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Teaching sustainability to accounting students: reducing their ecological footprint (EF)

Enseñando sustentabilidad a estudiantes de contabilidad: reduciendo su huella ecológica

Ensinando sustentabilidade a estudantes de ciências contábeis: reduzindo sua pegada ecológica (PE)

Authors

Ane Karoline de Oliveira Mendes
Bachelor in Accounting. State University of Ponta Grossa (UEPG). Address: Santos Andrade Square, n.º 01 - Center - CEP 84010-919 - Ponta Grossa – PR. Identifiers (ID):
Orcid: https://orcid.org/0000-0001-5752-0363
E-mail: karool.mendes2@gmail.com

Karine Bonfim da Silva
Bachelor in Accounting. State University of Ponta Grossa (UEPG). Address: Santos Andrade Square, n.º 01 - Center - CEP 84010-919 - Ponta Grossa – PR. Identifiers (ID):
Orcid: https://orcid.org/0000-0002-2596-7627
E-mail: karibonfim@hotmail.com

Franciele Machado de Souza
Doctor in Accounting. State University of Ponta Grossa (UEPG). Address: Santos Andrade Square, n.º 01 - Center - CEP 84010-919 - Ponta Grossa – PR. Identifiers (ID):
Orcid: https://orcid.org/0000-0002-5681-8704
Lattes: http://lattes.cnpq.br/1749982015214766
E-mail: fmsouza@uepg.br

Rosaly Machado
Doctor in Management. State University of Ponta Grossa (UEPG). Address: Santos Andrade Square, n.º 01 - Center - CEP 84010-919 - Ponta Grossa – PR. Identifiers (ID):
Orcid: https://orcid.org/0000-0002-7036-8754
Lattes: http://lattes.cnpq.br/7062557400395322
E-mail: rosalymachado@uepg.br

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Abstract

Purpose: To analyze the changes in ecological footprint (EF) composition of accounting students caused by the teaching of sustainability.

Methodology: Qualitative and quantitative approach, descriptive techniques and analysis of the collective subject discourse (CSD). Introduction to the topic and guidance to the WWF Brazil website to calculate EP.

Results: In the first round, EF was 1.96 global hectares. Relevant components: food, government and transport. After cluster analysis, CSD analysis of the three clusters generated was performed, with red meat consumption being the main cause of the result. Students were instructed to reflect on changes to recalculate EF with new habits, revealing a reduction in the second round.

Contributions of the Study: Consisted of a robust methodology to EF analysis, including the combination of cluster analysis with CSD.

Conclusion: Confirmation of the academic role in environmental awareness to achieve sustainable development. It illustrated the importance of education for sustainability by changing students' attitudes.

Keywords: Ecological footprint; Sustainability education; students.

Resumen

Objetivo: Analizar los cambios en la composición de la huella ecológica (HE) de estudiantes de ciencias contables planteada por la enseñanza de la sustentabilidad.

Metodología: Enfoque cualitativo y cuantitativo, técnicas descriptivas y análisis del discurso colectivo del sujeto (DCS). Introducción al tema y orientación al sitio *web* de WWF Brasil para calcular HE.

Resultados: En la primera ronda, el HE fue de 1,96 hectáreas globales. Componentes relevantes: alimentación, gobierno y transporte. Después del análisis de conglomerados, se realizó el análisis de DCS de los tres conglomerados generados, siendo el consumo de carne roja la principal causa del resultado. Se instruyó a los estudiantes a reflexionar sobre los cambios para volver a calcular la educación física con nuevos hábitos, lo que reveló una reducción en la segunda ronda.

Contribuciones del Estudio: Consistió en una metodología robusta para el análisis de HE, incluyendo la combinación de análisis de conglomerados con el DCS.

Conclusión: Confirmación del papel de la academia en la conciencia ambiental para lograr el desarrollo sostenible. Ilustró la importancia de la educación para la sostenibilidad cambiando las actitudes de los estudiantes.

Palabras clave: Huella ecológica; Educación para la sostenibilidad; estudiantes.

Resumo

Objetivo: Analisar as mudanças na composição da pegada ecológica (PE) dos estudantes de ciências contábeis suscitadas pelo ensino da sustentabilidade.

Metodologia: Abordagem qualitativa e quantitativa, técnicas descritivas e análise do discurso do sujeito coletivo (DSC). Introdução ao tema e direcionamento ao site da WWF Brasil para calcular a PE.

Resultados: No primeiro *round* a PE foi 1,96 hectares globais. Componentes relevantes: alimentação, governo e transporte. Após análise de *cluster*, realizou-se análise do DSC dos três *clusters* gerados sendo consumo da carne vermelha o principal causador do resultado. Os alunos foram orientados a refletir sobre mudanças para recalcular a PE com novos hábitos, revelando redução no segundo *round*.

Contribuições do Estudo: Consistiu na metodologia robusta para a análise da PE entre elas a junção da análise de *cluster* com o DSC. Confirmação do papel da academia na conscientização ambiental para alcançar o desenvolvimento sustentável. Ilustrou a importância da educação para a sustentabilidade mudando atitudes dos alunos.

Palavras-chave: Pegada ecológica; Educação sustentabilidade; Estudantes.

1 Introduction

The term "sustainable development" emerged as a response to humanity in face of the social and environmental crisis that the world was going through from the second half of the 20th century (Barbosa, 2008). The World Commission on Environment and Development (WCED), created in 1983 by the General Assembly of the United Nations (UN), created the Brundtland Report, which defines sustainable development "as development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1991), aiming at promoting harmony between human beings and nature.

Sustainability education, in turn, has gained a central role in the transition to a sustainable world since the Stockholm Conference in 1972, which recognized the importance of education in promoting environmental protection and conservation (Collins, Galli, Patrizi & Pulselli, 2018). Education for sustainable development aimed at developing skills that enable people to reflect on their actions, taking into account their current and future social, cultural, economic and environmental impacts, from a local and global perspective (Rieckmann, 2017).

For Calixto (2006), investment in sustainability education has transformed people's behavior and has great responsibility in the promotion and transmission of knowledge, with the participation of the public and private sectors. Thus, universities have responsibilities and obligations in the implementation of sustainable development strategies (Zheng et al., 2021), and are responsible for signaling the interdependence between environmental problems and personal behavior (Fernández, Alférez, Vidal, Fernández & Albareda, 2016). It is imperative that these institutions formulate effective low carbon policies to achieve sustainable development and address global climate change (Zheng et al., 2021).

The sustainability teaching can benefit from the use of qualitative and quantitative tools and indicators (Kapitulčinová, Atkisson, Perdue & Will, 2018). Among these tools is the EF, which has gained prominence in the sustainability debate (Collins et al., 2018). The EF consisted of an

environmental accounting methodology that assesses the pressure of human populations' consumption on natural resources, calculated by tracking the amount of biologically productive area needed to meet all human demands (GFN, 2008). It is expressed in global hectares (GHA), and allows comparing different consumption patterns, verifying if they are within the ecological capacity of the planet (Becker, 2012).

For Nicolaides (2006), universities need to become much more aware of the environmental and social point of view and promote education for sustainability. Furthermore, for Kapitulčinová et al. (2018) the process of integrating sustainability principles in Higher Education was not terminologically unified in the academic literature, bringing a certain degree of ambiguity to what is really meant by terms such as "integration of sustainability" or "transformational change" in the context of Higher Education.

EF has often been used by Civil Society Organizations (CSO) to illustrate and inform different audiences about sustainable development, both global and local (Collins et al., 2018). It consists of a tool that makes it possible to engage accounting students, as it converts personal behavior into quantitative data and helps in education for sustainability (Higino, Hilgenberg, Souza & Meurer, 2022). Fernández et al. (2016) recognized that, despite its limitations, EF is a valuable tool for engaging students.

Universities, important venues for training talent and technological innovations, must play an exemplary role in responding to climate change (Zheng et al., 2021). Thus, in view of the above, the problem that guided this work was expressed in the following question: **What are the changes in the composition of the ecological footprint (EF) of accounting students raised by the teaching of sustainability?** Therefore, this article sought to address this research gap using an individual EF calculator to measure it in the students of the aforementioned course, with the objective of analyzing the changes in the composition of the ecological footprint (EF) of accounting students raised by the sustainability teaching.

Analyzing the influence of sustainability teaching on accounting students' EF is socially relevant, as they experienced the multidimensional character of sustainability, from the point of view of how their daily activities impacted the planet. In practical terms, the accounting profession is changing and must lead in environmental, social and governance disclosures contributing to strong and sustainable financial markets and economies.

Thus, in five sections, the theoretical framework that supported the discussions of the results, the methodology applied and the results and discussions that led to the researchers' final considerations with the references that supported the development of this research were addressed.

2 Theoretical Framework

2.1 The ecological footprint (EF) and education for sustainability

Environmental education as one of the main tools for planetary sustainability, constituted a first step towards a more critical position in relation to attitudes that impacted the planet (Guedes, 2015). For Collins et al. (2018) education has gained a central role in the transition to a sustainable world since the Stockholm Conference in 1972, which recognized the importance of education in promoting environmental protection and conservation. It emerged, therefore, as a result of the increase in global concern with the scarcity of natural resources and with the future of generations of our species.

Jacobi (2003) stated that environmental education is a necessary condition to change a picture of increasing socio-environmental degradation. According to Rieckmann (2017) for individuals to

become agents of change towards sustainability, they needed knowledge, skills, values and attitudes that allow them to contribute to sustainable development.

In this context, EF, as a tool for Environmental Education actions, is a clear and direct way of representing the impact of human behavior on the planet (Guedes, 2015). Finally, Jacobi (2003) emphasized that environmental education should be seen as a process of permanent learning that values the different forms of knowledge and forms citizens with local and planetary awareness.

The term "ecological footprint" was created by Canadian scientists Mathis Wackernagel and William Rees, in 1990, [...] p. 6). The EF was configured as "an environmental accounting methodology that follows humanity's competing demands on the biosphere by comparing human demand with the planet's regenerative capacity" (Becker, 2012, p.15) created to help verify how much of nature's resources is used to sustain the lifestyle.

According to Scarpa (2012, p. 6), "in the early 1990s, economists William Rees and Mathis Wackernagel were looking for ways to measure the size of the growing footprint we leave on the planet". In 1996, they published the book: Ecological Footprint: reducing the impact of human beings on Earth, presenting to the whole world a new concept of sustainability, whose PE accounting method is coordinated by the Global Footprint Network (GFN), founded in 2003, and its 50 partner organizations (Becker, 2012).

The EF considers the biologically productive land area as the quantitative index to assess sustainability. The EF of a region is the area of bioproductive land needed to produce all the resources consumed by the people in that region and to absorb all the waste produced by these people (Zheng et al., 2021). It made it possible to establish, in a quantitative way, a diagnosis of the results of human activities in the ecosystem and the need in terms of appropriation of natural areas for the maintenance of their existence (Dias, 2002).

The main objective of EF has been based on verifying whether consumption and biocapacity are in balance. Becker (2012, p.15) explained that "biocapacity represents the capacity of ecosystems to produce renewable natural resources for human consumption and absorb waste generated by the activities of the population". Therefore, EF compares biocapacity with different types of consumption.

Thus, to simplify the collection of statistical data on human consumption, the EF method adopts a classification of five categories: food, housing, transport, consumer goods and services (Lisboa & Barros, 2010). Being considered for the calculation, the impact of consumption on renewable natural resources. The results have provided an overview of how an individual, city or country uses natural resources, according to consumption habits and lifestyles. This use of resources must be compatible with the planet's natural ability to regenerate them (Scarpa, 2012).

EF is composed by six components, namely: carbon, cultivated areas, pastures, forests, built-up areas and fish stocks (WWF, 2012), and was divided into six consumption categories, broken down according to the WWF (2012) as follows:

> Food – correspond to food and beverage items consumed within the household.
> Housing- brings together housing expenses, direct rents paid per household, occasional repairs, home maintenance, air conditioning, electricity and fuel for the home.
> Transport – refers to expenses with transportation of the population, vehicle acquisition, maintenance, public transport and fuel expenses.
> Goods – brings together consumer items for the home and personal items.
> Services – correspond to the population's consumption of domestic services, health and hospital services, postal and communication services, recreation and cultural services.
> Government – in this category, accounting is carried out indirectly by the amount of taxes paid by the population, it encompasses the federal, state and municipal spheres, as well as their administrative and infrastructure services.

In this way, each type of consumption is converted, through specific tables, into an area measured in hectares, which includes the reserved areas of land and water that guarantee the maintenance of biodiversity. WWF (2012) defined each of the components according to Table 1:

Table 1
Components of the Ecological Footprint

Components	Description
Carbon	Represents the extent of forested areas capable of sequestering CO^2 emissions derived from the burning of fossil fuels.
Cultivation Areas	It represents the extension of cultivated areas used for the production of food and fiber for human consumption, as well as for the production of animal feed, oilseeds and rubber.
Pastures	It represents the extension of pasture areas used for beef and dairy cattle and for the production of leather and wool products.
Forests	Represents the extent of forest areas needed for the supply of wood products, pulp and firewood.
Built-up areas	Represents the extent of areas covered by human infrastructure, including transport, housing, industrial structures and reservoirs for hydroelectric power generation.
Fish stocks	Calculated from the estimated primary production needed to sustain the fish and shellfish caught, based on catch data for marine and freshwater species.

Source: *WWF Brazil (2012).*

If Ecological Footprint exceeds the ecological carrying capacity that the region can provide, an ecological deficit will appear, on the contrary, an ecological increase will appear. The regional ecological deficit or ecological surplus reflects the use of the region's natural resources (Zheng et al., 2021). The synthetic and integrative nature of EF makes it easily understandable and a very valuable way of raising awareness of the environment and reflecting on the limits that the sustainability of the planet imposes on human behavior (Fernández et al., 2016).

There are three indicators in the footprint family that measure the impacts caused by human action on the environment, the Ecological Footprint, the Carbon Footprint and the Water Footprint (WWF, 2012). The Carbon Footprint measures humanity's impacts on the biosphere, quantifying the effects of resource use on the climate. The Water Footprint the impacts that human activities have on the hydrosphere, monitoring real and hidden water flows. EF, in turn, is the best-known indicator. However, Lisboa and Barros (2010) stated that the EF formulators themselves recognized that the method had some limitations.

2.2 Previous Studies

The literature on EF in students showed a growing flow of research developed on the subject. In this scope, studies by Marques (2010); Fonseca and Oliveira (2013); Silva and Cipolat (2016); Fernández et al. (2016); Arruda, Azevedo and Dalmas (2017); Collins et al. (2018); Zheng et al. (2021) and Higino et al. (2022).

Marques (2010) analyzed the environmental awareness and practices of graduate students, identifying the size of their ecological footprint and what they would be willing to do to reverse their impacts, through field research using WWF parameters, presenting as a result a footprint of on average 3 planets, despite being aware of the environmental hazards involved, the 83 respondents showed a lack of initiative to adopt more sustainable practices.

Fonseca and Oliveira (2013) investigated at State high school Polivalente de Apucarana-PR, through the EF test adapted from the WWF website, applied to thirty-three students of the sixth year of elementary school with the objective of analyzing the environmental impact caused by misuse of natural resources, reaching a satisfactory result due to the awareness of good sustainable practice.

Silva and Cipolat (2016), applied a questionnaire taken from the WWF website, to forty people, with the objective of analyzing whether employees used more natural resources than necessary and the impacts that these attitudes cause on the planet, through the result obtained were carried out changes to mitigate such impacts.

Fernández et al. (2016) conducted a sustainability training program for 119 students of the International University of Catalunya (UIC) who planned to become elementary school teachers. The main result of this training was the change in the consumption patterns of former students.

Arruda et al. (2017) carried out their study at the Universidade Guarulhos (UNG), using the same data collection questionnaire as the WWF, on three campuses of the aforementioned university, covering about a thousand students. They concluded that their students use an average of 2.8 planets to maintain their consumption of life, fulfilling their goals of awareness about sustainable consumption.

Collins et al. (2018) researched with the aim of filling an existing gap in research on methods of calculating EF, using a personal footprint calculator to measure students in two European universities. Footprint calculations were performed by 51 students at both institutions. Students were invited to calculate their EF using the electronic calculator and after that, to reflect on their habits and attitudes that resulted in its reduction.

Zheng et al. (2021) evaluated aspects of school sustainability practices and student behavior. Based on campus characteristics, they calculated the EF of energy, waste, water and food to analyze sustainability. EF index found was 8.9; reflecting a position of moderate unsustainability. The authors suggested that the university should come up with a plan for a "green campus", integrating technology, management and education and actively creating a healthy campus culture.

Higino et al. (2022) analyzed the factors that influence the ecological footprint of students in the Accounting Sciences course. The authors revealed that the components with the greatest impact on the students' EF are food, housing, goods and services. It was reported that the students with the highest EF were those who had an expressive use of services.

It is understood from the studies presented that students acquire greater awareness and are willing to change their habits when issues are approached from an environmental perspective. Further research is opportune to address these issues in other regions and samples.

3 Methodological Procedures

The data collection methods, the sample, the electronic questionnaire used to calculate the EF and the proposal of how the data were analyzed are presented. Firstly, a brief presentation of the State University of Ponta Grossa and the Accounting Sciences course was made, demonstrating its objectives and a contextualization of its history.

The main objective was to identify the characteristics of the ecological footprint of students in the 2nd year of the Accounting Sciences course at the State University of Ponta Grossa in 2019. In this sense, their classification regarding to the objectives was descriptive. Regarding to the methodological approach, the work can be classified as qualitative, as statistical techniques were used together with the analysis of the discourse of the collective subject (CSD).

3.1 Sample

The sample of this study consisted of 64 students from the 2nd year of the Accounting Sciences Course at the Universidade Estadual de Ponta Grossa, enrolled in the discipline of Environmental

Accounting. We sought to apply the original EF methodology, using the electronic questionnaire available on the WWF Brazil website.

The course is offered at the Central Campus in Ponta Grossa and at the University Campus in the city of São Matheus do Sul, taking place in the morning and evening periods. (UEPG, 2019). The discipline of Environmental Accounting is offered in the second year of the Accounting Sciences course at UEPG, and has a workload of 68 hours/class.

Its content begins with an introduction to the accounting environment and the environment, and covers topics such as: accounting for environmental events, environmental management, corporate sustainability, environmental and socioeconomic indicators of sustainable performance and integrated reporting (UEPG, 2019).

3.2 Data collection instrument

Initially, students had an introduction to the subject of EF in a specific class on the subject, held in the computer lab of the Accounting Department of UEPG, taught by the teacher of the discipline. After the explanation, an explanatory video on the EF calculation was watched. All students had access to the computer and the Internet and were invited to enter the WWF Brasil website, and access the specific link of the EF to carry out the online calculation of their footprint. Figure 1 shows the screens of the questionnaire made available to students:

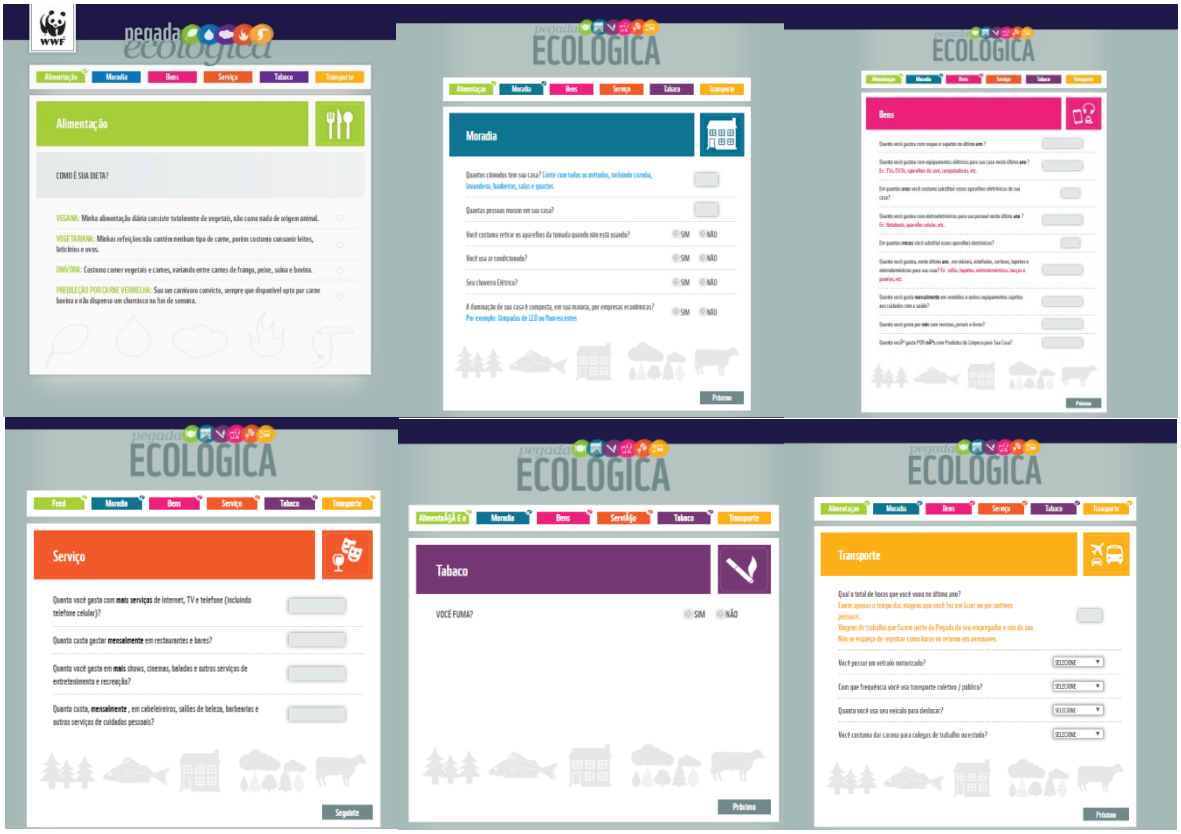

Figure 1 Ecological Footprint online questionnaire
Source: Adapted from WWF Brazil (2019).

The process used to calculate students' EF and possible EF reductions was adapted from the study by Collins et al. (2018), and carried out in 4 main stages:

Step 1: After introducing the theme, students were asked to complete a first round of calculating the EF using the online calculator made available on the website by WWF Brasil. The students' EF results were sent to the researchers' e-mail and the results were transcribed into Excel spreadsheets.

Step 2: Subsequently, a second interactive discussion with students was carried out to explore the types of changes needed to make the transition to a sustainable lifestyle versus those they would be prepared to adopt. Students were also asked to answer whether they were surprised by the extent to which they could reduce their EF. This discussion was guided by a reflection on the set of criteria that should be considered when dealing with the challenge of sustainability (ie, sustainability as a multidimensional concept).

Step 3: In another class on the subject, the results found in the first round were presented, and compared to the Brazilian and world average. Students were encouraged to reflect on the differences between consumption in developed and underdeveloped countries. Also, about the composition of your footprints individually and in general.

Step 4: The final step involved students reflecting on their outcome, considering ways to reduce their individual EF (eg, eating less meat, driving less, etc.). Students were asked to edit their answers to the calculator questions and recalculate their EF based on their possible changes. It is noteworthy that the study was planned so that discussions on sustainability were realistic and effective in actually changing attitudes. The recalculated EF and potential reductions were sent again to the researchers' e-mail. The results were transcribed into Excel spreadsheets for data analysis.

3.3 Cluster Analysis

This stage aimed at creating specific clusters of the 64 students, based on the open answers related to the questionnaire about their footprint and its reduction. The central objective of a cluster analysis is to identify similar characteristics in the discourse of the students surveyed. If there is such similarity, students are grouped together for a more specific analysis. For this purpose, the NVIVO software was used, due to the possibility of relating qualitative variables established in the research propositions, that is, the process identifies such groups from the groupings of words related to the questionnaire responses. NVIVO performs groupings by similarity of words, through the calculation of Pearson's coefficient.

3.4 Collective Subject Discourse Analysis

To analyze the discourse of the clusters, the Collective Subject Discourse (CSD) strategy was used. CSD consists of an analysis method that allows rescuing social representations obtained from empirical research, in which similar individual opinions are grouped into general semantic categories (Lefevre & Lefevre, 2017). The CSD consists of five steps: Obtaining testimonials, speech reduction (key expressions), search for meaning (central idea and anchoring), categorization and collective subject discourse (Lefevre & Lefevre, 2017).

According to Lefevre and Lefevre (2017) the key expressions (KE) consist of the most significant strata of the text, based on the question formulated. Once the KE are selected, it is necessary to verify if the researched person has a position on the research question that corresponds to the central idea (CI). The CI differs from the KE, because it represents the meaning of the statement, while the KE concerns the content. The CI that appears sometimes in the statements is called anchorage (AC). Categorization consists of identifying anchors of similar meaning. The last step deals with the meeting of EKE whose CI or CA have a similar meaning (Lefevre & Lefevre, 2017).

4 Results and Analysis

Afterwards, a descriptive analysis of the data from the first and second rounds was performed and, finally, the results of the analysis of the collective subject discourse of the clusters generated by the NVIVO software were presented.

Footprint calculations were performed with 64 2nd year students, of which 48% were female and 52% male. Table 2 provided the descriptive statistics of EP per capita of the students surveyed. In the first round of EF calculations, students resulted in a footprint of 1.9 global hectares.

Table 2
1st round results

Category	Minimum	Maximum	Average	Standard Deviation
General Footprint	1,15	4,40	1,96	0,6320
Female Footprint	1,15	3,53	1,81	0,6011
Male footprint	1,19	4,40	2,09	0,6365

Source: Prepared by the researchers.

Data in Table 2 revealed that the footprint of male students is greater than that of female students. In addition, it appears that the standard deviation is higher for males, in which the minimum EF was 1.19 and the maximum was 4.40.

In Figure 2, the comparison between the students' EF with the Brazilian and world average is presented. According to WWF (2012), the Brazilian EF is 2.9 global hectares per inhabitant, very close to the world average of 2.7 global hectares.

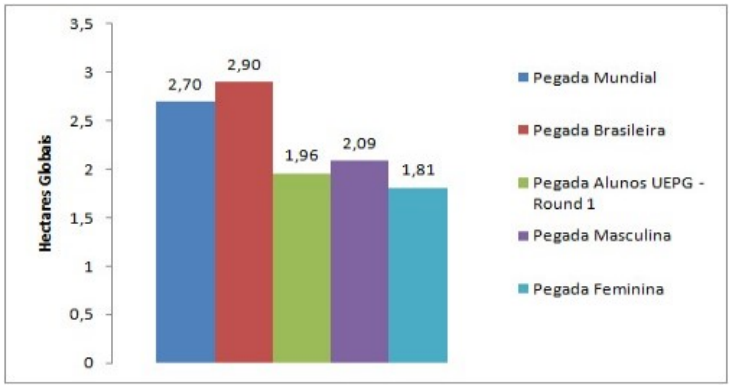

Figure 2: Footprint size comparison
Source: Prepared by the researchers

Data in Figure 2 showed that the average of the EF of the students surveyed was lower than the global and Brazilian average. The divergence from the national average can be explained by the fact that most university students do not own their own home, but live in student residences, shared apartments or with their parents (Zheng et al., 2021). However, if all the inhabitants of the planet had the same EF as those surveyed, it would take more than one planet to sustain their current lifestyle.

The results of this research differ from previous research (Marques, 2010; Fonseca & Oliveira, 2013; Silva & Cipolat, 2016; Arruda et al., 2017). The main difference consisted in the fact that the average of second year students at UEPG is lower than Brazilian and global EF. In comparison to the results of the EF from the students surveyed, which was 1.96 global hectares, Arruda et al. (2017) obtained a result of 2.7 global hectares, Marques (2010) got an average of 3 hectares, Silva and

Cipolat (2016) with an average of 3.6 to 5.4, and Fonseca and Oliveira (2013) with 4 to 5 global hectares.

These data must be interpreted with caution, because students may be at different stages of life and subject to different cultural factors, which interfere in the calculation of EF. In addition, another differential of this research was that the students surveyed were subjected to reflection on their footprint, whose reflections are in the sequence of the next topic.

4.1 Reduction of the ecological footprint

After the first round, in a specific class on the subject, students were instructed to reflect on which aspects of their consumption pattern would really be possible to change. Afterwards, they were invited to recalculate their EF based on these new habits, in order to verify the impact on EF. Table 3 presents the results of the descriptive statistics of the second round of calculating the average, minimum and maximum EF per capita of the students surveyed. After the students' reflection on their consumption patterns, the average EF was 1.47 global hectares.

Table 3
2nd round results

Category	Minimum	Maximum	Average	Standard Deviation
Female Footprint	0,89	2,00	1,38	0,2759
Male Footprint	1,00	2,88	1,58	0,4722
General Footprint	0,89	2,88	1,47	0,40484

Source: *prepared by the researchers.*

The second round results demonstrated a reduction in student footprint compared to the first round (1.9 global hectares). These findings are valid for both the female and male footprint, demonstrating that respondents understood the importance of rethinking their habits and awakening to a more critical and responsible consumption. In this sense, the study contributed to raising awareness about sustainability, as recommended by Nicolaides (2006). There is a need for universities to become much more aware and promote education for sustainability.

Figure 3 illustrated the composition of the EF of the students surveyed, comparing the general footprint with the EF of male and female:

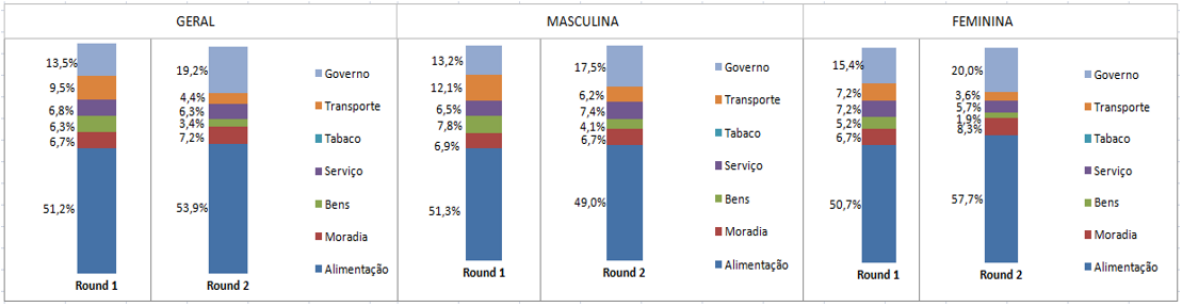

Figure 3 EF Composition
Source: *prepared by the researchers.*

Through the analysis of the composition of the general EF (Figure 3), it was found that the food category had the greatest impact on the composition of the index, and covered more than half of the footprint result, with a general average of 51.2% in the first round. In second place was the Government category, with an overall average of 13.5%, followed by the transportation category, with an overall average of 9.5% in the first round. With less impact, the service, goods and housing categories. This fact was due to the majority of students still living with their parents. The research

results corroborate the study carried out by Collins et al. (2018) and Zheng et al. (2021), who highlighted the food category as the most relevant in the PE calculation. These considerations were also validated in the comparison between females and males. Zheng et al. (2021) highlighted that students should be guided to avoid food waste and cultivate a low carbon lifestyle.

In the second round, food continued as the most expressive category in the EF composition. However, there was a greater use of public services (government) by respondents. Although in the second round there was no significant reduction in the food category in general, there was a reduction in the transport, goods and housing categories in the second round. It was found that the habit of consuming red meat daily was the main impact factor in this category. These considerations were also validated in the comparison between females and males.

As seen in Figure 3, the food category was the one that increased the EF the most, so the students highlighted that the reduction in the consumption of red meat would be fundamental, because according to the WWF (2013) when converting forests into pasture areas to food production, the production of ecological resources was reduced, and in the consumption of water necessary for production.

The male students reflected on their eating habits, and were willing to replace red meat with other protein options and consume more vegetables, resulting in a 2.3% reduction in their EF in the second round. The female students, however, did not give up the daily consumption of meat. However, the students surveyed reduced their EF in other consumption categories.

Collins et al. (2018) highlighted that the change in diet is essential for EF reducing. In this sense, Becker (2012) reported that EF is a tool capable of making society, especially students, reflect on the need for adaptations in consumption habits, to ensure access to ecological resources that sustain life for future generations.

4.2 Reflection on the Ecological Footprint

To analyze the reflection of the students surveyed about their current footprint and the possible reductions, the CSD technique was used. To perform the CSD, cluster analysis was first performed via NVIVO software, to identify similarities between the discourses of the 64 academics surveyed. 3 clusters were generated (C1; C2 and C3), illustrated in Figure 4.

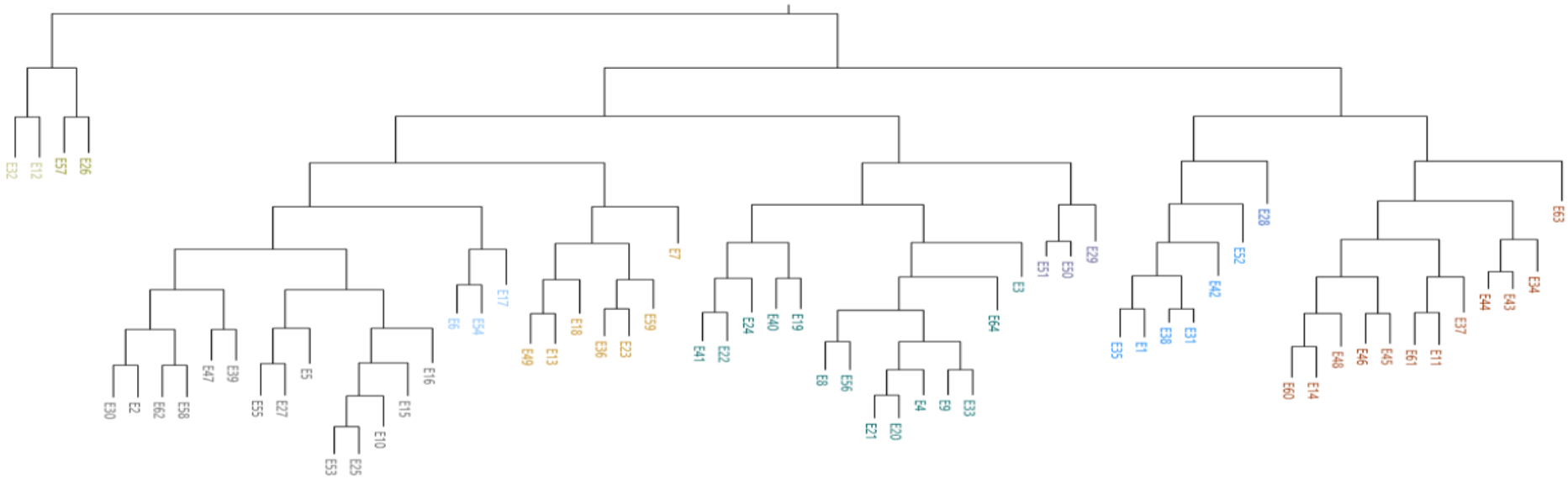

Figure 4 Clustered fonts by word similarity
Source: *Research data.*

Subsequently, the word frequency test was carried out for each of the clusters identified in this study, which made it possible to list the most used words in the academics' discourses about EF and its reduction. The cluster 1 word cloud can be seen in Figure 5.

Figure 5 Cluster 1 word cloud
Source: *Research data.*

Figure 5 revealed that the most prominent word in cluster 1 was “Less”, which demonstrated that academics were surprised with the result of their footprint, because they expected their result to be different, and considered their practices correct. The ideas expressed in this cluster can be observed through the analysis of C1's CSD:

> *“___I was surprised, I thought my footprint would be smaller, because I don’t consider myself a consumerist person, I change electronic devices only when they break and I rarely use public transport, I never smoked and I didn’t know I consumed so much red meat, I didn’t imagine that my attitudes had such an impact the environment."*

The speech of this group of students had as key expressions “I was surprised”, “I had no idea” and “I am not a consumerist”. These expressions confirmed that this group of academics has more conscious attitudes than the rest of their class. It was possible to observe that this group of students related the issue of not being consumerists to the size of the EF. In addition, C1 students also stated that they are “trying” to change their habits and “taking longer” to change their electronic equipment. Through the students' discourse, the concern with the environment and the consequences that their attitudes leave on the planet was remarkable.

Figure 6 Cluster 2 word cloud
Source: *Research data.*

In Figure 6, it can be seen that the most used words in the discourse of cluster 2 were “Consumption”, “Food” and “Meat”. Through the CSD, it was identified that the main key expressions focused on "I consume meat frequently", "I had no idea of the significance of my diet", "I really like meat", "it was scary", "food and transportation have raised my footprint a lot.” It can be seen that this group of students already imagined that their footprint was high due to the large consumption of red meat, “bad” customs and use of the car as a means of transport. However, in the discourse of this cluster, the change of habit was not present. So the C2 CSD consists of:

> *"___ I did not imagine how meat consumption would impact so much on my result, it was surprising and scary, food and transport greatly increased my footprint, as I use a car every day, I was worried, considering that I live with my parents, I thought it would be smaller. It would be impressive to see the impact of all these footprints together."*

C2 students had a lifestyle that impacted the outcome of their footprint negatively. It was observed that in the speech of C2, there was knowledge that their habits generate consequences and damage to the planeta and the greatest impact on the result of the EP of this group was the high consumption of red meat and transport. Many were surprised and frightened by the result, which made them reflect on possible changes.

Figure 7 Cluster 3 word cloud
Source: *Research data.*

In Figure 7, the words that stood out the most were "Consumption", "Habits", "Footprint" and "Impact". The analysis of the DSC that the discourse of cluster 3 revealed to be more balanced in relation to consumption and they were surprised by the results of their footprint, as observed in the CSD:

> *"___ It was a shock of reality, I did not imagine that my standard of living would leave such a footprint on the planet, because in my view my consumption habits are not that big, my diet is balanced and I don't drive a lot, I never stopped to thinking about how small attitudes impact so much on the environment, now I intend to change my lifestyle, I need to improve and reduce meat consumption."*

Although cluster 3 did not believe they were consumerists, their attitudes made them reflect on their way of life. The survey results revealed that tobacco had an influence on the C3 footprint. In addition, the transport component was evidenced by the students surveyed, who despite knowing that public transport is better for the quality of the planet, end up adhering to the private means of transport due to the convenience, agility and safety it provides. Especially in the female discourse, the research findings revealed that the students did not feel safe to walk alone at night, but even with all these difficulties and impediments to changes in habits, they were willing to change their style of life.

5 Final Considerations

With the objective of analyzing the changes in the ecological footprint (EF) composition from accounting science students raised by sustainability teaching, the research data revealed that, in the calculation of the EF, the most relevant components were food, government and transport, whose results corroborate the studies by Marques (2010), Fonseca and Oliveira (2013), Silva and Cipolat (2016), Arruda et al. (2017), Collins et al. (2018) and Zheng et al. (2021).

In the first round, the EF of the surveyed students reached 1.96 global hectares, and despite being below the global and Brazilian average, it would take more than one planet to support the lifestyle of these students. Other studies found similar results for the Brazilian reality, Arruda et al. (2017) obtained a result of 2.7 global hectares, Marques (2010) got an average of 3 hectares, Silva and Cipolat (2016) with a higher average of 3.6 to 5.4, and Fonseca and Oliveira (2013) with a very high average of 4 to 5 global hectares. In contrast, Collins et al. (2018) found an EF of high school and postgraduate students in Italy and the UK higher than the global average. However, underdeveloped countries have a lower EF than developed countries. Therefore, this result should be analyzed with caution. However, the comparison is valid to verify the impact of lifestyle and cultural factors on EF, and therefore on planet earth.

The results revealed that the students surveyed were able to appreciate the difference between their individual footprints and national and global averages. The use of the EF calculator also allowed them to discuss sustainable consumption in the context of their daily lives, inducing them to personally experience the multidimensional nature of sustainability. Students demonstrated the ability to quantitatively capture how awareness of the environmental consequences associated to certain consumption behaviors can facilitate better choices and encourage greater commitment to the sustainable use of resources.

Through cluster analysis, it was possible to divide the group of students by the frequency of the most used words, and then analyze the CSD of each distinct segment. In this analysis, it was observed that the consumption of red meat was the main cause of the result of the footprint and that most of them did not imagine that their habits had an impact on the planet, but they showed a willingness to change their lifestyle, in order to make it more sustainable.

In the second round, the students were instructed to reflect on which aspects it would be possible to improve in order to reduce their EF. The survey results revealed that academics lowered their average EF from 1.96 global hectares to 1.47, demonstrating that they understood the importance of lifestyle changes and were generally willing to rethink their consumption habits. These findings were also confirmed by Collins et al. (2018).

Students who will be future accountants had the opportunity to reassess their consumption habits and make them more aware of sustainability and their responsibility to the environment, through the great challenge of analyzing and experimenting to reduce their EF.

Education for sustainability is essential to contribute to sustainable development, through it, more responsible consumption habits are built and society becomes more committed to contribute to the environment. Thus, this study was able to influence the educational models of sustainability teaching in accounting science courses, as it invited students to reflect on their consumption habits. Furthermore, the EF tool has the potential to go beyond educating students about the use of resources, and assisting in the professional attitudes of future accountants in relation to the impacts of their actions on the business environment (Collins et al., 2018).

The main limitation of the research consisted in the size of the research sample, which did not allow generalizations. Thus, the findings of this research were valid only for this sample. In addition, this work did not capture cultural aspects that impacted the composition of the EF.

Future research will be able to perform the footprint calculation for a larger sample and compare the impact of sustainability education across Universities. Therefore, applying in other institutions will allow a comparison of sustainability between universities through the results obtained, thus contributing to possible improvements, proposing to make their users aware of the reduction in consumption patterns, in order to reduce the EF that has been left on the planet. In addition to exploring the environmental consequences of students' current consumption behaviors and the effects associated to selected changes in daily consumption activities.

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