



Article

Sustainability in Higher Education Institutions in the Amazon Region: A Case Study in a Federal Public University in Western Pará, Brazil

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Abstract: Sustainable development (SD) in higher education has occupied the agenda over recent decades. Higher education institutions make efforts to promote sustainability in education, curriculum, research, outreach, and campus operations. This article aims to analyze the level of implementation of sustainability in higher education in the Amazon. The specific objectives of this paper are to identify the curriculum greening (CG) characteristics in institutional development plans (IDPs) and to analyze the perceptions of students from a higher education institution in the Amazon region about sustainability. It follows a qualitative approach, with documentary research and questionnaires applied to students. Analysis content was used in the data analysis. The main findings are the presence of some CG characteristics in institutional documents that were analyzed as a commitment to the transformation of society–nature relations, contextualization, disciplinary order, democracy, theory and practice, students as knowledge protagonists, cognitive aspects, alternative scenarios, and methodological adequacy. The results show that commitment to sustainability cannot just be a declaration of good intentions. It is essential to discuss the ways of implementing sustainability in the academic environment, as it implies changes in epistemological, political, and social conceptions.

Keywords: sustainability; implementation; Amazon region; Brazil; higher education institutions; curriculum greening



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1. Introduction

The debate about the implementation of sustainability in higher education institutions (HEI) has become more intense [1,2]. A reason is that HEIs occupy a strategic place in the training and preparation of professionals of different degrees of education (bachelor's and graduate) and different knowledge areas, thus demonstrating that “no institution in modern society is better positioned and none is more obliged to facilitate the transition to a sustainable future than colleges and universities” [3]. However, no less important is the fact that complex challenges have never been more important and urgent since addressing climate change and the COVID-19 pandemic. Sustainable Development Goal (SDG) 4.7 calls for ensuring that “all learners acquire the knowledge and skills needed to promote sustainable development” [4]. In Education for Sustainable Development, which is a roadmap, Stefania Giannini (UNESCO Assistant Director-General for Education) highlights the COVID-19 pandemic that spread across the planet in 2020. It is a crisis that affects every aspect of our lives, and that reveals the fragility of the human interdependence with nature. Humankind learned that, as forests are destroyed, not only are wild animals endangered and ecosystems weakened, but humans are also exposed to unknown infectious agents that can threaten their lives [5].

The contradictions of capitalism in such a model make it unviable in the future, and it will make global-scale environmental disaster and human conflict inevitable. A new model

is needed, for the long-term prosperity of our lives on this planet, that is not based on accumulation and consumption but instead on simplicity and sharing [6]. As McCowan [6] states, “the university therefore cannot act as a blind workhorse for this vision of development, but should provide constant scrutiny and critique of the model, and imagine alternatives”. The higher education institutions should go beyond their walls. HEIs are considered answerable not only to their students but also to the communities and regions in which they dwell, i.e., universities have a responsibility to both students and the communities in which they reside [7]. It is necessary to overcome the “ivory tower view” [8].

Water, biodiversity, forest, fauna, and flora are all parts of nature that make us think about many parts of the globe, but one particular region calls our attention because of its dimensions and its importance to the planet: the Amazon. In Brazil, there is a particular concern about the Amazon because of its importance in regulating the global climate, preserving its biodiversity, and influencing the carbon cycle on Earth. Considering this article’s scope, it will use the concept of the Legal Amazon in Brazil. According to Complementary Law, 124/2007, the Legal Amazon involves the states of Rondonia, Amazonas, Roraima, Pará, Amapá, Tocantins, Mato Grosso, and part of Maranhão state. It covers an area of 5,015,067,75 km², and it corresponds to 58.9% of Brazilian territory (Available online: <https://www.ibge.gov.br/geociencias/cartas-e-mapas/mapas-regionais/15819-amazonia-legal.html?=&t=o-que-e>, accessed on 15 November 2021). The Federal University of Western Pará is a university that is strategically located in the Amazon. The purpose of this article is, first, to analyze the level of implementation of sustainability in higher education in the Amazon by first identifying the curriculum greening (CG) characteristics in the institutional development plan (IDP); and, second, to analyze the perceptions of students from a higher education institution in the Amazon Region about sustainability. The article starts with a short overview of the literature on Education for Sustainable Development and how it can contribute to teaching/learn about sustainability in the university. The models of the curriculum are studied with consideration to their design and characteristics. In sequence, the methodology is explained, and this is followed by the results and a discussion. In the conclusion, the article points to the challenges and opportunities with regard to sustainability in higher education in the Amazon.

2. Education for Sustainable Development Goals (ESDG) and Higher Education

Education for sustainable development (ESD) can be defined as holistic and transformational education that addresses the learning content and outcomes, the pedagogy, and the learning environment, and it also creates interactive and learner-centered teaching and learning settings [9]. As Azeiteiro et al. state [10], the role of ESD has been discussed for decades, mainly since Agenda 21 (United Nations Conference on Environment and Development, Rio de Janeiro, Brazil, 1992) at the second World Summit on SD in 2002, in Johannesburg, and in the UN Decade of Education for Sustainable Development UN-ESCO (2005), with a broadening of the visibility of and engagement in the sustainability of higher education institutions (HEIs). ESD is considered as part of quality education, from preschools to higher education, and in nonformal and informal education because it can deal intensively with matters of sustainable development, and it can promote skills and competencies to SD. In sum, ESD can contribute to an education that is relevant to every learner in the reason for today’s challenges [9].

Higher educational institutions (HEIs) play a vital role in the promotion of sustainable development [8–13]. Many HEIs have embedded ESD in education, research, campus operations, community outreach, assessment and reporting [14]. For a long time, universities have proceeded with no changes relying upon a Newtonian and Cartesian mindset in teaching and learning process [15]. Some authors stress the integration of sustainability in HEIs. Lozano et al. [15] explains that the following dimensions make part of the university: (i) institutional framework: policies, vision, mission; (ii) campus operation: energy use and efficiency, waste, transport, accessibility for disable people, and equality and diversity; (iii) education: courses on SD, programs on SD, transdisciplarity, curriculum reviews,

and educate-the-educators programs; (iv) research: research centers, holistic thinking, SD research used in teaching, publications, patents, new knowledge and technologies, collaboration, and transdisciplinarity; (v) outreach: exchange programs for students in the field of SD, joint research, SD partnerships (e.g., enterprises, non-governmental organizations, and governments), and SD events open to the community. There are two other dimensions SD through on-campus experiences, assessment and reporting.

In 2000, the Planet Summit led to the Millennium Declaration with eight Millennium Development Goals (MDG) to be achieved by 2015. In the Rio + 20 Conference in 2012, Agenda 2030 (2015–2030) was adopted, involving plans for a future of sustainable economic growth, social development, and environmental protection [4]. The global agreement approved unanimously by world leaders was Transforming Our World: The 2020 Agenda for Sustainable Development in September 2015. The agenda brings 17 goals with their 169 targets, which aim to guide different countries to solve problems such as the end of poverty and hunger, protecting the planet from degradation and addressing climate change, ensuring that all people can enjoy prosperous and healthy lives, and fostering peaceful and inclusive societies free from fear and violence [4]. ESD was recognized as a key enabler of all Sustainable Development Goals because it can empower people of all genders and ages, present and future generations, and respect cultural diversity. In this agreement, the universities play a critical and unique role in delivering the Education for Sustainable Development Goals (ESDGs): the capacity in education, research and innovation as well as their contribution to civic, societal and community-level leadership. The unique role in helping society address to sustainability is recognized.

Education for the Sustainable Development Goals (ESDGs) states the capability of universities to contribute to civic, societal and community-level leadership, meaning that the university has an important role in helping society regarding sustainability. The education dimension includes education for sustainable development, jobs for implementing the SDGs, capacity-building, and mobilizing young people. Research considers research on SDGs, interdisciplinarity and transdisciplinarity research, innovations and solutions, national and local implementation, and capacity building for research. Operation and governance incorporates SDGs into university reporting. External leadership is related to public engagement, cross-sectoral dialog and action, policy development and advocacy and demonstrates sector commitment [4].

3. Reflection about the Implementation of Sustainability in Curriculum

The implementation of EDS in universities presents a wide range of literature. The processes of implementation of sustainability are related to students' perceptions, participation, commitment, or sharing this experience in some countries, regions or universities [16–21], the role of transdisciplinarity in higher education for EDS [22,23] or just sharing knowledge about specific cases on the difficulties to sustainability insertion in engineering education in Brazil or other countries [24–26], or experiences from the implementation of sustainable development in higher education institutions [14,27]. As important as the implementation of sustainability is to evaluate its impact HEI. Different tools have been applied for measuring the sustainability impacts. Caeiro et al. [28] made a critical reflection about different tools to implement Education for Sustainable Development (ESD). The authors performed a literature review on the tools to assess sustainability in HEI.

There are many actions to engage the university with SD. One of them involves the combination of theoretical knowledge, abilities, and attitudes. Studies addressing and discussing competences for sustainable development (SD) were produced once it was incorporated into the curriculum of HEIs. However, the question is: what key competences are necessary to educate students in SD? The reason for this is that students, employers, and educators are calling for higher education sustainability programs to articulate the competencies they can develop in student training [29]. Before this question, another is still important: what is competence? Competence can be defined as a functionally linked complex of knowledge, skills, and attitudes that enable successful task performance and

problem-solving [30,31]. Competence is a way to reveal desired educational outcomes and includes functional, ethical, and personal dimensions, and considers complex knowledge, skills, and attitudes [32]. It also involves participation in goal-oriented, ethically grounded actions in practical reality, i.e., it goes beyond the processes of knowledge transfer [33]. The challenge is to link the definition of competence to sustainability. In general, competencies in sustainability have some ambiguity associating the terms: skills, abilities, capabilities, capacities, qualifications, and other concepts [34].

Table 1 presents the different kind of competences relating to education for SD.

Table 1. List of competences.

Authors	Competences
Wiek, Withycombe, and Redman [29]	systems-thinking, anticipatory, normative, strategic, and interpersonal competences
Rieckmann [33]	systemic thinking and handling of complexity, anticipatory thinking, critical thinking, acting fairly and ecologically, cooperation in (heterogeneous) groups, participation, empathy and change of perspective, interdisciplinary work, communication and use of media, planning and realizing innovative projects, evaluation, and ambiguity and frustration tolerance
Lambrechts et al. [7]	responsibility, emotional intelligence, system orientation, future orientation, personal involvement, and ability to take action.
Lozano et al. [34]	systems thinking; interdisciplinary work; anticipatory thinking; justice, responsibility, and ethics; critical thinking and analysis; interpersonal relations and collaboration; empathy and change of perspective; communication and use of media; strategic action; personal involvement; assessment and evaluation; and tolerance for ambiguity and uncertainty.

In this case, competences in sustainability are complexes in knowledge, skills, and attitudes that enable successful task performance and problem-solving related to real-world sustainability problems, challenges, and opportunities [35]. There have been some efforts to link pedagogical approaches to develop competences. How the competencies can be part of HEI reality is still a great challenge to address. There is no one formula or one right manner to achieve this. Considering different contexts, there are a great number of studies available in the literature about the implementation of sustainability or the competencies of sustainability in higher education [36].

It is possible to talk about green technology [37] or exploring alternative energy production, or energy transformation devices, all of them linked with sustainability. However, one question still remains: is it possible to identify a curriculum model of ESD? Is there any curriculum approach that is able to include sustainability?

Higher education institutions (HEI) occupy a prominent place in the environmental training of bachelors and graduates. Environmental training—the construction of knowledge, methods and interdisciplinary research and training projects—is being linked to universities and national centers for scientific research [38]. Sustainability requires research activity beyond boundaries or academic disciplines. Tilbury [39] pointed to some new attitudes and values about research for sustainability in higher education. For instance, there is a shift from a focus within just one discipline for inter- and multidisciplinary research. Another change is from the academic impact on social impact, from research that informs research that transforms technological and behavior change to social and structural change, experts to partner, and research on people to research people. Thus, colleges or universities cannot lock themselves in an “ivory tower view” [8]. It is necessary that the dialog and offer answers to the problems of society’s demands, of which sustainability is one of those challenges.

HEIs are directly involved in the perspective of changing to a sustainable future in society. A decisive factor to achieve the culture of sustainability is the education of students as future professionals [40]. In this sense, some experience provides an idea

about the efforts about the EDS in curriculum at HEI. For instance, students from the Department of Chemical and Biological Engineering, University of British Columbia, were required to undertake a term project or to write a term paper in the group about pollution prevention and sustainability. It resulted in three green engineering projects [37]. Makrakis and Kostolulas-Makrakis (2013) explained a model called RUCAS (Reorienting University Curriculum to Address Sustainability) [41]. This model consists in evaluating: (1) what to teach and how to teach it, (2) how to design and implement a course, and (3) how to ensure that students are learning what is being expected. The RUCAS model provided the guiding instrument in the revision, implementation, and evaluation process [42].

Lozano et al. (2015) suggested five main approaches to incorporate EDS into the higher education curriculum [21]. In the first approach, some examples are the discussion on the development of an e-learning introductory course on sustainability, basing the content on environmental ethics, ecology, and environmental economics. In the context of developing a specific SD course, Lozano et al. (2015) made a report of the University of Leeds (UL) that maintains the BA Environment and Business focuses on the role that businesses play in contributing to making societies more sustainable. The authors recognized assessment as the most important way to help students learn, highlighting that the most effective way to change student learning is to change the assessment.

Unesco [42] proposed the adoption of a multiple-perspective approach to incorporate the ESD in the curriculum. According to this approach, ESD in education promotes the balancing of economic growth, environmental conservation, cultural diversity and social well-being to include marginalized populations and attend to gender issues. A multiple-perspective approach helps students to understand the points of view of others who live in a community or across the world. It is possible to add the perspective into historical and geographical disciplines considering the society, students, and teaching and learning process about sustainability. It can also include other themes, such as human rights, gender equality, and cultural diversity. There is a recognition that in a few years, the students of today will become voters or will assume positions of leadership. As adults, they will have to deal with complex issues to create a more sustainable world. Multiple-perspective-approach skills and tools will help them assume their new roles.

Among other experiences about ESD in HEI curriculum, one calls the attention because its history and coverage. This particular experience involved participating countries from Europe and Latin America and aroused debates and agreements about the conception and characteristics of sustainability in the curriculum. In 2002, Girona University, located in the autonomous community of Cataluña, Spain, had the initiative to constitute the Environmental Curriculum Network for Higher Education (ACES—Ambientalización Curriculum en Educación Superior, acronym in Spanish). The universities that joined the ACES network had in common the desire to share their knowledge and results of studies and research, to generate a solid basis for the environmental models in higher education (HE), based on socio-environmental sustainability [43].

One of the network actions was the work meeting promotion in the First International Seminar on Sustainability in Higher Education, held at the Technical University of Hamburg-Harburg Technology. This meeting was held from 27 February to 3 March 2002 [25]. The ACES network started its activities by grouping universities with some previous experience in relation to curriculum greening [40]. A total of 11 (eleven) universities from 7 (seven) different countries made up part of the ACES network, as well as 5 (five) from Europe and 6 (six) from Latin America countries. This particular meeting had the financial support of the ALFA European Commission Program. Among the Latin American universities, three were Brazilian: Universidade Estadual Paulista (UNESP), Universidade Estadual de Campinas (UNICAMP), and Universidade Federal de São Carlos (UFSCAR).

The participation of these 11 (eleven) universities allowed them to work together; even though the institutions were from different realities and situations, they could present different points of view, projects, and environmental strategies. One objective of the network was to orient higher education towards sustainability and the necessity to perform a situation

diagnosis of each university, in addition to elaborating an intervention methodology in the context of these centers [44]. The definition of curriculum greening (CG) culminated in four concepts and ten characteristics. Curriculum greening is a complex process of harmonious integration and transversal knowledge understood as concepts, procedures, and attitudes, generating values and committed political participation. This process should promote incessant and open questioning, about knowledge and its production, in the way of the integral education of students [44].

The characteristics of curriculum greening were complexity, disciplinary order, contextualizing the curriculum in the project, the subject as the protagonist in knowledge, considering the cognitive affective states and actions of people, coherence and reconstruction in theory and practice, and alternative scenarios. The explanation of each characteristic can be observed in Table 2.

Table 2. CG characteristics based on ACES network [25].

Characteristics	Criteria
Complexity	CG should consider the interaction between the discipline and multiple explanations of reality, dialogic, and holographic; complex interpretation of reality; analysis of causes and effects problems; changing from a static to a dynamic view; openness to creativity/imagination in research solutions (positive, concrete, abstract) to reality.
Disciplinary order	Flexibility and permeability among disciplines is necessary for understanding the reality complexity. Professional participation in different knowledge areas. Professional exchange in the construction of disciplinary and non-disciplinary actions; incorporation of emerging themes (diversified themes); proportion between mandatory and elective discipline.
Contextualizing curriculum project	The incorporation of local problems; significant presence of areas in other fields of knowledge (incorporates the environmental, social and economic dimension); incorporation of global problems.
Subject as a protagonist in knowledge	Types and criteria for evaluation; ways of defining the contents (considering not only the individual but the group or the collective); diversified teaching methodologies; curriculum itineraries/adaptations; participation in the evaluation of the course teacher; adaptation of the relations between the numbers of students/teachers (proportion).
Considering the cognitive, affective furthermore action of people	Psychological, pedagogical and economic support to students; explicit intentionality to work on aspects that are not exclusively conceptual; appreciation of the various forms of knowledge (valuation based on the study plan, that all disciplines have the same value); proposition of action and intervention projects in reality; encouragement of different forms of language (different ways of expression: artistic, visual); recognition of differences and multiculturalism.
Coherence and reconstruction in theory and practice	Existence of practical work consistent with the theoretical proposals; identification of individual and collective attitudes related to the work developed; identification of changes in theory and practice from experience or program evaluation; coherence between discourse and developed practices (evaluation during the exercise of teaching). It may be the institutional discourse of a student association or of teachers.
Prospective guidance on alternative scenarios	Identification of whether there is training of professionals committed to future generations; identification of the use of technological options in the usual (most usual) and alternative ways; observation if there is a critical analysis of scientific and technological knowledge (past and present) that affects future scenarios.
Adapting new teaching and learning methodology	If there is a work with the problem-solving methodology, use of participatory methodologies.
Creation of spaces for reflection; furthermore, democratic participation	Participatory and collaborative work practices (practices understood as classroom activities); practice of self-regulation and disruption of linear relationships; typology of the evaluation criteria; ways of constructing the curriculum (whether open or closed, includes possibilities for field work, in groups); dynamics and functioning of teaching work; activities distributed in hourly loads; construction of records and documents (process history and reflection) How the teacher engages students; methodologies for reflection and participation.
Commitment to transforming relation between society ad nature	The presence of contents that address the problematic society–nature interaction; actions that appear in the dynamics of justification about society–nature.

There is a recognition that CG is a complex process and involves concepts, procedures, and attitudes; however, it highlights the political action by commitment to develop human integral education. In this concept, it is important not only for the student's cognitive development but comprehensive training. It refers to thinking about an interdisciplinary approach that involves, among other aspects, development and ecological and environmental awareness. Figure 1 provides a diagram of CG.



Figure 1. Diagram with CG characteristics [25].

CG has influenced many studies, particularly in Brazil. For instance, consulting theses in a digital repository called EArte (EArte Project is a project in Brazil that aims to make available complete theses and dissertations about environmental education made in Brazilian master and doctoral programs. Nowadays, the data need to be updated, but until 2019, the project was registering research. Available at <http://www.earte.net> (accessed on 17 January 2022), 27 studies on CG were found by only reading the title, from 2006 to 2019. It is possible that this number is even higher from 2019 onwards.

The conception and characteristics of GC aligns the definition of ESD mainly to the words holistic, learning environment, values, and attitudes. For instance, disciplinary order is understood as flexibility and permeability among disciplines, which is necessary for understanding the complexity of reality. In the promotion of ESD, it is advised to take disciplinary, interdisciplinary, and transdisciplinary views of key examples of sustainability changes.

These points reveal the necessity to discuss the HEI potential commitment to sustainability.

4. Materials and Methods

4.1. Research Strategy

The research has a qualitative nature, descriptive–exploratory, case study type, whose locus is the Federal University of Western Pará (Ufopa), in Santarém, Pará State, in Brazil's north region. The research was divided into documentary and field research. Since 2012, there were two IDP editions (the first version spanning from 2012–2016) [45]. In the documentary research, the Ufopa Institutional Development Plan (IDP) was analyzed (see Table 3) [46]. The Ufopa IDP is an official document from university, and it is a document required by federal law. The last IDP version (2019 to 2023) [46] was obtained in Portable Document Format (pdf) from Ufopa website (Available online: <http://www.ufopa.edu.br/ufopa/comunica/noticias/lancado-pdi-2019-2023-da-ufopa/>, accessed on 17 January 2022). IDP is a legal request in Brazil by Education Law 9.394/1996, Decree n° 5773/2006 that regulates, supervises, and evaluates HEI. It is a document that reveals the higher education institutions' intentionality, beliefs, and values.

Table 3. Methods developed in the research at Ufopa.

Method	Objective	Tools	Participants
Documentary	Identify the curriculum greening characteristics (CG)	Document analysis of the following institutional development plan (IDP): principles, commitments, aims, strategies and action in education, research, and outreach.	-
Survey	Analyze student perception about sustainability	Electronic questionnaires sent by email.	200 undergraduate students

The second one adjusted some goals but did not change the period. The third IDP (2019–2023), the updated version used in this article [46], is a dense document with 195 pages. It consists of the following sections: organization strategy, institutional pedagogical project, implementation and development timetable, organization and people management, administrative organization and management policies, physical infrastructure and academic installation, financial aspects and budget, and final statements. Special attention was given to the mission, vision, and values because they reflect the groundwork, the commitments assumed throughout the current plan for the next years.

In the field research, a survey-type questionnaire was applied to undergraduate students of the teacher-education course at Ufopa.

4.2. Federal University of Western Pará (Ufopa): The Research Locus

The Federal University of Western Pará (Ufopa) headquartered in the municipality of Santarém, State of Pará, was created on 6 November 6, 2009 by the dismemberment of the UFPA Campus (Federal University of Pará) and UFRA/Pólo Tapajós (Federal Rural University of the Amazon) in terms of Law 12,085/2009. Ufopa was the first federal university in the interior of the Brazilian Amazon, located in the municipality of Santarém, as can be seen in Figure 2. The institution emerged with regional coverage in the western portion of Pará State, installing campuses in Alenquer, Itaituba, Juruti, Monte Alegre, Óbidos, and Oriximiná municipalities. According to the Brazilian National Statistical Department (IBGE), the estimated number of inhabitants is 1,000,618 inhabitants, corresponding to 12.8% of the Pará States population. The indigenous population is 15,848 inhabitants in 20 territories and 28 different ethnicities. Ufopa's coverage area includes 60 quilombolas (In Brazil, quilombos are also called "mocambos", "contemporary quilombos", "quilombo communities", or "terras de preto", which refer to communities that maintain traditions from their ancestors brought from Africa, such as agriculture, medicine, religion, mining, architectural and construction techniques, crafts, dialects, cuisine, and the community relationship of land use, among other forms of cultural and technological expression. Anjos, R.S.A.D. (2005). *Territórios das comunidades remanescentes de antigos quilombos no Brasil*. Brasília: Editora Mapas e Consultoria) communities in Alenquer, Monte Alegre, Óbidos, Oriximiná, Santarém e Prainha.

In 2019, the Ufopa community comprised the rounded numbers of 5990 students in full-time education and 1090 employees, of whom 482 are professors and 608 belong to the administrative staff. It is structured into six academic institutes and one center: Science Education Institute (ICED), Social Science (ICS), Water Technology Institute (ICTA), Geoscience and Engineer Institute (IEG), Forest and Biodiversity Institute (IBEF), Collective Health Institute (ISCO), and Interdisciplinarity Formation Center (CFI). Ufopa offers 46 undergraduate programs, 10 master programs, and 3 Ph.D. programs.

Its social responsibility includes the mission, vision, and institutional values, according to its region characterized by ethnic and cultural diversity as indigenous and quilombos properties. The Amazon in the last 50 years excluded its traditional peoples (riverside people, indigenous people, remnants of quilombos, agrarian reform settlers, shellfish collectors, etc.). The institution, through its affirmative-action policy, promotes actions to combat discrimination to reduce social inequalities and contribute to the affirmation of

human dignity. Since the creation of Ufopa, indigenous people and remnants of quilombo as well as disabled people have been exercising their right to enter, stay, and train at a public university, contributing as active participants in the region's development process.

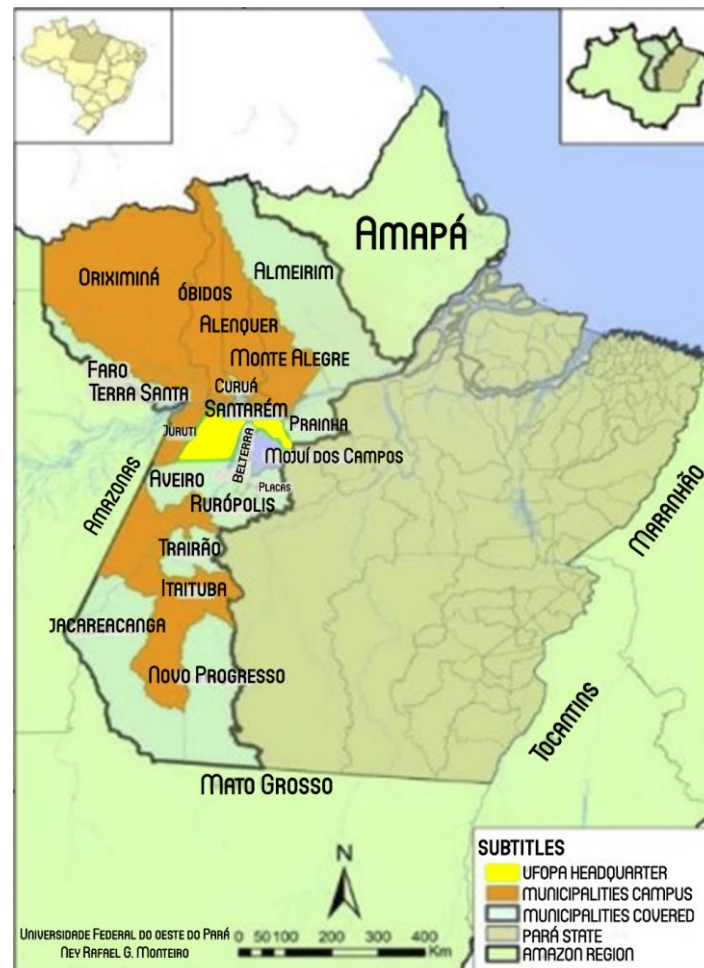


Figure 2. Ufopa regional coverage area in Ufopa [45].

Ufopa affirms its position of being an institution with educational policies and practices, teaching–learning, research, and extension, committed to historical and cultural references, to artistic production and dissemination, and to the preservation of cultural memory based on practice, in the experiences and values of the people of the Amazon.

With an integrative and interdisciplinary pedagogical proposal, sustainability commitment and the protection and preservation of the Amazon are some of Ufopa's principles. Undergraduate and graduate courses seek to train professionals committed to the appreciation of and care for the region and its population. Ufopa assumes its responsibility to be a preponderant element for the sustainable human development of the region.

5. Results and Discussion

The Results and Discussion section is organized as follows. First, data are analyzed based on documentary research. Second, the student perceptions about sustainability are presented.

5.1. Documentary Research

The contribution of universities to sustainability is increasingly being expressed through the publication and adoption of various strategies and declarations at an international, regional, and university level [47]. The research consisted in verifying the presence

of curriculum greening (CG) characteristics in education, research, outreach, and management in IDP. The following categories were used: Curriculum Greening, i.e., how the CG characteristic appears in Ufopa Institutional Development Plan; and the Amazon, which gains a position of relevance since the Amazon is present in both institutional documents and in the speech of participants.

Figure 3 presents the number of words or ideas related to CG characteristics found in the IDP document. In total, 8 of 10 CG characteristics were identified:

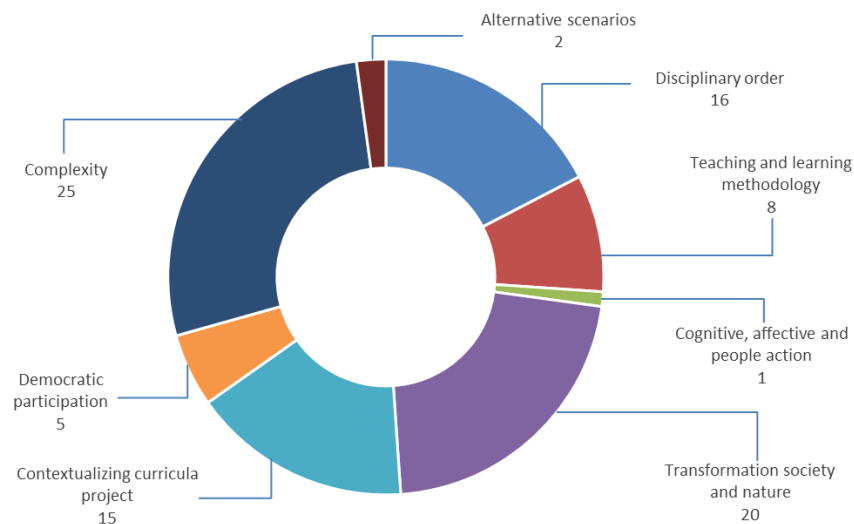


Figure 3. 8 CG characteristics found in IDP/Ufopa.

No words related to Theory and Practice Coherence and Subject as Knowledge Protagonist were identified. The characteristics with the highest likelihood of development were disciplinary order, transformative society and nature, contextualizing the curriculum project, and complexity. The characteristics with the lowest likelihood of development were teaching and learning methodology; cognitive, affective, and individual action; democratic participation; and alternative scenarios. The aim is not to determine the commitment degree of a specific characteristic, not to say which one is strong or weak; the most important thing is to reveal that it is possible to find CG in HEI located in the Amazon's interior region.

Lozano [18] and Caeiro [48] state that it is possible to verify sustainability in different dimensions of universities such as operation, education, research, outreach, experience, assessment, communication, and reporting. The effort is to present CG characteristics in different parts of the document. Despite the key competences to sustainability, the CG characteristics are adopted once they represent a feature or quality belonging to a person, place, or even a document. The sustainability approach used was mainly linked to the SDG. First, it was necessary to consider the concept of 10 CG characteristics. Second, it was necessary to establish other words related to each characteristic, for example, the creation of spaces for reflection and democratic participation is related to collaborative work, democracy, participation, and collective decisions. Third, it was necessary to establish the location in IDP of words or sentences related to each CG characteristic. It was necessary to read more than once to assure the right characteristic.

Ufopa is a social institution founded on ethics, freedom, respect for differences, and solidarity, governed by the principles of commitment to sustainable development in an integrative view of cultural, economic, and ecological expressions in the Amazon. An integrative vision was added to sustainable development, particularly with the Amazon in its cultural, economic, and ecological expressions. Mission, vision, and values constitute an essential part of IDP, as show in Table 4.

Table 4. Mission, vision and values declaration at Ufopa IDP [46].

Section	Sustainability Issue
Mission	Produce and socialize knowledge, contributing to citizenship, innovation, and development in the Amazon.
Vision	Vision: To be a reference in interdisciplinary knowledge production and technological dissemination, technological to contribute to sustainable regional development considering the citizen training.
Values	Democracy and pluralism; inclusion; environmental commitment, ethics; autonomy.

It is revealed that Ufopa has a strong link to Education for Sustainable Development Goals (ESDG) [49]. Addressing aspects of the ESDGs is a necessary transformative learning process that includes interdisciplinarity, action-based learning, and multi-actor involvement [49]. In its institutional framework, Ufopa declares a strong commitment to the transformative learning process. It is possible to verify other dimensions such as campus operation (A), education (B), research (C), and outreach (D).

A. Campus operation

The term “environmental management policies” was adopted to refer to the existence of institutional policies that focus on the environmental issue. Universities also generate environmental impacts; consequently, it is necessary that they have an environmental management system. This system should have the function of reducing the amount of material and energy, resulting in benefits of an environmental nature. There is a specific topic on environmental management (EM) in IDP in the section related to institutional management policies. Although there is no express reference to the EM tasks, some actions were announced, such as environmental licensing of the activities and units built and to be installed; application of questionnaires to collect data on solid waste; performing environmental awareness campaigns to reduce the consumption of materials and inputs: plastic cups, disposables, paper, and energy, among other actions. Table 5 summarizes education, research, outreach dimension, and the commitment of each one to sustainability.

Table 5. Education, research, and outreach dimensions related to sustainability at Ufopa IDP [46].

Section	Sustainability Issue
Education	The university proposes to offer quality teaching, with the following guidelines: (1) academic excellence, through the use of educational technologies; (2) the promotion of innovative curriculum models, to expand and diversify educational opportunities, enhance the regional vocation, and promote interdisciplinarity in teaching, research, and outreach; (3) articulation with society, to strengthen the interaction with basic education; and (4) the production of knowledge, aiming at expansion and dissemination. There is a goal to produce and socialize knowledge, contributing to citizenship, innovation, and development in the Amazon.
Research	Postgraduate courses at Ufopa aim to train citizens to be capable of transforming its social reality, in line with the society demands, valuing cultural diversity and contributing to the scientific and technological advancement of the Amazon region.
Outreach	Outreach activities are aimed at valuing cultural and environmental diversity, commitment to human rights, respect for differences among races, ethnicities, beliefs and genders, ethical principles, the promotion of social inclusion, and/or sustainable and regional development.

B. Education

Education has always been considered a way to improve the quality of life. Unesco (2005) states that education on sustainable forms of living is important. Curriculum and pedagogy transformation in universities and colleges is to make a meaningful contribution to sustainable development [50,51].

Ufopa will conduct a systematically organized dissemination of interdisciplinarity in continuing education along various academic paths. Interdisciplinarity refers to the flexibility and permeability between disciplines due to the complexity of reality [52,53].

The production of knowledge is reoriented towards a multi-, inter- and transdisciplinary perspective, associated with the commitment to regional development. IDP reinforces this perspective when it mentions the institution's vision and values. Interdisciplinarity challenges academics to reconcile ideas about reality accommodating different knowledge. It is seen as a key requirement of institutions and courses that seek to educate on sustainability [54]. Interdisciplinarity is a condition of sustainability education, even though it has been seen as a barrier and difficult to achieve. Morin [55] asseverates that university conserves, memorizes, integrates, and ritualizes a cultural heritage of knowledge because it plays the role of re-examining, updating, and transmitting it. The author highlights HEIs' role when affirming that the university has a transecular and transnational mission to respond to the challenge of scientific development by instituting freedom and becoming the place of problematization. An interrelation of processes, knowledge, and practices helps to understand the interdisciplinary approach considering the universities and relation with other knowledge areas. The hyperspecialization paradigm is one of the modern features that has had a strong influence on science [55]. It is necessary to possible professional collaboration possible from different knowledge areas to stimulate the dialogue and interchange among actors, not to reach a totality science, but to share knowledge and practices [55].

C. Research

In the research dimension, the attention to social demands is highlighted. In educational and pedagogical practices, articulation can be guaranteed by curriculum components of an integrating nature, such as seminars, lectures, cultural events, extension courses, participation in research and teaching projects, academic events, etc. The guidelines presented in Ufopa IDP are promoting (1) innovative curriculum models through the expansion and diversification of educational opportunities, promotion of interdisciplinarity in education, research and the enhancement of the regional vocation; (2) knowledge production, whose strategic objectives are to strengthen and expand the production and dissemination knowledge to intensify research activities of social relevance.

Graduate students are encouraged to participate in research and extension projects through scholarships, effectively contributing to the scientific and technological advancement of the Amazon region. Research on sustainability implies a capacity for human beings to frequently adapt to environmental and social conditions [56]. The university curriculum should pass on enduring value and subsidize students to be responsible and caring citizens capable of contributing to a just society. Another point is the articulation of subjects with nature, revealing the necessity of a new metaphor. Scott et al. [51] argue that schools (and universities) should help students think about their lives in relation to sustainable development in the context of everyday decision-making.

The Amazon region occupies a strategic role since scientific and technological communities should value its cultural diversity. One of the Ufopa guidelines in IDP refers to making research with the promotion of interdisciplinarity produce knowledge with social relevance. Here, an innovative argument is found through the convergence of sciences with the possibility of new inventions, in the attempt to generate new methodological and conceptual frameworks to influence human health and wellness, by analyzing all factors such as social, economic, political, environmental, and institutional [39]. In the Ufopa coverage area, there are some conversation units approved by law, where it is possible to find a wide area of preservation forest. The Tapajós-Arapiuns Extractive Reserve (Resex) and National Tapajós Forest are the fields Ufopa students utilize to carry out academic activities. Sustainable tourism, environmental education activities, and research on fauna and flora are some examples of the activities being carried out there.

D. Outreach

The outreach activities at Ufopa have a strong commitment to diversity, respecting differences between races, ethnicities, beliefs and genders, ethical principles, the promotion of social inclusion, and/or sustainable and regional development. We choose a small fragment to be analyzed.

In 2018, considering there were 4018 indigenous students (2.7%) and 3276 quilombola students (2.2%) from a total of 151,181 students in federal universities in the north region of Brazil [57], it remains a great challenge to universities mainly located in the Amazon region to overcome the inequality. Gough and Scott [8] argues that, with the onset of the industrial revolution, society became predicated on a reductionist, mechanistic, industrialist, materialist, utilitarian, and masculine set of assumptions. Higher education plays a role to promote a new paradigm based on a social, sustainability, and educative perspective. Gough and Scott [8] assert the necessity to understand environmental threats to human life through the application of science, and to change people’s behavior appropriately through education so that it becomes pro-sustainability. In IDP outreach policy, there are programs that aim to value the identity of peoples and native communities from the Amazon region, for example, in the Hora do Xibé Project and Culture, Identity and Memory Program in Amazon. Both programs promote research on cultural manifestations about quilombos and indigenous people. Sometimes, scientists and other experts understand only one way to produce knowledge: the transference of skills from more-developed communities to a less-developed one. These programs have an innovative approach in the promotion of informal dialog among individuals engaged in collaborative work. There is space for dialog rather than just for the mere transmission or exchange of points of view [22]. It reveals the commitment to diversity; environmental sustainability; human and animal rights; equity in the relations of gender, generation, race and ethnicity; and with administrative and financial transparency. Table 6 presents some programs to address sustainability beyond university limits.

Table 6. Examples of outreach [45].

Program	Objectives
“A Hora do Xibé” Project	Values and disseminates the history, culture, values, and identity of people and native communities from the Amazon region, especially those of the Lower Amazon, thus helping to recognize and protect the rich cultural heritage of the people and traditional communities of the region.
Culture, Identity and Memory Program in the Amazon	Promotes research and outreach actions in the municipalities of Pará in Santarém and Óbidos, to support the study and rescue of existing cultures in the interior of western Pará, the manifestations of identities of population groups, mainly from quilombola communities that are established on plateaus, flooded land, and land that never floods.
Archeology in Schools Program: histories from the Amazon	Proposes a didactic platform for the transfer of scientific knowledge produced in universities about the Amazon’s past to schools in the municipalities of Santarém and Monte Alegre, areas that exhibit an expressive archaeological heritage.

Issues and solutions for progressing sustainability must reach beyond the university walls to address [34] practices that HEI serves [36].

5.2. Survey Design and Procedures

A sample of 74 students was obtained. Of them, 40 (54.5%) were female and 34 (45.94%) were male. The age of respondents varied between 18 and 50. Most respondents were in the 18–25 age range (74.32%). All of them were enrolled in an undergraduate teacher-education course. The survey is an important tool for understanding the student perception about what happens in reality in their daily routine. In total, 200 questionnaires were sent by email, and 74 students replied. The platform was open from June to September 2019. Reminders were sent to participants asking them to answer the questionnaire, as well as to coordinators to encourage students to do so.

The electronic questionnaire (survey) was organized to provide strategic information for research. The first part contains the Informed Consent Form (TCLE in Portuguese), where the student had access to knowledge of the instrument, possible risks, and their ways of minimization, in addition to the benefits for the academic community, thus being able to accept or refuse to participate in the empirical research. Guidance on completing

the questionnaire was also provided, as well as the researcher’s email address for any questions, clarifications, or reports.

Then, there was a presentation on the research topic, its objectives, and the way the questionnaire was organized, as well as guidance on how it should be filled out. Personal information such as age, gender, course, year, and form of admission as well as professional information was requested. The respondent was asked to identify their perceptions about sustainability during the course period. Questions were asked to establish whether the students discussed sustainable issues during the course and how they would approach them in class.

Undergraduate students of teacher education had been chosen because they can reach numerous people in their profession. It was necessary to ask permission from undergraduate course coordinators to collect the email from the students. After obtaining the authorization, a mapping of the groups, courses, times, shifts, and places of operation was carried out. The categories elaborated were: (a) higher education and teacher education: how is the preparation of teacher education student related to sustainability at the university. How does this institution develop its role in relation to sustainability in teacher education? and (b) Sustainability: check the student’s perception of sustainability. All questionnaire sections included open-ended questions.

5.2.1. Students’ Perception about the Incorporation of ESD in Curriculum

Students’ perception was studied in terms of their level of agreement with ESD in their curriculum, how and what the students learn about sustainability, whether they feel prepared to approach the issue of sustainability, and whether the university promotes and encourages it.

In Table 7, 58.11% (*n*: 43; sum of answers: 3—agree, 4—high agree and 5—strongly agree) of the students agreed that their course contained issues about sustainability, 24.32% (*n* = 18; sum of answer 2—few agree) agreed, and only 6.76% (*n* = 5; sum of answer 1—strongly disagree) decided not to give their opinion, while 10.81% (*n* = 8) did not answer. More than half of the students (*n*: 45; 60.82%) agreed that sustainability was understood as something broad and interdisciplinarity (Table 7). The students agreed (*n* = 44; 59.5%) that they are prepared to approach sustainability in their professional career, but almost a quarter (*n* = 15; 20.27) did not agree. A total of 43.25% of the students (*n*: 32; prefer not to answer—NA, not agree—1, few agree—2) did not observe sustainability in practice by their professors, staff, or other students. It suggests there is a gap in the theory and practice.

Table 7. Students’ perception about sustainability in curriculum.

Sustainability in Curriculum	1		2		3		4		5		NA		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
S1. The course incorporated issues about sustainability.	5	6.76	18	24.32	12	16.22	14	18.92	17	22.97	8	10.81	74	100
S2. Sustainability was understood as something broad and interdisciplinary, much more than a specialty.	4	5.41	14	18.92	14	18.92	12	16.22	19	25.68	11	14.86	74	100
S3. Feel prepared to approach about sustainability in your professional career.	3	4.05	15	20.27	16	21.62	12	16.22	16	21.66	12	16.22	74	100
S4. The sustainability was practiced by professors, staff, and other students.	4	5.41	15	20.27	22	29.73	8	10.81	12	16.62	13	17.57	74	100

Note: NA—not answer; 1—strongly disagree; 5—strongly agree.

5.2.2. Pedagogical Approaches about ESD

Students were asked to mention what kind of pedagogical approach has been practiced regarding sustainability. A combination of different approaches was related to the educational goals and sustainability learning [11].

Considering the classroom reality, the survey revealed some pedagogical approaches that are frequently developed. Figure 4 shows the categories: motivation to participate in events, sustainability discussion in class, book and article reading and discussion, environmental law, written tests, individual projects, and teamwork.

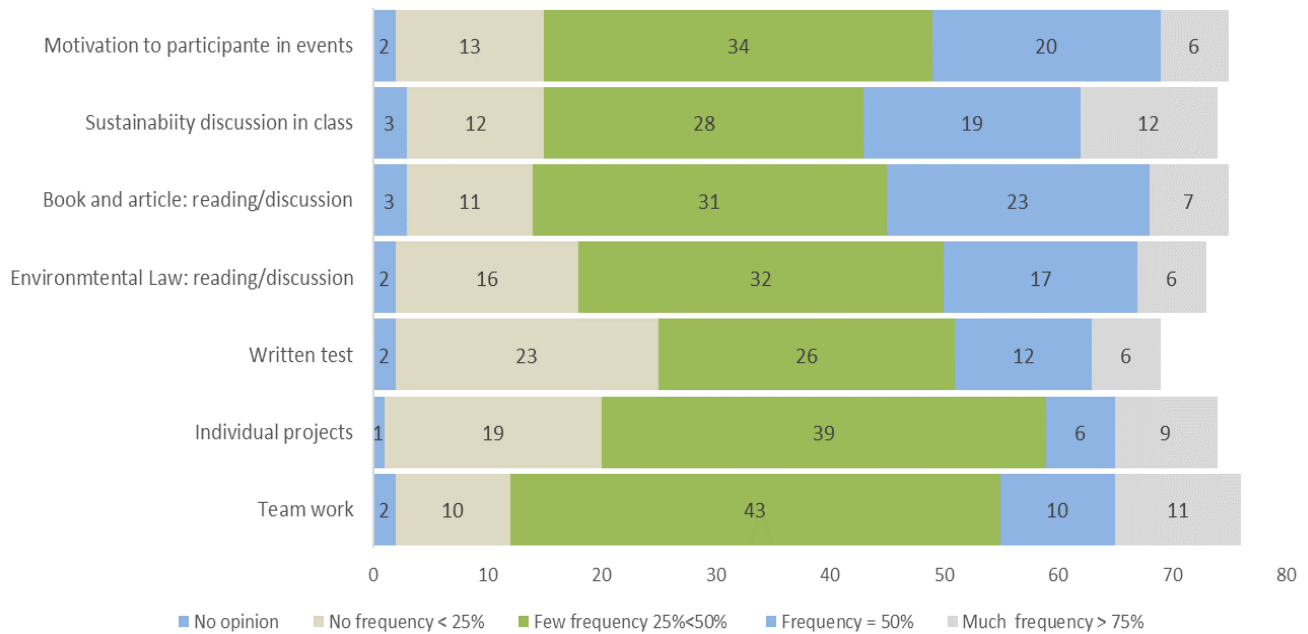


Figure 4. The frequency of some pedagogical approaches in classroom.

All pedagogical approaches were considered by the students’ perceptions; however, it is meaningful to mention the top three of each category. With no frequency, there was a low number of students who pointed to written tests, individual projects, and environmental law. With few frequencies, the majority pointed to teamwork, individual projects, and motivation to participate in events. Frequently, there were book and article reading/discussions, motivation to participate in events, and sustainability discussion in class. Another low number of students pointed to sustainability discussion in class, teamwork, and individual projects as high-frequency pedagogical approaches. We must shift from a traditional pedagogical approach to innovation in pedagogical methodologies [58]. Professors play a clear role in this process [59]. Teaching sustainability and sustainable development requires professors to reflect on their own teaching [60]; therefore, the commitment of professors and academics is needed to foster change in learning and education for sustainability [59].

5.2.3. Topics Related to ESD

Another question was the intensity contribution of the following subject: sustainability, environment, social and environmental responsibility, environmental education, green areas/conservation of flora and fauna, wastewater treatment, solidarity economy, and pedagogical technique in EDS. Each respondent could choose more than one option. The students chose no one influence (1), few (2), regular (3), fairly (4), much influence (5) or not answered (0), as shown in Table 8.

Table 8. The intensity contribution about sustainability.

Themes	0		1		2		3		4		5		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
I1. Education for Sustainable Development (ESD)	6	8.11	0	0	7	9.46	19	25.68	18	24.32	24	32.43	74	100
I2. Environment Pollution	4	5.41	0	0	5	6.76	15	20.27	22	29.73	28	37.84	74	100
I3. Social Responsibility	6	8.11	0	0	8	10.81	15	20.27	18	24.32	27	36.49	74	100
I4. Environmental Education	4	5.41	0	0	4	5.41	15	20.27	22	29.73	29	39.19	74	100
I5. Fauna and flora conservation/green areas	8	10.81	2	2.70	5	6.76	16	21.62	19	25.68	24	32.43	74	100
I6. Green shopping	10	13.51	5	6.76	12	16.22	20	27.03	16	21.62	11	14.86	74	100
I7. Effluent treatment	10	13.51	7	9.46	12	16.22	19	25.68	15	20.27	11	14.86	74	100
I8. Pedagogical technique on Environmental Education	8	10.81	5	6.76	14	18.92	13	17.57	17	22.97	17	22.97	74	100

The top-five specific topics indicated as being highly prevalent were: environmental education (*n*: 29; 39.19%); environment pollution (*n*: 28; 37.84%); social responsibility (*n*: 27; 36.49%); ESD, fauna and flora conservation (*n*: 24; 32.43%); and pedagogical technique on environmental education (*n*: 17; 22.97%). These topics could be part of a course unit, the subject of a specific part of the syllabus.

5.2.4. Student Feedback

As a theoretical foundation, books and articles play an important role in the training of professionals in different areas. However, students were also encouraged to answer the open-ended questions about what strategies they use to improve their knowledge and skill about EDS, as presented in Table 9.

Table 9. Student feedback on qualitative questions.

Question	Feedback
Please indicate what type of source you use to improve your knowledge and skills about ESD	Most of the students indicated that they watch videos on YouTube, media in general, and TV shows and documentaries. They attend courses on afforestation and participate in lectures about sustainability.
Please list the activities you most enjoy in your course related do ESD	An activity they highlighted was the experience in local schools or community volunteering along the Amazon River to share their knowledge, on sustainability. Other activities include stimulating garbage collection, planting seeds, community garden construction, sustainability lectures, and so on within the community.
What could be done to improve the ESD approach in your course?	Most of the students mentioned that interdisciplinarity is necessary. Participation in events to debate ESD, mainly in Amazon region. More experiences outdoors at the university. They suggested the promotion of workshops, lectures, and short-duration courses about ESD, environment education. They understood the necessity of providing more incentives to perform research on ESD.

Universities have the idea that students learn the theory and must leave the campus to experience the practice, but it is possible to obtain the first contact with reality during their courses [19]. In other words, universities should be considered as a trial run for sustainable behavior and serve as a model of social justice and sustainability governance [61]. Additionally, ethical discussions are the central base for the inclusion of sustainability in undergraduate courses and should involve students from different backgrounds (exact, human, social, etc.) and other stakeholders [59].

Undoubtedly, education and knowledge transmission would permit each citizen to collaborate in well-functioning societies and a new procession of management and sustainability [62]. This means that the university has a great responsibility in the Amazon to address Earth's environmental emergencies and human well-being together, it contributes to research the transformation of food, water, and energy systems to meet growing human needs in an equitable, resilient, and environmentally friendly manner with special attention to the Amazon. In this reality, Ufopa should operate as a knowledge and reflection institution, developing critical thinking and transformative learning and not only transferring knowledge.

6. Conclusions

This research analyzed how sustainability is being integrated into higher education institutions settled in natural areas such as the Amazon. The curriculum greening characteristics in the Ufopa institutional development plan were identified and the students' perceptions about sustainability issues were evaluated. Although the presence of some CG characteristics (commitment to the transformation of society–nature relations, contextualization, disciplinary order, democracy, theory and practice, subject as protagonist of knowledge, cognitive aspects, alternative scenarios, methodological adequacy) is present in the documents, it is necessary to go further. It is desirable to open channels of dialog with the academic community to transpose environmental sustainability actions to the academic reality, mainly in a higher education institution located in the Amazon. The commitment to sustainability can be verified when black and indigenous people are included at the university. It implies a change in attitude and epistemological, political, and social conceptions based on the participation of different actors.

Data suggested that almost all students agree that education for sustainability is a reality in their undergraduate course. Even with opportunities to approach sustainability in class, it was verified that when they participate in sustainability activities at schools or community volunteering, it is a good strategy to improve their skills and competence. Most of the students are concerned about the Amazon, deforestation, pollution and mineral exploration, invasion, and the displacement of traditional populations from their territories. It means that multiple actors will need to cooperate to use inclusive wealth in decision-making, policies, and strategies to integrate biodiversity conservation and restoration. Human innovation will create new social and economic opportunities in the transformation to a sustainable future.

The transformation of Ufopa towards sustainability has started, involving inter- and transdisciplinary approaches, but there is still a long way to go. This article adds new insights into how the implementation of sustainability could be performed in HEI integrated in regions such as the Amazon, where the nature values and earth connectivity should be a priority.

Additionally, this research provides an idea about improvements that are still needed in undergraduate students of teacher education course. Improvements can be made in terms of considering other undergraduate courses and institutions located in the Amazon to analyze other experiences on sustainability and higher education. A debate about the contribution and impact that curriculum greening may have on subsequent professional student's lives can also bring further important insights.

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