ANALYTICAL APPROACH ON ENVIRONMENTAL EDUCATION AND CLIMATE CRISIS

ABORDAGEM ANALÍTICA SOBRE EDUCAÇÃO AMBIENTAL E A CRISE CLIMÁTICA

ENFOQUE ANALÍTICO DE LA EDUCACIÓN AMBIENTAL Y LA CRISIS CLIMÁTICA

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ABSTRACT: This article presents an analytical approach to Environmental Education (EE) and the climate crisis (CC). The research used various sources of literature, such as articles, dissertations, theses, and books, as well as considering the current state of knowledge in the area, with the aim of expanding existing knowledge. The study discusses the importance of this crisis in the school curriculum and highlights environmental education as an essential tool for mitigating environmental impacts. The article also addresses the challenges faced by environmental education when trying to incorporate the climate crisis into the school curriculum, as well as ways to promote awareness of this crisis in informal educational spaces. It concludes that the analytical approach is fundamental to understanding the relationship between EE and CC. In addition, its inclusion in the school curriculum considered essential to form conscious and responsible citizens, capable of acting in favor of the environment and sustainability.

KEYWORDS: Scientific knowledge. Climate change. Environmental and climate education policies.

***RESUMO**: Este artigo apresenta uma abordagem analítica sobre a Educação Ambiental (EA) e a crise climática (CC). A pesquisa utilizou diversas fontes de literatura, como artigos, dissertações, teses e livros, além de considerar o estado atual do conhecimento na área, visando ampliar o conhecimento existente. O estudo discute a importância dessa crise no currículo escolar e destaca a EA como um instrumento essencial para mitigar os impactos ambientais. O artigo aborda, também, os desafios enfrentados pela EA ao tentar incorporar a crise climática no currículo escolar, bem como maneiras de promover a conscientização sobre esta crise em espaços educacionais informais. Conclui-se que a abordagem analítica é fundamental para compreender a relação entre a EA e a CC. Além disso, a inclusão dela no currículo escolar é considerada essencial para formar cidadãos conscientes e responsáveis, capazes de agir em prol do meio ambiente e da sustentabilidade.*

***PALAVRAS-CHAVE**: Conhecimento científico. Mudanças climáticas. Políticas educacionais ambientais e climáticas.*

***RESUMEN**: Este artículo presenta una aproximación analítica a la Educación Ambiental (EA) y la crisis climática (CC). La investigación utilizó diversas fuentes bibliográficas, como artículos, disertaciones, tesis y libros, además de considerar el estado actual del conocimiento en el área, con el objetivo de ampliar el conocimiento existente. El estudio discute la importancia de esta crisis en el currículo escolar y destaca la educación ambiental como una herramienta esencial para mitigar los impactos ambientales. El artículo también aborda los retos a los que se enfrenta la educación ambiental cuando intenta incorporar la crisis climática al currículo escolar, así como las formas de promover la concienciación sobre esta crisis en los espacios educativos informales. Se concluye que el enfoque analítico es fundamental para entender la relación entre EA y CC. Además, su inclusión en el currículo escolar se considera esencial para formar ciudadanos conscientes y responsables, capaces de actuar a favor del medio ambiente y la sostenibilidad.*

***PALABRAS CLAVE**: Conocimientos científicos. Cambio climático. Políticas de educación medioambiental y climática.*

Introduction

Environmental Education (EA) is currently applied at the international level, such as in the United States, in the states of Arizona (Stern; Powell; Hill, 2014) and Colorado (Schmidt, 2022); in Australia (Gough; Gough, 2022); in India (Talukder, 2014); in Italy (Quendoz, 2021), in Malaysia (Jannah *et al*., 2013) and in Portugal (Morais; Pereira; Durão, 2015). At the national level, there are the states of Rio Grande do Norte (Silva; Torres, 2020), Rio de Janeiro (Souza; Andrade, 2022) and Rio Grande do Sul (Prochnow; Silveira, 2017).

However, these applications are not always directly associated with the climate crisis, as the central focus is increasing environmental sensitivity and promoting actions favorable to sustainability. In order to understand this global application, it is necessary to understand why EA emerged in 1970 and how it operates. At the same time, it is used as a necessary tool for combating, conserving, and implementing good environmental practices, as well as reversing, controlling and even preventing environmental impacts (e.g., excessive use of natural resources) caused to the environment (Ozosco, 2019).

When the complexity and dynamics of (EA) are well understood, it is clear that it has been inserted into both formal and informal educational spaces, seeking to promote learning through two complementary approaches: theoretical and practical/experimental. However, it is important to highlight that the second approach is not yet widely associated, from a pedagogical point of view, with investigation, experimentation and self-reflection on climate issues and, with this, there will be a contribution to the 4th and 13th objectives of the 2030 Agenda (Kiers; De La Peña; Npawan, 2020; Pedrosa; Tamaio, 2022).

In this context, the EA faces a significant challenge when dealing with the climate crisis, because in terms of this type of crisis, the EA must encompass the structural changes that occur in the ecology, the use of aerospace technologies, in addition to investments for the formation of critical and creative individuals regarding behavior and changes in habits, since its role as a learning tool depends on a reform in pedagogical curricular designs, in order to be more adequately allocated to the study of this crisis (Layrargues, 2020).

From the rupture of the state of conservation to which this education was subjected due to economic capital and the consumer market, EA must associate the cause-effect relationship of the environmental crisis, to further explore this crisis in terms of complexity, genesis, political content and sociocultural issues, with the aim of providing viable and applicable environmental solutions (Lima, 2013), regardless of the nomenclatures that the crisis presents in research and academic studies.

This statement is due to the fact that there are other names for it such as "climate collapse or climate emergency". One of the most severe climate crises today is intrinsically associated with anthropogenic global warming (Carvalho; Barbosa, 2019; Gomes, 2022; Güney *et al.,* 2023; Junges; Massoni, 2018; Pinsky, 2019), whose focus for studies and evidence involves the political and social context, given that the crisis under study interferes with the way of life of communities, as it highlights socio-environmental impacts such as droughts and floods (Becker; Marcomin, 2021). For future generations, the nomenclature will change to "climate legacy", as they will inherit the changes that have occurred (Fredericks, 2022).

Studies on global warming began in the 1980s with the drought in Indonesia and Australia (Allan; Heathcote, 1987; Mallingreau, 1987). In light of these events, international bodies established study groups such as the *Intergovernmental Panel on Climate Change* (IPCC) whose initiative was the responsibility of the *United Nations World Organization* (UN) and *World Meteorology Organization* (WMO).

In this view, the climate crisis can be explained "like all the climate changes that are currently occurring or could still occur in the minimum possible period of time when compared to what could occur naturally, that is, without human actions (Guterres, 2019)". Its evolution, at a global level, has caused an increase since 1987 in the atmospheric concentrations of the so-called "security borders" that are essential to the well-being of humanity, biodiversity and hydrobiogeochemical cycles (Witte, 2023).

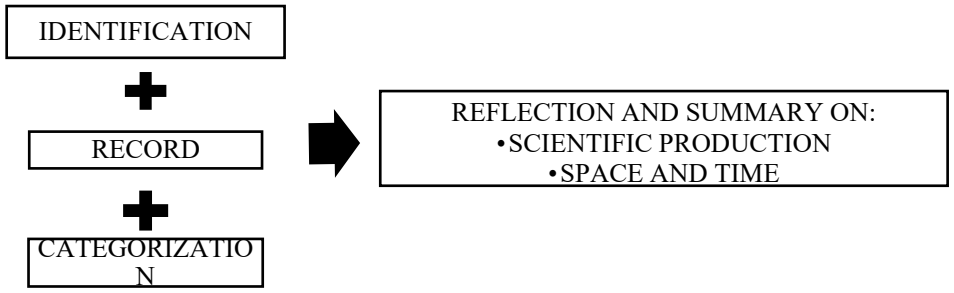
Furthermore, these climate changes are agents that modify landscapes, causing disturbances in ecosystems and the services (provision, regulation, cultural and support) they provide. Therefore, universities, and other places of formal and non-formal education, have become environments that train individuals with the necessary aptitude for analyzing and constructing concrete and effective environmental actions, as they assume the obligation to transmit knowledge about these facts. (Kiers; De La Peña; Npawan, 2020). However, it is noted that academic courses are deficient in both knowledge and use of technologies (Pouliot; Arseneau; Groleau, 2020).

All these expositions about EA and the climate crisis require frequent discussions, which justified and increased the relevance of this research, whose objective was to verify, in the last decade (2014 to 2023), what forms of relationships have already been discussed about both, both in the international and national context, as well as identifying the similarities and differences found.

Methodology

The method used was the analytical approach, as it allows an interpretation associated with a rigorous analysis with the complementation of quantitative and qualitative data (Pereira *et al.,* 2018). The composition of the *corpus* was based on past literature such as articles, dissertations, theses and books (De Luca; Lacerda; Montes 2022; Kohls-Santos; Morosini, 2021), and on the state of knowledge (Morosini; Fernandes, 2014), as These authors state that this expands the state of the art in a certain area (in this case, EA and climate crisis) and in a certain period of time (for this research: 2014 to 2023), and can be carried out in four stages (Figure 1).

Figure 1 – Steps for building the state of knowledge (CE).



Source: Prepared by the authors based on data contained in Morosini and Fernandes (2014).

In addition to these four steps, for the process of composing this *corpus*, academic productions contained in electronic databases were used (*Google Scholar, Elsevier, Plos One*, The Journal of Environmental Education, Columbia Climate School, Climate, Earth and Society, repositories of national public and private higher education institutions, among others), which researched and discussed EE and the environmental crisis, in an isolated/associated way, whether in basic education, undergraduate or postgraduate -graduation, based on selective descriptors associated with *Boolean strings* (Table 1).

Table 1 – Selective descriptors associated with *Boolean strings.*

	Descriptors and search *strings*
1	All fields: environmental education ***and*** environmental practice
2	All fields: climate crisis and the knowledge of students ***or more*** teaching students
3	All fields: environmental education ***and*** landscape modifications
4	All fields: environmental education ***and*** the climate crisis
5	All fields: environmental education ***and*** theoretical-practical application

Source: Prepared by the authors based on data contained in De Luca, Lacerda, Montes (2022).

Statistical analysis was carried out using Descriptive Statistics (absolute and relative frequencies, mean and standard deviation). To compare the data obtained for the themes analyzed separately or associated, the non-parametric Mann-Whitney test, developed by Wilcoxon in 1945, was used to obtain the *p value* to identify whether research on these two themes is more significant to learning, when performed separately or in combination.

Results

Corpus composition

The data obtained and analyzed for the literary composition of the *corpus,* in the two contexts analyzed, indicated that 74 publications, in the period analyzed (2014 to 2023) met the five selective descriptors applied (Table 1).

Table 1 – Data obtained regarding the survey and selection of literature to compose the *corpus*.

		Quantitative	
	Descriptors	Found	Selected
1	All fields: environmental education and environmental practice	37	17
2	All fields: climate crisis and the knowledge of students or students	41	12
3	All fields: environmental education and landscape modifications	36	14
4	All fields: environmental education and the climate crisis	39	15
5	All fields: environmental education and theoretical-practical application	28	16
	Total academic productions	181	74

Source: Prepared by the authors.

Environmental Education, Climate Crisis and Environmental Education *vs.* Climate Crisis

The data obtained and analyzed indicated that, of the 74 literatures selected, 29 of them (n = 39.2%) followed the guidelines for selection and constitution of the *corpus* on this topic. For the international context, the majority (n = 11.0; 37.9%) followed the same guideline. It was also found that the years 2015 and 2020 (n = 2.0; 18.2%, respectively) were the most prolific. For the national context, there was an increase, as more than half of these literatures (n = 18; 62.0%) contained pre-established guidelines, and the most prolific periods were the years 2020 and 2023 (Table 2).

Table 2 – Quantitative data for the international (I) and national (N) context, for the themes: environmental education, climate crisis and environmental education *vs* climate crisis in the last 10 years.

	EA				**CC**				**EA *vs* CC**			
	I		**N**		**I**		**N**		**I**		**N**	
	fi	***fr (%)***	***fi***	***fr (%)***	***fi***	***fr (%)***	***fi***	***fr (%)***	***fi***	***fr (%)***	***fi***	***fr (%)***
2014	1	9.1	0	0.0	0	0.0	0	0	0	0.0	0	0
2015	2	18.2	0	0.0	1	4.3	0	0	0	0.0	0	0
2016	1	9.1	1	5.6	0	0.0	0	0	0	0.0	0	0
2017	0	0.0	2	11.1	0	0.0	1	20	0	0.0	1	12.5
2018	1	9.1	1	5.6	1	4.3	0	0	0	0.0	0	0
2019	1	9.1	0	0.0	4	17.4	0	0	0	0.0	0	0
2020	2	18.2	4	22.2	2	8.7	1	0	5	62.5	0	0
2021	1	9.1	2	11.1	0	0.0	1	20	0	0.0	3	37.5
2022	1	9.1	1	5.6	4	17.4	2	40	1	12.5	3	37.5
2023	1	9.1	7	38.9	11	47.8	1	20	2	25.0	1	12.5
Totals	11	100	18	100	23	100.0	6	100	8	100	8	100
Maximum	2	--	7	--	11	--	2	--	5	--	3	--
Minimum	0	--	0	--	0	--	0	--	0	--	1	--
$\bar{x}\pm\sigma$	1.1±0.6	--	1.8±2.2	--	2.3±3.4	--	0.6±0.7	--	0.8±1.6	--	0.8±1.2	--
p value	$p > 0.05 = 1.0$				$p > 0.05 = 0.3075$				$p > 0.05 = 0.7624$			

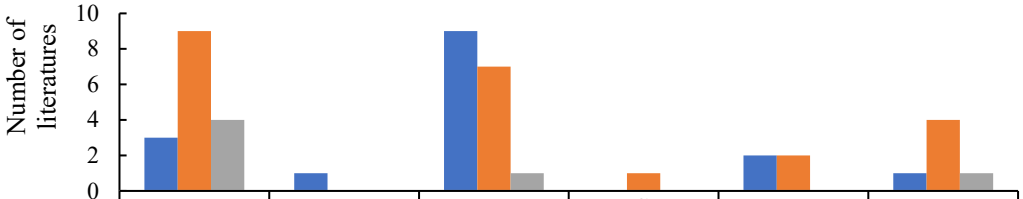
Subtitles: EA – Environmental Education; CC – Climate Crisis; EA x CC – Environmental Education *vs.* Climate Crisis; *fi – absolute frequency* ; *relative frequency* (%).
Source: Prepared by the authors.

As can be seen in Table 1, EA, in the international context (1.1±0.6) presented a lower average value than the national one (1.8±2.2). This may have occurred due to greater concern with research on climate crises (2.3±3.4), which did not occur in the national territory (0.6±0.7). However, in the analysis for the association between the themes (EA *vs.* CC), statistically no variations were observed (I = 0.8±1.6; N = 0.8±1.2). However, associated studies were statistically more significant (p= 0.7654). As for the isolated analysis of the two themes, studies and research on EA, regardless of the context, was extremely significant (p = 1.0), as it did not occur with research on CC (p = 0.3075). Therefore, climate crises, whose degree of emergency is increasingly high, still do not receive the most effective attention at a global level, which could cause environmental impacts such as water scarcity, increased food vulnerability, among others, even more severe on natural resources and the quality of life of the world population.

Geographic distribution of literature in contexts: international and national

Regarding geographic distribution, the analysis of the data obtained indicated that there was similarity, in the international context (Figure 2) in four of the five areas analyzed, both for the largest, North America and the European continent, and for the smallest amount, the Asian continent and the United Kingdom. In the national context (Figure 3), the northern region was more prolific in EA studies, however, no publications on climate crises and between EA x CC were identified.

Figure 2 – Geographic distribution in international literature context of selected themes: Environmental Education; Climate Crisis and Environmental Education *vs.* Climate Crisis.



	A. Norte	C. Asiatico	C. Europeu	C. Sulamericano	Oceania	R.Unido
EA	3	1	9	0	2	1
CC	9	0	7	1	2	4
EAxCC	4	0	1	0	0	1

Subtitles: EA – Environmental Education; CC – Climate crisis; EA *vs* CC – Environmental Education *vs* Climate Crisis.
Source: Prepared by the authors.

Figure 3 – Geographic distribution in national collection context of selected literature with the themes: Environmental Education; Climate Crisis and Environmental Education *vs.* Climate Crisis.

	Centro-oeste	Nordeste	Norte	Sudeste	Sul
EA	1	7	6	1	3
CC	1	1	0	2	1
EAxCC	1	1	0	1	4

Subtitles: EA – Environmental Education; CC – Climate crisis; EA *vs* CC – Environmental Education *vs* Climate Crisis.
Source: Prepared by the authors.

In Figure 3, the number of research and publications on the two themes analyzed individually or associated shows more frequent evolution in North America, especially with regard to the climate crisis. However, it is clear that in Europe, the EA has a greater quantity, which can be justified by the number of component countries. On the Asian continent, there is still little academic production on the topics covered by this research.

Discussion

Environmental Education - International context

To discuss and/or evaluate the use, application and evolution of EA, it is advisable to ask two important questions: what do we measure? And what have we learned? (Stern; Powell; Hill, 2014). In the United States, responses are linked to forms of methodological approaches, new ideas about environmental ethics, whether inter, multi or transdisciplinary, as well as the involvement of traditional communities (Fasolya, 2016). This will all be very measured and learned as long as EE is applied from kindergarten to the completion of basic education and continues into higher education (Ardoin *et al.,* 2018).

The use of community knowledge and tradition is one of the tools that allows for greater impact in both measurement and learning, and this is carried out on the Asian continent. In Japan – (Watanabe, 2015), and in India (Talukder, 2014), this knowledge can improve investigations in the context of EA, make them closer to theory, and better application of interdisciplinarity or, perhaps, transdisciplinarity, with more effective and experimental participation, as occurs in Australia (Gough; Gough, 2022).

On the European continent, in Évora, Portugal, the generations born in the era of climate change still have an academic education marked by two visions: the humanist, the one that promotes equality and opportunity for all, and the pedagogical, that is, the educator- educating (Fonseca; Bernardes, 2015; Vasconcelos, 2015). Therefore, it is necessary to fragment the current pedagogical foundation so that these generations understand both the meaning and the relationship between EA and the climate crisis (Morais; Pereira; Durão, 2015).

In this context, younger people must pay attention to good environmental practices with a theoretical basis of EE, especially in formal spaces, where the time spent in these places will facilitate this type of "polishing of "Generation Z" which, in the Aosta Valley – Italy is more consumerist and self-indulgent (Quendoz, 2021). However, all these ruptures for better application of EA must occur as in Ukraine, as, in this country, there is participation of state

and municipal bodies both in protecting natural resources and in maintaining environmental balance (Fasolya, 2016).

National context

EA is identified as an instrument of transformation available for social mobilization that allows to problematize experienced situations, which is why it is effective in confronting water scarcity (Piccoli *et al.,* 2016). This aspect demonstrates that this education is linked to water resources, whether in Porto Alegre - RS (Prochnow; Silveira, 2017), Natal – RN, (Santos; Oliveira; Silva, 2018; Silva; Torres, 2020), Rio de Janeiro - RJ (Souza; Andrade, 2022), or even in Brasília - DF (Tamaio; Chagas, 2021).

In the first case, water quality, in the perception of EE for 8th grade students, is linked to solid waste, riparian forests, air pollution, urban afforestation, and birdlife. In the second, the factor (water quality) was associated with the misuse of this natural resource by members of family farming, who still do not receive adequate instructions that allow them to make the best use of this natural resource for organic cultivation. Therefore, the application of EA in this area of the national territory still lacks more practical applications to increase the water sensitivity index, for improvements and conservation of water and its quality.

An effective application of EA in relation to water resources was identified in schools in the municipality of Colinas - TO, in northern Brazil (Paz; Bispo, 2020): the capture of rainwater and its use in agriculture for irrigation. This action is a precursor to increasing the understanding of the student community and the surrounding area regarding two factors: understanding what EA is and the importance of this type of water conservation and use for the world. In the municipality of Marabá - PA (Miranda *et al.,* 2023), in this same region, the tool used was informative (booklet) for the management of the Itacaiunas river basin.

In Rio de Janeiro - RJ, still on the topic of "water", water scarcity is defined as an "environmental crisis" and the use of water as a "focus of conflict", based on the dichotomy between EA and problem-based learning (ABP). In the view of elementary school students, obtaining information about this resource in the environment and the problems it faces allows these students to participate better, as well as generating more practical solutions about the use of water in everyday life.

Regarding the knowledge constructed and mediated to students about EE, the curricular training of future teachers must be observed, who need to build, in their training, theoretical-

practical knowledge about the environment and problems, as well as having practical solutions, especially in areas of formal education. In Ariquemes - RO, northern region (Leal; Nunes; Ronquim, 2023), they reported that teachers from a municipal school in this location still do not apply EE in a theoretical-practical way that allows students an adequate understanding of conservation and environmental preservation.

The best EA actions, with positive impacts, only occur when municipal, state and federal educational institutions work together to better apply EA. In Parauapebas - PA, this union occurred (Silva *et al.,* 2023). In 2005, the Municipal Secretariat for the Environment, the city hall of this municipality, the Federal University of Pará (UFPA) and the Brazilian Institute for the Environment and Renewable Resources (IBAMA), implemented the Parauapebas Environmental Education Center (CEAP), which it already has a positive impact by developing environmental actions that improve both the quality of life of the community in that location and contribute to better use and conservation of natural resources.

Climate crisis - International context

The literature analyzed for this topic from the European continent indicated a concern with the consequences arising from this crisis. One of the examples comes from Canada, the city of Edmonton (Van Kessel, 2020). This place is concerned about climate crises because they are associated with floods, floods and floods that did not occur before. One of the explanations for these occurrences comes from Italy (Mangia *et al.,* 2020): the climate crisis and atmospheric warming are two phenomena that, in addition to being interconnected, interact with each other.

Still in Italy, the Department of Human and Social Sciences at the University of Bergamo emphasized that the understanding of this crisis will become more complete when aspects such as geography, geopolitics and the characteristics of populations, which can present different behaviors, are analyzed (Bougleax, 2017). In this context, a new subject appears in the Italian curriculum: “study of climate change” at all levels of education (Abbate, 2020).

After this insertion, this type of study began to exert a fascination on the new generation (Generation Z) when compared to other academic topics, and their active participation can generate new understandings as well as guarantee a more equitable future for this generational group (Ruvolo, 2020). In Spain, the climate changes that have an influence on this crisis must be associated with responsible consumption with simple pro-environmental acts, such as the use of public transport, the use of solar or wind energy, and how these acts interfere with climate change, but in positively (Velasco-Martinez *et al.,* 2020).

In New Zealand, the University of Wiakato, according to Hamilton (Everth; Bright, 2023), characterized climate change as "anthropogenic", and this culminates in a need for society to create actions that mitigate the consequences of these changes. Regardless of characterizations and definitions. In the United Kingdom, the University of Oxford, England, analyzed this crisis based on data contained in reports issued by the Conferences of the Parties (COP) in 2015 (COP 21): CO_2 levels continue to rise, as in 1990, was equal to 354.4 $ppmv^{-1}$, and in 2018, it increased to 408.5 $ppmv^{-1}$ (Banister, 2019).

National context

Concern about climate change described in the literature (Blanck, 2015) is growing due to: episodes of drought that occurred in the Amazon since 2005, and excessive rainfall in the southern region (Silva *et al.,* 2023), in 2004, 2005 and 2006. This is a proven fact, since, due to episodes of rain and drought in equidistant regions, government authorities promulgated Federal Decree No. 9,802, whose focus was on information and "awareness" of society about these changes and what should be done, with the effects caused by them, as a increase in the "greenhouse effect" (Brazil, 2017).

The climate crisis has already been identified in national literature (Alves, 2021), and tends to occur in areas where agricultural activity is more frequent due to changes in climatic factors and agricultural activities that damage the environment. Furthermore, the climate crisis may act on the body of ocean water, as well as on the soil, and tends to unbalance the planet's environment, which will lead to the loss of biodiversity and habitats, and undermine health and well-being of the human species (Gomes, 2022).

To change this reality, the Federal University of Mato Grosso, in the Center-West, promoted the installation and operation of an EA research group that develops studies on the climate (Willms; Nogueira, 2022). One of these teaching resources for studying climate emergencies used by them was a poem: *Vaqueiro Mariano*. Using this teaching tool, the study of the climate crisis and environmental impacts (e.g.: spontaneous fires) in the face of human degradation installed there becomes more in-depth.

Environmental education and the climate crisis - International context

With the integration of these themes, research began to emerge. In California, United States, the Department of Human Ecology at the University of that state indicated that the best way to reconcile EA with the climate crisis is to get students to use their brains so that their hands can build and manage landscapes on *Campus*, and sustainable ways that address the climate crisis (Kiers; De La Peña; Npawan, 2020). In Italy, the discussion is based on global environmental protection, as this protection must include environmental education in discussions (Lambri, 2022).

In Australia, one of the urgent actions of this association is curricular changes. This must occur through the insertion of the study on climate change and the knowledge of teachers, as well as in the form of transmitting this knowledge to students/students, with outdoor practices (Fox; Thomas, 2022; Reid, 2019). This could increase the environmental sensitivity of learners because, in Malaysia, (Karim *et al.,* 2022), an analysis of the secondary education curriculum content, indicated that there is no awareness of climate and environmental changes among students, which compromises the EA.

As for environmental sensitivity, it can be characterized by the inclusion or not of studies on climate change within the EA. This insertion has already been carried out in Glasgow, Scotland, United Kingdom, since 2021 (Cho, 2023). This occurred during COP-26, where the country's Ministers of Education and Environment recognized that, in environmental studies, the gap regarding climate change was in the expansion of content to be transmitted and learned. This fact contrasts with the situation in England, where this association has not yet been implemented due to the pedagogical rigidity in force (Dunlop *et al.,* 2020).

National context

The challenge of associating EA with the climate crisis is real at Brazilian level. However, it is necessary for there to be a rapprochement between the formal and informal contexts, and for the scope of EA projects to be more real and contemporary (Lima, 2017). The national concern regarding the insertion of climate change in Brazil, according to the Ministry of the Environment, Secretariat for Institutional Coordination and Environmental Citizenship, effectively occurred as a result of Brazilian subscription to a technical cooperation project signed between this country and the Nations Program United for Development (Brazil, 2010).

From another perspective, the association EA *vs.* CC is involved in the lifestyle that the planet's inhabitants have developed, as the economy governs this action. Therefore, it is a good

idea that this association is known to teachers working in primary education, because the environment has four common elements, which will allow students to: increase creativity and criticality regarding the environmental problems that accelerate the climate crisis (Becker; Marcomin, 2021). In this context, there will be a development of scientific literacy, which can be increased by the Kahoot tool[8], especially with regard to the scientific concepts inherent to this association (Kataoka; Moser, 2021).

This vision is noticeable when analyzing the document prepared by the United Nations Educational, Scientific and Cultural Organization (UNESCO), called "Preparing for the climate: a guide for schools on climate actions" (Pedrosa; Tamaio, 2022). In the conclusion drawn up by them, it was identified that in the proposition of this document, in terms of education, there is only one vision for sustainable development (EDS); the actions contained therein are punctual and must only occur in the formal space; there is no expansion of these actions to communities and social layers, nor does it present an emergency nature for the relationship between Environmental Education and the Climate Crisis.

However, the term "in preparation" does not coincide with the climate crisis, as in 1979, in Geneva-Switzerland, the First World Climate Conference took place, and the document analyzed was prepared in 2021 (Hughenin; Silva; Meirelles, 2022). These gaps may be causing a widening gap in scientific knowledge, because a year before this conference, in Brazil, the Pantanal biome, in November, suffered 4,611 fires, whose energy increase emerged in the Anthropocene, with the advent of industrial growth, especially from the use of heavy machinery and the expansion of agricultural frontiers (Willms; Nogueira, 2022).

All this degradation generated by the climate crisis requires educational instruments such as EA, in addition to deeper knowledge about human actions, to improve personnel training. This way, it will be possible to devise actions to combat, control and mitigate this problem. It is up to public authorities such as the Ministry of Education and Culture (MEC) and the Ministry of the Environment (MMA) to take the initiative to develop effective measures to mitigate deficiencies, in addition to providing training for all those involved, based on effective knowledge about the CC (Oliveira, 2023; Ramos *et al.,* 2023).

[8] Electronic platform that stores and allows countless games as an educational tool. These games are based on several multiple choice tests (https://ceduc.unifei.edu.br/tutoriais/como-utilizar-a-plataforma-kahoot/#:~:text=Kahoot!,Web%20ou%20do% 20application%20Kahoot.).

Final remarks

As can be seen, regardless of geographic space, the application of EA is already a fait accompli and its complexity is present both in higher education institutions and at basic levels. Several mechanisms have already been used to improve environmental perception, reasoning, interpretation, as well as the interrelationship of EA with other sciences. However, the results did not increase or stagnated, which creates a gap expressed by water scarcity, causing environmental crises and conflicts.

Another gap identified is "climate emergencies", arising from the climate crisis and which are objects of studies based on climate change, which generates this fact. There is an urgency for global solutions that allow the reversal of this crisis, whose consequences for the user, capitalists or not, carriers of new technologies or not, replacing harmony between man and nature, lies in the (possible?) resurgence of *Carpe diem*.

There is also global disagreement regarding how to measure the data obtained and the environmental factors that are included in these data, especially environmental ones, such as variations in ocean and land surface temperatures. Inserting consumption behavior into the analytical context, based on economic and social power, is of utmost importance. Also considering the destination of solid waste produced and how much this contributes, whether in reduction or increase, to climate change and its inclusion in the context of EA is equally relevant.

Therefore, a uniformity regarding the association of EA with the climate crisis is necessary with a certain urgency, in order to not leave a cruel and irreversible climate legacy to future generations, which would compromise food security and increase water scarcity.

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