all, distribution by years of the articles in nature and environmental education has been examined. According to the findings, it was seen that articles published were on a specific rate although there was an increase at specific times between 1977-2022 (1980, 1981, 1993, 1997, 2004). However, it draws attention that there is a remarkable spike at the numbers of studies at this field after 2007. Especially, studies numbers reached its first climax in 2012, then all time high in 2018, 2019 and 2020. Even if there has been a sharp decrease in study number at this field as of 2021, it can be said that study numbers until 24-25 April, 2022 when the research was done has remained high compared to the past years. Pandemic (COVID-19) could be pointed out as one of the important reasons along with so many basic reasons for the decrease in study number published in 2021 (Aladağ et al., 2021; Grabowska & Saniuk, 2022). However, it draws attention that there has been a remarkable decrease on study numbers regarding nature and environmental education when considering the start ranges of the Covid-19 pandemic. As all know, nature and

environmental education is a learning activity that is done out-of-school environments. As Ozaner said (2004), nature education is done in nature, not in the classes. Hence, conducting these kind of studies cause difficulties like time, money and work burden. However, when considering the study numbers, it draws attention that there is an increasing interest in nature and environmental education. This situation has positive effects and the need of giving much more importance to this field has been supported with so many study findings (Gigliotti, 1990; Güler, 2009; Meier & Sisk-Hilton, 2017; Phenice & Griffone, 2003; Ramey-Gassert, 1997).

The other finding of the study was obtained from the countries with most research in nature and environmental education. At this field, United States of America is by far the first with twice as much studies than England which is the closest country to itself. England, Australia and Canada are the countries which have close study number rate to each others among 30 country that researched at this field. This is respectively followed by Turkey, Spain, Sweden, Germany and Israel. So many countries' having researched at this field show that countries are trying to increase the effectiveness at this field. However, when examing the study numbers of the countries after the first seven countries, it can be said that study numbers at this field are not at desirable levels. Although there have been studies in nature and environmental education in so many different countries, the unbalance on study numbers of countries draw attention. In this regard, it is really important both leading countries like USA, England, Australia and Canada should focus more colloboration with other countries and similarly, countries with insufficient study numbers should be in contact with those countries. Kahyaoglu (2015) who draws attention to this, state that humanity became desensitized because of technological developments and progresses and at the same time, the disharmony between education and training systems, urbanization, and the decrease in natural areas keep individuals away from nature day by day. Therefore, even if some countries do so many researches at this field, other countries' tendency for it pose great importance (Hannaman, 2013; Taylor & Kuo, 2009; Ünal & Dımıřki, 1999).

The other finding of the study was obtained from institutions where most research has done in nature and environmental education. According to this, League of European Research Universities which is a search-based network inter European Universities takes the lead at this area. This is respectively followed by The United States University of North Carolina, Virginia Polytechnic Institute State University, Cornell University, Pennsylvania Commonwealth System of Higher Education which are USA Universities and Monash University from Australia. According to these findings, it can be said that studies about this field mostly concentrate on state and foundation universities of United States of America. Even if there are studies on this field in state universities of countries like Australia, England and Germany which are from the first 20 insitutions, universities of United States of America mostly has taken the lead in publishing more studies on nature and educational environment and supported researchers. In positive changes of individuls' behaviours towards nature, the importance of ecologic programmes has reflected on so many study's findings (Bařal, 2003; Bogner, 2002; Bogner & Wiseman, 2004; Ozaner, 2004) and it was determined that activities done in out-of-school environments helps for students to get information at their own learning pace and courages their learning behaviours (Aladağ et al., 2021; Farmer et al., 2007; Gerber et al., 2001; Melber & Abraham, 1999). Therefore, having diversity in institution number supporting studies in nature and environmental education and their more support in related field is really important. Limited number of institutions' coming to the forefront at this area could cause limitations in terms of both qualification and quality of studies.

The other finding of the study was obtained from journals publishing studies in nature and environmental education. In line with this, Environmental Education Research journal has published important studies at this field and published twice as much studies than Journal of Environmental Education which is the closest to itself. Environmental Education Research journal also has contained in itself more than one of three of all studies published and leads in this study number at this field compared to the other journals. There are, of course, so many different reasons for this, but publishing frequency, prestige and productivity of journal boards can be shown as the most important reasons. On the other hand, other journals in the first 20 in nature-environment education are International Journal of Science Education, International Journal of Sustainability in Higher Education, Journal of Biological Education, Eurasia Journal of

Mathematics Science and Technology Education, Research in Science Education, Enseñanza de Las Ciencias, Journal of Philosophy of Education and Chinese Education and Society.

The other finding of the study was obtained from the authors with most research in nature and environmental education. According to this, Krasny, M.E. is the author who has the highest number at this field. This is respectively followed by Stern, M. J., Ardoin, N. M., Bogner, F. X., Powell, R. B., Kopnina, H., Erdogan, M., Cincera, J., Goldman, D., Gough, A., Payne, P. G., Reid, A., Scott, W., Tal, T., and Van Petegem, P. Studies on this field has been handled and examined by so many different author. However, specific journals distinguish at this field. Hence, increase in the numbers of specific journal can contribute to this field. Especially, content and subject oriented journals can present valuable contributions. It is known that giving real life experience to students and forming learning environments that will enable them to obtain first hand experience increase their gains and cognitive learning inside and outside the classroom (Aladağ et al., 2021; Gerber et al., 2001; Melber & Abraham, 1999; Heather, 1999). In this regard, it can be helpful that different type of journals publish studies that have similar trends and increase the number.

Another finding from the research was obtained from the studies most cited in nature and environmental education. In this regard, “the new environmental paradigm scale: from marginality to worldwide use” is the publication that is the most cited. The study’s being a scale and having practice use in so many study are one of the reasons for this. This is respectively followed by “globalization and environmental education: looking beyond sustainable development” and “the child in the garden: an evaluative review of the benefits of school gardening”. Considering the ratio of the citations from the publication year to the present day, “the new environmental paradigm scale: from marginality to worldwide use” is the first, while the study named “ecomobile: integrating augmented reality and probeware with environmental education field trips” is the second and the study named “globalization and environmental education: looking beyond sustainable development” is in the third place. One of the most important features of this study is that environmental education issue has been handled from a broad perspective and the mentality of sustainability has ruled. Besides, they have the contents of not only for the society they live in but also for all other societies. At the same time, these studies have been published in prestigious, high quality journals scanned by many field indexes. So many institutions and organizations can access easily these journals which have wide target audience. Students can learn concepts related to nature, environment and science more easily in out-of-school areas than in a classroom (Ballantyne & Packer, 2008; Bogner, 1998; Bogner & Wiseman, 2004; CEE, 2004; Devall, 1994). In this regard, it may be beneficial for researchers studying in this field to focus on the studies in this direction in order to obtain more citations.

One of the distinct findings of the study was obtained from co-author network analysis in nature and environmental education. It is seen that co-publishing authors in the co-analysis of the studies in nature and environmental education usually work separately and in groups. According to this finding, interest for studies at this field shows continuity and it has been addressed by so many authors. Although it is evident in the color scale that there has been a decrease in co-author studies in recent years, it draws attention that the intensity of co-publishing in this area is high, especially between 2012 and 2016. In particular, authors like Krasny, M. E., Stern, M. J., Ardoin, N. M., Stanisstreet, M., and Powell, R. B. forming focus networks shows that they have significant works in this area. The other distinct feature of the findings is the interaction among the authors who do not co-publish. It is seen that the authors co-publishing at this field are in close cooperation with each other, as well as on the issue of co-authors. Out-of-school areas are very effective environments for teaching basic concepts about the environment and nature. These environments are important learning materials for students to see the cycles in nature and the cause and effect relationship in natural life. Trainings and field trips planned in natural areas help students to gain both cognitive, affective and psychomotor gains (Erdogan, 2009; Farmer et al., 2007). Education in nature gives students an interdisciplinary perspective by bringing together different disciplines, and supports the multidimensional development thinking skills. In this regard, studies that will be formed at the end of a collaboration of writers from different cultures, languages and countries will have significant contributions to the field. It will be very valuable in the formation of qualified studies that different numbers of authors take part together in studies to be done at this field.

Another finding of the study was obtained from the co-network analyses of studies in nature and environmental education. According to this, in the co-citation network analysis, there were 15 different colored clusters and it was determined that these clusters were in intense interaction with each other. Especially, Krasny, M., Bogner, F. X., Kopnina, H., Erdogan, M., Stern, M. J., Ardoin, N. M., and Powell, R. B. are prominent authors in co-citation network analysis. It can be said that, in the citation index with a strong network, researchers follow each other's publications closely and are aware of their current studies in nature-environment education. Even if there are co-citations for independent studies, it can be said that the overall pattern has a dynamic structure and is frequently cited within itself. On the other hand, having more than one focus point provides important clues regarding the richness and content of the studies. This situation emphasizes the productivity of study numbers at this field and shows that many researchers are in interaction. Although this situation is quite positive, it is important to have more interaction for increasing the nature and environmental awareness of societies. However, considering the fact that today's children live further away from nature, not just an information-based but also a holistic environmental education that students could interact with nature directly and grasp the unity in nature, with activities in appropriate natural areas are needed (Demir & Yalçın, 2014; Heather, 1999; Hungerford & Volk, 1990; Jickling & Wals, 2008).

One of the distinct findings of the study was obtained from co-keyword network analysis in nature and environmental education. In the analysis which there are 63 clusters in different colors, it was determined that there was a dense network. According to this, the notion of environmental education has been the most preferred keyword by researchers. According to this finding, it is expected that this notion will be preferred more in studies whose focus is in environmental education. However, many factors come forward in the use of these notions because similar notions related to environmental education are generally used in expressions with similar meaning burden. Looking at the related literature, it is seen that the notions of environment and nature are used interchangeably (Erdogan, 2009; Ozaner, 2004). For this reason, sharp distinctions were not made when examining the studies, and conducting studies were evaluated together. On the other hand, the notions of sustainable development, sustainability, higher education, climate change, environmental literacy and science education were frequently used as keywords by researchers. The remarkable detail here is that studies shows sustainability and continuity. Hence, the importance of sustainability was emphasized and frequently used in many keywords. Other than these, notions such as learning, teaching, evaluation, global warming, zoo, science, garden-based teaching, environmental values, and education policy were frequently used as keywords by researchers. When the structure of the network analysis is examined in general, it draws attention that there is an intense interaction among word groups.

Although the notion of environmental education is the focus, the usage of different types and numbers of keywords point out a rich network structure. The environment together with human, livings and non-livings, is defined as an open system with its physical, chemical, biological and social factors affecting all kinds of actions and behaviors of livings (Atasoy, 2005; Kahyaoğlu & Yetişir, 2015). As is seen, the environment is a very comprehensive and borderless notion. Therefore, it can be said the studies have been carried out mostly with the notion of environment and that the components of the environment notion has been handled least. However, considering the components of the notion of environment, it can be said that many metaphor studies can be done about how people perceive the environment (Çakmak, 2018). In this regard, keywords in studies should be handled in a way that they reflect more subject content and should include diversity in terms of reaching more people.

The last finding was obtained from the co-citation network analysis of studies in nature and environmental education. According to this, it draws attention that there is an intense network in 5 different colors. It is also seen that the interaction level and network connection among the authors frequently cited in the publications are quite intense and strong. Especially, it was determined that the number of co-citations is quite high and they have focal points in the studies conducted by Chawla, I., UNESCO, Jickling, B. and Kopnina, H.. So much so, the blue cluster consists of 732 nodes, the red cluster 683, the yellow cluster 470, the green cluster 336 and the purple cluster 139 nodes. Therefore, the blue cluster has been with the highest knot density. That is to say, UNESCO has taken part in co-citations in many studies, in a way that it would be the focal point. One of the remarkable points of the network structure is that the

number of citations in many authors studies is in a dense pattern. This finding points out the richness of the studies in terms of content and the intensity of the sources used in different types. However, scientific studies and projects are carried out and reported in many countries in nature and environmental education. In this regard, it can be said that there is an intense interaction in reaching the publications that have a strong impact on the related publications. According to the findings, it can be said that the studies at this field are in a close relationship with each other. Along side all these expressions, there are certain limitations of the study. One of the most important limitations of the study is that the terms of nature and environmental education are at the center of the research. Besides, the resources in the study were limited to the WoS database and the search category was chosen as Education Educational Research. In this regard, there may be differences in the content of the studies in different categories. The date of scanning was also limited to 24-25 April 2022, and studies uploaded to the system after this date were not included in the study. Therefore, whole of 2022 and other WoS categories can be included in the studies to be done in a similar way. In this way, the trends and contents of the studies at this field can be presented with a broader perspective.

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