

Environmental education in Brazil: trends and gaps from 2015 to 2019

Educação ambiental no Brasil: tendências e lacunas de 2015 a 2019

Educación ambiental en Brasil: tendencias y brechas de 2015 a 2019

Received: 03/03/2022 | Reviewed: 03/13/2022 | Accept: 03/15/2022 | Published: 03/23/2022

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Abstract

Here we carried out a review of the open-access literature concerning Environmental Education in the prominent Brazilian journals from 2015 to 2019, aiming to provide trends in the field of Environmental Education Research in Brazil and highlighted well-studied areas and potential research gaps. We found a total of 695 articles from four scientific journals that met the selection criteria, and identified five key results: i) a predominance of qualitative research approach; ii) sex-biased authorship skewed towards women; iii) high educational attainment, led by authors with doctoral degrees; iv) a majority of authors affiliated to public institutions, and v) a predominance of authors from institutions at the southeast region of Brazil. Therefore, our results highlight that the major gaps to be filled in Environmental Education are the lack of quantitative studies, low scientific production by private universities, and centralization of production in the southeast and south regions.

Keywords: Environmental education; Literature review; Public policies; Scielo; Scientific journals.

Resumo

Aqui realizamos uma revisão da literatura de acesso aberto sobre Educação Ambiental nos principais periódicos brasileiros de 2015 a 2019, com o objetivo de fornecer tendências no campo da Pesquisa em Educação Ambiental no Brasil e destacar áreas bem estudadas e potenciais lacunas de pesquisa. Encontramos um total de 695 artigos de quatro revistas científicas que atenderam aos critérios de seleção e identificamos cinco resultados principais: i) predominância da abordagem qualitativa da pesquisa; ii) autoria com viés de sexo voltado para as mulheres; iii) alto nível educacional, liderado por autores com doutorado; iv) maioria de autores vinculados a instituições públicas, e v) predominância de autores de instituições da região sudeste do Brasil. Portanto, nossos resultados destacam que as principais lacunas a serem preenchidas na Educação Ambiental são a falta de estudos quantitativos, a baixa produção científica das universidades privadas e a centralização da produção nas regiões Sudeste e Sul.

Palavras-chave: Educação ambiental; Revisão da literatura; Políticas públicas; Scielo; Revistas científicas.

Resumen

Aquí llevamos a cabo una revisión de la literatura de acceso abierto sobre Educación Ambiental en las principales revistas brasileñas de 2015 a 2019, con el objetivo de proporcionar tendencias en el campo de la Investigación en Educación Ambiental en Brasil y destacar áreas bien estudiadas y posibles lagunas de investigación. Encontramos un total de 695 artículos de cuatro revistas científicas que cumplieron con los criterios de selección e identificamos cinco

resultados clave: i) un predominio del enfoque de investigación cualitativo; ii) autoría con sesgo sexual hacia las mujeres; iii) alto nivel educativo, liderado por autores con doctorado; iv) mayoría de autores afiliados a instituciones públicas, yv) predominio de autores de instituciones de la región sureste de Brasil. Por lo tanto, nuestros resultados destacan que los principales vacíos a ser llenados en Educación Ambiental son la falta de estudios cuantitativos, la baja producción científica de las universidades privadas y la centralización de la producción en las regiones del sureste y sur.

Palabras clave: Educación ambiental; Revisión de literatura; Políticas públicas; Scielo; Revistas científicas.

1. Introduction

An introduction about the Brazilian Environmental Education

In recent decades, the implementation of public policies in Brazilian Environmental Education resulted from a historical sequence of national and international proposals and initiatives (Reiguel et al. 2020). For instance, we can highlight (i) the Stockholm Conference, (ii) the Belgrade Charter, (iii) the Tbilisi Conference, (iv) the Earth summit (ECO-92), (v) the Rio + 20 Conference, and (vi) the declaration of The United Nations Decade of Education for Sustainable Development (2005–2014). These events resulted in agreements signed by several countries committed to reformulating their educational programs to bring environmental problems into all aspects of education and learning, developing effective strategies for environmental education.

In the 1990s, fundamental laws for the development of Brazilian educational policies were passed, such as (i) the Law of Directives and Bases of National Education (Lei de Diretrizes e Bases da Educação Nacional – LDB; no. 9394/1996), (ii) the National Curriculum Parameters (Parâmetros Curriculares Nacionais – PCN, Resolution CEB no. 03/1998), and (iii) the National Policy for Environmental Education (Política Nacional de Educação Ambiental – PNEA; Act 9795/99). The PNEA determined Environmental Education as a fundamental component that should be included in all levels and modalities of education, formal and non-formal (BRASIL, 1999). In 2003, the National Environmental Education Program (Programa Nacional de Educação Ambiental – ProNEA, Act 9795/99) was created to develop Environmental Education actions at school and in environmental management. Other editions of ProNEA were released in 2005, 2014, and 2018.

From 2000 onwards, essential programs were launched to strengthen Environmental Education in school curricula, such as (i) the Environment and Quality of Life Committees (Valois & Cavalari 2015), (ii) the More Education Program (Programa Federal Mais Educação – PME, Interministerial Ordinance no. 17/2007), and (iii) the Direct Money in School Program – Sustainable School (Programa Dinheiro Direto na Escola – PDDE-ES, Resolution CD/FNDE no. 18 of 2013). These programs allocated financial resources to Brazilian public schools to improve the quality of teaching and promote Environmental Education actions. In 2012, the Environmental Education in the School Curriculum was approved, which delegated the inclusion of Environmental Education in primary and higher education curricula. In addition, it was determined the inclusion of Environmental Education as mandatory content in the National Education Guidelines and Framework Law (Lei de Diretrizes e Bases da Educação – LDB, No. 9394 of 1996).

However, in 2016, Provisionary Measure No. 746 annulled the mandatory inclusion of Environmental Education in the LDB. The change in public management from 2016 onwards led to several changes in ministries and government policies. As a result, there were changes and revocation of Brazilian Environmental Education programs that for decades had been consolidating (Frizzo & Carvalho 2018). After 2016, the leading programs that should guide Brazilian Environmental Education, such as the National Education Plan 2014-2024 (Plano Nacional de Educação – PNE, Law no. 13.005/2014) and the National Common Curriculum Base (Base Nacional Comum Curricular – BNCC, Resolution CNE/CP no. 2/2017), overlooked Environmental Education (Frizzo & Carvalho 2018; Silva & Loureiro 2020).

The implementation of public policies for environmental defense has always been a challenge for many political leaders. Challenges resulted from policymakers not relying on scientific information as much as possible, the difficulties in

finding such information, or fragmented information (Ananiadou et al. 2010). In addition, developing countries, like Brazil, have a complex scenario marked by low availability of financial resources and conflicting environmental and economic agendas (Magnusson et al. 2018; Thomaz et al. 2020). Threats to Brazilian biodiversity are growing at an alarming rate due to the weakening of the Environmental Policy of 1981 (Law no. 6983/81) (Tollefson 2019). This alarming scenario highlights the need to implement Environmental Education programs to promote environmental awareness and critical thinkers, allowing individuals to be in a position to stand concerning the current scenario, occupy leadership positions, and think about innovative solutions.

In this context, literature reviews evaluate as many studies as possible for a specific theme or research area (Hart 2003). In this way, research reviews can identify directions, even the controversial ones, where efforts did not result in satisfactory results. Literature reviews are also a way to update knowledge, clarify issues, and provide guidance. In addition to the advantages mentioned above resulting from literature reviews, in the present work we also (i) identified trends in the field of Environmental Education Research in Brazil and ii) highlighted well-studied areas and potential research gaps. In this context, this work aims to investigate the spatiotemporal evolution of scientific articles that address Environmental Education using the prominent Brazilian scientific journals in the area between 2015 and 2019.

2. Methodology

Search criteria

This study includes a literature review of research articles available on Brazilian Environmental Education open access journals. Scientific journals selection was carried out following our interest in understanding the tendencies of Environmental Education in Brazil; therefore, for the selection of the journal, we used the following inclusion criteria: (1) be published in Brazil and focused on Environmental Education, (2) be classified at Brazilian Coordination for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – CAPES) Qualis/CAPES list of 2020 (<http://qualis.capes.gov.br/webqualis/>) as grade "B" or greater, and (3) encompasses the keyword "Environmental Education".

The Qualis/CAPES is an official system to classify the scientific production in Brazil and is used as part of the evaluation process of Brazilian Post-Graduation Programs (Costa et al. 2020). The journals are classified into eight categories, A1, A2, A3, A4, B1, B2, B3, B4, and C, in which A1 is the highest classification. Journals from grade A are those with international relevance, grade B comprises those with national (B1 and B2) or intermediate (B3 and B4) relevance, and C with low relevance (Costa et al. 2020). A scientific journal will not figure in Qualis/CAPES list if no article has been previously published by authors affiliated to a Post-Graduation Program in the same field of knowledge (Barradas 2016). Thus, the cutoff chosen can be considered a proxy to evaluate Environmental Education as a research field in Brazil, based on high national and international relevance journals.

Data collection

A total of four scientific journals were selected based on the search criteria, *Revista Brasileira de Educação Ambiental* (REVBEA), *Revista Eletrônica do Mestrado em Educação Ambiental* (REMEA), *Pesquisa em Educação Ambiental* (PEA), and *Revista Sergipana de Educação Ambiental* (RSEA). These journals belong to Qualis/CAPES strata A3 (REVBEA), A4 (REMEA), B1 (PEA), or B2 (RSEA) (Table 1). Each article was accessed individually for textual analysis. Considering a large amount of information available in the selected articles, we used broad categories to provide a comprehensive view of the general trends of the theme addressed in the article within the field of Environmental Education, rather than providing exhaustive interpretations on each specific theme. For each article, we extracted the following information: (i) geographical

location of the institution, (ii) type of institutions – private or public, (iii) gender of the first author – woman or men, (iv) educational attainment – doctoral, masters, specialist or graduate levels, (v) the number of authors, (vi) the number of international co-authors, (vii) the number of educational institutions, and viii) methodological approach – qualitative or quantitative. The categories implemented here can be considered an extension of more than a decade of research in Environmental Education and is supported by previous efforts by several other authors (Carvalho et al. 2009; Carvalho et al. 2019; Carvalho & Farias 2011; Farias et al. 2018; Filho 2019; Matos, unpublished data; Reigota 2007).

Table 1. Selected scientific journals in the Environmental Education field and their respective 2020 Qualis/CAPES classification (<http://qualis.capes.gov.br/webqualis/>).

ISSN	Journal name	Stratum
1981-1764	Revista Brasileira de Educação Ambiental - REVBEA	A3
1517-1256	Revista Eletrônica do Mestrado em Educação Ambiental - REMEA	A4
2177-580X	Pesquisa em Educação Ambiental - PEA	B1
2359-4993	Revista Sergipana de Educação Ambiental - RSEA	B2

Source: Authors.

Data analysis

All articles were analyzed following the assumptions of Bardin's content analysis (2011) following the stages of (i) pre-analysis, consisting of the selection of documents, construction of hypotheses, objectives, and formulation of the descriptors, (ii) coding of information extracted from the text, and (3) treatment of results, inference, and interpretation of data.

The content analysis methodology can be defined as: a set of communication analysis techniques aiming, by systematic and objective processes, to describe the content of messages to obtain indicators (quantitative or not), allowing the inference of knowledge related to the production and reception conditions (inferred variables) of these messages. (Bardin, 1998, p. 47).

The categories for each selected journal were tabulated and their percentages were computed. Since each article could present more than one instrument for data constitution and data analysis methodology, the frequency for each category was divided by the total number of instruments or methodologies identified and multiplied by 100. Finally, tables and graphs were developed to express the results visually.

3. Results and Discussion

Geographical distribution of scientific production in Environmental Education in Brazil

We found a total of 695 articles, and the selected volumes and issue numbers of the selected publications are given in Table 2.

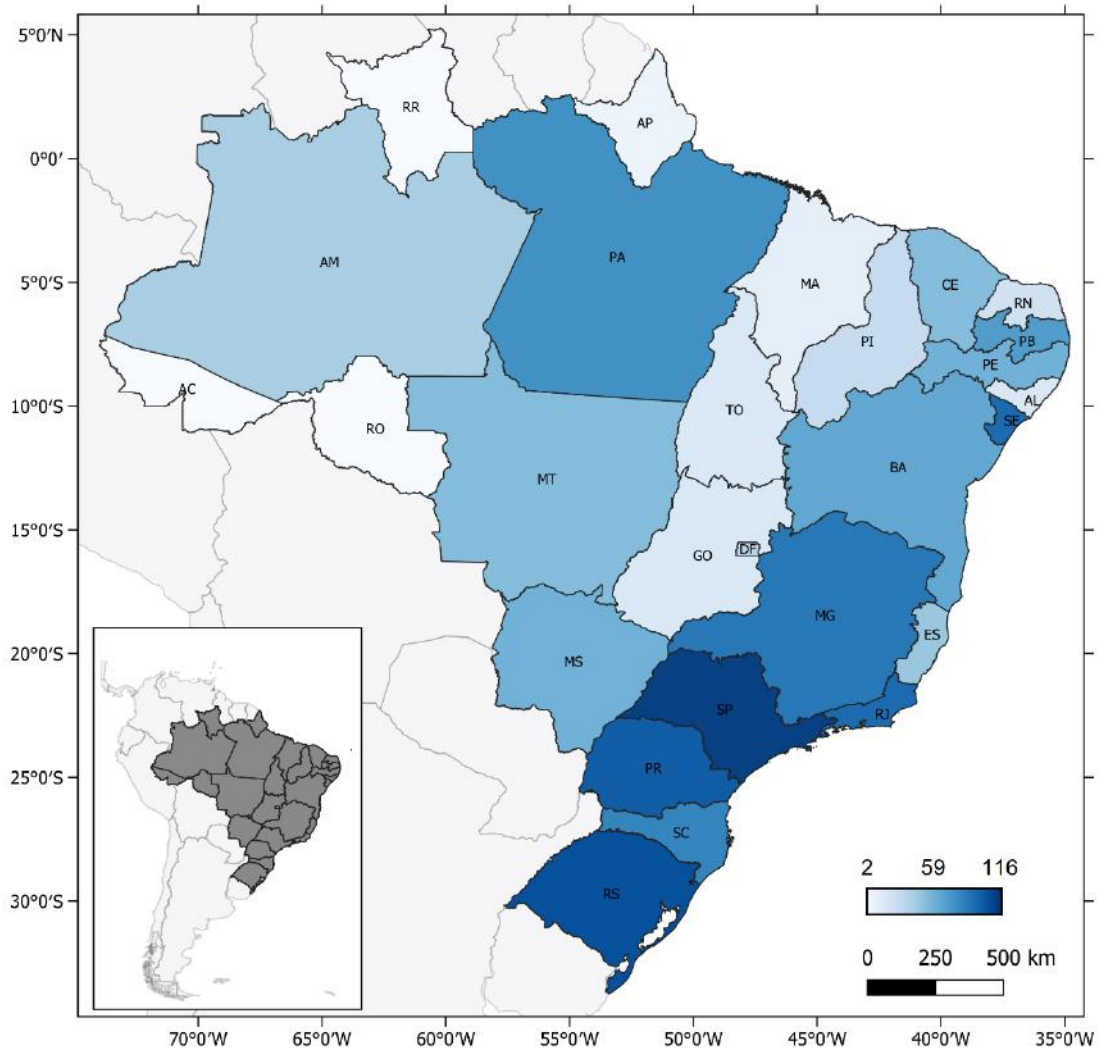
Table 2. Volume and issue numbers of the selected scientific journals with articles in the Environmental Education field from 2015 to 2019.

Journal name (<i>No. articles</i>)	Year	Volume	Issues
REVBEA (295)	2015	10	1,2,3, and 4
	2016	11	1,2,4, and 5
	2017	12	1,2,4, and 5
	2018	13	1,2,3, and 4
	2019	14	1,2,3, and 4
REMEA (246)	2015	32	1 and 2
	2016	33	1, 2, and 3
	2017	34	1, 2, and 3
	2018	35	1, 2, and 3
	2019	36	1, 2, and 3
PEA (98)	2015	10	1 and 2
	2016	11	1 and 2
	2017	12	1 and 2
	2018	13	1 and 2
	2019	14	1 and 2
RSEA (56)	2015	2	1
	2016	3	1
	2017	4	1
	2018	5	1 and 2
	2019	6	1 and 2

Source: Authors.

We observed a small variation in the number of published articles from 2015 to 2019, with a mean of 139 articles per year. Most of the reviewed articles were carried out in the Southeast Brazil (n = 218; 32.4%), followed by South (n = 174; 25.9%) and Northeast regions (n = 170; 25.3%). The states of São Paulo, Rio Grande do Sul, Paraná, and Rio de Janeiro stand out, while the states with lower production are in the North (n = 58; 8.6%) and Midwest Brazil (n = 52; 7.7%) (Figure 1). Historically, there is a tendency to centralize scientific production in Environmental Education in Brazil's Southeast and South regions (Fracalanza et al. (2005), Farias et al. (2018)). This tendency was found based on the analysis of doctoral and masters thesis from 1981 to 2004 (Fracalanza et al. (2005)) and the publications in the National Association of Research and Graduate Studies on Education (Associação Nacional de Pós-Graduação e Pesquisa em Educação – ANPEd), the National Association of Graduate Courses and Research in Environment and Society (Associação Nacional de Pesquisa de Pós-Graduação em Meio Ambiente e Sociedade – ANPPAS), and the Research Meetings about Environmental Education (Encontros de Pesquisa em Educação Ambiental – EPEA) from 2001 to 2012 (Farias et al. (2018)). Finally, Carvalho et al. (2019) mapped doctoral and master's theses published from 1981 to 2012 and found the same trend. Our study indicates a similar scientific production by researchers associated to institutions at Northeast and Southeast Brazil (n = 170 and 174 articles, respectively). This result may indicate that the Northeast region is managing to solve a historical gap within research in Environmental Education.

Figure 1. Geographical distribution of the research articles published in the selected journals in the Environmental Education field.

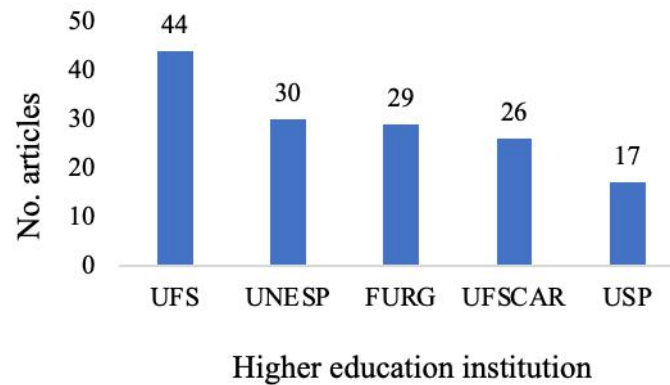


Source: Authors.

In particular, the Federal University of Sergipe (UFS) stands out as the institution with the highest publication rate in the last five years (Figure 2). These positive results may be related to the strengthening of Environmental Education programs in the Northeast region. In this sense, more studies are needed to identify which policies are being adopted to strengthen their research programs and serve as a model for other regions.

The centralization of scientific research may be related to the fact that there is a high rate of inequality in investments for research and education in Brazil, resulting in a skewed number of scientific articles by region (Soares-Almeida et al. 2020). In addition, it may lead to high inequality in terms of quality and equity in primary education (Soares 2006). Therefore, the reduced number of studies carried out on some Brazilian regions may negatively impact promoting the population's environmental awareness and consecutively the environmental conservation in these regions.

Figure 2. Total of scientific articles published from 2015 to 2019 in the selected journals in the Environmental Education field according to higher education institution that the authors are affiliated. Universidade Federal de Sergipe (UFS), Universidade Estadual Paulista (UNESP), Universidade Federal do Rio Grande (FURG), Universidade Federal de São Carlos (UFSCAR), and Universidade de São Paulo (USP).

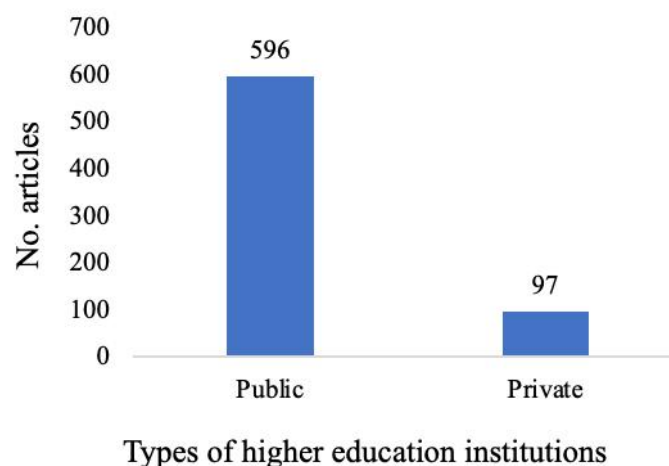


Source: Authors.

Higher education institutions as a center of scientific production in Environmental Education in Brazil

Our results demonstrate a predominance article published by authors from public institutions (n = 596; 86%) than from private institutions (n = 97; 13,99%; Figure 3). The prevalence of public institutions reported was also supported by other studies (Carvalho & Farias 2011; Farias et al. 2018; Reigota 2007). This finding reinforces the importance and leadership of public educational institutions within the Brazilian scientific context.

Figure 3. Type of higher education institution in the authors' affiliation of the articles published from 2015 to 2019 in the selected journals in the Environmental Education field.



Source: Authors.

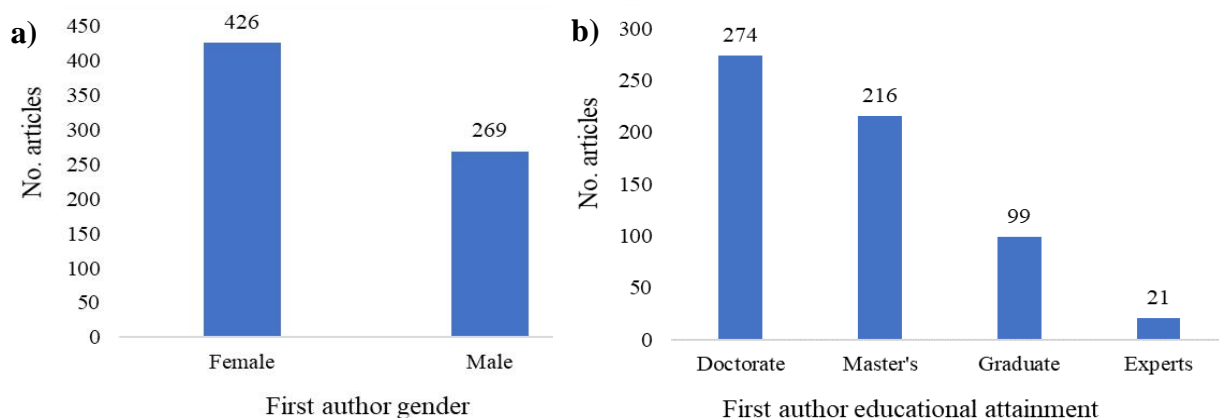
The low production in the field of Environmental Education by private institutions may be related to a lack of funding. The resources allocated to Brazil's science and technology areas are essentially from public research funds, marked by a cut of about 40% in research funding from 2015 to 2019 (Quintans-Júnior et al. 2020). The reduction in the number of

postgraduate scholarships offered by the Coordination for the Improvement of Higher Education Personnel (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – CAPES) during the last years is another relevant aspect that can negatively affect the most impoverished regions. A survey carried out by the Brazilian Society for the Advancement of Science (Sociedade Brasileira para o Progresso da Ciência – SBPC) has highlighted the negative impacts of the reduction in the scholarship offers. Graduate students carry out a large part of the research in Environmental Education in Brazil, and the reduction in scholarships can put the knowledge generation and qualification at risk in the medium and long term. Funding is already scarce for public institutions (Soares-Almeida et al. 2020), and an alternative to this alarming scenario would be multilateral financing mechanisms. These funding programs raise resources from particular countries through Burden-Sharing Agreements and then distribute the resources as grants to finance projects in the environmental field worldwide (Chan 2019). Countries that finance these projects help mitigate global environmental problems and generate local benefits for beneficiary countries (Chan 2019).

Characterizing the profile of the first author of the research on Environmental Education in Brazil

Most of the studies have women as authors ($n = 426$; 61.3%), while men represented a smaller part ($n = 269$; 38.7%; Figure 4A). The predominance of women authoring the articles agrees with previous educational research (Carvalho & Farias 2011; Farias et al. 2018; Matos, unpublished data). Once Environmental Education has its praxis built from the dialogue with education, some authors argue that when dealing with questions of Environmental Education we must look at educational aspects (Matos, unpublished data). In this sense, gender issues have been studied within the teaching profession and critical points raised to explain the predominance of women publishing articles in Environmental Education relied on historical and cultural contexts. On the one hand, the predominance of women authors may be directly related to the predominance of women in teaching activities, which in turn is possibly a result of the feminization of teaching activities (Farias et al. 2018).

Figure 4. Gender (a) and educational attainment (b) of the authors of the research articles published from 2015 to 2019 in the selected journals in the Environmental Education field.



Source: Authors.

Considering the educational attainment, our review showed a predominance of authors with doctoral degrees or candidates to this title ($n = 274$; 44.9%; Figure 4B). This result reinforces the trend in previous studies focusing on scientific research presented at Brazilian Conferences, highlighting the prevalence of high educational attainment authors (Carvalho & Farias 2011; Farias et al. 2018). Besides the relevance of national events for the progress of the Environmental Education field, some of them did not include the participation of undergraduate students. Therefore, studies based on these events may

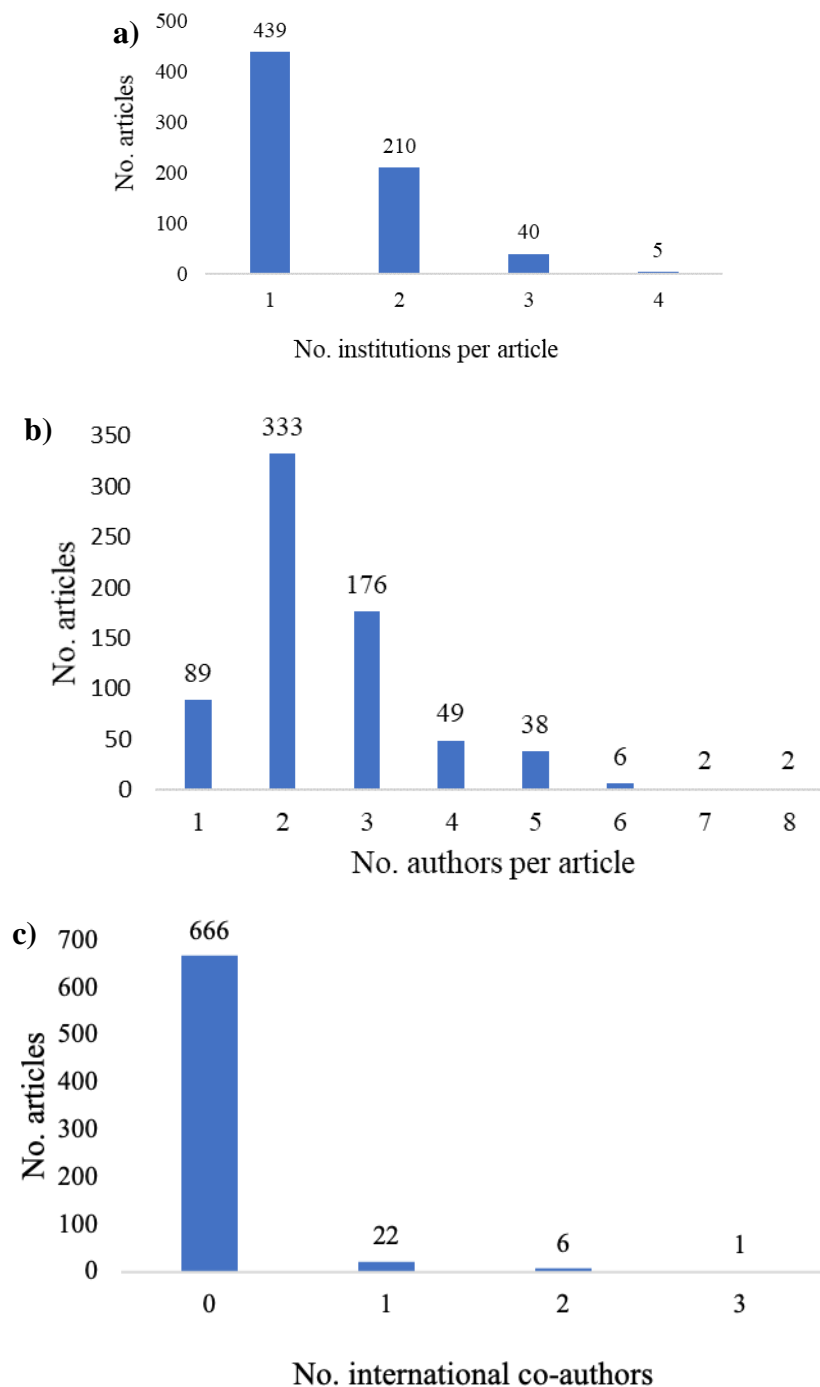
underestimate the research work by authors with undergraduate and specialization levels. Indeed, we found about 20% of the articles authored by undergraduates and specialists, while only half of this value was reported by Carvalho and Farias (2011). However, our study omits monographs on Environmental Education not published in journals due to our methodological approach. In this sense, new studies may carry out such surveys to characterize research in Environmental Education in the initial training of researchers.

Coauthorships as indicative of interinstitutional collaboration

We found little inter-institutional collaboration in scientific production in the field of Environmental Education. Our results showed that most articles rely on the collaboration of authors from the same higher education institution (n = 439; 63.25%; Figure 5A) or were signed by only two authors (n = 333; 47.9%; Figure 5B). The little collaboration observed can limit the circulation and dissemination of the articles in the scientific community, affecting the impact and, subsequently, the relevance of the scientific knowledge produced. Another factor that indicates low inter-institutional collaboration is the low presence of international co-authorships (n = 29; 4.16%; Figure 5C). The low inter-institutional collaboration may indicate endogenous processes in Brazilian Environmental Education.

These findings agree with the literature, indicating that inter-institutional collaboration is still a major challenge in Latin America (Lima et al. 2007; Maia & Caregnato 2008). Another relevant aspect is that authors from states with greater scientific production and more resources tend to collaborate proportionately less with researchers from other regions (Gazda & Quandt 2010). The lack of collaboration can limit the results to a domestic context, making applications in a broader context unfeasible. Additionally, the lack of success in cooperation between the large urban areas and the interior may delay the environmental awareness of the population from this latter. Considering that the cities of the interior harbor the largest forest remnants in Brazil, a delay in the population's environmental awareness can contribute to increasing environmental degradation at the national level.

Figure 5. The number of institutions per article (a), authors per article (b), and international co-authors per article (c) of the research articles published from 2015 to 2019 in the selected journals in the Environmental Education field.



Source: Authors.

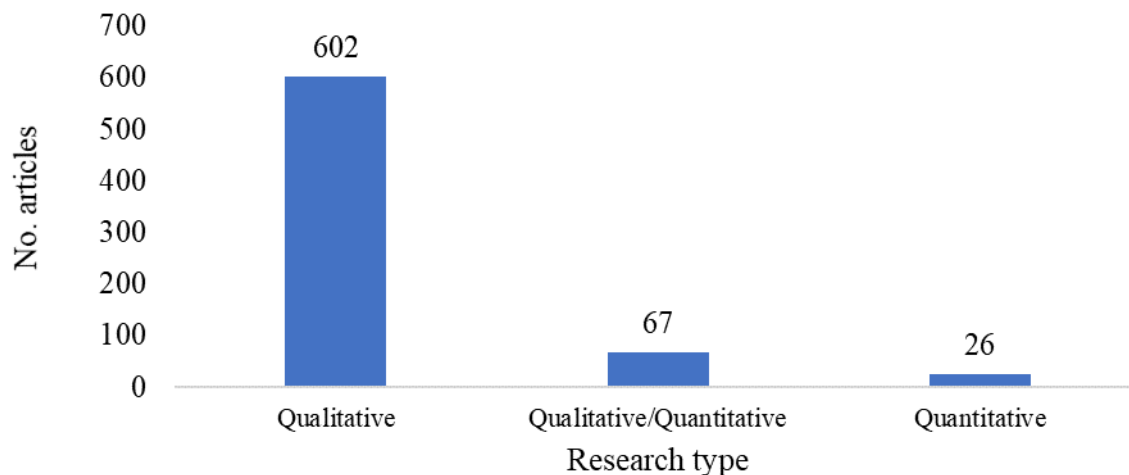
Methodological trends in research in Environmental Education in Brazil

The reviewed articles indicate the predominance of qualitative studies (n = 602; 86.6%), followed by quantitative studies (n = 26; 3.7%) and mixed approaches (n = 67; 9.6%; Figure 6). The predominance of the qualitative approach agrees with the pattern found in a review of the literature published from 2002 to 2006 (Carvalho et al. 2009). Still, Carvalho et al. (2019) found a more pronounced result, which estimated that approximately 90% of the theses and dissertations registered in

the EArt Project (www.earte.net) adopted a qualitative approach.

A possible explanation for such trends is the very nature and purpose of most educational research, as researchers often seek interpretive analysis rather than quantifying data (Zanette 2017). The use of the qualitative approach results mainly in studies with local impacts may occur due to the limitations of this approach. In turn, it emphasizes the importance of conducting review studies that can serve as a tool in the construction of databases. Databases built from qualitative data can be analyzed quantitatively in scientometric studies, enabling a macro perspective of a specific area. For instance, a meta-analysis is a robust tool that has been increasingly used to combine the results of various scientific studies into a single estimate (Kulik & Kulik 1989), and their results can be used as a starting point to build guidelines, recommendations, and action plans. Therefore, scientometric studies may allow us to make more effective decisions about environmental problems, strengthening the Environmental Education field.

Figure 6. Type of methodological approach used in scientific articles covering Environmental Education in selected journals from 2015 to 2019.



Source: Authors.

4. Conclusion

Based on the results, we presented several shortcomings for the Environmental Education field, as follows: (i) lack of quantitative studies; (ii) low scientific production by private universities; (iii) centralization of production in the southeast and south regions; and (iv) low inter-institutional collaboration. These problems highlight the need to develop effective public policies that face low investments in research in Brazil. Notwithstanding, we could observe that some research groups were able to treat these challenges with merit and highlight women doctors' relevance in advancing the Environmental Education research field and promoting environmental awareness. Thus, we suggest that future research focus on specific mechanisms for funding research in Environmental Education in Brazil and the best ways to distribute these funds. Finally, future studies can further explore the quantitative character of Environmental Education, for which meta-analytical studies may be an option.

Acknowledgments

RSR is grateful to the National Council for Scientific and Technological Development (CNPq) and Chico Mendes Institute for Conservation of Biodiversity (ICMBio) in Projects Number 421288/2017–5 and 405290/2018–7. We thank the logistic support from the Foundation to Support the Research and Innovation of State of Santa Catarina (FAPESC) and the

Community University of the Chapecó Region (Unochapecó; Ar. 171 no 23/2019 and UNIEDU no 013/2019).

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