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Environmental Education and Sustainability in the Brazilian High School: To Raise Awareness is to Commit to Life

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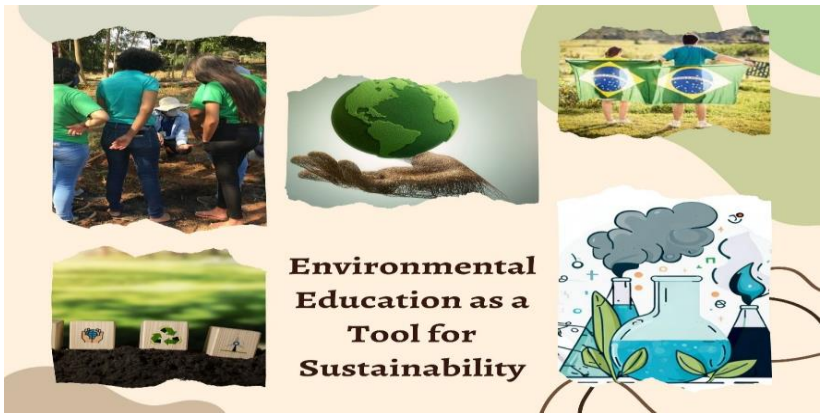
Environmental Education (EE) is an essential theme that must be addressed broadly and effectively in High School. Brazilian High School students are aware of environmental issues that devastate the country they live in. Thus, the Base Nacional Comum Curricular (BNCC) is a mandatory document whose norms guide and define common learning results of curricula in all public and private schools in Brazil. Therefore, this study aimed at analyzing how EE was inserted into the latest version of the High School BNCC. It is an exploratory study which analyzed documents and bibliographic sources. Regarding its methodology, key words connected to EE and to promotion of sustainability in High School were used for the search in the document. After data issued by the BNCC were analyzed, we perceived that EE is briefly inserted in the document; as a result, it is neither taught nor practiced as it should be. Since EE is generically treated and poorly addressed, it does not contribute to a broad, transversal and integrative approach. Teaching EE and sustainability in High School is an important step to achieve legally established goals, go beyond theories and, mainly, put into practice speeches given by the Brazilian public management.

Graphical abstract



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1. Introduction

The use of the term sustainability in the educational field has been increasingly perceptible. Its most disseminated sense is the one defined by the UN World Commission on Environment and Development which states that sustainable development should meet the needs of the present without compromising the ability of future generations to meet their

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own needs [1]. Thus, sustainability is the focus of several fields of knowledge and goes beyond the idea of saving natural resources which has been exhaustively debated in High School.

Environmental Chemistry has emerged in the scope of sustainable technologies to mitigate impact on the environment, promote adequate management of solid and liquid residues and lead to conscious use of renewable energy sources and other innovations in this field. It is an important area in Chemistry which is able to favor and encourage young students to construct scientific knowledge if appropriately inserted into Brazilian High School curricula [2].

Sustainability was believed to be restricted to environmental goals and to have no economic nature for a long time. However, the economic sector has shown much interest in the work with sustainable development nowadays. Environmental Chemistry and Geography teaching have dealt with several current themes that benefit the society, such as Certified Emission Reductions, fair commerce networks and clean energy companies that assemble household generators [3].

Concerning pedagogy, a school is where educational and social attainment takes place, where relevant themes must be addressed, since students, as citizens and future professionals in the labor market, must know the social reality and its capitalist means of production. Questions about how schools have dealt with the issue of sustainable development, environment and sustainable technologies must be clarified: *have Brazilian High School students really acquired such important knowledge to their lives in society?* [4].

We believe that both themes Environmental Chemistry and sustainability must be addressed in class and focus on sustainable management of natural resources in order to prevent irreversible tragedies which may compromise needs of the next generations. In fact, several issues related to sustainability and EE must be discussed in the school context. Efforts have been made to enable High School students to take kindly to Environmental Chemistry, which is not loved by everyone, since it is an area that requires much attention to theoretical, methodological and practical development [5].

When we analyzed the theme of EE in the new Law of High School (NLEM) and the Base Nacional Comum Curricular (BNCC), we noticed that something was missing [6]. *What is missing in such important documents to make Brazilian EE more effective? Is it implicit? Should teachers bring up this issue? Which should be their theoretical grounds? Should teachers choose them?* We would like readers to know that the idea of environment has changed significantly in Brazil in the last decades. This polysemic term has been understood in different ways, depending on the context and on interests at stake. The definition of this concept takes to the definition of EE itself and to how it is taught in High School [6].

The BNCC should not only address EE in Brazil in detail but also provide tools that may suggest different ways of teaching it, since all 27 Brazilian states have distinct realities. There is lack of holistic and emancipatory knowledge which may re-educate the population to ensure sustainable present and future for the next generations on the planet. It is disappointing to know that, in the BNCC, the themes are addressed superficially, a fact that means the approach is fragile [6].

Even though the field is briefly mentioned in both documents, its characterization, intention and objectivity are not pointed out. It may be said that its existence is acknowledged but the theme of EE is not effectively found in both documents. It results from the lack of public policies, mainly on update and reformulation of policies on EE from 2012. Some specific measures have been taken and the National Program of EE (ProNEA), issued in 2003 to introduce guidelines, goals and target public of EE in Brazil, was re-edited in 2018 [6]. It was the fifth edition of the program but it did not include any news and problematizations, even considering challenges for the next decades of the Anthropocene. The second part of the text aims at finding out how this void emerged and at understanding it in the light of the Brazilian political and economic situation over the last years [6].

The 2020's, for instance, started with concern for the planet due to the current climate crisis resulting from global warming, anthropic actions, silencing of public policies, movements against Science and several other issues related to the model of modern consumption [7]. Consonant with it, since the last decade, there has been some reformulation in the field of Education in Brazil by means of the BNCC, which went into effect in 2020 (Elementary School) and in 2022 (High School) when the so-called "*New High School*" was established. EE became an indispensable theme in every curriculum in all teaching levels in the search for critical and epistemic debate about contemporaneous issues, mainly to form social actors able to take wise decisions in different social loci [7].

Based on these remarks, this study aims at giving an overview of research into the environmental theme in the Brazilian High School by means of a bibliographic review of papers published by Brazilian authors and analyzing how EE was inserted into the latest version of the High School BNCC.

2. Theoretical Framework

To debate about the BNCC and insertion of environmental themes is necessary because we believe that the proposal of a national curriculum in Basic Education requires participation, critical position and dialogue with the civil society, mainly with its most interested group, i. e, teachers.

Worrisome and alarming facts shall be discussed in this section. Firstly, when the descriptor "Environmental Education (EE)" was used, it only appeared once – in the Introduction – in the document (BNCC) [8]. EE has been presented as one of the contemporaneous themes that must be inserted into curricula and pedagogical proposals in schools, in transversal and integrative ways, sine 2018. Unfortunately, EE has been almost excluded from the BNCC, which is a strange fact, since it is a developing field of knowledge which has got strong in national and international public policies [8].

It should be highlighted that there has been advance in public policies regarding acknowledgement and obligation of EE in Basic and Higher Education. The document – National Curriculum Guidelines for Environmental Education – says that: "EE is a dimension of Education, an intentional activity of social practice, which must enable individuals to develop socially in their relation with nature and the other human beings to potentialize human activity to fill it with social practice and environmental ethics" [9].

Broadly, EE cannot be practiced as a formal course in school; it is not a desperate situation since it may keep its privilege of interdisciplinary nature. On the other hand, even though this diffuse practice makes sense, it does not necessarily take place. Several courses in High School state that they teach EE; as a result, EE has no "*place*". Since EE

belongs to everybody, it ends up being nobody's responsibility [10].

After some years, EE went beyond the sphere of interdisciplinarity to reach the dimension of multidisciplinarity. Environmental themes surpass engagement of professionals, such as biologists, geographers and ecologists, and reach all citizens, or rather, all social actors, since everyone is subject to effects of environmental issues [11]. Regarding the inclusion of practical activities in EE in school, students must "learn by doing" and aggregate value to the theory. Students' engagement in environmental projects makes them feel responsible for concrete tasks related to the theme since they carry out teamwork and exercise cooperation and collective work. Students' participation arises socio-environmental issues and the perception of the need to contribute to environmental preservation, sustainability and ethical-citizenship behavior [11].

Concern for developing citizens that care for sustainability involves an awareness-raising process which may trigger their self-motivation [12]. In the scope of EE, teaching that aims at conscious consumption is based on the idea that ostentatious and wasteful consumption, together with population exponential growth and its demographic explosion, culminated in shortage of natural resources and keeps degrading the environment. In other words, EE uses Ecology and the environment as excuses to act on human integrity. Simple attitudes, such as learning how to save, recycle, share, complement, preserve and accept differences, may represent a revolution in the social context [12].

Much has been said about EE in Basic Education and its contributions to the development of citizenship and sustainability. A new discussion about environmental issues and transformation of knowledge, values and attitudes – which must be followed in the new reality to be constructed – needs to be included in the educational process [13]. EE is recent and has increasingly developed in educators' everyday practices. It plays an important role in reaching the whole population, including new generations, and form citizens that may take on the process of changes in the current environmental state of Earth. Since traditional educational does not prepare individuals to face the complex global reality, EE becomes a necessity, a continuous and permanent process that must encompass all school levels and steps in formal and informal Education [13].

Thus, this theme was chosen due to significant changes that have taken place in the field of EE and affected the BNCC directly in the last years. Besides, they shall affect Pedagogical Political Projects (PPP) and curricula which have been designed, adapted and applied to guide the educational field [14]. However, the consequence shall be changes in EE in Brazil; thus, a critical analysis of current public educational policies on EE is fundamental to understand the changes and propose a dialogue that prevents potentialization of the market at the expense of negative environmental impact on the environment [14].

3. Material and Methods

3.1 Methodological procedures

This study employed the Discursive Textual Analysis (DTA), a methodology that analyzes qualitative information and has an exploratory nature to produce new understanding of texts and discourses. The DTA may be understood as a self-organized construction process in which new understanding emerges from a recursive sequence of three components: corpus deconstruction, unitarization and categorization [15].

The DTA aims at deepening the process of deconstruction called unitarization, a recursive one that enables to dive into senses attributed to texts under analysis. Units of significance lead to the process of organization of units and development of initial categories which enable the development of intermediate categories and, finally, final categories emerge from the researcher's perspective about the phenomenon [15]. Categorization is the process of learning and communication of new understanding in a movement of synthesis and construction of systems of categories with new learning and comprehension that originate a metatext [15].

The BNCC was read to start the first process of analysis which consists in deconstructing texts and carrying out unitarization. This fragmentation led to the units of analysis which were codified to know their origins.

In this methodology of analysis, firstly, units of significance are organized in three components of categorization, which are: unitarization of collected information, its categorization and production of comprehensive syntheses. Thus, nothing is lost when units of sense are recorded since any item that has been registered several times in the analysis of answers is as useful as the one that emerges once [15].

The prospection enables the DTA to clearly perceive what prevails and what is not so evident – in document descriptions – to the analysis [15]. The corpus was rigorously selected when the terms "EE and sustainability", "EE in High School" and "Environmental themes in High School" were used for the search in the BNCC. Thirty-four references were selected to construct this text. There was no chronological criterion for selecting the papers

4. Results and Discussion

4.1 EE in the new BNCC in the Brazilian High School

EE in the new BNCC in High School is questioned, mainly because of the relation between EE and the other public policies, which have been formally instituted in the Brazilian Education since the 1990's. It enabled to show how the theme got space in the Brazilian legislation; it was even considered mandatory in all steps and levels of formal and informal Education in Brazil.

This study shows that the new BNCC does not treat EE as a fundamental element to the whole development of Basic Education students. It is in Basic Education, mainly in Childhood Education and Elementary School, where the new generation must construct the basis of the awareness-raising process. Since the new BNCC plays a guiding role in educational curricula, it must ensure and keep educational needs by adopting EE which is exclusively based on the National Policy on EE (PNEA). It enables the environment to be understood in its multiple and complex relations which involve ecological, legal, political, social, economic, scientific, cultural and ethical aspects [16].

Since the term EE is only mentioned once in the document which determines the new basis that re-structures Brazilian Education, the new BNCC is not really a significant advance in the History of Education [34]. This fact shows how contradictory the new basis is by comparison with legal framework of EE proposed by the PNEA, which does not propose EE to be developed in an integrative and interdisciplinary way (let alone a multidisciplinary one) [16].

Both concepts – socioenvironmental and sustainability – are within the field of EE but are not enough to account for an educational strategy which is pedagogically planned, as is the case of EE.

As a result, the BNCC is not clear about the way EE should follow. We have inferred that the new BNCC is restrictive since both terms – socioenvironmental and sustainability – have been attributed to the field of Sciences of Nature. Thus, we believe that effective EE has lost its space in pedagogical practices in educational networks and in schools. Showing EE in a critical, emancipatory and transforming way in schools is increasingly necessary to problematize social relations and bet on Education to emancipate [16].

4.2 The "New Brazilian High School" and its relation with EE: a major theoretical and practical problem!

The new High School must develop general interdisciplinary competence which encompasses ethical-emancipatory knowledge about sustainability in EE contents, whose transversal skills must constitute mandatory curriculum planning. However, there is clear lack of correspondence between what state documents say and EE materiality [17].

The theme EE is basically null in the NLEM and in the BNCC (documents that report the content). It may be considered an absence. Since both documents organize, regulate and guide national Education, we understand that the absence of EE is significant. Its symbolism occurs in choices made by the group that wrote the document based on specific educational guidelines from which the environment, the value of the natural world and the emancipatory potential of EE are excluded [18].

The previously mentioned NLEM only refers to the field of knowledge in Article 35-A "III – Sciences of Nature and their technologies". This field of knowledge was not specified in the document. Besides, in Article 36, it is treated as a curriculum composition. Nothing else is mentioned about it in the NLEM; not even other fields of knowledge/curriculum compositions. The new policy on the Brazilian High School, which is detailed in the BNCC, has several gaps, mainly related to EE [18].

The BNCC, in its introduction, highlights what should be done with EE. It was added to the list of "[...] curricula and pedagogical proposals which address current themes that affect human life locally, regionally and globally, mainly in transversal and integrative ways [...]", together with children's and adolescents' rights and traffic Education. However, application of this knowledge is a decision taken by "teaching systems and networks" and by schools. In this case, the document suggests that the principle of autonomy and institutional competence should lead to decisions and, in a footnote, it inserts the laws and decrees that regulate the application of EE to the Brazilian educational system [19].

Regarding this theme, is it all? Would the absence be so meaningful? Has the whole policy on Brazilian EE in High School been summarized in a paragraph in the BNCC? [20]. Was the tradition of academic research into the topic discarded? Was all experience produced in class and in other school practices ignored and included in a footnote? Yes. Simple answer. EE in Brazil, the result after years of experts' discussion about public policies, such as the National Curriculum Parameters (PCN), the PNEA and the Law of Guidelines and Bases of Brazilian Education (LDB), in agreement with international conferences, stopped being a strategic area to develop citizens in the second decade of the 21st century [20].

In the other parts of the BNCC, the environment is just related to a phenomenon that derives from the natural world and is restricted to some courses, such as "Geography (5th grade)", "Religious Teachings" and "Languages and their Technologies"; only the last one is taught in High School [21]. Definitions of environment are vague, imprecise and limiting. Even though High School students may not have deep knowledge of sustainability, they understand it and reflect upon it when they learn the content taught in class [34]. However, dynamic contents result in more qualified Education. After all, after three years in High School, students may construct new knowledge – inherent in sustainable habits – in corporations and/or academic communities in graduation courses [22-23].

In the High School BNCC, as an answer to the role of the environment in Education, the following compositions are found: "Languages and their Technologies", "Sciences of Nature and their Technologies" and "Human and Social Applied Sciences". In all, the concept of environment is associated with either the natural world or socioenvironmental aspects [24]. We acknowledge that it characterizes an interesting proposal since it associates the environment with bots its scientific aspects and the human societies. In its introduction, the High School BCNN states: "In High School, the area of Sciences of Nature and their Technologies suggests that students should construct and use specific knowledge of the area to argument, propose solutions and face local and/or global challenges to life conditions and the environment" [24].

It may be considered an advance, by comparison with Elementary School, since it challenges students to solve problems and, as a result, understand the situation of the environment. In Human Sciences, the environment is not mentioned; it only emerges when the area deals with its own themes. Besides, the introduction to High School proposes the implementation of clubs and observatories so that students may deal with environmental preservation and conditions of the environment, among other aspects [25].

In the case of the curriculum composition named "Languages and their Technologies", the "field of personal life" introduces the environment, together with other themes, such as welfare, health and leisure. It is the only reference, with no further explanation about which environment they refer to. It is also included in "Competence 3" since students are expected to develop skills in languages so that they may become protagonists in several areas, such as the environmental one [26].

In the other curriculum contents, the environment has a much broader space. For instance, in Sciences of Nature, environmental issues are part of subsections "Life and Evolution" and "Earth and Universe" which aim at developing "scientific culture" among High School students [27]. The focus is "natural phenomena and technological processes" so that students may know "forms of organizing knowledge produced in different historical and social contexts". Therefore, these themes would be capable of providing conditions to enable students to understand issues connected to human beings and the other living beings. The environment would be included in it and understood in the BNCC as being nature, humans and non-humans [27].

The description of competences and specific skills related to "Sciences of Nature and their Technologies" clearly shows the association of the environment with the natural world. In this case, Education focuses on the impact of human beings on the environment, on harm caused by human activities to

biodiversity and on ecosystem processes in general. It is a broad proposal but it ends up diluting the environment in several themes, with no specific study of the current situation [27].

This "political" discussion with High School students should be the focus of "Human and Social Applied Sciences". Even though the general characterization of the area does not address the environment, the item "Individual, nature, society, culture and ethics" mentions the intention to discuss the relation between society and nature and the interference of the former in the latter. Thus, the social aspect is inserted into the environment [28].

Certain issues, such as waste recycling, consumerism, public policies, government regulation and economic impact, are part of the skills. They are important themes which enable students to understand some current environmental issues [29]. They address an instrumentalized dimension of the environment, typical of the whole document when it refers to this topic. The point is that, even though the environment emerges in several moments in the High School BNCC, it is diluted and sectioned in curriculum areas. Parts related to Biology, Physics and Chemistry are restricted to their conceptual universes; the same takes place in Human and Social Applied Sciences. In fact, the environment is not treated in inter/trans/multidisciplinary ways, not even when sustainability is addressed [30].

EE should contribute to holistic and emancipatory knowledge which could re-educate the population to ensure sustainable present and future to the planet and the next generations. The environment and EE were addressed by several intergovernmental documents and by national and international researchers who spent much time studying the theme [34], but the BNCC only mentions the surface of the problem, resulting in a fragile approach to the issue [31].

We observed that the absence is symptomatic since it is not really a gap, something non-existent. The word is there, but its meaning is absent. The discussion about what environment is was not proposed. *Would it be implicit? Would it be the teacher's role to promote the debate? Which would be the theoretical framework? Would it also be free?* We know that the idea of environment has changed significantly in the last decades. The polysemic term is understood differently, depending on the context and people's interests. The definition of this concept leads to the definition of EE itself and how it is applied to schools [32].

The environment is instrumentalized in the BNCC and the NLEM, a fact that affects the emancipatory capacity of EE, as we pointed out in the introduction of this paper. It may be one of the reasons for its absence, be it conceptual or related to its educational and pedagogical importance [33]. However, two questions should be asked: *what is the reason for the absence of EE in Brazilian policies on Education in the 21st century? Will an answer be given, mainly reflecting upon the period prior to the drafting of the NLEM and the BNCC?*

5. Conclusions

This review brought up several sensitive issues related to "EE and sustainability". It should be mentioned that the new BNCC does not treat EE as a fundamental element to wholly develop Basic Education students. However, it is Basic Education, mainly Pre-school and Elementary School, which must construct the primordial grounds to raise students' awareness. Since it plays a key role in educational curricula, the new BNCC must ensure and meet educational needs by adopting EE based exclusively on the PNEA. It develops integrated understanding of the environment and its multiple and complex relations which involve ecological, legal, political, social, economic, scientific, cultural and ethical aspects.

It has been known that environmental changes on the planet are deep, perhaps irreversible and extremely harmful to biodiversity and human societies. Concern for the future is directly related to people's current attitudes, from individual to broad actions in all societies. To reflect upon everyday life, daily activities and the whole picture, which includes industrial production, economic cycles, political choices, social interaction and human ethics for humans and non-humans, is essential for future expectations on the planet. EE plays a fundamental role in this process.

This review reinsured that Education is the fundamental tool to keep the humankind in balance while it causes changes to the environment. Education also enables human beings to analyze their lives critically and holistically. The bond between Education and the environment enables us to think over what the humankind, societies and individuals may do to ensure the future of the next generations. Faulty policies on Education and the ones that ignore certain factors transform the whole country into a secondary one which falls behind others and may increase global risks to the environment.

Finally, it should be highlighted that there is an urgent need to develop effective EE in all teaching levels. EE and sustainability are issues that cannot be postponed! To ignore the crucial role of EE in the 21st century is to reinforce issues that have been common locally, regionally and nationally over the last years: dam collapses, waste accumulation, lack of basic sanitation, land sliding, floods, storms, drought, deforestation, lack of biodiversity, oil spilling, fire in refineries, short winters, among others that form a huge list. Therefore, young Brazilian people must get aware of the situation to carry out critical analyses, expose their political and social views, think over their economic activities and, finally, construct effective EE to be a strong and representative pillar in the 21st century.

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Author Contributions

C.C.F and M.L.D.M. outlined the whole research project. J.G.S and I.J.M.M.S conducted the systematic literature review. M.L.D.M contributed to the writing of the manuscript and was in charge of the final review and submission to *Orbital: The Electronic Journal of Chemistry*.

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