Environmental Education, Racial Issues, and the 2030 Agenda:

Necessary dialogues with Africa and Latin America

UNESCO Chair in
Distance Education

Environmental Education, Racial Issues, and the 2030 Agenda:

Necessary dialogues with Africa and Latin America

2024

Research Coordination and Supervision
Rita Silvana Santana dos Santos - University of Brasília (UnB)

Editorial team
Rita Silvana Santana dos Santos - University of Brasília (UnB)
Rafael Nogueira Costa - Federal University of Rio de Janeiro (UFRJ)

Intern
Nícolas Chenquel Nogueira
Undergraduate student in Biological Sciences - Federal University of Rio de Janeiro (UFRJ)

Layout and cover design
Isabela Campos Menezes - UNESCO Chair in Distance Education (UnB)

UNESCO Chair in Distance Education
Tel Amiel – University of Brasília (UnB)

———————————————

———————————————

———————————————

How to cite

APA
Santos, R. S. S. dos, Costa, R. N., & Nogueira, N. C. (2024). Environmental Education, Racial Issues, and the 2030 Agenda: Necessary dialogues with Africa and Latin America. UNESCO Chair in Distance Education. https://doi.org/10.5281/zenodo.10553090

ABNT
SANTOS, R. S. S.; COSTA, R. N.; NOGUEIRA, N. C. Environmental Education, Racial Issues, and the 2030 Agenda: Necessary dialogues with Africa and Latin America. Brasília: UNESCO Chair in Distance Education, 2024. Disponível em: https://doi.org/10.5281/zenodo.10553090

| SUMMARY

INTRODUCTION

■ INTRODUCTION

The debate about education focused on environmental issues is polysemous and presents a series of convergences and divergences. In Latin American and African contexts, two predominant approaches can be identified (Castellanos; Queiruga-Dios, 2022): Environmental Education (EE) and Education for Sustainable Development (ESD) or Education for Sustainability. In these approaches, is there an articulation between environmental and racial issues to understand the historical colonial foundations that compromise the sustainability of the planet?

Perhaps the answers to this question will guide our actions to overcome the "double colonial and environmental fracture of modernity" (Ferdinand, 2022), which separates ethnic-racial issues from environmental issues, contributing to epistemicide, environmental racism, and silencing in the 2030 Agenda for Sustainable Development. The decolonial intellectual movement present in many universities also questions and inquires into these divisions[1].

This history of Environmental Education must be told from other perspectives. Numerous doctoral dissertations and theses trace the history of Environmental Education based on international conferences, which reinforced Eurocentric epistemologies. The studies presented in this report indicate that scientists and intellectuals from the African continent and Latin America are not equally part of the standard, hegemonic thinking about Environmental Education. This is the central argument of Santos (2017; 2019), which points to the need for coordination between Environmental Education and Anti-Racist Education.

Understanding how the articulation between these two areas has been debated and systematized by researchers on the African continent and in Latin America, between 2012 and 2022, provided the impetus for the development of this research. The following report presents an effort to contribute to Anti-Racist Environmental Education and seeks to generally answer the following questions:

---

[1] Available at: https://www.gov.za/documents/national-education-policy-act-national-curriculum-statement-grades-r-12-approval

1. What are the intersections between the field of Environmental Education with ethnic-racial issues and the Sustainable Development Goals defined in the 2030 Agenda?

2. What are the main theoretical-methodological frameworks adopted in the field of Environmental Education in Africa and Latin America?

3. Are there intersections between the field of Environmental Education and Open/Distance Education?

This report seeks to contribute to the creation of paths for other types of environmental education to emerge and guide new educational policies attentive to the intellectual productions of the African continent and Latin America.

Finally, the investigation analyzes the intersections of these themes with Open Education, the central theme of action of the UNESCO Chair in Distance Education. The 2019 UNESCO Recommendation on Open Educational Resources (OER) makes it clear that promoting Open Education is a central mechanism for us to achieve the goals of SDG 4 (Sustainable Development Goals), centered on Education. This study presents a mapping of the relationship between Open Education and Environmental Education, and provoke reflections on new approaches in both fields.

METHODOLOGICAL SUMMARY

METHODOLOGICAL SUMMARY

The research was carried out based on a systematic literature review of the **integrative review** type, with a quantitative-qualitative approach (Botelho; Cunha; Macedo, 2011).

In the field of Environmental Education, the integrative review has already been adopted in research such as i) global policies (Aikens; Mckenzie; Vaughter, 2016) ii) teacher education (Coelho; Oliveira; Almeida, 2021); iii) understanding of the nursing professional's role in promoting environmental sustainability (Leite et al., 2019); iv) intersections between environmental education and the Marxian theoretical reference (Machado; Santos, 2020); v) Environmental Education in the context of River Basins (Lopes; Campos; Nogueira, 2021), among others.

The research sought to find the intersections between Environmental Education and ethnic-racial issues, the 2030 Agenda/SDG, and Open and Distance Education, in Latin America and Africa. The search terms used were divided into three categories: i) Environmental Education; ii) Education for Sustainable Development and iii) Open Education Resources. In order to maintain standardization with international literature, we have used English acronyms throughout the text: EE (Environmental Education), ESD (Education for Sustainable Development) and OER (Open Education Resources).

Methodological rigor is important so that other research can be carried out comparatively and even understand how the field of knowledge behaves in geographical, political, temporal, and cultural scenarios.

The **methodological stages** used in this report are described in detail in the **last section of the document**, following the references.

RESULTS:
AFRICA

RESULTS: AFRICA

In this chapter, the results of the systematic review on Environmental Education and Education for Sustainable Development on the **African continent** are presented: intersections between ethnic-racial issues and the 2030 Agenda.

In this chapter, we highlight the most significant results based on the questions prepared in the methodological stage. Some questions were not presented at this stage because the data was not considered sufficient.

| Question: What kind of education is present in the articles?

The answer to this question is presented in Figure 1. There is a greater number of articles in the ESD field, with a total of 227 scientific articles. For the EE field, 182 articles were found and, for the OER field, 64 articles were found.

Figure 1. Number of articles in each search.
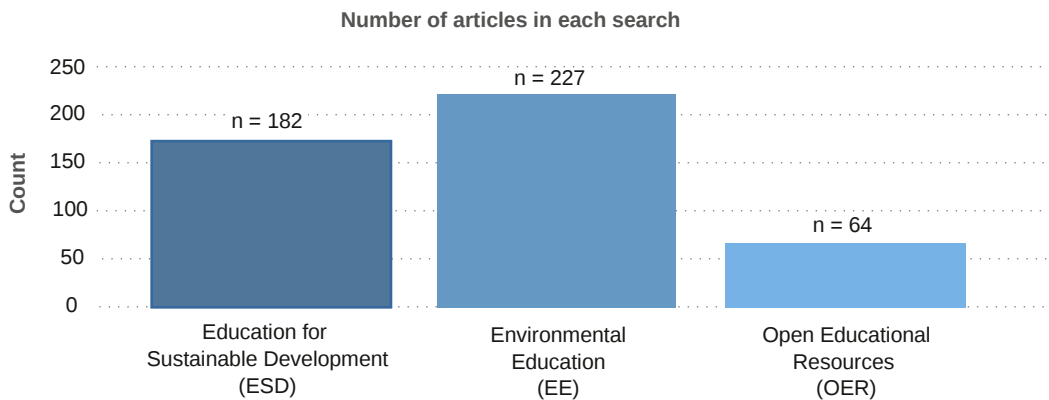
Number of articles in each search

Source: Created by the authors with *Bibliometrix*.

Question: What are the intersections between the Environmental Education field and ethnic-racial issues?

Only three articles were found at the intersection between Environmental Education and Education and Sustainable Development with ethnic-racial issues.

To verify the presence or absence of ethnic-racial issues (Table 1), a search was carried out on the title, abstract, and keywords of the 473 articles found using the following descriptors: "Ethnic-Racial Relations" or "Racial" or "Diaspora" or "African Philosophy" or "African Cosmoperception" or "African Cosmovision" or "African Epistemology".

Table 1. Presence or absence of "Ethnic-Racial Relations" in the articles found.

	Abstract			Title			Keyword		
	Present	Absent	NA	Present	Absent	NA	Present	Absent	NA
EE	3	177	2	0	182	0	0	167	15
ESD	0	266	1	0	227	0	0	217	10
OER	0	63	1	0	64	0	0	58	6

NA = Number of "Not available" occurrences in the database.

Source: Created by the authors.

In the set of 473 scientific articles, only 3 presented some type of presence of descriptors (Table 2), which demonstrates a path[2] to be followed in the scientific debate and a need to carry out research relating the field of Environmental Education and ESD with ethnic-racial issues.

Table 2. Ethnic-Racial Relations with EE, ESD and OER.

Title	Year	Keyword	Doi
Trends in Population and Demographics of U.S. Environmental Engineering Students and Faculty from 2005 to 2013	2016	Assessment, innovations in environmental education, diversity, demographics, outreach	10.1089/ ees.2016.0063
Envisioning Black space in environmental education for young children	2017	Antiblackness, environmental education, early childhood education, speculative fiction	10.1080/1361332 4.2019.1592837
A People's Future of Leisure Studies: Political Cultural Black Outdoors Experiences	2022	African Americans, Outdoor recreation, public lands, self-determination, resistance	10.18666/JPRA-2021-11006

Source: Created by the authors.

---

[2] When exporting the data from the *SCOPUS* and *WOS* databases, some information such as the title, abstract, and keywords were lost due to formatting issues. This artifact generates "NA" in the table. Thus, the sum of the Absent and Present column generates a number equal to the total number of articles in the category.

| Question: Is the debate on the 2030 Agenda present?

Table 3 demonstrates the presence or absence of the subjects "2030 Agenda", "Sustainable Development Goals" or "Sustainable Development" in the EE, ESD, and OER fields.

Table 3. Terms: "2030 Agenda" for "SDG" or "Sustainable Development".

|	Abstract			Title			Keyword		
	Present	Absent	NA	Present	Absent	NA	Present	Absent	NA
EE	15	165	2	6	176	0	15	152	15
ESD	211	15	1	82	145	0	110	107	10
OER	1	62	1	0	64	0	1	57	6

NA = Number of "Not available" occurrences in the database.

Source: Created by the authors.

| Question: What are the interfaces/intersections between EE, ESD, and OER?

Figure 2 presents the emerging terms in the abstracts of articles studied. The figure was generated using the *biblioshiny* interface of the *bibliometrix* package. The package uses a matrix multiplication method called *Co-occurrence Matrix*, which is later illustrated as a network.

Figure 2. Network chart.
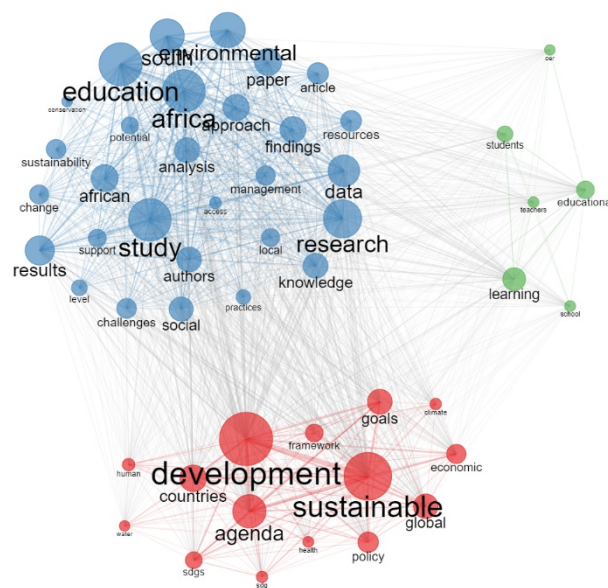
Source: Created by the authors with *Bibliometrix*.

|Question: What is the annual production defined by the intersections established in the research?

The chart in Figure 3 presents the evolution of articles from January 2012 to December 2022. In 2012, 11 articles were published. From the year 2018 onwards there was a considerable increase, quadrupling the production of articles, the same occurred from 2018 to 2020. Between 2020 and 2022, we saw a stabilization in the number of publications.

Figure 3. Annual scientific production.
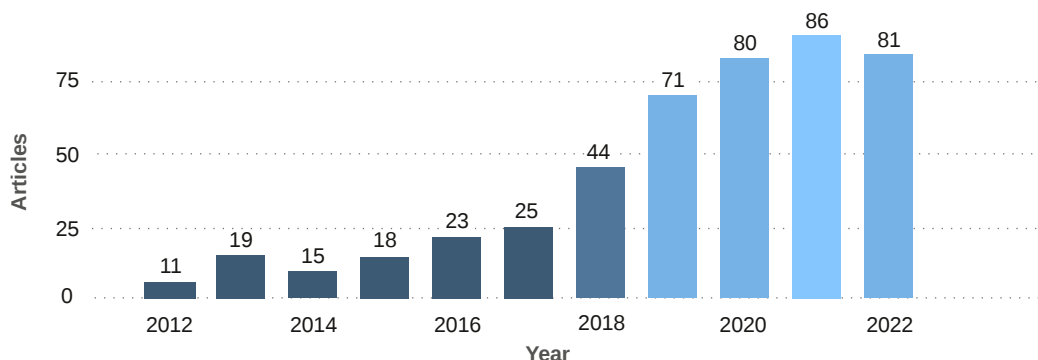
Source: Created by the authors.

| Question: Who are the standout authors of the last ten years?

Figures 4 and 5 show the results of the authors with the greatest contributions to the field under debate. Figure 5 presents the most relevant authors and the number of articles published between 2012 and 2022.

Figure 4. Most relevant authors.

Most relevant authors in the past 10 years
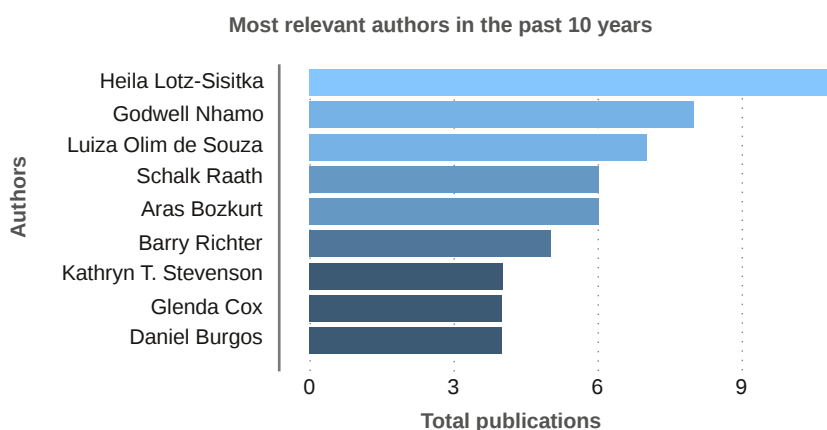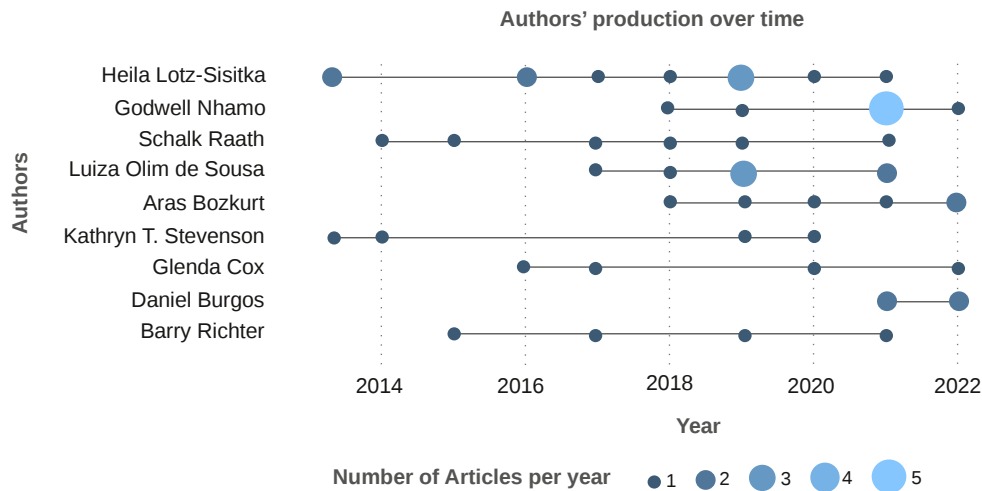

Source: Created by the authors with *Bibliometrix* and ggplot2.

In Figure 5, it is possible to follow the authors' production over the years. This type of information can help in understanding the evolution of thinking on a given subject, indicating paths for reading and preparing syntheses.

Figure 5. Authors production over time.

Source: Created by the authors with *Bibliometrix* and ggplot2.

| Question: Who are the most frequently cited authors in scientific articles?

The authors who presented the greatest impact can be seen in Figure 6. The article by Lee et al. (2015) obtained the highest number of citations (551) among the analyzed articles. As such this work had a high impact on the scientific community from an approach to climate change and global risk perception.

Figure 6. Most cited articles in the sample.
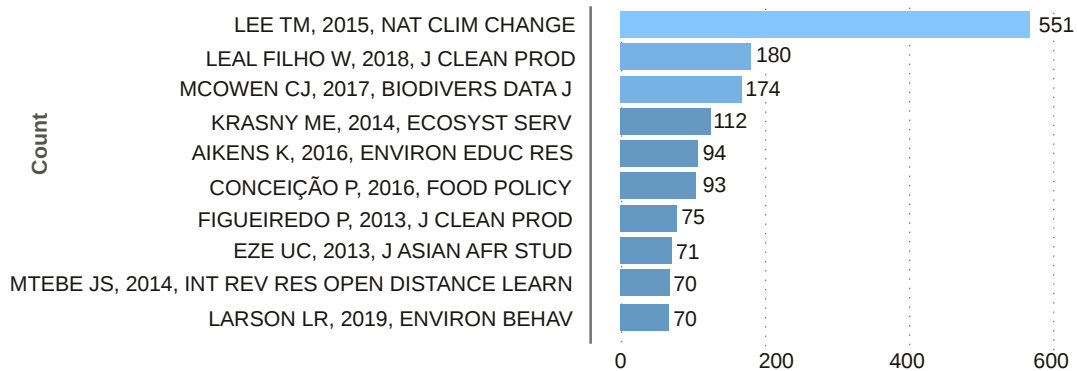
Source: Created by the authors with *Bibliometrix* and ggplot2.

| Question: What is the scientific production per country?

Figure 7 presents scientific production by country. The countries that presented the greatest prominence in this were South Africa, the USA, and the United Kingdom.

National publications from the last 10 years
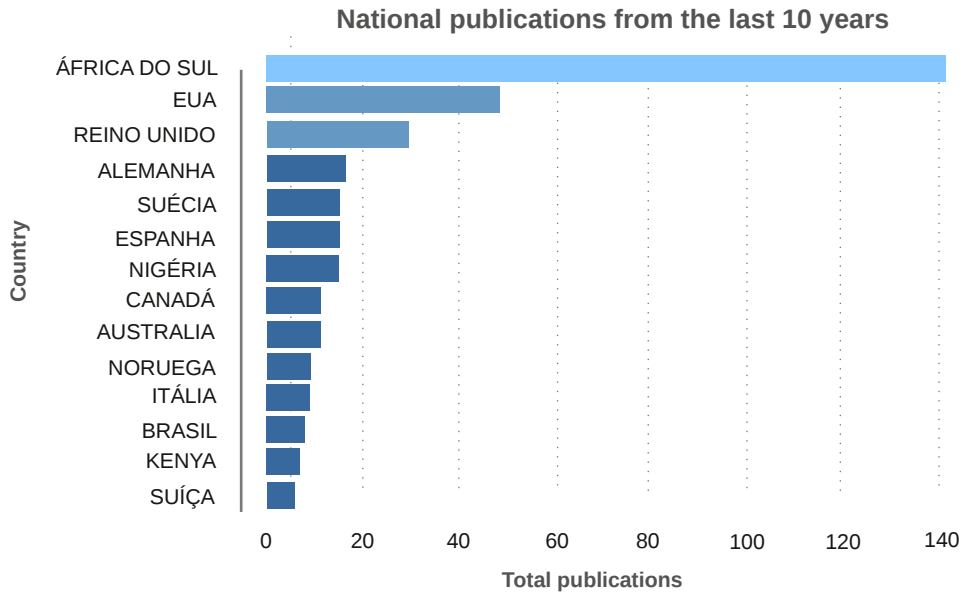
Source: Created by the authors with *Bibliometrix.*

| Question: Is there collaboration between countries?

Figure 8 presents the countries' production map. This analysis was performed using the *bibliometrix* package, through its user interface. The color scale measures author appearances by country affiliations, where the affiliation of each author of a given publication confers a maximum of one point for each country. Connections are made when a publication has authors from more than one country of origin.

Figure 8. Country Collaboration Map.
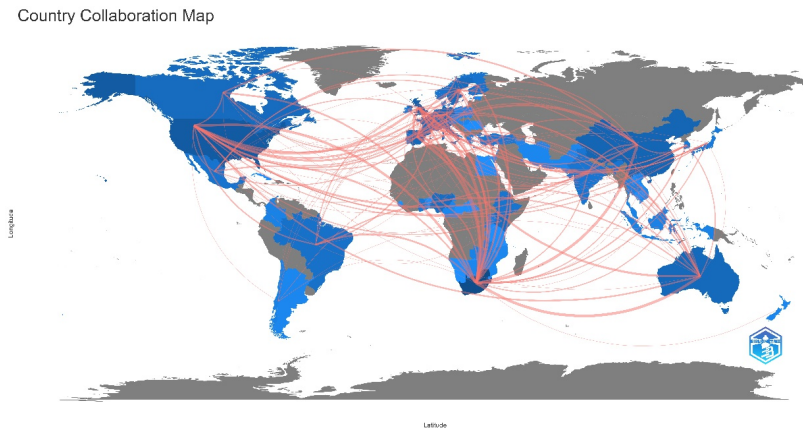
Source: Created by the authors with *Bibliometrix.*

| Question: What are the most cited journals?

Figure 9 highlights the most relevant journals. For the group of articles researched, three journals stood out: Environmental Education Research, Sustainability (Switzerland), and Sustainability.

Figure 9. Most Relevant Sources.

Most Relevant Sources

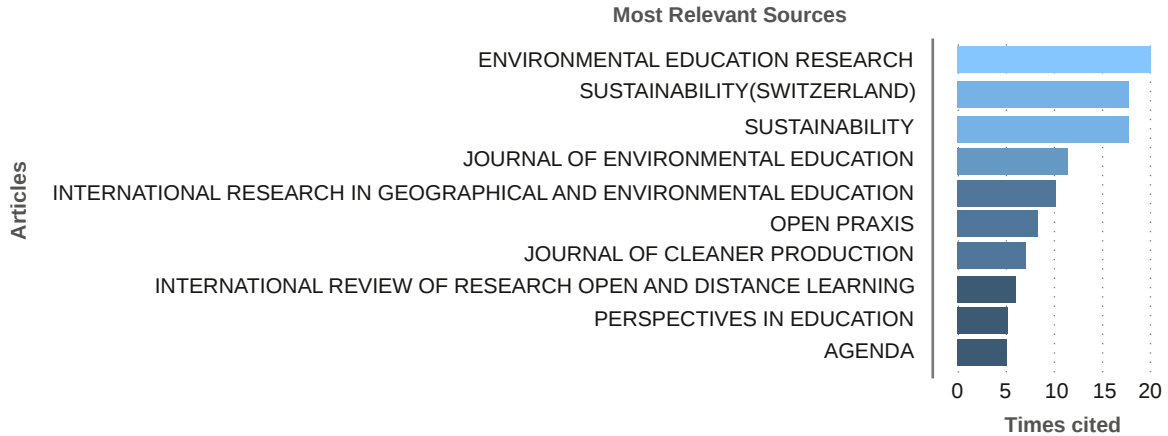| Source	Times cited
ENVIRONMENTAL EDUCATION RESEARCH	20
SUSTAINABILITY(SWITZERLAND)	18
SUSTAINABILITY	18
JOURNAL OF ENVIRONMENTAL EDUCATION	11
INTERNATIONAL RESEARCH IN GEOGRAPHICAL AND ENVIRONMENTAL EDUCATION	10
OPEN PRAXIS	8
JOURNAL OF CLEANER PRODUCTION	7
INTERNATIONAL REVIEW OF RESEARCH OPEN AND DISTANCE LEARNING	6
PERSPECTIVES IN EDUCATION	5
AGENDA	5

Source: Created by the authors with *Bibliometrix* and ggplot2.

| Question: What are the scientific journals that publish this type of research in the context of the African continent?

The answer to this question enables readers and researchers in the field to choose which journals will be considered in the article submission process (Figure 10). Among the most significant journals we can highlight: Environmental Education Research (https://www.tandfonline.com/journals/ceer20), International Research in Geographical and Environmental Education (https://www.tandfonline.com/journals/rgee20) and Sustainability, Switzerland (https://www.scopus.com/sourceid/21100240100).

Figure 10. Main scientific journals.

Main scientific journals

Source	Times cited
ENVIRONMENTAL EDUCATION RESEARCH	19
INTERNATIONAL RESEARCH IN GEOGRAPHICAL AND ENVIRONMENTAL EDUCATION	17
SUSTAINABILITY(SWITZERLAND)	17
JOURNAL OF ENVIRONMENTAL EDUCATION	11
MEDITERRANEAN JOURNAL OF SOCIAL SCIENCES	9
APPLIED ENVIRONMENTAL EDUCATION AND COMMUNICATION	8
MARINE POLICY	7
ENVIRONMENT DEVELOPMENT AND SUSTAINABILITY	6
AMERICAN JOURNAL OF PRIMATOLOGY	5
AFRICAN JOURNAL OF HOSPITALITY TOURISM AND LEISURE	4

Source: Created by the authors.

It can be seen that ESD presents a greater quantity of scientific articles when compared to EE and OER. Perhaps we are facing a change of perspective regarding the debate on environmental issues in education or a change of paradigm regarding EE.

The research proves the absence of scientific debate in the field of Environmental Education and Education for Sustainable Development in the interface with ethnic and racial issues. Of the 473 scientific articles found in the two databases researched, only three articles present some type of connection with this debate.

Regarding the three articles found, we can systematize them as follows: Blaney et al. (2016), present an analysis of the demographics of Environmental Engineering students and faculty in the USA using the American Society for Engineering Education (ASEE) Data Management System. The objectives of the study were to evaluate the growth of environmental engineering and identify changes in the gender demographics of the courses. In addition to assessing ethnicity and race in the diversity of students and professors.

Nxumalo; Ross (2019), present a debate about environmental education for black children in North America. This article argues how the coloniality that underpins dominant understandings of nature is still present in black childhoods in environmental education contexts.

In the same vein, Sene-Harper; Mowatt; Floyd (2022) present an excellent discussion on the future of leisure studies about black cultural policies. For the authors of the article, public policies and opportunities for contact with nature are imbued with a history of centuries disseminated by the colonial regime. In this way, other spaces are forged through cultures of resistance, centered on African practices, which present distinct ways of managing territory.

Sene-Harper; Mowatt; Floyd (2022) defend the coexistence of multiple cultural imaginaries of nature through the realities of racialized people, presenting new paradigms of fun in contact with nature.

Contrary to the subject of ethnic-racial issues, a wide penetration of this debate is perceived in articles that discuss EE and ESD. In the abstracts, the search for the terms "2030 Agenda", "Sustainable Development Goals" or "Sustainable Development" found 15 articles for EE, 211 articles for ESD, and 1 for OER. The title search found 6 articles for EE, 82 for ESD, and none for OER. The keyword search found 15 documents for EE, 110 for ESD, and only 1 for OER.

On the African continent, as expected, Environmental Education presents a varied set of debates, actions, and scientific reflections. For example, Mashaba, Maile; Manaka (2022), sought to understand the level of knowledge and skills in environmental education among primary school students in South Africa,

following the Grades R-12 National Curriculum Statement[3]. The authors concluded the research by pointing out that students receive adequate environmental educational knowledge and are capable of contributing to the maintenance of a clean environment and conservation in their communities.

On the other hand, research carried out at the University of Venda (Univen), located in Thohoyandou, in the province of Limpopo, South Africa, examined students' knowledge of solid waste management, pointing out that students' knowledge is low and inappropriate for this topic (Owojori; Mulaudzi; Edokpayi, 2022).

Still, in South Africa, another study pointed to the problem of invasive exotic species, which generate social, ecological, and economic impacts. The research concluded that people with a lower educational level do not understand the problems related to the invasion of exotic species and their impacts (Jubase; Shackleton; Measey, 2021).

Other topics appeared in the research, such as

I. the Chimpanzee Conservation Project in Sierra Leone, the western border of the Upper Guinea Tropical Forest in West Africa, and proposals for environmental education for children (Chesney et al., 2021);
II. identification of how instruments are used by non-governmental organizations when applied to environmental security and sustainable development in Ethiopia (Zikargae, 2021);
III. Environmental protection problems in Rwanda and the deficiency in the teaching of Environmental Impact Assessment in undergraduate and postgraduate programs in the country (Kabera, 2017) and;
IV. 2030 Agenda and Sustainable Development Goals (Erin; Bamigboye, 2021), among many other topics that deserve a more detailed analysis in future work.

Regarding the debates, based on the articles found, we highlight:
I. Wildlife conservation;
II. Environmental Education in schools, and;
III. Education for Sustainable Development.

---

[3] This reflection can find fertile ground in the International Network of Decolonial Studies in Scientific and Technological Education (RIEDECT), in the Study Group on Environmental Education from the Sur, and many others who understood the need to incorporate the decolonial debate linked to ethnic-racial issues in the field of Environmental Education.

| Wildlife conservation

Breuer et al. (2017) worked with the concept of flag species and used gorillas in the Republic of Congo as a conservation model. To this end, the authors worked with video and theater within the scope of short-term Environmental Education projects. Leeds et al. (2017) also worked with primate conservation in Uganda and researched the use of films as educational components. To this end, films were presented about the conservation of great apes and questionnaires were administered to assess the participants' knowledge.

| Environmental Education in schools and teaching activities

Sousa, Hay and Liebenberg (2019) worked on the production of conceptual maps of systemic thinking about the relationship between soil and climate change with basic education teachers in South Africa. The authors reported difficulties in working with teachers.

El Batri et al. (2022) conducted a study to reveal the impact of teaching methods and instruments on 636 basic education teachers. The research was conducted in Morocco, in urban and rural schools. The data were obtained by applying questionnaires and identified that the most used methods were oral and teacher-centered (dialogue and demonstration) without student-centered activities. By contrast, the least used methods were laboratory experiments. The authors defend the need for continued training for Moroccan teachers, using systemic and interdisciplinary approaches. El Batri et al. (2019, 2020) conducted a research with students from 48 environmental clubs belonging to urban and rural areas in Morocco.

Kanyimba; Richter; Raath (2014, 2015) researched environmental management systems in 60 primary schools in South Africa over two years. The authors recommend the use of outdoor classrooms as a way of supporting educational practices.

Lee et al. (2021) used questionnaires to investigate the perceptions of 71 authors of primary and secondary geography textbooks from seven countries on five continents.

Lucas et al. (2019) researched a multidisciplinary approach from an environmental conservation education approach with students near Kibale National Park.

| Education for Sustainable Development

Feinstein, Jacobi and Lotz-Sisitka (2013) carried out a comparative study in three countries: Brazil, the United States, and South Africa. The authors related Education for Sustainable Development (ESD) to Climate Change Education (CCE).

In this line of research, we can mention researcher Helia Lotz-Sisitka, with work involving policy engagement focused on Education for Sustainable Development (Lotz-Sisitka, 2016; Lotz-Sisitka; Rosenberg; Ramsarup, 2021).

A panoramic analysis of the summaries of the most cited documents revealed that the main themes covered include the history of literature on EE, ESD, and the 2030 Agenda (Aerts, 2019), effects of human action and water resources management (Owa, 2013), the importance of environmental management within the context of hotels and beaches (Lucrezi; Saayman; Merwe, 2015; Mensah; Blankson 2013), conservation of biodiversity through environmental education programs and policies (Aerts, 2013; Rakotomamonjy et al., 2015; Ballouard et al., 2013), management of land use and flood risk (Ogato et al., 2020), encouraging pro-environmental actions (Mtutu; Hondhlana, 2016) and effects of extracurricular environmental education programs on school-aged children (Borchers, 2013).

| Final considerations

In this research, we identified minimal dialogue between the field of Environmental Education and Education for Sustainable Development with ethnic-racial issues on hegemonic scientific bases, which reinforces a gap that needs to be filled.

For the debate on ethno-racial issues, the search found only three articles. Among the articles identified, all reflect the North American point of view. The search found no articles written by Africans about the African continent. From the perspective of local history and the diversity of narratives, what does this data reveal?

Our interest and curiosity stimulate us and make us believe that these narratives exist, although they are not present in the hegemonic scientific bases, still dominated by a labyrinth, with the presence of many paid journals and the impossibility of reading them for ordinary citizens and workers. Are we facing an exclusionary, exclusivist, and colonialist science? So where are these narratives circulating? How can we have access to narratives that are not part of these productions? Perhaps these answers can be offered by our brothers and sisters

on the African continent. Perhaps we can promote scientific listening through the proliferation of voices, of echoes.

South Africa presents a wide variety of debates on EE and can be considered a center of scientific knowledge for this field of knowledge. Nevertheless, a wide variety of approaches, research methods, and intentions were found. Environmental Education is used for many purposes and it is practically impossible to talk about a specific field of study, as it is a proliferation of views.

In future work, we recommend a robust analysis of these approaches, aiming to create categories that can highlight the limitations and potential of research in different contexts on the vast African continent. Apparently, in an analysis that is still superficial, we identified several similarities with the Brazilian context.

There is a diversity of topics, such as water pollution, forest conservation, studies on river basins, management of coastal ecosystems, fauna conservation, early childhood education, and economic activities.

Despite the variety of subjects, we see in many articles the intention of conserving fauna and flora above the interests, conceptions, and imaginations of African people. It is as if Environmental Education were at the service of diffuse interests, functioning as pathways for colonialist practices. That is, Environmental Education appears from top to bottom and with little dialogue. However, this is a reason for further research.

However, what are the ways to encounter scientific productions from other regions of the vast African continent? These are new issues that open up for future work. It is expected that this type of study will be able to identify how these intersections can contribute to Brazilian curricular policies.

RESULTS:
LATIN AMERICA

RESULTS: LATIN AMERICA

In this chapter, we sought to identify the last ten years of scientific production in the fields of Environmental Education, Education for Sustainable Development, and Open Education in Latin America. In total, 922 scientific articles were found in the Scopus database and 1,322 scientific articles in the Web of Science database for the EE descriptors set. The search for the keywords in the ESD set revealed 96 documents in Scopus and 94 in Web of Science. Continuing with the research, OER descriptors sampled 44 documents in the Scopus database and only 34 articles in Web of Science.

Dialogues were found between the debate on Environmental Education and Education for Sustainable Development and ethnic-racial issues in Latin America, based on a list of descriptors (Table 4). The articles, although still in small numbers, are a sign that there is a group of contemporary intellectuals who have noticed the intertwining between the fields. Perhaps, some kind of initiative could strengthen this debate.

Table 4. List of descriptors used for the three languages.

English	Portuguese	Spanish
AFRICAN	AFRICANO	AFRICANO
AFRICAN COSMOPERCEPTION	COSMOPERCEPÇÃO AFRICANA	COSMOPERCEPCIÓN AFRICANA
AFRICAN EPISTEMOLOGY	EPISTEMOLOGIA AFRICANA	EPISTEMOLOGÍA AFRICANA
AFRICAN COSMOVISION	COSMOVISÃO AFRICANA	COSMOVISIÓN AFRICANA
AFRICAN PHILOSOPHY	FILOSOFIA AFRICANA	FILOSOFÍA AFRICANA
AFRO	AFRO	AFRO
ANTI-BLACK	ANTI-NEGRO	ANTI-NEGRO
ANTI-BLACKNESS	ANTI-NEGRITUDE	ANTI-NEGRITUD
BLACK	NEGRO	NEGRO
DECOLONIAL	DECOLONIAL	DECOLONIAL
DECOLONIALITY	DECOLONIALIDADE	DECOLONIALIDAD
COLONIAL	COLONIAL	COLONIAL
DIASPORA	DIÁSPORA	DIÁSPORA
ETHNIC-RACIAL RELATIONS	RELAÇÕES ÉTNICO-RACIAIS	RELACIONES ÉTNICO-RACIALES
NATURE	NATUREZA	NATURALEZA
NEGRITUDE	NEGRITUDE	NEGRITUD
RACE	RAÇA	RAZA
RACE-ETHNICITY	RAÇA-ETNICIDADE	RAZA-ETNICIDAD
RACIAL	RACIAL	RACIAL
RACISM	RACISMO	RACISMO
UBUNTU	UBUNTU	UBUNTU

Source: Created by the authors.

Figure 7 presents the most used words in the summaries of all scientific articles found. The term Environmental Education was removed to broaden the visualization of the main terms.

Figure 7. Word cloud created based on words from the abstracts of all articles.
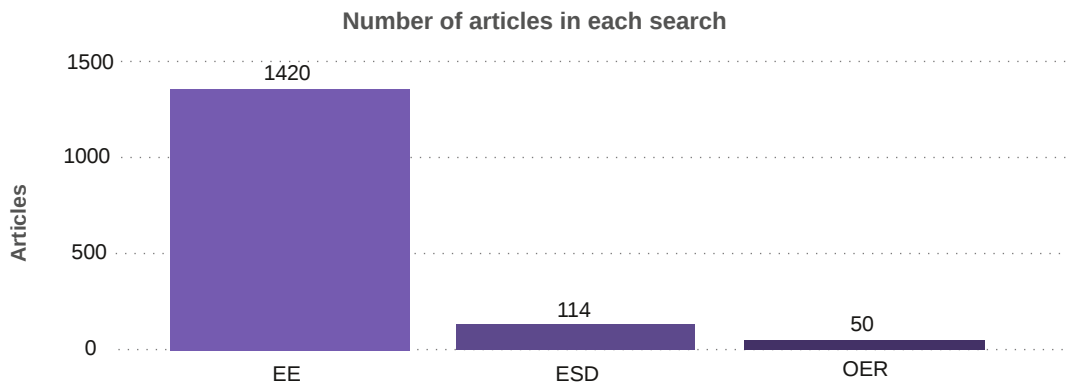

Source: Created by the authors.

| Question: What type of education is present in the articles?

The answer to this question is presented in Figure 8. A greater number of articles in the field of EE can be seen, presenting a total of 1,420 scientific articles. For the ESD field, 114 articles were found and, for the OER field, 50 articles were found.

Figure 8. Number of articles in each search.

Source: Created by the authors with *Bibliometrix.*

In Table 5, we present the list of descriptors used in the search with Environmental Education as its central theme. For each object of the research, we present the results found. The research found 60 articles at the interface between Environmental Education and some relationship with ethnic-racial issues, removing duplicates. The search engine looks for the descriptor in Portuguese and/or English and/or Spanish. Of this total, articles were found for the following terms: African (4), Afro (3), Black (14), Decolonial (12), Colonial (18), Race (22), Racism (2).

At this stage, we also used the word Nature, which generated 228 results.

Table 5. EE search results in relation to descriptors.

Descriptor	Absent	Present
AFRICAN | AFRICANO | AFRICANO	1416	4
AFRICAN COSMOPERCEPTION | COSMOPERCEPÇÃO AFRICANA | COSMOPERCEPCIÓN AFRICANA	1420	0
AFRICAN EPISTEMOLOGY | EPISTEMOLOGIA AFRICANA | EPISTEMOLOGÍA AFRICANA	1420	0
AFRICAN COSMOVISION | COSMOVISÃO AFRICANA | COSMOVISIÓN AFRICANA	1420	0
AFRICAN PHILOSOPHY | FILOSOFIA AFRICANA | FILOSOFÍA AFRICANA	1420	0
AFRO | AFRO | AFRO	1417	3
ANTI-BLACK | ANTI-NEGRO | ANTI-NEGRO	1420	0
ANTI-BLACKNESS | ANTI-NEGRITUDE | ANTI-NEGRITUD	1420	0
BLACK | NEGRO | NEGRO	1406	14
DECOLONIAL | DECOLONIAL | DECOLONIAL	1408	12
DECOLONIALITY | DECOLONIALIDADE | DECOLONIALIDAD	1417	3
COLONIAL | COLONIAL | COLONIAL	1402	18
DIASPORA | DIÁSPORA | DIÁSPORA	1420	0
ETHNIC-RACIAL RELATIONS | RELAÇÕES ÉTNICO-RACIAIS | RELACIONES ÉTNICO-RACIALES	1420	0
NATURE | NATUREZA | NATURALEZA	1192	228
NEGRITUDE | NEGRITUDE | NEGRITUD	1420	0
RACE | RAÇA | RAZA	1398	22
RACE-ETHNICITY | RAÇA-ETNICIDADE | RAZA-ETNICIDAD	1420	0
RACIAL | RACIAL | RACIAL	1420	0
RACISM | RACISMO | RACISMO	1418	2
UBUNTU | UBUNTU | UBUNTU	1420	0

Source: Created by the authors.

In Table 6, the list of descriptors used in the search is presented, with Education for Sustainable Development as the central theme. For each object of the research, we present the results found.

Table 6. ESD search results.

Descriptor	Absent	Present
AFRICAN | AFRICANO | AFRICANO	114	0
AFRICAN COSMOPERCEPTION | COSMOPERCEPÇÃO AFRICANA | COSMOPERCEPCIÓN AFRICANA	114	0
AFRICAN EPISTEMOLOGY | EPISTEMOLOGIA AFRICANA | EPISTEMOLOGÍA AFRICANA	114	0
AFRICAN COSMOVISION | COSMOVISÃO AFRICANA | COSMOVISIÓN AFRICANA	114	0
AFRICAN PHILOSOPHY | FILOSOFIA AFRICANA | FILOSOFÍA AFRICANA	114	0
AFRO | AFRO | AFRO	113	1
ANTI-BLACK | ANTI-NEGRO | ANTI-NEGRO	114	0
ANTI-BLACKNESS | ANTI-NEGRITUDE | ANTI-NEGRITUD	114	0
BLACK | NEGRO | NEGRO	114	0
DECOLONIAL | DECOLONIAL | DECOLONIAL	114	0
DECOLONIALITY | DECOLONIALIDADE | DECOLONIALIDAD	114	0
COLONIAL | COLONIAL | COLONIAL	113	1
DIASPORA | DIÁSPORA | DIÁSPORA	114	0
ETHNIC-RACIAL RELATIONS | RELAÇÕES ÉTNICO-RACIAIS | RELACIONES ÉTNICO-RACIALES	114	0
NATURE | NATUREZA | NATURALEZA	103	11
NEGRITUDE | NEGRITUDE | NEGRITUD	114	0
RACE | RAÇA | RAZA	114	0
RACE-ETHNICITY | RAÇA-ETNICIDADE | RAZA-ETNICIDAD	114	0
RACIAL | RACIAL | RACIAL	114	0
RACISM | RACISMO | RACISMO	114	0
UBUNTU | UBUNTU | UBUNTU	114	0

Source: Created by the authors.

In Table 7, the list of descriptors used in the search is presented, with Open Education as the central theme. For each object of the research, we present the results found.

Table 7. OER search results.

Descriptor	Absent	Present
AFRICAN | AFRICANO | AFRICANO	50	0
AFRICAN COSMOPERCEPTION | COSMOPERCEPÇÃO AFRICANA | COSMOPERCEPCIÓN AFRICANA	50	0
AFRICAN EPISTEMOLOGY | EPISTEMOLOGIA AFRICANA | EPISTEMOLOGÍA AFRICANA	50	0

Descriptor	Absent	Present
AFRICAN COSMOVISION | COSMOVISÃO AFRICANA | COSMOVISIÓN AFRICANA	50	0
AFRICAN PHILOSOPHY | FILOSOFIA AFRICANA | FILOSOFÍA AFRICANA	50	0
AFRO | AFRO | AFRO	50	0
ANTI-BLACK | ANTI-NEGRO | ANTI-NEGRO	50	0
ANTI-BLACKNESS | ANTI-NEGRITUDE | ANTI-NEGRITUD	50	0
BLACK | NEGRO | NEGRO	50	0
DECOLONIAL | DECOLONIAL | DECOLONIAL	50	0
DECOLONIALITY | DECOLONIALIDADE | DECOLONIALIDAD	50	0
COLONIAL | COLONIAL | COLONIAL	50	0
DIASPORA | DIÁSPORA | DIÁSPORA	50	0
ETHNIC-RACIAL RELATIONS | RELAÇÕES ÉTNICO-RACIAIS | RELACIONES ÉTNICO-RACIALES	50	0
NATURE | NATUREZA | NATURALEZA	50	0
NEGRITUDE | NEGRITUDE | NEGRITUD	50	0
RACE | RAÇA | RAZA	50	0
RACE-ETHNICITY | RAÇA-ETNICIDADE | RAZA-ETNICIDAD	50	0
RACIAL | RACIAL | RACIAL	50	0
RACISM | RACISMO | RACISMO	49	1
UBUNTU | UBUNTU | UBUNTU	50	0

Source: Created by the authors.

| Question: What are the intersections between the EE field and ethnic-racial issues?

To verify the presence or absence of ethnic-racial issues (Tables 5, 6, and 7), a search was carried out in the abstract, title, and keywords of the sampled articles.

| Question: Is there a relationship between the scientific literature about EE/ESD and Open Educational Resources?

The approach used to reveal guidance on this issue consisted of an analysis of the summaries of the documents present in the OER object. We scan the summaries looking for descriptors for this object. We use the terms "Environmental Education", "Sustainability", "Natural Resources" and "Education for Sustainable Development". The search engines found no occurrences of the debate on Environmental Education and Education for Sustainable Development within the abstracts.

| Question: Is the debate on the 2030 Agenda present?

We searched for their presence in the title, summary, and keyword fields of the three sample objects individually. The search results and descriptors used are displayed in Tables 8, 9, and 10.

Table 8. Research for EE (n = 1,420).

Descriptor	Absent	Present
2030 AGENDA | AGENDA 2030 | AGENDA 2030	1416	4
SUSTAINABLE DEVELOPMENT GOALS | OBJETIVOS DO DESENVOLVIMENTO SUSTENTÁVEL | OBJETIVOS DE DESARROLLO SOSTENIBLE	1402	18
SUSTABINABLE DEVELOPMENT | DESENVOLVIMENTO SUSTENTÁVEL | DESARROLLO SOSTENIBLE	1414	6
SUSTENTABILITY | SUSTENTABILIDADE | SOSTENIBILIDAD	1410	10

Source: Created by the authors.

Table 9. Search in ESD object (n = 114).

Descriptor	Absent	Present
2030 AGENDA | AGENDA 2030 | AGENDA 2030	105	9
SUSTAINABLE DEVELOPMENT GOALS | OBJETIVOS DO DESENVOLVIMENTO SUSTENTÁVEL | OBJETIVOS DE DESARROLLO SOSTENIBLE	88	26
SUSTABINABLE DEVELOPMENT | DESENVOLVIMENTO SUSTENTÁVEL | DESARROLLO SOSTENIBLE	106	8
SUSTENTABILITY | SUSTENTABILIDADE | SOSTENIBILIDAD	111	3

Source: Created by the authors.

Table 10. Search in OER object (n = 50)

| Descriptor	Absent	Present
2030 AGENDA | AGENDA 2030 | AGENDA 2030	50	0
SUSTAINABLE DEVELOPMENT GOALS | OBJETIVOS DO DESENVOLVIMENTO SUSTENTÁVEL | OBJETIVOS DE DESARROLLO SOSTENIBLE	50	0
SUSTABINABLE DEVELOPMENT | DESENVOLVIMENTO SUSTENTÁVEL | DESARROLLO SOSTENIBLE	50	0
SUSTENTABILITY | SUSTENTABILIDADE | SOSTENIBILIDAD	50	0

Source: Created by the authors.

In the search for debate promoted based on the 2030 Agenda. Adding the documents and after removing the duplicates, we found a subsampling volume of 38 articles.

| Question: What is the annual production defined by the intersections established in the research?

Figure 9 presents the evolution of the annual production of articles related to the EE object between January 2012 and December 2022. We saw relatively constant production from 2012 to 2017, and after that year, production exceeded 100% when compared to the previous period. Furthermore, we highlight that the trend of the last two years, 2021 and 2022 is downward.

Figure 9. Annual scientific production of the EE object.

Annual scientific production
Environmental Education
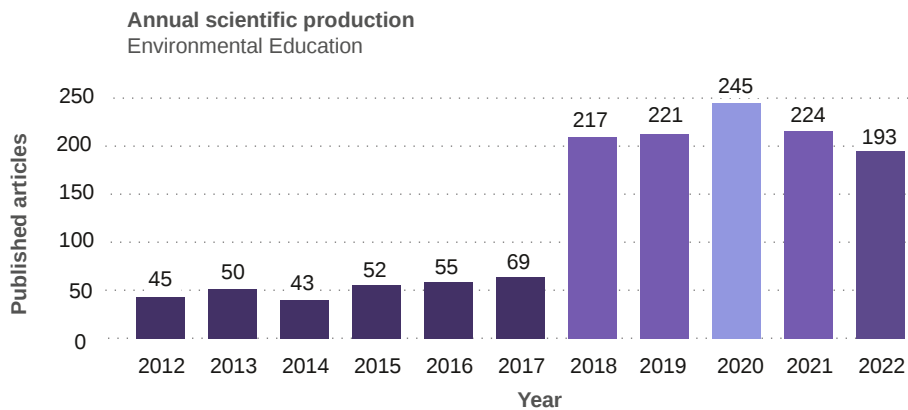
Source: Created by the authors.

In Figure 10, as well as in the previous one, we present the number of articles sampled per year from 2012 to 2022 for the ESD object. In the general picture, we see a growth trend, despite some drops compared to the previous year in 2016 and 2021.

Figure 10. Annual scientific production for ESD.

Annual scientific production
Education for Sustainable Development
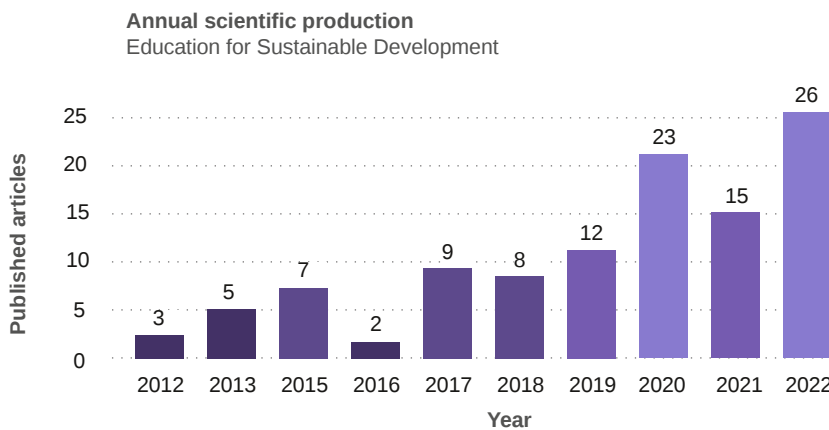
Source: Created by the authors.

Regarding the history of the OER object, we noticed a general growth trend, as well as the ESD object. Figure 11 illustrates the scenario and provides an understanding of the situation.

Figure 11. Annual scientific production of the OER object.

Annual scientific production
Open Education
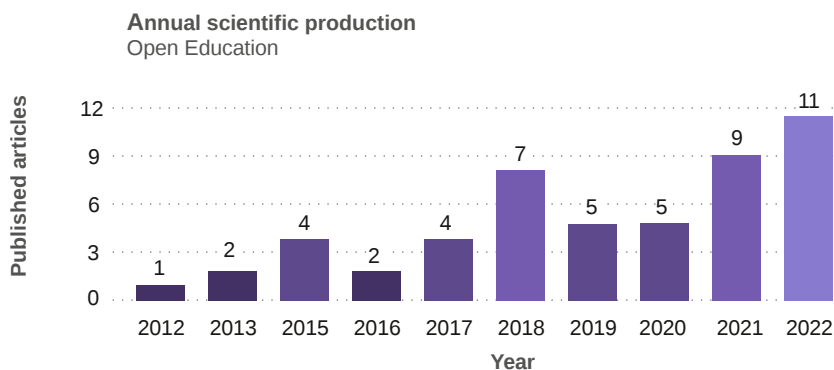
Source: Created by the authors.

| Question: Who are the standout authors of the last ten years?

To answer question 7, we extract the names of the articles' authors from our object and perform a count. However, the nature of Latin American names did not permit perfect screening. *Bibliometrix* tools consider authors' surnames as unique, so several authors with the word "of" in their surname are neglected by this method.

Figure 12 reports the authors with the highest volume of publications on the EE object, between the years 2012 and 2022, indexed in the *Scopus (Elsevier)* and *Web of Science (Clarivate)* databases.
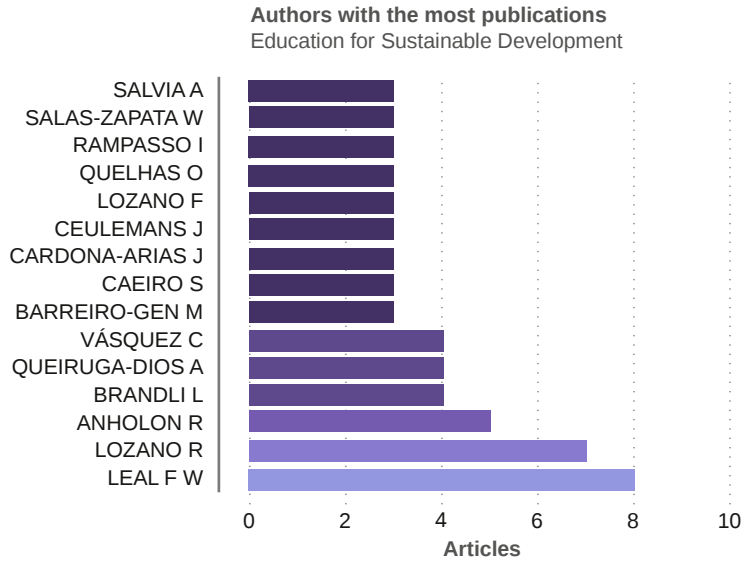
Figure 12. Annual scientific production of the EE object.

Authors with the most publications
Environmental Education

Source: Created by the authors.

Figure 13 illustrates the authors with the most publications on the ESD object, taking into account the study period and articles sampled in the selected databases.
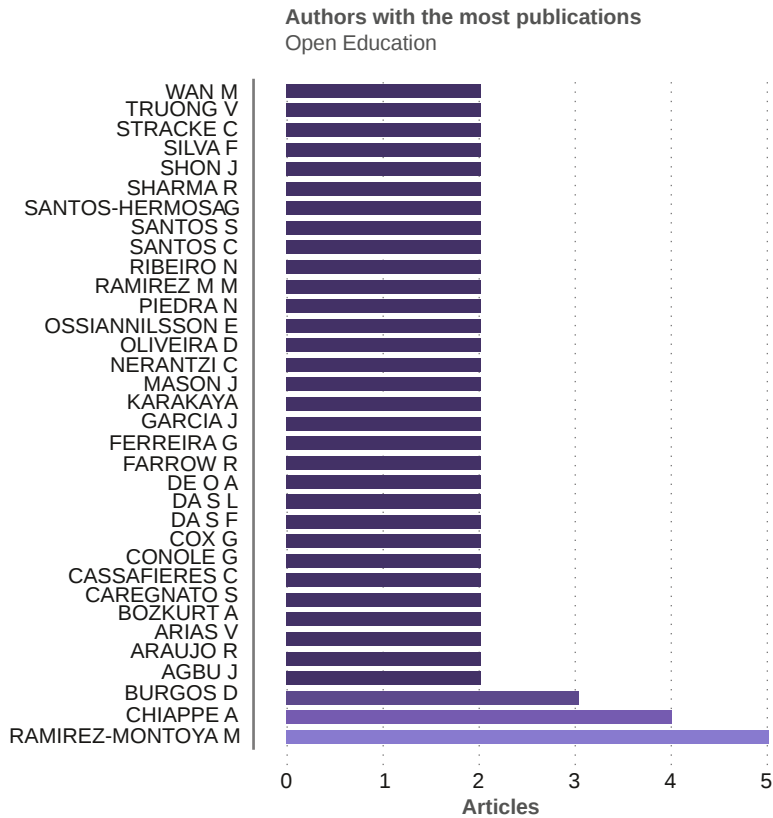
Figure 13. Annual scientific production of the ESD object.

Authors with the most publications
Education for Sustainable Development

Source: Created by the authors.

Regarding the OER object, we point out the main authors of the sample in Figure 14.

Figure 14. Annual scientific production of the OER object.

Authors with the most publications
Open Education

Source: Created by the authors.

In Figures 15, 16, and 17 it is possible to monitor the authors' production over the years. This type of information can help in understanding the evolution of thinking on a given subject, indicating paths for reading and preparing syntheses.

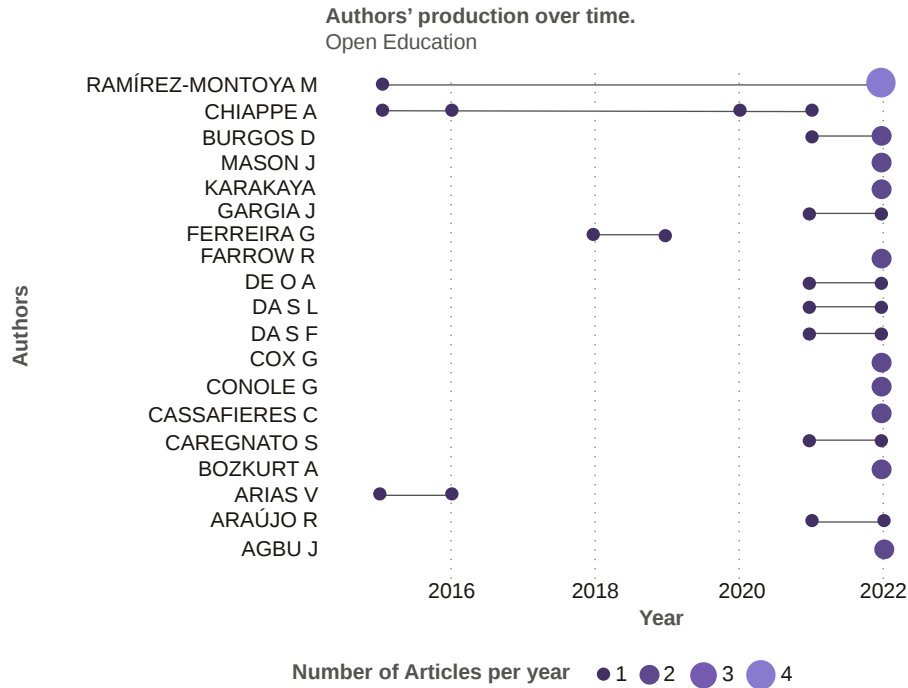**Figure 15.** Authors' production over time.
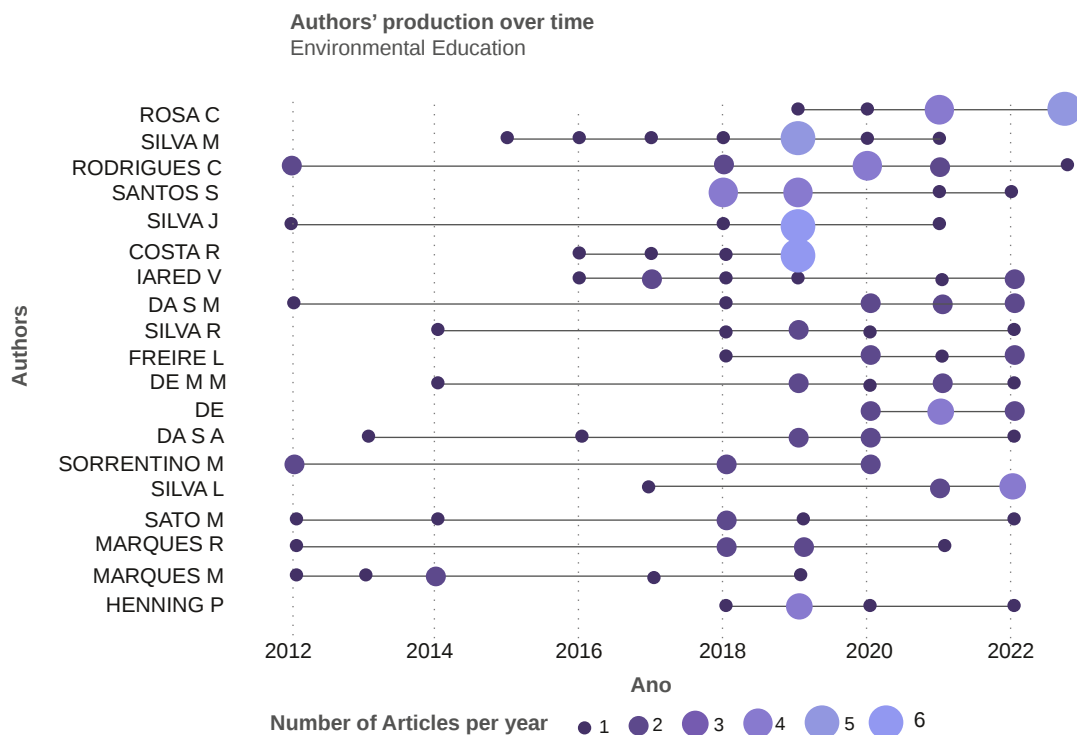
Source: Created by the authors with *Bibliometrix* and ggplot2.

Figure 16. Authors' production over time.
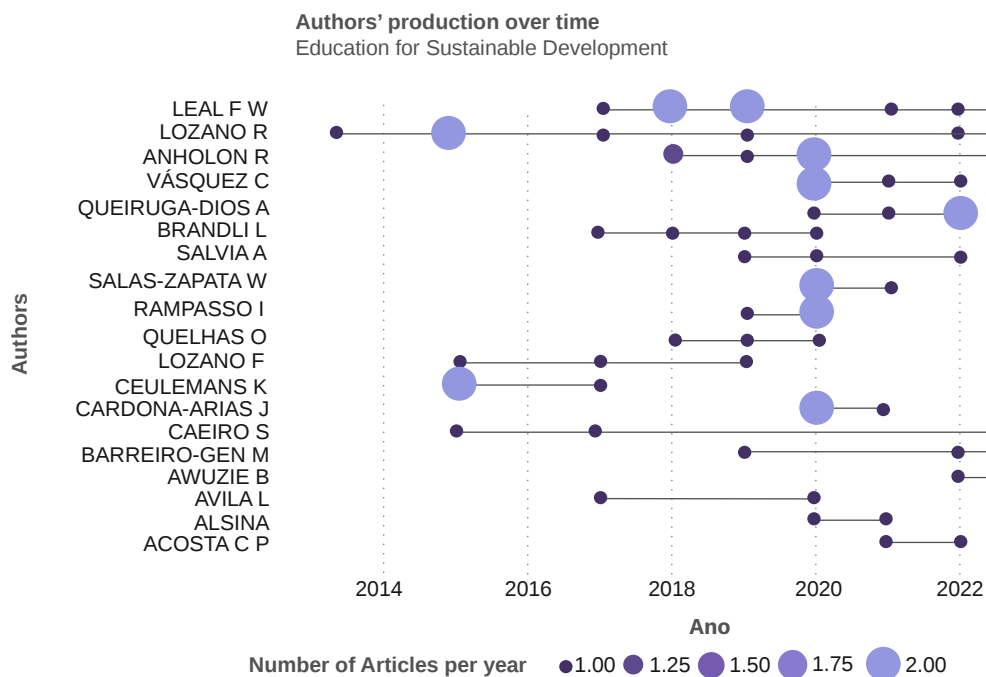
Source: Created by the authors with *Bibliometrix* and ggplot2.

Figure 17. Authors' production over time.

Source: Created by the authors with *Bibliometrix* and ggplot2.

| Question: Who are the most frequently cited authors in scientific articles?

The most cited documents within our sample are presented in Tables 11, 12 and 13, corresponding to the EE, ESD and OER objects.

Table 11. Most cited articles in the EE object.

ENVIRONMENTAL EDUCATION

Paper	DOI	Times Cited	Times Cited Per Year
TAPIA-FONLLEM C, 2013, SUSTAINABILITY	10.3390/su5020711	123	11,18181818
PINTO RS, 2018, WASTE MANAGE	10.1016/j.wasman.2018.02.044	84	14
EASTMAN LB, 2013, OCEAN COAST MANAGE	10.1016/j.ocecoaman.2013.02.014	77	7
MOECKE EHS, 2016, J CLEAN PROD	10.1016/j.jclepro.2016.05.167	65	8,125
DE ANDRADE GUERRA JBSO, 2018, J CLEAN PROD	10.1016/j.jclepro.2016.11.179	59	9,833333333
TRIBESS B, 2015, J ETHNOPHARMACOL	10.1016/j.jep.2015.02.005	57	6,333333333
SJÖSTRÖM J, 2017, STUD SCI EDUC	10.1080/03057267.2017.1384649	52	7,428571429
SMITH RF, 2016, FRESHW SCI	10.1086/685096	52	6,5
SALEEM M, 2020, SUSTAINABILITY	10.3390/su12083314	51	12,75
GARCÍA-CEGARRA AM, 2017, AQUATIC CONSERV MAR FRESHW ECOSYST	10.1002/aqc.2754	49	7

Source: Created by the authors.

Table 12. Most cited articles in the ESD object.

EDUCATION FOR SUSTAINABLE DEVELOPMENT

Paper	DOI	Times Cited	Times Cited Per Year
LOZANO R, 2013, J CLEAN PROD	10.1016/j.jclepro.2011.10.006	520	47.27
LOZANO R, 2015, J CLEAN PROD	10.1016/j.jclepro.2014.09.048	450	50.00
LOZANO R, 2017, SUSTAINABILITY	10.3390/su9101889	282	40.29
LEAL FILHO W, 2018, J CLEAN PROD	10.1016/j.jclepro.2018.07.017	209	34.83
RAMOS TB, 2015, J CLEAN PROD	10.1016/j.jclepro.2015.05.110	154	17.11
HENS L, 2018, J CLEAN PROD	10.1016/j.jclepro.2017.11.082	151	25.17
LEAL FILHO W, 2017, J INTEGR ENVIRON SCI	10.1080/1943815X.2017.1362007	12121	17.29
LOZANO R, 2019, SUSTAINABILITY	10.3390/su11061602	101	20.20
BURFORD G, 2013, SUSTAINABILITY	10.3390/su5073035	98	8.91
LEAL FILHO W, 2018, INT J SUSTAINABLE DEV WORLD ECOL	10.1080/13504509.2018.1461707	60	10.00

Source: Created by the authors.

Table 13. Most cited articles in the OER object.

OPEN EDUCATION

Paper	DOI	Times Cited	Times Cited Per Year
TOVAR E, 2014, IEEE TRANS EDUC	10.1109/TE.2014.2359257	35	3.50
HERNÁNDEZ-CARRANZA EE, 2015, COMUNICAR	10.3916/C44-2015-09	27	3.00
GARCÍA ESPINOSA BJ, 2015, RUSC UNIV KNOWL SOC J	10.7238/rusc.v12i1.2185	25	2.78
MARTINEZ NAVARRO A, 2018, INT J INTERACT MULTIMED ARTIF INTELL	10.9781/ijimai.2018.02.003	24	4.00
CHICAIZA J, 2014, COMMUN COMPUT INFO SCI	10.1007/978-3-319-11716-4_2	20	2.00
STRACKE CM, 2022, SUSTAINABILITY	10.3390/su14031876	14	7.00
AMAYA-GÓMEZ R, 2019, EDUC CHEM ENG	10.1016/j.ece.2019.02.001	13	2.60
CHIAPPE A, 2016, INT REV RES OPEN DISTANCE LEARN	10.19173/irrodl.v17i6.2846	12	1.50
MERCADO-VARELA MA, 2017, TURK ONLINE J DISTANCE EDUC	10.17718/tojde.285812	11	1.57
SANCHEZ-GORDON S, 2018, J EDUC COMPUT RES	10.1177/0735633117727597	11	1.83

Source: Created by the authors.

To present an overview of the topics discussed, we read the abstracts of the 15 most cited articles on the EE object. From these articles, we excluded those that did not have a theme related to the field of Environmental Education.

Reading the abstracts of these documents revealed the main themes addressed by the set of articles. The most frequently cited scientific text, Tapia-Fonllem et al.

(2013) investigates sustainable behavior actions through reports from university students and their correlations with emotional and rational factors. The production of Pinto et al. (2018), reports on an awareness campaign in a university canteen aiming to reduce food waste and encourage sustainable actions. Eastman et al. (2013) carried out a study of the demographic profile and related it to the educational level of beach users in Chile. The research concluded that Environmental Education is a way to be considered for reducing pollution on beaches. The work of Moecke et al. (2016) explores the production of biodiesel with cooking oil to supply artisanal fishing boats in Brazil. The paper presented the environmental, social, and economic impacts of adopting this initiative. Guerra et al. (2018) propose a guide to implement Environmental Education actions at universities. Tribess (2015), presents a study of the ethnobotany of plants used in rural communities in the Atlantic Forest region.

Sjöström et al. (2017) explore a German concept called Bildung in education, including its interfaces with environmental education and sustainability education. Smith (2016) talks about the renovation of urban streams, proposing a framework that integrates environmental education, ecology, and societal actions, also highlighting the importance of public involvement and multidisciplinary collaboration. Saleem (2018) investigates how leadership positioning in the workplace influences employees' ecological positioning.

## | Questions: What is the scientific production per country?

Figures 18 and 19 illustrate the scientific production by countries in each sample object. In all objects, Brazil is highlighted as a country with the largest scientific production. Countries like Colombia, Mexico, Chile, and Ecuador also stand out with significant production.

Figure 18. Scientific Production per country for EE (2012-2022).
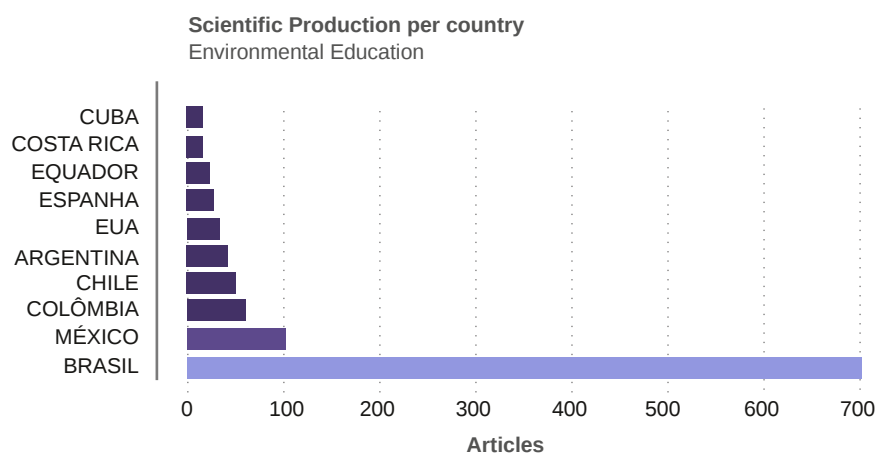
Source: Created by the authors.

Figure 19. Scientific Production per country for ESD (2012-2022).

Scientific Production per country
Education for Sustainable Development
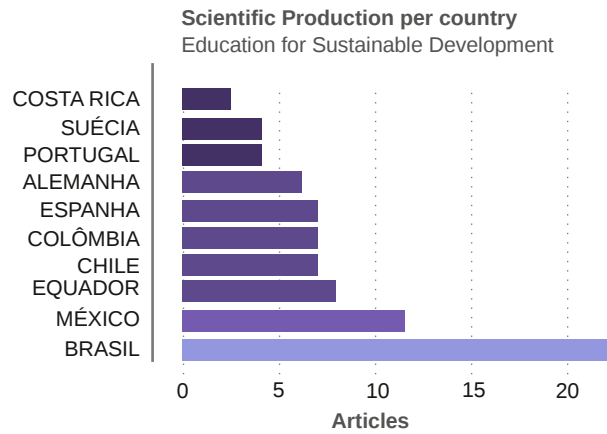
Source: Created by the authors.

## | Question: What are the most productive journals?

In Figures 20, 21, and 22, the most relevant journals for the EE, ESD, and OER objects are highlighted. To obtain the results, we carried out a count of the production of each journal.
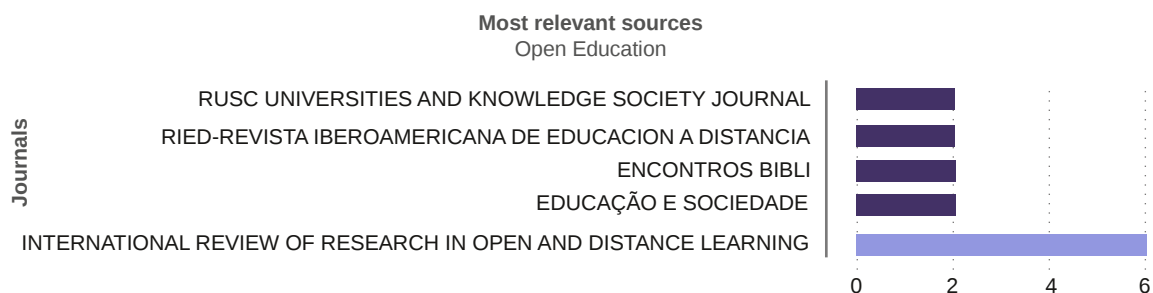
Figure 20. Most relevant sources for EE.

Most relevant sources
Environmental Education
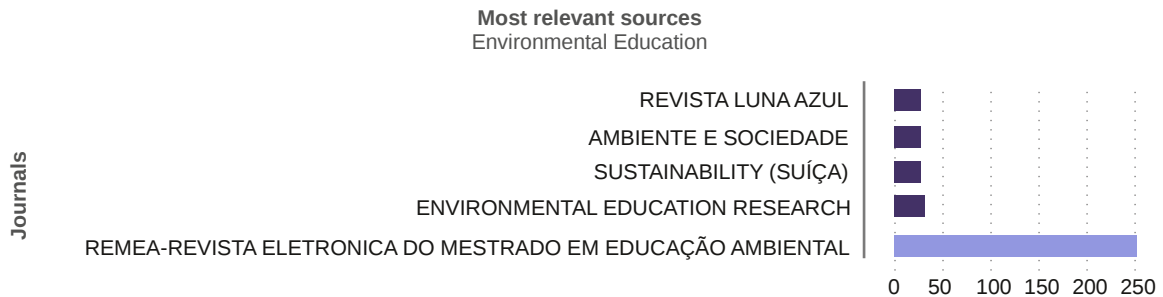
Source: Created by the authors.

Figure 21. Most relevant sources for ESD.

Most relevant sources
Education for Sustainable Development
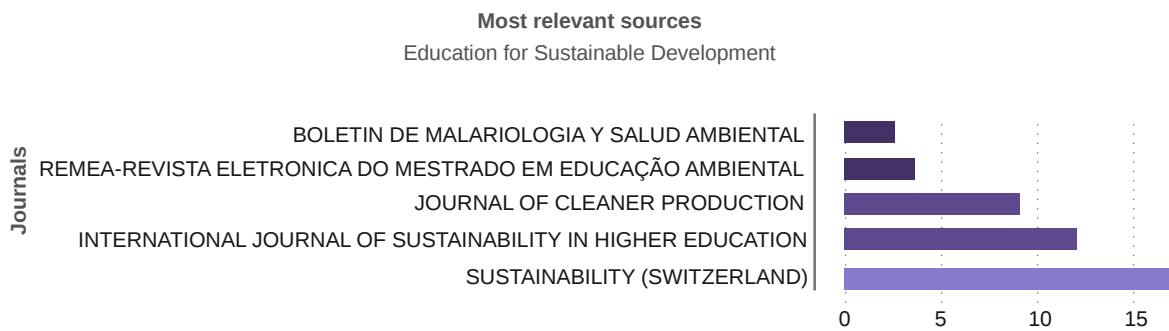
Source: Created by the authors.

Figure 22. Most relevant sources for OER.

Most relevant sources
Open Education

Source: Created by the authors.

| Final considerations

The analyzes established, based on three distinct searches for scientific articles, indicate the need for research in the field of Environmental Education related to ethnic, racial issues and the Sustainable Development Goals/Agenda 2030, in the African and Latin American context. The investigative path allows researchers to (re)make journeys or find new findings based on the articles already identified in this report.

It is recommended that Brazilian scientific research be brought closer to the topics covered in Africa, as there are many points of convergence and few dialogues between the works.

We also recommend the creation of a dossier or an ebook on the subject to be disseminated in an invitation format to African or Afro-diasporic researchers, aiming to further expand the network of scientists in the field of Environmental Education.

The main limiting factor for this research was time. More time is needed so that the articles can be processed, read, analyzed, and receive more in-depth treatment. However, we believe that this study can provide the basis for new intellectual investments aimed at expanding research. Therefore, as mentioned, we have not exhausted the subject, on the contrary, this movement needs to be strengthened in research groups aimed at creating new alliances, in a logic of cooperation and intense exchanges.

In future studies, it is recommended that we delve deeper into the authors' main scientific questions, expanding the location of countries, universities, and educational institutions involved with themes in the fields of EE, ESD, and OER. In this way, we can better understand how, why, by whom, when, in favor of whom, and against whom, they study, research, and struggle!

REFERENCES

■ REFERENCES

Aikens, K., M. Mckenzie, and P. Vaughter. 2016. Environmental and sustainability education policy research: a systematic review of methodological and thematic trends, Environmental Education Research, 22 (3): 333-359. 10.1080/13504622.2015.1135418

Aria, M., and C. Cuccurullo. 2017. bibliometrix: An R-tool for comprehensive science mapping analysis. Journal of informetrics, 11 (4): 959-975. https://doi.org/10.1016/j.joi.2017.08.007

Ballouard, J.-M., Ajtic, R., Balint, H., Brito, J. C., Crnobrnja-Isailovic, J., Desmonts, D., ElMouden, E. H., Erdogan, M., Feriche, M., Pleguezuelos, J. M., Prokop, P., Sánchez, A., Santos, X., Slimani, T., Tomovic, L., Uşak, M., Zuffi, M., & Bonnet, X. 2013. Schoolchildren and one of the most unpopular animals: Are they ready to protect snakes? Anthrozoös, 26 (1): 93–109. https://doi.org/10.2752/175303713X13534238631560

Blaney,KI L., R. Kandiah, J. J. Ducoste, J. A. Perlinger, and S. L. Bartelt-Hunt. 2016. Trends in Population and Demographics of U.S. Environmental Engineering Students and Faculty from 2005 to 2013. Environmental Engineering Science, 33(8), 578-590. https://doi.org/10.1089/ees.2016.0063

Botelho, L. L. R.; C. C. de A. Cunha, and M. Macedo. 2011. O método da revisão integrativa nos estudos organizacionais. Gestão e Sociedade. Belo Horizonte, v. 5, n. 11: 121-136. https://doi.org/10.21171/ges.v5i11.1220

Breuer, T., F. B. Mavinga, R. Evans, and K. E. Lukas. 2017. Using video and theater to increase knowledge and change attitudes—Why are gorillas important to the world and to Congo?. American Journal of Primatology, 79 (10), e22692. https://api.semanticscholar.org/CorpusID:3873571

Castellanos, A. P. M., and A. Queiruga-Dios. 2022. From environmental education to education for sustainable development in higher education: a systematic review", International Journal of Sustainability in Higher Education, 23 (3): 622-644. https://doi.org/10.1108/IJSHE-04-2021-0167

Chesney, C., N. Casado Bolaños, B. A. Kanneh, E. Sillah, B. Amarasekaran, and R. M Garriga. 2021. Mobonda Community Conservation Project: Chimpanzees, oysters, and community engagement in Sierra Leone. Am J Primatol. 83. https://doi.org/10.1002/ajp.23219

Coelho, Y. C. de M., E. M. de Oliveira, and A. C. P. C. de Almeida. 2021. Discussões e tendências das teses e dissertações sobre formação de professores de ciências em espaços não formais: uma revisão bibliográfica sistemática. Ensaio Pesquisa em Educação em Ciências, Belo Horizonte, 23. https://doi.org/10.1590/1983-21172021230103.

Guerra, J. B. S. O. de A., J. Garcia, M. L. de Andrade, S. B. Barbosa, M. L. Heerdt, and I. I. Berchin. 2018. A proposal of a Balanced Scorecard for an environmental education program at universities. Journal of Cleaner Production, 172: 1674-1690. https://doi.org/10.1016/j.jclepro.2016.11.179

Eastman, L. B., P. Núñez, B. Crettier, and M. Thiel. 2013. Identification of self-reported user behavior, education level, and preferences to reduce littering on beaches–A survey from the SE Pacific. Ocean & Coastal Management, 78, 18-24. https://doi.org/10.1016/j.ocecoaman.2013.02.014

El-Batri, B., A. Alami, M. Zaki, and Y. Nafidi. 2019. Extracurricular environmental activities in Moroccan middle schools: Opportunities and challenges to promoting effective environmental education. European Journal of Educational Research, 8 (4): 1013-1028. doi: 10.12973/eu-jer.8.4.1013

El-Batri, B., A. Alami, M. Zaki, and Y. Nafidi. 2020. Environmental education in Moroccan primary schools: Promotion of representations, knowledge, and environmental activities. Ilkogretim Online, 19 (1). https://doi.org/10.17051/ilkonline.2020.653790

El-Batri, B., L. Maskour, J. Ksiksou, E. Jeronen, J. Ismaili, A. Alami, and M. Lachkar. 2022. Teaching Environmental Themes within the "Scientific Awakening" Course in Moroccan Primary School: Approaches, Methods and Difficulties. Education Sciences, 12 (11): 837. https://doi.org/10.3390/educsci12110837

Erin, Olayinka Adedayo; Bamigboye, Omololu Adex. 2021. Evaluation and analysis of SDG reporting: evidence from Africa. Journal of Accounting & Organizational Change. 10.1108/jaoc-02-2020-0025

Feinstein, N. W., P. R. Jacobi, and H. Lotz-Sisitka. 2013. When does a nation-level analysis make sense? ESD and educational governance in Brazil, South Africa, and the USA. Environmental Education Research, 19 (2): 218-230. https://doi.org/10.1080/13504622.2013.767321

Ferdinand, M. 2022. Uma ecologia decolonial: pensar a partir do mundo caribenho. Tradução Letícia Mei. São Paulo: Ubu Editora.

Jubase, N.; R. T. Shackleton, and J. Measey. 2021. Public Awareness and Perceptions of Invasive Alien Species in Small Towns. Biology 10 (12). https://doi.org/10.3390/biology10121322.

Kabera, T. 2017. Environmental impact assessment in higher education institutions in East Africa: the case of Rwanda. Environ Sci Pollut Res 24. https://doi.org/10.1007/s11356-017-8525-4

Kanyimba, A. T.; B. W. Richter, and S. P. Raath. 2014. The effectiveness of an environmental management system in selected South African primary schools. Journal of Cleaner Production, 66: 479-488. https://doi.org/10.1016/j.jclepro.2013.10.052

Kanyimba, A., B. Richter, and S. Raath. 2015. The integration of pedagogical aspects in environmental management systems in selected South African primary schools. Africa Education Review, 12 (2): 232-252. https://doi.org/10.1080/18146627.2015.1107999

Lee, J., S. Catling, G. Kidman, R. Bednarz, U. Krause, A. A. Martija, K. Ohnishi, D. Wilmot, and S. Zecha. 2021. A multinational study of authors' perceptions of and practical approaches to writing geography textbooks. International Research in Geographical and Environmental Education, 30 (1): 54-74. https://doi.org/10.1080/10382046.2020.1743931

Lee, T., E. Markowitz, P. D. Howe, Ko, C-Y, and A. A. Leiserowitz. 2015. Predictors of public climate change awareness and risk perception around the world. Nature Climate Change 5: 1014–1020. https://doi.org/10.1038/nclimate2728

Leeds, A., K. E. Lukas, C. J. Kendall, M. A. Slavin, E. A. Ross, M. M. Robbins, and R. A. Bergl. 2017. Evaluating the effect of a year-long film focused environmental education program on Ugandan student knowledge of and attitudes toward great apes. American Journal of Primatology, 79 (8). https://doi.org/10.1002/ajp.22673

Leite, T. S. A., J. L. Martins, N. B. de Assunção, A. A. de. Almeida, F. D. Silva, J. M. de A, Costa, and S. A. dos Santos. 2019. Enfermagem na promoção da sustentabilidade ambiental: uma revisão integrativa. Revista Observatório, 5 (6): 567-612. https://doi.org/10.20873/uft.2447-4266.2019v5n6p597

Lopes, L. P., M. A. T. Campos, V. Nogueira. 2021. Educação Ambiental em contextos de Bacias Hidrográficas: uma revisão integrativa das pesquisas nacionais e internacionais no período de 1996 a 2020. REMEA - Revista Eletrônica do Mestrado em Educação Ambiental, 38, 1: 336–361. https://doi.org/10.14295/remea.v38i1.12379

Lotz-Sisitka, H. 2016. Reviewing strategies in/for ESD policy engagement: Agency reclaimed. The Journal of Environmental Education, 47(2), 91-103. https://doi.org/10.1080/00958964.2015.1113915

Lotz-Sisitka, H., E. Rosenberg, and P. Ramsarup. 2021. Environment and sustainability education research as policy engagement: (re-) invigorating 'politics as potentia' in South Africa. Environmental Education Research, 27, 525 - 553. https://doi.org/10.1080/13504622.2020.1759511

Lucrezi, S., Saayman, M., and Van der Merwe, P. 2015. Managing beaches and beachgoers: Lessons from and for the Blue Flag award. Tourism Management, 48: 211-230. https://doi.org/10.1016/j.tourman.2014.11.010

Lukas, K., Leeds, A., Slavin, M., Tinka, J., & Kendall, C. (2019). Impact of teacher training in conservation education on student learning in primary schools adjacent to Kibale National Park, Uganda. Oryx, 53(3), 497-504. doi:10.1017/S0030605317000965

Machado, A. de B., & Santos, J. V. A. dos. 2020. Revisão integrativa: intersectando concepções de educação ambiental com referencial teórico marxiano. Educação, 45 (1): 1–26. https://doi.org/10.5902/1984644436961

Mashaba, Ernest Khalabai; Maile, Simeon; Manaka, Malose Jack. 2022. "Learners' Knowledge of Environmental Education in Selected Primary Schools of the Tshwane North District, Gauteng Province" International Journal of Environmental Research and Public Health 19 (23). https://doi.org/10.3390/ijerph192315552

Mensah, I., and E. J. Blankson. 2013. Determinants of hotels' environmental performance: Evidence from the hotel industry in Accra, Ghana. Journal of sustainable tourism, 21(8):1212-1231.
https://doi.org/10.1080/09669582.2013.776058

Moecke, E. H. S., Feller, R., dos Santos, H. A., de Medeiros Machado, M., Cubas, A. L. V., de Aguiar Dutra, A. R.; Soares, S. R. 2016. Biodiesel production from waste cooking oil for use as fuel in artisanal fishing boats: Integrating environmental, economic and social aspects. Journal of Cleaner Production, 135: 679-688. https://doi.org/10.1016/j.jclepro.2016.05.167

Mtutu, P., and G. Thondhlana. 2016. Encouraging pro-environmental behaviour: Energy use and recycling at Rhodes University, South Africa. Habitat International, 53, 142-150. https://doi.org/10.1016/j.habitatint.2015.11.031

Nxumalo, F., and K. M. Ross, K. M. Ross. 2019. Envisioning Black space in environmental education for young children, Race Ethnicity and Education, 22(4), 502-524. https://doi.org/10.1080/13613324.2019.1592837

Ogato, G. S., A. Bantider, K. Abebe, and D. Geneletti. 2020. Geographic information system (GIS)-Based multicriteria analysis of flooding hazard and risk

in Ambo Town and its watershed, West shoa zone, oromia regional State, Ethiopia. Journal of Hydrology: Regional Studies, 27, 100659. https://doi.org/10.1016/j.ejrh.2019.100659

Owojori, O. M., Mulaudzi, R., & Edokpayi, J. N. 2022. Student's knowledge, attitude, and perception (KAP) to solid waste management: A survey towards a more circular economy from a rural-based tertiary institution in South Africa. Sustainability, 14 (3): 1310. https://doi.org/10.3390/su14031310

Pinto, R. S., dos Santos Pinto, R. M., Melo, F. F. S., Campos, S. S., and Cordovil, C. M. D. S. 2018. A simple awareness campaign to promote food waste reduction in a University canteen. Waste management, 76: 28-38. https://doi.org/10.1016/j.wasman.2018.02.044

Qiu, X. 2024. Data Science and Predictive Analytics: Biomedical and Health Applications using R, 2nd ed., Journal of the American Statistical Association. https://doi.org/10.1080/01621459.2024.2303323

R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Rakotomamonjy, S.N., Jones, J.P., Razafimanahaka, J.H., Ramamonjisoa, B.S., & Williams, S. 2015. The effects of environmental education on children's and parents' knowledge and attitudes towards lemurs in rural Madagascar. Animal Conservation, 18. https://doi.org/10.1111/acv.12153

Ramos, Y. F., Xavier, F. C., & Minello, M. 2020. O som como ferramenta de estudo ambiental: Análise bibliométrica sobre estudos em paisagem acústica. Boletin do Observatório Ambiental Alberto Ribeiro Lamego, 13, 317-336. https://doi.org/10.19180/2177-4560.v13n22019p317-336

Saleem, M., Qadeer, F., Mahmood, F., Ariza-Montes, A., & Han, H. 2020. Ethical leadership and employee green behavior: A multilevel moderated mediation analysis. Sustainability, 12(8): 3314. https://doi.org/10.3390/su12083314

Santos, R. S. S. 2017. Diálogos: Educação Ambiental e Educação Antirracista no Contexto da Formação Docente. Revista Eixo, 6(8), 8-15.

Santos, R. S. S. 2019. Caminhos formativos para inserção da educação ambiental no currículo de formação de professores. Revista Observatório, 5, 134-157. http://dx.doi.org/10.20873/uft.2447-4266.2019v5n1p134

Sene-Harper, A., Mowatt, R. A., & Floyd, M. F. 2022. A people's future of leisure studies: Political cultural black outdoors experiences. Journal of Park and

Recreation Administration, 40(1), Special Issue–Sustainability and Outdoor Recreation Management on Public Lands: New Directions. https://js.sagamorepub.com/jpra/article/view/11006

Sjöström, J., Frerichs, N., Zuin, V. G., & Eilks, I. 2017. Use of the concept of Bildung in the international science education literature, its potential, and implications for teaching and learning. Studies in Science Education, 53(2), 165-192. https://doi.org/10.1080/03057267.2017.1384649

Smith, R. F., Hawley, R. J., Neale, M. W., Vietz, G. J., Diaz-Pascacio, E., Herrmann, J., Lovell, A. C., Prescott, C., Rios-Touma, B., Smith, B., & Utz, R. M. (2016). Urban stream renovation: Incorporating societal objectives to achieve ecological improvements. Freshwater Science, 35 (1): 364-379. https://doi.org/10.1086/685096

Souza, L. O., E. A. Hay, and D. Liebenberg. 2019. Teachers' understanding of the interconnectedness of soil and climate change when developing a systems thinking concept map for teaching and learning, International Research in Geographical and Environmental Education, 28: 4, 324-342. https://doi.org/10.1080/10382046.2019.1657684

Tapia-Fonllem, C., Corral-Verdugo, V., Fraijo-Sing, B., & Durón-Ramos, M. F. 2013. Assessing sustainable behavior and its correlates: A measure of pro-ecological, frugal, altruistic and equitable actions. Sustainability, 5(2), 711-723. https://doi.org/10.3390/su5020711

Tribess, B., Pintarelli, G. M., Bini, L. A., Camargo, A., Funez, L. A., de Gasper, A. L., & Zeni, A. L. B. 2015. Ethnobotanical study of plants used for therapeutic purposes in the Atlantic Forest region, Southern Brazil. Journal of Ethnopharmacology, 164, 136-146. https://doi.org/10.1016/j.jep.2015.02.005

Zikargae, M. H. (2021). Assessment of Applying Global Instruments in Nongovernmental Organizations for Environmental Security and Sustainable Development in Developing Countries. Education Research International, 2021. https://doi.org/10.1155/2021/9135290

METHODOLOGICAL STAGES

■ METHODOLOGICAL STAGES

The review was performed based on a sequence of six stages consisting of i) Identification of the topic and selection of the research question; ii) Establishment of inclusion and exclusion criteria; iii) Identification of pre-selected and selected studies; iv) Categorization of selected studies; v) Analysis and interpretation of results and vi) Presentation of the review and synthesis of knowledge (Botelho; Cunha; Macedo, 2011).

The stages are described below:

| 1st stage: Identification of the topic and selection of the research question.

As a first stage, 11 research questions presented in Table 14 were developed. Subsequent data analysis sought to answer these questions.

Table 14. Research Questions.

Dimensions	Research Questions	Possible answers based on literature
Theme	1. What type of education is present in the articles?	1. EE
		2. ESD
		3. OER
	2. Is there a relationship between the scientific literature on EE/ESD and ethnic-racial issues?	1. Yes
		2. No
	3. Is there a relationship between the scientific literature on EE, ESD and OER?	1. Yes
		2. No
	4. Is the 2030 Agenda debate present?	1. Yes
		2. No
Approaches, interfaces and trends	5. What are the interfaces/intersections between EE and ESD?	1. Ethnic-racial issues
		2. Open Education
		3. 2030 Agenda
Metrics	6. What is the annual scientific production on the themes established in the research?	Number of publications per year
	7. Who are the authors with the highest number of publications sampled in the research?	Author, country and area of knowledge
	8. What are the most cited articles by the research samples?	Number of citations
	9. What is the scientific production per country on the topic?	number of publications per country
	10. Is there collaboration between countries?	Author intellectual structure network
	11.What are the most prominent journals in the field?	Number of citations

Source: Created by the authors.

| 2nd stage: Establishment of inclusion and exclusion criteria.

The inclusion criteria for the articles were as follows (Table 15):

I. only publications between 2012 and 2022 were considered in data collection;

II. only publications of the "article", "review article" or "research article" type were considered;

III. only publications indexed in Scopus or Web of Science were considered and

IV. only publications with the presence of the descriptors presented in Tables 3 and 4 in the title, abstract, or keyword fields were considered.

The exclusion criteria for articles were as follows:

I. documents with missing information in the field corresponding to the documents' DOI were disregarded;

II. duplicates were removed.

Table 15. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Publications made between 2012 and 2022	Documents with information regarding the DOI missing from the databases
Publications like "Article", "Review Article" or "Research Article"	Duplicate records across databases
Publications indexed in Scopus or Web of Science	–
Publications with the presence of the descriptors used in the title, abstract or keywords fields	–

Source: Created by the authors.

The **3rd stage** consists of collecting and identifying the bibliographic data in the databases. In this stage, we use selected descriptors to identify and collect the data used. For research in the context of scientific production on the African continent, we used the descriptors presented in Table 3 only in the Scopus and Web of Science databases. For the search referring to production in Latin America, we used the descriptors present in Table 4 in the Scopus and Web of Science databases.

| Data collection: Africa

The terms used in the search can be categorized into two different groups. The first seeks to index articles that discuss questions linked to African epistemology. The second large group indexes articles discussing EE, ESD, and OER. Adding the terms from the large groups, we search for articles that work at the intersection between these themes. We present the list of descriptors in Table 16. It is crucial to point out that, on the Web of Science platform, we base our search on the main collection Web of Science Core Collection.

Table 16. Descriptors: Africa.

Databases	Key terms		
SCOPUS (ELSEVIER) <TITLE-ABS-KEY>	"Africa" OR "African" OR "Afro" OR "African Cosmovision" OR "African Epistemology"	AND	"Environmental Education"
			"Education for Sustainable Development"
			"Open Educational Resources"
WoS (CLARIVATE) <ALL>	"Africa" OR "African" OR "Afro" OR "African Cosmovision" OR "African Epistemology"	AND	"Environmental Education"
			"Education for Sustainable Development"
			"Open Educational Resources"

Source: Created by the authors.

Six searches were carried out in the Scopus and Web of Science databases, three in each base, with the intersections of the key terms in Table 3. 1,309 documents were found, 655 from Scopus and 654 from Web of Science. After the elimination of duplicates and screening, the study presented 473 articles. Data were exported from the databases in bibtex format.

| Data collection: Latin America

In the research, terms were used to filter publications to restrict the collection to publications with authors affiliated with countries in Latin America. The objective was to identify the prevalence of scientific debate in the context of countries. Details of the search terms are presented in Table 17.

Six searches were performed in the *Scopus* and *Web of Science databases*, three in each database, with the intersections of the key terms above. 2,512 documents were found, 1,062 from *Scopus,* and 1,450 from *Web of Science*. After the elimination of duplicates and screening, the study presented 1,553 articles. Data were exported from the databases in *bibtex* format.

Stages 4, 5, and 6 are presentations, analysis, and interpretation of results, in addition to the synthesis of knowledge. In short, in these stages, the selected studies were characterized, with illustrations, categories, and systematization.

Table 17. Descriptors: Latin America.

Descriptors	Scopus (Elsevier)	Web of Science (Clarivate)
EE	TITLE-ABS-KEY ("ENVIRONMENTAL EDUCATION" OR "EDUCAÇÃO AMBIENTAL" OR "EDUCACIÓN AMBIENTAL") AND AFFILCOUNTRY ("ARGENTINA" OR "BOLIVIA" OR "BRAZIL" OR "CHILE" OR "COLOMBIA" OR "COSTA RICA" OR "CUBA" OR "EL SALVADOR" OR "ECUADOR" OR "GUATEMALA" OR "HAITI" OR "HONDURAS" OR "MEXICO" OR "NICARAGUA" OR "PANAMA" OR "PARAGUAY" OR "PERU" OR "DOMINICAN REPUBLIC" OR "URUGUAY" OR "VENEZUELA") AND PUBYEAR > 2011 AND PUBYEAR < 2023 AND (LIMIT-TO (DOCTYPE , "ar"))	ALL=("ENVIRONMENTAL EDUCATION" OR "EDUCAÇÃO AMBIENTAL" OR "EDUCACIÓN AMBIENTAL") AND CU = ("ARGENTINA" OR "BOLIVIA" OR "BRAZIL" OR "CHILE" OR "COLOMBIA" OR "COSTA RICA" OR "CUBA" OR "EL SALVADOR" OR "ECUADOR" OR "GUATEMALA" OR "HAITI" OR "HONDURAS" OR "MEXICO" OR "NICARAGUA" OR "PANAMA" OR "PARAGUAY" OR "PERU" OR "DOMINICAN REPUBLIC" OR "URUGUAY" OR "VENEZUELA") AND DOP=(2012-01-01/2022-12-31) AND DT = ("article")
ESD	TITLE-ABS-KEY ("EDUCATION FOR SUSTAINABLE DEVELOPMENT" OR "EDUCAÇÃO PARA O DESENVOLVIMENTO SUSTENTÁVEL" OR "EDUCACIÓN PARA EL DESARROLLO SOSTENIBLE") AND AFFILCOUNTRY ("ARGENTINA" OR "BOLIVIA" OR "BRAZIL" OR "CHILE" OR "COLOMBIA" OR "COSTA RICA" OR "CUBA" OR "EL SALVADOR" OR "ECUADOR" OR "GUATEMALA" OR "HAITI" OR "HONDURAS" OR "MEXICO" OR "NICARAGUA" OR "PANAMA" OR "PARAGUAY" OR "PERU" OR "DOMINICAN REPUBLIC" OR "URUGUAY" OR "VENEZUELA") AND PUBYEAR > 2011 AND PUBYEAR < 2023 AND (LIMIT-TO (DOCTYPE , "ar"))	ALL=("EDUCATION FOR SUSTAINABLE DEVELOPMENT" OR "EDUCAÇÃO PARA O DESENVOLVIMENTO SUSTENTÁVEL" OR "EDUCACIÓN PARA EL DESARROLLO SOSTENIBLE") AND CU = ("ARGENTINA" OR "BOLIVIA" OR "BRAZIL" OR "CHILE" OR "COLOMBIA" OR "COSTA RICA" OR "CUBA" OR "EL SALVADOR" OR "ECUADOR" OR "GUATEMALA" OR "HAITI" OR "HONDURAS" OR "MEXICO" OR "NICARAGUA" OR "PANAMA" OR "PARAGUAY" OR "PERU" OR "DOMINICAN REPUBLIC" OR "URUGUAY" OR "VENEZUELA") AND DOP=(2012-01-01/2022-12-31) AND DT = ("article")
OER	TITLE-ABS-KEY ("OPEN EDUCATION" OR "EDUCAÇÃO ABERTA" OR "EDUCACÍON ABIERTA") AND AFFILCOUNTRY ("ARGENTINA" OR "BOLIVIA" OR "BRAZIL" OR "CHILE" OR "COLOMBIA" OR "COSTA RICA" OR "CUBA" OR "EL SALVADOR" OR "ECUADOR" OR "GUATEMALA" OR "HAITI" OR "HONDURAS" OR "MEXICO" OR "NICARAGUA" OR "PANAMA" OR "PARAGUAY" OR "PERU" OR "DOMINICAN REPUBLIC" OR "URUGUAY" OR "VENEZUELA") AND PUBYEAR > 2011 AND PUBYEAR < 2023 AND (LIMIT-TO (DOCTYPE , "ar"))	ALL=("OPEN EDUCATION" OR "EDUCAÇÃO ABERTA" OR "EDUCACÍON ABIERTA") AND CU = ("ARGENTINA" OR "BOLIVIA" OR "BRAZIL" OR "CHILE" OR "COLOMBIA" OR "COSTA RICA" OR "CUBA" OR "EL SALVADOR" OR "ECUADOR" OR "GUATEMALA" OR "HAITI" OR "HONDURAS" OR "MEXICO" OR "NICARAGUA" OR "PANAMA" OR "PARAGUAY" OR "PERU" OR "DOMINICAN REPUBLIC" OR "URUGUAY" OR "VENEZUELA") AND DOP=(2012-01-01/2022-12-31) AND DT = ("article")

Source: Created by the authors.

| Bibliometrix tool and the R language

The R programming language (R Core Team, 2023) is a tool created for statistics and data analysis that was created in the mid-1990s. Embracing the free software community, it is today considered a powerhouse in data science, bioinformatics, and other areas (Qiu, 2024). In this way, the user community develops packages of functions that create niches within the programming language, enabling analyses and uses not implemented in the base program.

Bibliometrix is one of these packages. It adds a series of tools to R for analyzing and reviewing bibliometric data collected from databases such as *Scopus*, *Web of Science*, *PubMed*, and even Scielo. Aria and Cuccurullo (2017) point out some potential for these bibliometric analyses:

> [...] Essentially, bibliometrics is the application of quantitative analysis and statistics to publications such as journal articles and their accompanying citation counts. Quantitative evaluation of publication and citation data is now used in almost all scientific fields to evaluate growth, maturity, leading authors, conceptual and intellectual maps, trends of a scientific community (Aria; Cuccurullo, 2017b).

The workflow with *Bibliometrix* can be summarized in a few main points, namely, collecting data sets in bibliographic databases, importing them into the R environment, normalizing and standardizing sets, and producing and exporting results.

The process of collecting data for use in the software can be performed on platforms such as *Scopus* (Elsevier) and *Web of Science* (Clarivate Analytics). However, in the context of Latin America, the relevance of the SciELO Citation Index stands out, as it has considerable access to the scientific community. It is important to note that it is possible to access articles indexed by SciELO directly on the *Web of Science* platform (Aria; Cuccurullo, 2017b).

After data collection, we imported and normalized the data into the R environment. At this stage, functions for renaming and formatting the data are applied, generating a final result common to all bases. Thus, it is possible to perform a search with the same descriptors in different databases, expanding the sample coverage of our research.

The production of results and analyses within the *bibliometrix* package can be performed on the R program command line. However, its creators also built an application with a web interface called biblioshiny.

To further explore the methodological possibilities and applications of this package, we suggest reading the following works: Aria; Cuccurullo (2017a), Aria; Cuccurullo (2017b) and Ramos; Xavier; Minello (2020).

| Data screening: Africa

Figure 23 presents the four-stage screening procedure based on the PRISMA protocol. In the identification phase, articles from the two databases were considered: *Scopus* and *Web of Science* for EE, ESD, and OER, presenting a total of 1,309 articles. During the screening phase, duplicate articles were removed. Regarding the eligibility phase, only publications between 2012 and 2022, scientific articles in English, and only documents with DOI (verified by the

databases) were considered. Finally, in the inclusion stage, the articles that comprised the quantitative and qualitative analyses were considered.

Figure 23. Africa: PRISMA 2020 flow diagram for new systematic reviews that included database and registry searches only.
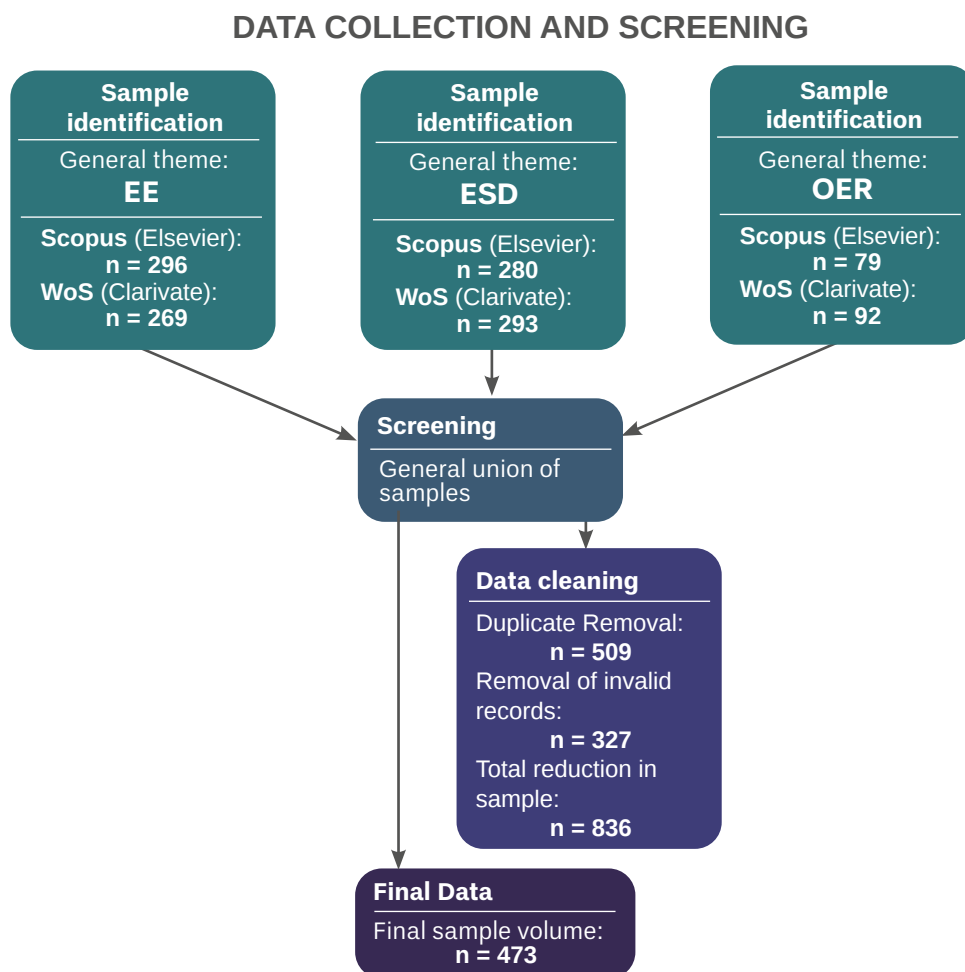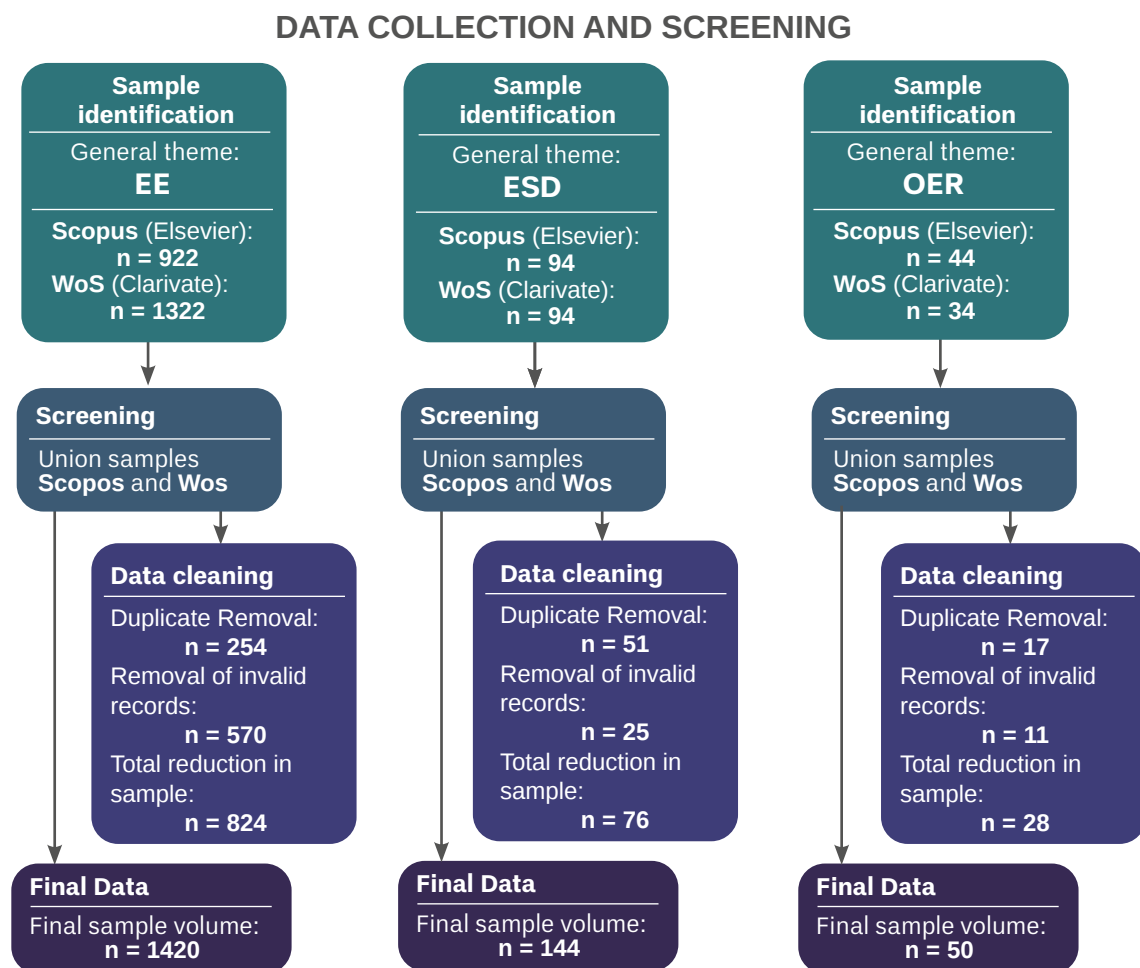

Source: Created by the authors and adapted from Page et al. (2021).

The databases were imported to the RStudio environment using functions from the bibliometrix package. A portion of the duplicate observations was excluded through automation methods, using the mergeDBSources function from the bibliometrix package, removing 336 duplicates. Next, a second cleaning stage with the distinct function from the dplyr package evaluated and removed duplicates from the column referring to the DOI, also excluding observations with missing information (NA), excluding another 183 observations. In the last stage, observations with a year of publication between 2012 and 2022, document type "article", document language "English" and information in the DI column, referring to the evaluable DOI, were filtered and retained. After the exclusions, in the end, the study object that makes up this analysis is 473 scientific articles.

| Data screening: Latin America

Figure 24 presents the screening procedure in the same 4 steps previously established, based on the PRISMA protocol. During the screening phase, duplicate articles were removed. Regarding the eligibility phase, only those with DOI assessable by the bases were considered. Finally, in the inclusion stage, the articles that comprised the quantitative and qualitative analyses were considered.

Figure 24. Latin America: PRISMA 2020 flow diagram for new systematic reviews that included database and registry searches only.

DATA COLLECTION AND SCREENING

Source: Created by the authors and adapted from Page et al. (2021).

The databases were imported to the RStudio environment using functions from the *bibliometrix* package. The samples were merged into three objects within the R environment with the mergeDbSources function, each one corresponding to a research category: EE, ESD, and OER. For each group, a portion of observations corresponding to duplicate articles were excluded through automation methods. A second cleaning stage with the distinct function in the dplyr package scanned the samples again in search of duplicates, evaluating the column referring to DOI. At this stage, any sample not containing identifiable DOI was removed. After exclusions, in the end, the study objects that make up this analysis total 1,420 articles for EE, 114 articles for ESD, and 50 articles for OER.