

BRAZILIAN BIOMES AND ENVIRONMENTAL EDUCATION: POTENTIALS FOR THE SCIENTIFIC AND ECOLOGICAL FORMATION OF HIGH SCHOOL STUDENTS

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Abstract

The results of the study conducted by the authors indicate that the Brazilian biomes content did not receive the proper attention, in the period from 2015 to 2019, in the "Natural Sciences and their Technologies" section of the National High School Examination (ENEM), which might suggest that these are considered secondary content in these exams. This can impact the scientific education of students and the development of skills that enhance the idea of belonging to a specific place in defined space and time. In educational, political, cultural, and social discussions, biomes are in focus and are understood as essential for the conservation of Earth's biodiversity. All of these aspects relate to environmental education and the ecological formation of individuals. In this qualitative study, a pedagogical intervention activity is reported, which was conducted with a group of high school students from a Brazilian Basic Education school as part of a master's research project. The students' activity consisted of creating six infographics, each covering one of the Brazilian biomes. These infographics, developed based on bibliographic research, were printed in poster format and displayed in the classroom as a didactic and motivational resource. The intention was to contribute to the scientific and ecological education of the students, especially regarding their awareness that knowledge about biomes is essential for their preservation. Emphasis was placed on the maintenance of genetic heritage of species, the ongoing need for soil and water conservation, as well as the preservation of forests, which are crucial for regulating rainfall and the planet's climate. It is concluded that the appropriate approach to biomes could be useful for the scientific and ecological education of students and should have a central place in basic education, not as an option but as a responsibility that must be urgently taken on.

Keywords

Environmental, Biodiversity, Pampas, Amazon, Pantanal.

Resumo

Os resultados de estudo realizado pelas autoras indicam que o conteúdo biomas brasileiros não recebeu a devida atenção, no período 2015-2019, na prova de Ciências da Natureza e suas Tecnologias, no Exame Nacional do Ensino Médio (ENEM), possibilitando inferir que esses são considerados conteúdo secundário nessas avaliações. Isso pode impactar a formação científica dos estudantes e o desenvolvimento de competências que potencializam a ideia de pertencimento a um determinado local, em espaço e tempo definidos. Nas discussões educacionais, políticas, culturais e sociais, os biomas estão em foco e são entendidos como imprescindíveis à conservação da biodiversidade da Terra. Todos esses aspectos dizem respeito à educação ambiental e à formação ecológica das pessoas. Nesse estudo, de abordagem qualitativa, relata-se uma atividade de intervenção pedagógica realizada com uma turma de estudantes do Ensino Médio, de uma escola de Educação Básica brasileira, ao abrigo de uma pesquisa de mestrado. A atividade dos estudantes consistiu na elaboração de seis infográficos contemplando cada um dos biomas brasileiros. Elaborados a partir de pesquisa bibliográfica, os infográficos impressos em formato de poster ficaram expostos em sala de aula como recurso didático e motivacional. Pretendeu-se contribuir com a formação científica e ecológica dos estudantes, principalmente no que diz respeito à consciência de que o conhecimento relativo aos biomas é fundamental à sua preservação. Procurou-se dar destaque à manutenção do patrimônio genético das espécies, à necessidade permanente de cuidados com o solo e com a água, assim como a conservação das florestas, imprescindíveis



à regulação das chuvas e do clima do Planeta. Conclui-se que a abordagem apropriada dos biomas poderá ser útil para a educação científica e ecológica dos estudantes, devendo ter um lugar central na educação básica, não se constituindo uma opção, mas uma responsabilidade que deve ser assumida com urgência.

Palavras-chave

Meio ambiente, Biodiversidade, Pampa, Amazônia, Pantanal.

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Introduction

The current global context we experience, in various and frequent moments and situations, has shown that we are reaching the limits of planetary conditions. The consequences of climate change, for instance, concern the vast majority of the population, as they constitute the most vulnerable segment to environmental disasters. Hence, it is likely that few people, when asked about the importance of scientific studies on this topic, would deny its urgency and society's responsibility in the face of socio-environmental, economic, and health-related conflicts. In addition to this, we have the increasing social inequalities, the disrespect towards the space and knowledge produced and cultivated by traditional communities, scientific denialism, and climate changes, among many other situations. It is becoming increasingly urgent for humanity to assume, with science and prudence, the role of being and existing in the world in a more balanced and responsible manner, by adopting ecologically oriented attitudes and overcoming the individual-nature dichotomy (Leff, 2003; Luzzi, 2012; Carvalho, 2013). In this context, Environmental Education and the ecological formation of individuals have been identified as crucial to the development of environmentally sustainable societies.

It is understood that the production of scientific knowledge to underpin educational proposals largely originates from the field of Ecology, a promising area concerning the formation of critical and socio-environmentally responsible citizens. In this article, referencing the definition by Ab'Sáber (2009, p. 18), ecology is defined as follows: "*Ecology is the science that studies habitats and the environment, examining the relationships between living beings and the physical environment in which they live*" (Ab'Sáber, 2009, p. 18). Thus, as a science with a broad approach, Ecology is related to the organization of Brazilian biomes, which is the scope of this article.



Currently, the concept of a biome is associated with the idea of nature conservation, and its visualization has been sought through the aggregation of ecosystems by proximity and regionalization. According to the Brazilian Institute of Geography and Statistics (IBGE), a biome comprises a set "of life (plant and animal) constituted by the grouping of contiguous and identifiable types of vegetation on a regional scale, with similar geoclimatic conditions and a shared history of changes, which results in a unique biological diversity" (Brazilian Institute of Geography and Statistics - IBGE, 2004, p. 11). This is a political definition of the concept of a biome, resulting in six groups — large landscape and macro-ecological domains — in Brazil, named: Caatinga, Cerrado, Pantanal, Amazon, Atlantic Forest, and Pampa (Ab'Sáber, 2003, 2009).

In his book, *Ecosistemas do Brasil* (Ecosystems of Brazil, in English), from 2009, the author locates these six landscape domains as follows: (1) Amazon as lowland forested domains of the Amazon; (2) Caatinga as semi-arid inter-plateau depression domains of the Northeast; (3) Atlantic Forest as forested hill sea domains; (4) Cerrado as plateau domains covered and penetrated by gallery forest; (5) Araucaria plateau domains as the southern Brazilian plateau, stretching from São Paulo to Rio Grande do Sul; and (6) Pampa as mixed prairie domains of the southeast of Rio Grande do Sul. The first four domains are intertropical, while the latter two are referred to as Brazilian subtropical domains.

It is worth noting that Brazilian high school Biology textbooks contain different definitions and numbers of Brazilian biomes. However, in this study, the classification of biomes according to the IBGE, also endorsed by Ab'Sáber (2009), is adopted as described in previous paragraphs. Furthermore, it is important to consider that there are studies indicating various weaknesses in the content approach of these textbooks. Specifically, concerning the content related to Brazilian biomes, Raiol, Oliveira, and Lemos (2019) identified in their research that there is an absence of maps that show aquatic environments and that important and current aspects, such as potential threats to the integrity of the biomes, are not addressed in these textbooks.

In addition to this, there is the evidence obtained in research carried out by the authors of this article when analyzing the questions in the Science of Nature and its Technologies test of the National High School Exam (ENEM) in the period 2015-2019 (Schneider, Boer and Scheid, 2021). The results related to questions on Brazilian biomes in this test, considering the time frame, showed that knowledge of Ecology was frequent in the Science of Nature and its Technologies tests, however, questions related to Brazilian biomes were practically non-existent. This suggests that the topic of Brazilian biomes is considered secondary content in ENEM assessments, which could affect the teaching of biology in Brazilian schools, given that the content chosen in the exam is generally a reference for teachers' didactic-pedagogical planning.

Therefore, teachers and students need to employ additional resources beyond textbooks through active methodologies to address the study of biomes in the face of current challenges. To help the understanding of high school students regarding Brazilian biomes, it is necessary to bring them closer to the reality of their life context and create learning situations in which they become protagonists of their knowledge. For this to happen, the



methodology used needs to be active and engage with the everyday language of the students.

One of these possibilities is the development of a Didactic Sequence (DS), so that students engage in knowledge production through research. It is understood that this is one way to provide a meaningful experience for both the teacher and the learner. In this sense, digital Information and Communication Technologies (ICT) can expand the possibilities for teaching and learning (Moran *et al.*, 2000), as in today's world, those who are not "*connected and lack digital literacy lose important opportunities to inform themselves, access rich materials available, communicate, become visible to others, publish their ideas, and increase their future employability*" (Moran *et al.*, 2000, p. 26). Further, according to Nascimento, Guimarães, and El-Hani (2009), a well-developed DS can contribute to teaching knowledge by fostering the articulation between reflective thinking, knowledge, and professional practice.

Given such a context and considering that all of these aspects can have an impact on students' scientific education and the development of skills that enhance the idea of belonging to a certain place, in a defined space and time, this article reports on a pedagogical intervention activity carried out with a group of high school students from a Brazilian elementary school, as part of a master's research project whose central theme was the study of Brazilian biomes. This topic is justified because in educational, political, cultural and social discussions, biomes are in the spotlight and are understood to be essential for the conservation of the Earth's biodiversity. All of these aspects relate to environmental education and people's ecological education, as stated in the article's title.

Considerations on the Ecological Education of Students in the Brazilian Context

The United Nations Educational, Scientific and Cultural Organization (Unesco), in its recently released report "Learn for Our Planet: A Global Review of How Environmental Issues are Integrated into Education" (Unesco, 2021), calls on society to intensify efforts by 2030 to address environmental issues, considering that:

The world has long recognized the need to harness the power of education to tackle the challenges of sustainable development, but there is still not enough systematic information about countries' positions in addressing climate change, biodiversity, and the environment more broadly in educational systems. To make progress, we must understand where the gaps lie (Unesco, 2021, p. 4).

In Brazil, although there is a strong understanding that Environmental Education should be integrated into the development of all curriculum components, in most basic education curricula, it is confined to one subject: Natural Sciences in Elementary School and Biology in High School. Considering this article discusses issues related to Brazilian biomes and



the content covered in Biology education, the following paragraphs provide information about this curriculum component.

The study of Biology in High School aims to present and develop the main concepts associated with living organisms for high school students, enabling their integration with biological knowledge that will be necessary for daily life (contextualization) and used in the assessment processes of the ENEM and university entrance exams (entrance exams for higher education courses).

According to the National Common Curricular Base (BNCC), in High School, the Biology curriculum is part of the area of Natural Sciences and their Technologies and is characterized as the science that studies "*life in its various aspects as well as the transformation of living organisms over time*" (Ministry of Education, 2018), with the purpose of promoting improvement in the quality of life and the preservation of the ecosystem as a whole. With the implementation of the BNCC throughout Brazil, High School consists of Basic General Education and Formative Paths, which allow students to deepen their knowledge in the desired area.

The current organization of the High School curriculum was developed to consolidate and deepen the knowledge acquired in Elementary School, and as a result, the area of Natural Sciences and their Technologies is characterized by the presence of themes such as Matter and Energy, Life, Earth, and Cosmos, traversing through the ten general competencies established by the BNCC. Regarding the methodological aspects of teaching, this document encourages student protagonism and learning through research. Therefore, it is advocated that active methodologies enhance the construction of knowledge in Biology, making learning more meaningful and interesting for the student.

It is worth mention that, according to the BNCC and complementary guidelines, for the area of Natural Sciences and their Technologies, three specific competencies have been defined to be developed over the three years of High School:

Competence 1: Analyze natural phenomena and technological processes, based on interactions and relationships between matter and energy, to propose individual and collective actions that enhance productive processes, minimize socio-environmental impacts, and improve living conditions at the local, regional, and global levels.

Competence 2: Analyze and use interpretations of the dynamics of Life, Earth, and the Cosmos to develop arguments, make predictions about the functioning and evolution of living beings and the Universe, and ground and defend ethical and responsible decisions.

Competence 3: Investigate problem situations and evaluate applications of scientific and technological knowledge and their implications in the world, using procedures and languages specific to the Natural Sciences, to propose solutions that consider local, regional, and/or global demands, and communicate their findings and conclusions to various audiences, in diverse contexts and through different media and digital ICTs.

It is observed that the Brazilian educational legislation, in its curriculum guiding documents, is aligned with the challenges faced by society. However, the question that



arises relates to the approach to these competencies and skills necessary for citizenship education in basic education schools, which often is not adequate.

The Context of Pedagogical Intervention

The BNCC (Ministry of Education, 2018) determines that Brazilian biomes are part of the content or objects of knowledge in Biology and Geography in High School. However, they are generally addressed superficially in these curriculum components. To give meaning to the theme and actively engage students, a DS was proposed, following the perspective of Zabala (2010) and Oliveira (2013), using ICT resources as learning enhancers. Therefore, the activities were planned to be developed using smartphones, tablets, or notebooks with Internet access. The development of this DS occurred within the framework of a research project that resulted in a Master's thesis and the proposal of an Educational Product, developed in a Postgraduate Program in Scientific and Technological Education at a Community University in southern Brazil.

The specifications of the stages of the DS are described in Table 1 below.

Table 1: Stages and Description of Procedures in the Didactic Sequence: Study of Brazilian Biomes.

Stage	Description of Activities	Workload
1 st Stage Initial questions	<ul style="list-style-type: none"> - Which biome do we live in? - What are the environmental conditions of this biome? - Do you know of any measures to preserve this biome? To answer the questions, the students researched websites and books. <ul style="list-style-type: none"> - Collective discussion of the answers. 	2 hours/class
2 nd Stage Organization of groups and orientation of research activities	<ul style="list-style-type: none"> - The class was divided into small groups; - Each group was given a biome to research on websites and books indicated by the teacher; Group 1: Caatinga biome Group 2: Cerrado Biome Group 3: Pantanal Biome Group 4: Amazon Biome Group 5: Atlantic Forest Biome Group 6: Pampa Biome	2 hours/class
3 rd Stage Extracurricular Activity	<ul style="list-style-type: none"> - Research in the library and virtual environment with the following items: - Geographical location and climate; - Main characteristics of the biome's fauna and flora; - Identification of the main environmental problems of the biome researched - Organization of information in a PowerPoint presentation. 	4 hours/class
4 th Stage Presentation Seminar	<ul style="list-style-type: none"> - Each group presented their researched biome to the class; - Discussion of the causes and consequences of human impact on these biomes. 	4 hours/class



5 th Stage Infographic Assembly The activity took place in the computer lab or remotely	- With the knowledge acquired from the research and presentations, each group created an infographic to display in the classroom; - The infographics were created using the Canva tool, available at https://www.canva.com/	3 hours/class
6 th Stage Infographics Presentation	- Exhibition of the infographics in the classroom. - Presentation of each infographic to the class. - Discussion on the topic of Brazilian biomes.	2 hours/class
7 th Stage Ecological Trail	- For on-site knowledge of a fragment of the Atlantic Forest biome, an ecological trail was conducted in an environmental preservation area located 20 km from the school. - Observations and identification of plant species, mosses, lichens, fungi, animals, and anthropogenic environmental changes in the area were made. - Students took photos and videos using their cell phones.	4 hours/class
8 th Stage Video Extracurricular Activity	After the trail, each group made a video with the photos taken, reporting the main issues encountered and the importance of the researched biome. The video was shared on the school's social media platforms and served as material for analysis.	3 hours/class
9 th Stage	Presentation / Exhibition	4 hours/class
10 th Stage	The students carried out an evaluative activity on Brazilian biomes, answering 10 objective questions taken from ENEM exams and entrance exams from different universities.	1 hour/class

Source: The Authors (2020)

The implementation of the DS took place during the second semester of 2020, involving a first-year class of High School at a private school located in a municipality in the northwest of the state of Rio Grande do Sul, in southern Brazil. The study included 25 students aged between 15 and 16, which of the nine were females and were males. Considering that in 2020 there were restrictions imposed by the Coronavirus pandemic, all activities except the Ecological Trail were conducted remotely, using *Google Meet* and *Google Forms* resources. The educational trail was conducted in person in 2021.

In accordance with the arguments of Oliveira (2013), that a DS can be considered both a teaching technique and a research method, the research project was submitted for review by the CEP/Conep system, as provided for in Resolution CNS/MS 510/2016, as follows: "*research in human and social sciences requires respect and guarantee of the full exercise of the rights of the participants, and must be conceived, evaluated, and conducted in such a way as to foresee and avoid possible harm to the participants*" (National Health Council, 2016). Such a resolution lays down norms applicable to research in Human and Social Sciences in Brazil. Thus, all activities were ethically designed and studied for the level of development of the participants, seeking benefits in student learning. Parents signed a Free and Informed Consent Form (FICF) and students consented to participate in the study through the Assent Form. The research



protocol was approved by the Ethics Committee on Research with Human Beings of the University (CEP/URI) on August 31, 2020.

Results

As this article focuses on the analysis of the six infographics produced by high school students and the contributions of this activity to their scientific and ecological education, we begin by presenting the analysis related to the application of the DS.

The activity that led to the creation of the infographics began with the students' inquiry about their prior knowledge of Brazilian biomes. The responses were recorded in a Field Diary by the teacher-researcher (one of the authors), allowing for an evaluation of the knowledge production process by the students.

The students were divided into 6 (six) groups, each tasked with preparing a presentation about the biome assigned to them through a previous draw, as well as organizing an infographic containing the main information about the biome under study (biome name, location, flora, fauna, climate, importance, and references). Theoretical concepts, visualization, and presentation of the characteristics of each biome were considered fundamental for understanding the species of fauna and flora that live in each biome, as well as for arousing the students' awareness of the importance of environmental preservation.

The Canva tool (<https://www.canva.com/>), freely accessible, was used by all groups to create the infographics. The infographics were displayed on a clothesline in the classroom and remained available for consultation throughout the semester. Figures 1 to 6 depict the infographics of the six biomes produced by two groups.



Figure 1: Infographic Amazon Biome



Figure 2: Infographic Atlantic Rainforest Biome



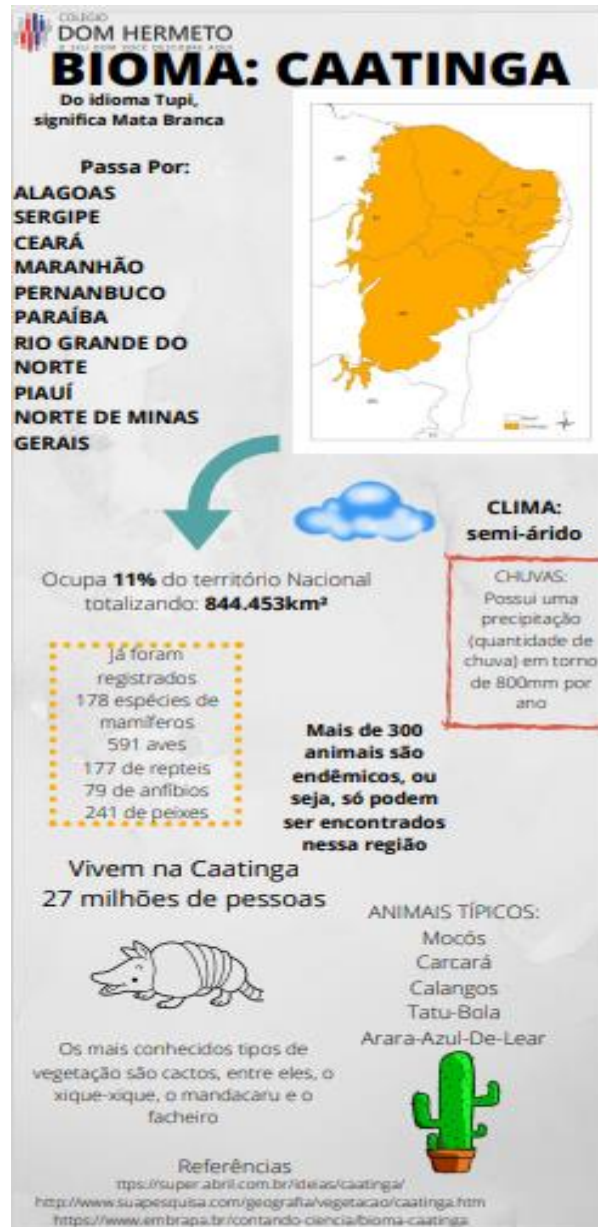
Source: Research Data



Figure 3: Infographic Cerrado Biome



Figure 4: Infographic Caatinga Biome



Source: Research Data



Aspects Highlighted by the Students in the Developed Activity

Regarding the Amazon Biome, as referenced in Favaretto (2015), they highlighted that about 60% of the total area of this dense ombrophilous forest (which spans nine South American countries) is located in Brazil, where it covers 40% of the territory. To a greater or lesser extent, it covers the states of Rondônia, Acre, Amazonas, Roraima, Amapá, Pará, Maranhão, Mato Grosso, and Tocantins. Rainfall and temperature are high, favoring life development, which enables the flourishing of one of the greatest biodiversities on Earth. In the Amazon rainforest, agricultural and livestock activities, as well as logging, are progressively depleting the forest.

Similarly, they identified that this biome occupies the largest area of Brazilian territory with great importance due to its rich biodiversity of flora and fauna, and in cloud formation, modifying the climate globally. During the presentation, the group responsible for the research mentioned the documentary "A River in the Sky" produced by National Geographic (available at <https://www.youtube.com/watch?v=8auUznr49pM>), which highlights the great importance of the Amazon rainforest for the maintenance of life on our planet.

The main types of anthropization found were deforestation, wildfires, cattle ranching, and grain cultivation. Additionally, the illegal trade of animals is another way of driving various species to extinction.

Based on data from the Brazilian Ministry of the Environment (2020), the students reported that the Atlantic Forest biome was the second-largest ombrophilous forest in South America, covering the entire coast of Brazil (from Rio Grande do Sul to Rio Grande do Norte). Currently, due to deforestation (mainly from the 20th century onwards), it is greatly reduced, being one of the ten most threatened tropical forests on the planet, as stated by Favaretto (2015). Originally, the biome covered more than 1.3 million km² in 17 states of Brazilian territory, extending across much of the country's coast. However, due to human occupation and activities in the region, today only around 29% of its original coverage remains (Ministry of the Environment, 2020).

In the context of the studied biomes, the Pampa biome is the most familiar to the students because the pampas (also called mixed grasslands, southern grasslands, or Gaúcho grasslands) constitute an herbaceous formation that occurs in Rio Grande do Sul, extending into Argentina and Uruguay. Rainfall is not high; the predominant vegetation consists of grasses, with remaining forests along the riverbanks. The pampas are subject to erosion and desertification caused by intense grazing and common wildfires in the region, as warned by Favaretto (2015). The natural landscapes of the Pampa vary from hills to plains, rocky hills to hillocks. The biome exhibits an immense cultural heritage associated with biodiversity, as highlighted by the Brazilian Ministry of the Environment (Ministry of the Environment, 2020).

With an average altitude of 100m, the Pantanal biome is the largest flooded plain in the Americas, with an estimated area of 150,000 km². It occupies a significant part of the states of Mato Grosso and Mato Grosso do Sul, extending into Bolivia and Paraguay. In the higher lands, various vegetation formations can be found, such as grasslands,



savannas, scrublands, and forests (Favaretto, 2015). Despite being the smallest continental biome in Brazil in terms of territorial extension, as stated by the Ministry of the Environment (Ministry of the Environment, 2020), this fact does not detract from the abundant richness that this biome harbors.

The capital of Brazil, Brasília, is located in the Cerrado biome. The students, based on Favaretto (2015), highlighted that the cerrados, covering 25% of the national territory, contain one-third of all Brazilian species. They are situated practically in the center of the country, occupying parts of Rondônia, Tocantins, Mato Grosso, Mato Grosso do Sul, Goiás, the Federal District, Bahia, among others. The cerrados have an annual rainfall of around 1500 mm, with soil poor in nutrients and rich in aluminum. Considered one of the world's biodiversity hotspots, the Cerrado exhibits an extremely high abundance of endemic species and undergoes exceptional habitat loss. From a biological diversity perspective, the Brazilian Cerrado is recognized as the richest savanna in the world, harboring 11,627 species of native plants already cataloged (Ministry of the Environment 2020).

The students attributed great importance to the Cerrado biome because it is the only one that connects with the other Brazilian biomes, except for the Pampa biome. They were also surprised by its biodiversity and attributed its anthropization mainly to deforestation for crop cultivation and pastureland.

The Caatinga biome is exclusively Brazilian and covers almost 10% of the national territory (Castro *et al.*, 2006), suffering anthropization in the form of wildfires, deforestation, and hunting, leading to its fragmentation and habitat reduction. It can be considered a particular type of savanna that occupies, to a greater or lesser extent, the states of the Northeast, as well as some regions of northern Minas Gerais. Its temperatures are high, and air humidity is low. Rainfall is scarce, and rains only occur in the winter, occasionally leading to prolonged dry periods (Favaretto, 2015). The Ministry of the Environment (Ministry of the Environment, 2020) states that despite its importance, the biome has been rapidly deforested, mainly in recent years, due primarily to the consumption of native wood, illegally and unsustainably exploited for domestic and industrial purposes, overgrazing, and conversion to pastureland and agriculture.

In summary, the Brazilian biomes encompass all the diversity of fauna and flora that the country possesses. However, their conservation is increasingly threatened by anthropogenic activities, mainly those related to the conversion of natural landscapes into areas for agricultural production and real estate development (Aleixo *et al.*, 2010). This is mainly due to population growth and the lack of public policies aimed at their preservation.

Results Discussion

During the implementation of the DS, it was evident that the students engaged with the content. The use of technological resources sparked an interest in the subject matter. Theoretical concepts, visualization, and presentation of the characteristics of each biome



were crucial for understanding the species of fauna and flora inhabiting each biome, as well as for instilling in the students an awareness of the importance of preservation.

Specifically regarding the infographics, it was observed that the students understood the concept of biomes and were able to accurately characterize the six Brazilian biomes. They utilized information, text, and images as visual representation of the content studied, thereby developing technological skills and text interpretation abilities. It highlights the importance of providing the necessary encouragement for students to seek answers to the challenges posed through research.

The use of active methodologies in the classroom helps students develop the skills required by the BNCC. The organization of the study of Brazilian biomes in an DS proved to be appropriate as an innovative and efficient methodology for school learning. Similarly, it is observed that the activity of elaborating infographics is aligned with the skills foreseen in the BNCC (Ministry of Education, 2018), especially the EM13CNT302 skill:

Communicate, to varied audiences, in diverse contexts, results of analyses, research, and/or experiments, elaborating and/or interpreting texts, graphics, tables, symbols, codes, classification systems, and equations, through different languages, media, digital information, and communication technologies (TDIC), in order to participate and/or promote debates around scientific and/or technological topics of socio-cultural and environmental relevance (Ministry of Education, 2018).

It was observed that during the discussions about the research conducted, students realized that the main anthropogenic actions in some biomes are cattle ranching, grain cultivation, and wildfires. All of this is causing a process of desertification in various regions of the biomes, such as the Pampa and the Cerrado, highlighting the need to preserve each ecosystem so that they maintain their own characteristics and biodiversity.

Final Considerations

Given the challenges humanity currently faces, particularly regarding the socio-environmental issues affecting the entire planet, such as climate change and its global ramifications, authors like Sauv  (2005), Leff (2003, 2007), and Luzzi (2012) argue that societies need to adapt their way of life and organization so that humans can cope with increasingly frequent and severe environmental problems. In this regard, it is acknowledged that schools are not the sole solution to these socio-environmental issues. However, it is precisely within this space that there are conditions and potential for the collaborative and transformative production of new knowledge, enabling intervention at the root causes of problems rather than merely addressing their effects.

In line with the points raised by Unesco, it is essential to adopt new directions and perspectives for Environmental Education in the Brazilian school context.



The results obtained in this developed project indicate that the appropriate approach to biomes could be useful for the scientific and ecological education of students, should have a central place in basic education, not constituting an option, but a responsibility that must be assumed urgently.

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