Journal of Cleaner Production 327 (2021) 129429

Contents lists available at ScienceDirect

Journal of Cleaner Production

journal homepage: www.elsevier.com/locate/jclepro

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https://doi.org/10.1016/j.jclepro.2021.129429
Received 24 November 2020; Received in revised form 13 September 2021; Accepted 18 October 2021
Available online 22 October 2021
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Artigo disponível em: https://doi.org/10.1016/j.jclepro.2021.129429

Higher Education Students' perceptions of Sustainable Development in Portugal

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Highlights:

- Most students are keen to learn more about sustainable development

- Most students learnt about sustainable development during secondary education
- Students want to work in companies that actively support sustainable development
- Women participate more in and are more sensitive to sustainability
- About 8% of students are largely sceptical about climate change

ABSTRACT

Higher education institutions play an increasingly important role in advancing sustainable development. Various studies have demonstrated the key contribution made by teachers to achieving sustainable development. However, few works have addressed students' perceptions in this regard and given that the students of today will be the main influencers and decision-makers of the future, a greater understanding of their beliefs and attitudes towards sustainable development should be gleaned.

The aim of this research is to analyse the perceptions of sustainable development held by students at Portuguese public higher education institutions. To this end, a descriptive and exploratory study was conducted by administering an online questionnaire. The sample is made up of 1257 students from different Portuguese public higher education institutions (68.6% women; average age 24.96 years).

The results show that although the students recognise the importance of sustainable development and most of them have already heard about the sustainable development goals (16% never heard about them), they believe that the higher education institutions could and should give more training on this matter. Most students state that they would accept a lower salary from a company with a good social and environmental performance in some circumstances. The majority also have pro-sustainability habits and behaviours. Most of the students are concerned about climate change, most speak of some reusing, reducing and recycling practices, but fewer students contribute to sustainable development by participating in activities (e.g., environmental or community volunteering) organised by environmental organisations or the higher education institution. Differences in the behaviours and habits related to sustainability were observed between the students of different genders, ages and scientific areas.

The results further present four clusters of students regarding their perception of sustainable development and related practices. The largest cluster (about 45%) includes students who are more concerned about climate change, actively contribute to sustainable development with reuse, reduction and recycling practices, and participate in organised activities to promote the protection of the environment or society. The smallest cluster (about 8%) includes students who are still sceptical about climate change and therefore adopt less environmentally friendly practices.

Five years after the publication of the sustainable development goals, students feel that sustainability is starting to be integrated in education. However, the impact on their behaviours and attitudes remains moderate.

KEYWORDS: Sustainable Development**,** Sustainable Development Goals, Higher Education Institutions, Student Perceptions, Portugal, Survey

Acknowledgements

Thanks are due for the financial support to: (a) CESAM, to FCT/MCTES through national funds, and the co-funding by the FEDER, within the PT2020 Partnership Agreement and Compete 2020; (b) Life Quality Research Centre, to FCT - Fundação para a Ciência e Tecnologia (UID/04748/2020).

1 INTRODUCTION

Since 1992, UNESCO has been improving the general education initiatives for sustainable development (SD) with the aim of changing the way people think about taking actions which can, in turn, foster greater awareness of sustainability and adoption of related attitudes and behaviours. It is of the utmost importance that all society, and students in particular, discover new ways of thinking and acting to foster a sustainable society by developing new skills, behaviours, values, and attitudes. Educational institutions, especially in higher education, therefore play an important role since their main aim is to educate future employers and leaders. Indeed, Higher Education Institutions (HEIs) worldwide demonstrated a greater commitment to promoting sustainability increased following the discussions at Agenda 21 (United Nations Conference on Environment and Development, 1992), the 2nd World Summit on Sustainable Development in Johannesburg in 2002, and during the UN Decade of Education for Sustainable Development (UN-DESD, 2005-2014). Moreover, the Nagoya Declaration in 2014 reaffirmed this responsibility by supporting the realignment of the economic, social, cultural, environmental and education goals in HEIs so that the objectives set in Rio de Janeiro can be achieved ("Nagoya Declaration on Higher Education for Sustainable Development" 2014). In 2000, the Millennium Summit led to the Millennium Declaration with the creation of the eight Millennium Development Goals (MDG), to be reached by 2015. Later, the Conference Rio+20 in 2012 adopted Agenda 2030 (2015-2030), a fifteen-year plan for a future of sustained economic growth, social development, and environmental protection (e.g., United Nations, 2015), including 17 Sustainable Development Goals (SDGs) to be met by 2030. SDGs are different from MDGs; SDGs focus on the relationship and interlinkage between the various sustainability dimensions, and ensure that the policies of each country embrace these goals, namely their priorities at national level (Bautista-Puig et al., 2021). According to Bautista-Puig et al. (2021) HEIs should play a critical role in promoting SDGs. Focusing on global inequalities and the promotion of a more social world (e.g. extreme poverty and human and civil rights), Pérez-Foguet et al. (2018) refer to other development approaches such as human development and sustainable human development (SHD). The concept of SHD is mainly related with "the fulfilment of basic needs and the expansion of human capabilities within SD approaches" (Pérez-Foguet et al., 2018, p. 4287).[1]

The purpose of this study was to extend the knowledge of the promotion of SD in Portuguese HEIs by learning more about students' perceptions of SD and the SDGs. Several studies note the importance of the different HEI stakeholders in fostering SD, namely top management, faculty and students (Aleixo, Azeiteiro, et al., 2018; Aleixo, Leal, et al., 2018; Cebrián et al., 2019; Dagiliūtė et al., 2018;

[1] For a broader reflection on the concepts of sustainability and SD and its historical evolution, the pillars of SD or related concepts such as SHD, we suggest consulting Leal Filho (2011), Lozano et al. (2015), Pérez-Foguet et al. (2018), Sammalisto et al. (2015), and Waas et al. (2011), among others.

Ferrero-Ferrero et al., 2018; Nejati & Nejati, 2013; Pérez-Foguet & Lazzarini, 2019; Zsóka et al., 2013). However, more detailed information is required regarding the students' opinions of their HEIs' commitment to SD and the SDGs, their understanding of SD and SDGs, the importance they place on a company's SD performance as future professionals, their perceptions and behaviours related with climate change and mitigation practices as well as their participation in activities to promote environmental and social protection. The studies of Zsóka et al. (2013) and Lambrechts et al. (2018) addressed the students' attitudes to sustainability; however, to our knowledge, no prior research has examined the perceptions and attitudes to SD and SDGs of Portuguese HEI students as well as their behaviours and knowledge. The paper presents descriptive and exploratory research exploring public HEI students' perceptions about SD by analysing not only their habits, behaviours and experiences but also their knowledge of SDGs and the importance they will give to SD in their future professional lives.

2 THEORETICAL FRAMEWORK

The 17 SDGs should be implemented at all levels (international, national, regional, local). The Education for Sustainable Development (ESD) plays a determinant role in the achievement of the 17 SDG. In 2019, UNESCO proposed a framework for the implementation of ESD beyond 2019 (UNESCO, 2019). It "focuses on strengthening ESD's contribution to the achievement of all 17 SDGs, focusing on policies, learning environments, teachers and educators, youth as well as communities" (p.1). HEIs play a critical role in societies' transition to SD since they educate future professionals and leaders (Lozano et al., 2013; Pérez-Foguet et al., 2018). Major et al. (2017) have noted that some European countries have recognised the importance of HEIs to sustainability and its incorporation in education and campus life. Despite the increasing adoption of best practices for sustainability around the world, particularly in Europe (Lozano, Ceulemans, Alonso-Almeida, Huisingh, Lozano, Waas, Lambrechts, Lukman, & Hug, 2015), much still needs to be done to pursue SD and sustainability in HEIs, namely by integrating the SDGs in the formative offer (Aleixo et al., 2020). There has been a fertile discussion of this topic in areas such as engineering (e.g., Guerra, 2017; Pérez-Foguet & Lazzarini, 2019; Pérez-Foguet et al., 2018; Segalàs et al., 2010; Tejedor et al., 2017) and management (e.g., Adomssent et al., 2014; Eizaguirre et al., 2019; Fisher & Bonn, 2017; Kumar & Afreen, 2021; Lambrechts et al., 2018). But transversal attention should be given to sustainability in all HEIs regardless of the students' training area and curricula.

HEIs should not only define their SD strategy, but also identify the main stakeholders responsible for its incorporation. The key HEI stakeholders for sustainability have been identified in several studies (e.g., Dagiliūtė et al., 2018; Leicht et al., 2018; Nejati & Nejati, 2013; Yuan & Zuo, 2013; Zsóka et al., 2013) but, specifically in the Portuguese context, Aleixo, Leal, et al. (2018) define them as: (i)

leaders of HEIs; (ii) faculty; (iii) staff; (iv) students; and (v) external stakeholders (local and regional level). As these stakeholders can have a considerable influence on advancing SD in the context of higher education, it is necessary to know their perceptions and opinion about SD; indeed, their involvement and participation are indicative of their commitment to achieving those goals. Special focus is given herein to students; according to Aleixo, Leal, et al. (2018), they are among the most important stakeholders in the development of more sustainable societies. Dagiliūtė et al. (2018) state that students can have a significant impact on sustainability, and that curricula and course plans could help shape students' personality. Chuvieco et al. (2018) believe there needs to be a greater understanding of the factors linked to-environmentally-friendly attitudes and behaviours, while Segalàs et al. (2010) note that students' knowledge of SD increases when courses take a more community-oriented and constructive, active learning approach.

Students' attitudes and behaviours may "reflect the national context and the institutional priorities" (Cotton et al., 2016). Cebrián et al. (2019) identified the levels of sustainability competencies: (i) knowledge (conceptual learning); (ii) knowhow (practical skills), and (iii) do (practical action) and stated that participation in sustainability projects might determine the level of students' sustainability competencies. Dalvi-Esfahani et al. (2020) studied students' pro-environmental behaviours that led to Green Information Technology (Green IT) practices and how their personality traits influenced the development of pro-environmental behaviours Dalvi-Esfahani et al. (2020); they concluded that the intention to practice Green IT was significantly determined by students' attitude, perceived behavioural control, and personal norms, where awareness determines the behaviour. For Cogut et al. (2019) students' awareness of sustainability issues makes them more likely to adopt behaviour that fosters sustainability. García-González et al. (2020) argue that HEIs should strive to improve students' critical thinking, social criticism and their analysis of local contexts so that solutions are found to on-going sustainability crises such as climate change. Chan et al. (2017) go further and note the lack of alignment between teaching pedagogy, curriculum, students' experience and learning strategy, as well as the poor conception of HEIs' mission; as a result, it is not possible to guarantee the development of common competences using the same conceptual base. Several authors (e.g., Chan et al., 2017) find there is still insufficient institutional and curriculum support, which influences students' and teachers' perceptions; therefore, both parties show less sensitivity and teachers lack confidence to teach generic competencies. In this scope, a range of studies have been conducted in recent years to examine the perceptions of higher education students but in most cases they have limited their analyses to business schools and courses related to accounting and management (e.g., Getachew, 2018; Lambrechts et al., 2018; Larrán et al., 2018; Osgerby et al., 2018). Two other studies presented cluster analyses with regard to students' knowledge and attitudes toward sustainability issues (Lambrechts et al., 2018; Zsóka et al., 2013). Zsóka et al. (2013) group the students according

to the following five clusters: (i) active environmentalist, (ii) familiar, (iii) techno-optimist, (iv) hedonist, and (v) careless. Lambrechts et al. (2018) present four segments: (i) moderate problem solvers, (ii) pessimistic non-believers, (iii) optimistic realists, and (iv) convinced individualists. These are two ways of characterising students' behaviour in relation to the environment and SD, according to their knowledge, attitudes and consumption behaviour.

Salovaara et al. (2021) draw attention to the theory of interconnected learning (pedagogy of interconnected learning) to study students' approaches to achieve a transformative sustainability education based on a holistic approach (nature-culture, global-local and social-individual). For Caniglia et al. (2018), thinking *glocally* in higher education for SD can foster transnational collaboration, and this model combines the use of digital technologies for global collaboration with experiences and engagement for local learning and impact. Moreover, Nejati and Nejati (2013) believe HEIs should address sustainability holistically on campus and off-campus, adopting basic sustainability principles across all operations on campus (e.g., waste management and efficient use of energy) and by signing international sustainability declarations, committing to international policies and through community engagement projects. Although much is said about endorsing national and international declarations and projects for SD, this commitment must start within the HEIs' actual operations and daily activities; however, these basic sustainability principles continue to be ignored by many planners and decision makers in HEIs. Lambrechts et al. (2018) go further and say that it is necessary to consider the students' perspective when defining competences and curricular innovation.

This study is based on students' perceptions (e.g.,Aleixo, Leal, et al., 2018; Chaplin & Wyton, 2014; Cotton et al., 2016; García-González et al., 2020; Islam et al., 2021; Kagawa, 2007; Lambrechts et al., 2018; Zsóka et al., 2013). Several factors can influence student perceptions about SD; García-González et al. (2020) argue that life experiences and students' undergraduate education influence their knowledge and action for SD.

3 METHODS

Students' perceptions were analysed using an on-line questionnaire administered to all students of Portuguese public HEIs, namely polytechnics and universities. It is a descriptive and exploratory study supported by a quantitative reporting of the findings.

3.1 Survey design and procedures

The questions to be used in this study were organised in a table with an exhaustive listing of all empirical studies about the students' perceptions of SDGs and SD in HEIs, as well as the data collection tools employed, namely questionnaires and interviews. Three studies (Chuvieco et al., 2018; Dagiliūtė et al., 2018; National Union of Students, 2018) were chosen from the list of more

than 10 studies (e.g., Aleixo et al., 2017; Aleixo, Leal, et al., 2018; Dagiliūtė et al., 2018; Emanuel & Adams, 2011; Figueredo & Tsarenko, 2013; Fisher & McAdams, 2015; Nejati & Nejati, 2013; Wachholz et al., 2014; Zeegers & Clark, 2014), to elaborate the questionnaire to be administered to Portuguese HEI students. Most of the questions were adapted from the studies by National Union of Students (2018), Chuvieco et al. (2018), and Dagiliūtė et al. (2018). Although some questions had to be adapted to the Portuguese reality, preference was given to already validated questions.

The survey was designed to explore HEI students' perspectives of SD by examining their SD-related habits, behaviours' and experiences, what they know about SDGs and how SD will influence their decisions as future professionals.

The first section includes questions regarding demographic information. Students were asked to indicate their age, gender, name of HEI, and name and level of the course. The questions in the second section sought to measure students' perceptions of the promotion of SD in HEIs, the incorporation of SD in courses and the extent to which it was incorporated. The aim of the third section was to find out whether students believe the HEI where they study is concerned about the environment and society. In section four, students were asked to indicate which level of education had encouraged them to think about and act to help the environment and people, to provide information about the higher education experiences that had made them more environmentally aware and raised their awareness of the need to support the environment and people, and, finally, whether their HEI could do more to ensure a better training for SD. The fifth section is devoted to the students' plans after graduation and during the job-seeking process based on three possible scenarios. The sixth section addresses the students' knowledge of the SDGs. The final section measures the level of agreement on different climate change statements and is divided into two parts: the first is about students' sustainability habits and the second about their involvement in sustainability.

The questionnaire survey was pre-tested by some students, and the feedback provided was used to improve the instrument. Data were collected after approval of the study by the Ethics Committees of the Polytechnic of Leiria and the General Data Protection Regulation Office at Aveiro University.

3.2 Data collection and sample

The questionnaire was administered to Portuguese polytechnics and universities students in Portugal using the students' institutional e-mails, after obtaining the HEIs' approval. Students participated voluntarily in the study in autumn 2019 (the data were collected between September and December 2019).

A sample of 1257 students was obtained. Of the students surveyed, 862 (68.6%) are female and 395 (31.4%) male. The age of respondents varies between 17 and 71, but the highest response rate is in the 17 to 27 age range (age mean: 24.96; sd: 8.72). Most respondents are at the undergraduate level (n: 779; 61.97%).

The scientific domains and scientific areas of the courses were also registered, divided in accordance with the FCT - Fundação para a Ciência e Tecnologia (2017) list. Most courses are from the Social Sciences and Humanities scientific domain (n: 706; 56.2%), directly followed by exact sciences and engineering (n: 256; 20.4%), life and health sciences (n: 195; 15.50%) and natural and environmental sciences (n: 100; 8%).

3.3 Statistical analysis

The data were first analysed using descriptive statistics methods. The differences in the respondents' age, gender, and scientific area of the course attended were then examined. As these variables do not follow a normal distribution within each group, the non-parametric Kruskal-Wallis Test (for age groups and scientific areas) and Mann-Whitney Test (for gender) were applied in most situations. Where significant differences were found, multiple comparison were made. In this procedure, the age variable was divided into four groups: a) 17-19 years (n: 324), b) 20-22 years (n: 428), c) 23-26 years (n: 193) and 27 or over (n: 312). When applicable, the differences in responses due to age, gender, or scientific area were studied through the chi-square test (using Monte Carlo simulation).

An exploratory factor analysis (EFA) was performed for the students' perceptions about climate change as well as behaviours and habits in the SD domain. The "aim of an EFA, as a statistical tool, is to find a solution where there is a simple structure to the data" (Lanario et al., 2020, p. 4). The data were extracted with the Principal Component method and the results analysed after the rotation performed with Varimax with Kaiser Normalisation method. Before proceeding with EFA, the Bartlett's Test of Sphericity (χ^2 = 8878.75; p = .000) and the Kaiser–Meyer–Olkin measure of sampling adequacy (.859; meritorious adequancy, Hair et al., 2006) were calculated. The EFA with the 20 items of students' perceptions resulted in five factors with eigenvalues greater than one, which explain 59.73% of the variance of the data (Table 1). The factors were interpreted as:

- Factor 1 – Reuse and reduce: this factor represents the students' perceptions and practices related with the reuse of materials (e.g., plastic objects, paper) and the reduced consumption of materials with a strong impact on the environment (e.g., water, energy, printing);
- Factor 2 – Climate change concerns: this factor represents the students' perceptions related with the effects of climate change, its impact on human lives, and Governments' actions in this domain;
- Factor 3 – Activities organised by the HEI in the SD area: this factor represents the students' participation in SD activities organised by their HEI, namely environmental and social activities;
- Factor 4 – Contributing to environmental protection: this factor represents the students' perceptions and actions related with their participation in environmental activities;

- Factor 5 – Recycle: this factor represents the students' perceptions and practices about recycling actions (e.g., separating garbage by type).

Table 1 – Results from the exploratory factor analysis of the students' perceptions about climate change and behaviours and habits in the SD domain (with Principal Component extraction and Varimax with Kaiser Normalisation rotation)

Students' perceptions items	Factor loading				
	1	2	3	4	5
Factor 1: Reuse and reduce					
I usually reuse plastic bottles	.67				
I try to respect the environment	.66				
I try to save water at home	.62				
I try to buy energy efficient appliances	.61				
I try to reuse things that can be useful for me or for other people	.60				
I print double-sided documents to save paper	.57				
I try to avoid printing documents	.53				
Factor 2: Climate change concerns					
Governments from across the world should do whatever it takes to address climate change		.82			
I am concerned about the effects of climate change		.78			
I would vote for a Government that increased action to tackle climate change		.76			
Climate change will negatively impact me and my lifestyle		.73			
Factor 3: Activities organised by the HEI in the SD area					
I participate in social activities organised by my educational institution			.91		
I am actively involved in activities at my educational institution			.87		
I participate in environmental activities organised by my educational institution			.84		
Factor 4: Contributing to environmental protection					
I am a volunteer in nature conservation activities (cleaning beaches, etc.)				.83	
I participate in actions in favour of the environment in public places				.81	
I read blogs and participate in social networks or pages related to environmental protection				.71	
I plan my holiday around the environmental interest of the destination				.43	
Factor 5: Recycle					
I leave the waste in the proper places					.78
I separate the garbage by type					.71
Eigenvalues	5.27	2.65	1.87	1.15	1.00
% of Variance	14.39%	12.87%	12.55%	12.20%	7.72%

Note: Factor loadings equal to or less than .4 are not shown in the table.

Following EFA results, subscales were constructed on the basis of the factor loadings by taking the mean of items loading on any factor. This is a common procedure in the literature (e.g., Lanario et al., 2020). The subscales were used for cluster analysis which was also carried out. A hierarchical cluster analysis was performed (the Ward's method was used as cluster method and the Squared Euclidean distance was used as measure of distance) with the five factors identified in Table 1. Through the observation of the Dendrogram, four clusters were identified. See respective results in section 4.7. Non-parametric Kruskal-Wallis tests were also applied to compare clusters (it was not possible to apply the parametric methodologies due to violation of the assumptions of normality of

data and homoscedasticity of variances). Nevertheless, before cluster analysis, descriptive analysis of this data was also carried out in which the original items were used.

Regarding reliability, two measures were used: Cronbach's Alpha for items with response sets measured at an ordinal level, and Kudar-Richardson 20 (KR-20) for survey items with response sets measured at a categorical level (Table 2). The different sections of the survey showed fair reliability. Only the "HEIs' actions for student training in SD" and "Factor 5: Recycle" showed a value below .70; however, these sections were retained given the exploratory and descriptive nature of the study. Due to the nature of the questions: "To what extent has SD been considered in your course?", "Students' knowledge of the United Nations SDG", and "Student interest in working in SD companies", it is not appropriate to calculate reliability indicators.

Table 2 – Reliability analysis

Survey topic	Number of items	Range	Cronback Alpha	Kudar-Richardson 20
Students' perceptions about incorporation of SD in HEIs	3	1-5	.85	-
Concepts and issues associated with SD	14	0-1	-	.73
HEIs' actions for student training in SD	8	0-1	-	.61
HEI action for SD	4	1-5	.80	-
Students' perceptions and behaviours about SD:				
Factor 1: Reuse and reduce	7	1-5	.74	-
Factor 2: Climate change concerns	4	1-5	.80	-
Factor 3: Activities organised by the HEI in the SD area	3	1-5	.89	-
Factor 4: Contributing to environmental protection	4	1-5	.78	-
Factor 5: Recycle	2	1-5	.60	-

4 RESULTS

The results section is organised as follows. First, data are analysed using descriptive statistics methods and the difference between groups was examined (groups considered by gender, age and scientific area of the course). Second, using the results of EFA, a cluster analysis of the student perceptions and behaviours was performed.

4.1 Students' perceptions about the promotion and incorporation of SD in HEIs

Students' perceptions of HEI actions in support of SD were studied, namely in terms of their impact, what the students learnt, their interest in learning more about SD and whether the HEIs could do more to promote and incorporate SD.

As can be seen in Table 3, 95.70% (n: 1203; sum of answers 4 – agree and 5 – totally agree) of the students believe that SD should be more actively incorporated and developed by their HEI, 90.93% (n=1143) say all courses should actively incorporate and promote SD, and 89.58% (n=1126) want to learn more about SD. Also, in this context, students were asked about the extent to which SD was addressed in the course they attend (Table 4). Only about a quarter say that SD is considered

extensively (n:107; 9%) or broadly (n:193; 16.3%) in the course. About another quarter (n:303; 25.5%) consider that SD is only partly considered in the course. Almost half of the students state that SD is only sporadically addressed in the course (n:335; 28.2%) or not at all (n:248; 20.9%).

Table 3 – Students' perceptions of SD

Students' perceptions of SD questions	1		2		3		4		5		Total		Kruskal Wallis test (p-value)	Mann-Whitney test (p-value)	Kruskal Wallis test (p-value)
	N	%	N	%	N	%	N	%	N	%	N	%	Age	Gender	Areas
SD is something which all universities/colleges should actively incorporate and promote	16	1.27	7	0.56	31	2.47	343	27.29	860	68.42	1257	100	.911	.000	.006
SD is something which all courses should actively incorporate and promote	13	1.03	18	1.43	83	6.60	420	33.41	723	57.52	1257	100	.121	.000	.003
SD is something which I would like to learn more about	19	1.51	10	0.80	102	8.12	508	40,41	618	49.17	1257	100	.560	.000	.014

Note: 1 - Strongly disagree; 5 - Strongly agree

Table 4 – To what extent has SD been considered in your course?

Students' perceptions of SD questions	The SD is extensively considered in my course.		The SD is broadly considered in my course.		The SD is partly considered in my course.		The SD is sporadically considered in my course.		The SD is not considered at all in my course.		Total		Kruskal Wallis test (p-value)	Mann-Whitney test (p-value)	Kruskal Wallis test (p-value)
	N	%	N	%	N	%	N	%	N	%	N	%	Age	Gender	Areas
SD has been covered in my course	107	9%	193	16,3 %	303	25.5 %	335	28.2 %	248	20.9 %	1186	100 %	.635	.263	.000

Note: 71 students did not answer this question.

The *Kruskal Wallis Test* revealed no significant differences between individuals in different age groups. Notwithstanding, differences are found between women and men and between students from different course areas. Women express greater concern about the incorporation of SD in courses and learning processes at HEIs. Students from the natural and environment sciences courses are the most aware of the topic (66% of the students from these courses assert that SD is extensively or broadly integrated in their courses, whereas the percentage in the other course areas is 25% or below).

4.2 SD teaching

Some of the SD related topics that are already studied in degree courses stand out (Table 5). The specific issues and concepts most frequently addressed are accountability and ethics (n: 615; 11.0%); cultural diversity and equality (n: 527; 9.5%), and human rights (500; 9.0%). Ecosystems and ecological principles (254; 4.6%) and biological diversity and nature (n: 244; 4.4%) are the least commonly covered concepts related to SD. This response rate may be dependent on the courses studied by the respondents. Note that these topics could be the title of a course unit, the subject of a

specific module or simply the theme of one or more seminars. They are however topics covered in the students' formal training.

Table 5 – Topics covered in higher education students' degree courses (formal education)

Topics	N	% relative to total answers	% relative to total students
Accountability and ethics	615	11.0%	49.1%
Cultural diversity and equality	527	9.5%	42.1%
Human rights	500	9.0%	39.9%
Social and corporate responsibility	460	8.3%	36.7%
Health and wellness	428	7.7%	34.2%
Waste, water and energy	397	7.1%	31.7%
Climate change	396	7.1%	31.6%
Citizenship and democracy	382	6.9%	30.5%
Business Ethics	357	6.4%	28.5%
Consumerism, global and ethical trade	307	5.5%	24.5%
Social justice	303	5.4%	24.2%
Rural and urban development	286	5.1%	22.8%
Ecosystems and ecological principles	254	4.6%	20.3%
Biological diversity and nature	244	4.4%	19.5%
None of the previous topics	110	2.0%	8.8%
Total	5566	100.0%	--

Note: The students could select all topics that have been covered in their course from a list; 1257 students answered the question.

When asked if HEIs could do more to guarantee students receive adequate training on SD, 94.4% of students (n=1186) confirm that the HEI they attend could do more. Most students selected the following actions from the list of options presented (Table 6): offer free SD courses/workshops (n: 782; 62.2%), promote actions on SD (n: 742; 59.0%), and encourage volunteer actions in the community (n: 740; 58.9%). Participation in practical on-campus actions and promoting participation in social and environmental campaigns were the next most important for more than 50% of the students.

Table 6 – HEIs' actions for student training in SD

What the HEI can do to ensure better training of its students in the SD area	N	% relatively to the total of answers	% relatively to the total of students
Offer free courses / workshops on SD	782	17.0%	62.2%
Promote actions on SD	742	16.1%	59.0%
Encourage voluntary actions with the community	740	16.0%	58.9%
Promote student participation in practical actions on campus	680	14.7%	54.1%
Promote participation in social and environmental campaigns	674	14.6%	53.6%
Promote involvement in the institution's planning activities	428	9.3%	34.0%
Introduce an optional course unit on SD	343	7.4%	27.3%
Introduce a mandatory course unit on SD	223	4.8%	17.7%
Total	4612	100.0%	--

Note: The students could select any topic they wished from a list; 1257 students answered the question.

Most students referred to secondary education when asked about the educational path and level of education that most encouraged them to care about the environment and people (n: 473, 37.6%); higher education appears as the second level of education where students have acquired the most knowledge about SD (n:437; 34,8%). However, 46 (3.7%) mention other kinds of training (e.g., informal education and social media), and 25 (2%) they have not yet been taught anything about SD.

4.3 HEI action for SD

For 40.10% (n=504) of students, the HEI takes action to limit its negative impact on the environment and society while 42.88% (n=539) of students say the HEI provides opportunities to get involved in actions to limit the negative impact on the environment and society (Table 7). When asked about how their studies influence their behaviour vis-à-vis SD, 31.27% (n=393) students say that they allow them to learn how to make changes in their lifestyle to help the environment, and more than 50% (n: 673; 53.54%) say that they allow them to learn how to have a positive impact on the world around them.

Table 7 – Recognise HEIs' action for SD

Recognise action by HEIs on SD questions	1		2		3		4		5		Total		Kruskal wallis test (p-value)	Man-Whitney test (p-value)	Kruskal wallis test (p-value)
	N	%	N	%	N	%	N	%	N	%	N	%	Age	Gender	Scientific areas
My institution takes action to limit the negative its impact on the environment and society.	52	4.14	159	12.65	542	43.12	412	32.78	92	7.32	1257	100.00	.000	.119	.000
My institution provides opportunities for students to get involved in actions to limit its negative impact on the environment and society	74	5.89	205	16.31	439	34.92	396	31.50	143	11.38	1257	100.00	.000	.440	.000
My studies allow me to learn how to make changes in my lifestyle to help the environment	167	13.29	295	23.47	402	31.98	262	20.84	131	10.42	1257	100.00	.259	.317	.000
My studies are helping me learn how to have a positive impact on the world around me	60	4.77	142	11.30	382	30.39	427	33.97	246	19.57	1257	100.00	.838	.715	.000

Note: 1 - Strongly disagree; 5 - Strongly agree

For these variables, the Kruskal Wallis test showed significant differences between individuals of different age groups and from different scientific areas, but not between women and men. The 17-19 year age group, on one hand, and the students from exact sciences and engineering courses and from natural environmental sciences, on the other, believe most strongly that the institutions take actions and give them opportunities to limit their negative impact on the environment and society. The students from natural environmental sciences courses feel most strongly that their studies help them to learn how to make changes and have a positive impact in the environmental area.

4.4 Students' knowledge of the United Nations Sustainable Development Goals

When asked to describe what they know about the SDGs (Table 8), most students say they have not only heard about them but also know what they are (n: 632; 50.3%). On the other hand, 34.0% (n: 427) have heard about the SDG but do not know them; and 15.8% (n=198) have never heard about SDGs.

Table 8 - students' knowledge of SDG and Chi-square tests

Which of the options describes what you know about the SDGs	N	%	Chi-square test with Monte Carlo Simulation (10000 samples)		
			Age	Gender	Scientific areas
I've heard about SDG and I know what they're about	632	50.3	$\chi^2(2)=39.450$ p=0.000	$\chi^2(2)=3.319$ p=0.193	$\chi^2(2)=19.610$ p=0.004
I've heard about SDG but I don't know what they're about	427	34.0			
I've never heard about SDG	198	15.8			
Total	1257	100.0			

When data are analysed by age group, it is the oldest group of students who most often say they have heard about SDG and know what they are (age 17-19:41.7%; age 20-22:45.3%; age 23-26:55.4%; age27+: 62.8%). Students in the 17 to 19 and the 20 to 22 year age groups most often claim they have heard about the SDG but do not know what they are (age17-19:39.2%; age20-22:39.7%; age23-26:30.1%; age27+:23.1%), while those in the youngest age group state most often they have never heard of the SDG (age17-19:19.1%; age20-22:15.0%; age23-26:14.5%; age27+:14.1%). The chi-square test also indicates that knowledge of the SDG is not independent of the students' age ($\chi^2(2)=39.450$; p=0.000). It is concluded that older students have more knowledge of the SDG.

When analysing the data by gender, it was found that slightly more women than men say they have both heard about SDG and know what they are (Women(W): 51.3%; Men(M):48.1%), or that they have heard about SDG but do not know what they are (W:34.2%; M:33.4%). A higher percentage of men say they have never heard of SDG (W:14.5%; M:18.5%). However, the chi-square test suggests that students' knowledge about SDG is gender independent ($\chi2(2)=3.319$; p=0.193).

An analysis of the data by scientific area reveals that students of Natural and environmental sciences courses say most often that they know the SDG (Exact sciences and engineering (Ese):46.5%; Life and health sciences (Lhs):43.1%; Natural and environmental sciences (Nes):64.0%; Social sciences and humanities (Ssh):51.7%), while students of Life and health sciences courses state most often that they have heard of SDG but do not know what they are (Ese:32.4%; Lhs:41.0%; Nes:23.0%; Ssh:34.1%); students in the Exact sciences and engineering say most often that they have never heard of the SDG (Ese:21.1%; Lhs:15.9%; Nes:13.0%; Ssh:14.2%). The chi-square test indicates that the knowledge of the SDG is not independent of the area of the courses attended: students in the Natural

and environmental sciences areas have the most knowledge of the SDG while those in the Exact sciences and engineering have the least.

4.5 Student interest in working in SD companies

Three scenarios were presented to students to assess their interest in working in companies reputed as being SD aligned. The scenarios are described in Table 9. In scenario A, 90.3% (n: 1135) of students would accept a salary 5% lower than average to work in a company with a good social and environmental record. In scenario B, 65.1% (n: 818) would accept a salary 15% lower than average to work in a job that contributes to a good social and environmental record. In scenario C, 66.0% (n: 829) would accept a salary 15% lower than average to work in a job that contributes to positive social and environmental change.

Table 9 – Student interest in working in companies reputed as being SD aligned

Student interest in working in companies reputed as being SD aligned questions			**Kruskal Wallis test (*)**	**Mann-Whitney test (*)**	**Kruskal Wallis test (*)**
Scenario A	**N**	**%**	**Age**	**Gender**	**Area**
Accept a salary 5% over the average to work in a company with a bad social and environmental record	122	9.70	.053	.001	.127
Accept a salary 5% lower than average to work in a company with a good social and environmental record	1135	90.30			
Scenario B	**N**	**%**			
Accept a salary 15% over the average to work in a company with a bad social and environmental record	439	34.90	.026	.000	.055
Accept a salary 15% lower than average to work in a company with a good social and environmental record	818	65,10			
Scenario C	**N**	**%**			
Accept a salary 15% over the average to work in a job that does not contribute to positive social and environmental change	428	34.00	.080	.000	.000
Accept a salary 15% lower than average to work in a job that contributes to positive social and environmental change	829	66.00			

Note: (*) For the nonparametric tests, in each scenario, the two options are converted into dummy variables, where the scenario with the lower salary and better SD performance is coded 1, and the other option 0. The values reported are the p values.

In relation to the students' future employment, there are significant differences per age group for scenario B, as well as gender differences in the three scenarios, and differences per scientific area of the course in scenario C.

The 23-26 age group is least willing to earn a lower salary to work in a company with a good social and environmental reputation, while the youngest age group, 17-19 years, are the most willing or prefer to work in sustainable companies even though the salary is below average. Women state more often than men that they would accept a lower than average salary to work in a company that is concerned about SD or for a job where they contribute to positive environmental and social change. On the other hand, students in exact sciences and engineering courses are the least likely to accept a lower salary to work in a job where they contribute to positive environmental and social change as opposed to one that made a less evident contribution to SD.

4.6 Students' perceptions about climate change and behaviours in the SD domain

In this section the results are organised in line with the EAF factors: perceptions of climate change (factor 2), reuse and reduce (factor 1), recycle (factor 5), contributing to environment protection (factor 4), and activities organised by the HEI in the SD area.

4.6.1 Perceptions of climate change

In relation to climate change, 92.20% (sum of answers 4 and 5) of students feel it will negatively influence their lifestyle; 95.63% say they are concerned about its effects; 95.86% say that Governments from across the world should do whatever it takes to address climate change. In addition, 85.84% say that they would vote for a Government that increased action to tackle climate change (Table 10).

Table 10 - Student commitment for SD

	1		2		3		4		5		Total		Kruskal Wallis test (p-value)	Mann-Whitney test (p-value)	Kruskal Wallis test (p-value)
	N	%	N	%	N	%	N	%	N	%	N	%	Age	Gender	Areas
Climate change will negatively impact me and my lifestyle	22	1.75	18	1.43	58	4.61	404	32.14	755	60.06	1257	100.00	.487	.834	.004
I am concerned about the effects of climate change	11	0.88	15	1.19	29	2.31	392	31.19	810	64.44	1257	100.00	.003	.000	.003
Governments from across the world should do whatever it takes to address climate change	7	0.56	16	1.27	29	2.31	313	24.90	892	70.96	1257	100.00	.762	.012	.034
I would vote for a Government that increased action to tackle climate change	13	1.03	20	1.59	145	11.54	416	33.10	663	52.75	1257	100.00	.155	.000	.001

Note: 1 - Strongly disagree; 5 - Strongly agree

The 17-19 age group is the most concerned about the effects of climate change. There are statistically significant differences for gender, with women being more sensitive to climate change issues and to the governments' responsibility for these issues. Statistically significant differences are also found as regards the scientific area of studies, with students from natural and environmental sciences expressing greater concern about climate change.

4.6.2 Perceptions and behaviours related with reuse and reduce practices

It is in the reuse and reduction of materials that we see the greatest level of students' commitment in the SD area (Table 11). More than 50% of the students state they always try to respect the environment (always: 64.52%), print double-sided documents to save paper (always: 55.21%), reuse plastic bottles (always: 52.67%), and try to save water at home (always: 51.63%). Between 40% and 50% of the

students say they always try to reuse things (always: 49.01%), and try to buy energy efficient appliances (always: 45.82%). Although with a lower response percentage, 35.64% state they always avoid printing documents.

Table 11 – Student perceptions and behaviours related with reuse and reduce practices

Students behaviours for SD	1		2		3		4		5		Total		Kruskal Wallis test (p-value)	Mann-Whitney test (p-value)	Kruskal Wallis test (p-value)
	N	%	N	%	N	%	N	%	N	%	N	%	Age	Gender	Areas
I usually reuse plastic bottles	37	2.94	51	4.06	142	11.3	365	29.04	662	52.67	1257	100	.068	.000	.042
I try to respect the environment	3	0.24	4	0.32	45	3.58	394	31.34	811	64.52	1257	100	.170	.001	.022
I try to save water at home	11	0.88	31	2.47	160	12.73	406	32.3	649	51.63	1257	100	.789	.090	.013
I try to buy energy efficient appliances	14	1.11	43	3.42	185	14.72	439	34.92	576	45.82	1257	100	.000	.403	.062
I try to reuse things that can be useful for me or for other people	11	0.88	31	2.47	123	9.79	476	37.87	616	49.01	1257	100	.834	.000	.007
I print double-sided documents to save paper	23	1.83	50	3.98	150	11.93	340	27.05	694	55.21	1257	100	.301	.000	.000
I try to avoid printing documents	37	2.94	164	13.05	287	22.83	321	25.54	448	35.64	1257	100	.000	.570	.000

Note: 1 - Never; 5 – Always

Statistically significant differences are found between age groups when it comes to describing practices for reusing and reducing materials. The 27 or over age group most frequently says they buy energy efficient devices and avoid printing documents. Statistically significant differences are found between genders. Women demonstrate more frequent practices related with: reusing plastic bottles, respecting the environment, reusing objects, and printing double-sided documents to save paper. Statistically significant differences between reuse and reduction practices are also found in the various scientific areas. The students from life and health sciences courses are more proactive in the following practices: trying to reuse things, reusing plastic bottles, and printing double-sided documents to save paper. The students from the natural and environmental sciences were more proactive with the following: trying to save water at home, and trying to respect the environment.

4.6.3 Perceptions and behaviours related with recycling practices

Recycling practices are the most frequent among students after reuse and reduction (Table 12). About 45% of the students say they always separate the garbage by type (always: 45.58%) and leave the waste in the proper places (always: 43.6%). These practices are more frequent among women, students in the 27 or over age group, and students from natural and environmental courses.

Table 12 – Student perceptions and behaviours related with recycling practices

Students' behaviours for SD	1		2		3		4		5		Total		Kruskal Wallis test (p-value)	Mann-Whitney test (p-value)	Kruskal Wallis test (p-value)
	N	%	N	%	N	%	N	%	N	%	N	%	Age	Gender	Areas
I leave the waste in the proper places	30	2.39	61	4.85	191	15.19	427	33.97	548	43.6	1257	100	.000	.038	.021
I separate the garbage by type	47	3.74	125	9.94	207	16.47	305	24.26	573	45.58	1257	99.99	.000	.009	.002

4.6.4 Perceptions and behaviours related with contributing to environmental protection

Many students do little to contribute to environmental protection (Table 13). Perceptions and practices in this field show that a large number of students have never volunteered in nature conservation activities (never: 37.07%); have never participated in actions in favour of the environment in public places (never: 23.55%); have never read blogs or have participated in social networks or pages related to environmental protection (never: 23.15%) and have never planned their holiday around the environmental interest of the destination (never: 14.96%).

Table 13 – Student perceptions and behaviours related with contributing to environmental protection

Students behaviours for SD	1		2		3		4		5		Total		Kruskal Wallis test (p-value)	Mann-Whitney test (p-value)	Kruskal Wallis test (p-value)
	N	%	N	%	N	%	N	%	N	%	N	%	Age	Gender	Areas
I am a volunteer in nature conservation activities (cleaning beaches, etc.)	466	37.07	332	26.41	263	20.92	122	9.71	74	5.89	1257	100	.001	.000	.000
I participate in actions in favour of the environment in public places	296	23.55	329	26.17	319	25.38	202	16.07	111	8.83	1257	100	.011	.000	.000
I read blogs and participate in social networks or pages related with environmental protection	291	23.15	291	23.15	298	23.71	233	18.54	144	11.46	1257	100	.597	.000	.000
I plan my holiday around the environmental interest of the destination	188	14.96	214	17.02	469	37.31	267	21.24	119	9.47	1257	100	.010	.000	.010

Note: 1 - Never; 5 – Always

Women exhibited greater involvement in all these practices. Although significant statistical differences are found in relation to the planning of holidays around the environmental interest of the destination, the difference is not uniform; the 23-26 age group pays least attention to the environmental interest of the destination when planning holidays, and the 17-19 and the 27 or over age groups pay the most. Significant differences are also found between the participation in environmentally friendly actions in public places (cleaning beaches, planting trees, etc.) of groups ,

with the youngest participating in more actions. As regards volunteering in nature conservation actions, the 17-19 age group reports the most participation, and the 23-26 age group the least. A different pattern is found in reading blogs and participating in social networks or pages related to environmental protection, with the older students report the most participation, and the younger students the least. There are also significant differences between the course areas. Students from the natural and environmental sciences registered the highest values in all the items of this domain, while the students from exacts sciences and engineering registered the lowest.

4.6.5 Perceptions and behaviours related with activities organised by the HEI in the SD area

The perceptions and behaviours related with activities organised by the HEI in the SD area reveals an incipient involvement of the students (Table 14). Only a small number of students agree/strongly agree that they have participated in social activities organised by their educational institution (sum of 4 and 5 answers: 24.74%), were actively involved in activities at their educational institution (4/5: 19.10%), and participated in environmental activities organised by their educational institution (4/5: 21.72%).

Table 14 – Student perceptions and behaviours related with activities organised by the HEI in the SD area

Students pro SD behaviours	1		2		3		4		5		Total		Kruskal Wallis test (p-value)	Mann-Whitney test (p-value)	Kruskal Wallis test (p-value)
	N	%	N	%	N	%	N	%	N	%	N	%	Age	Gender	Areas
I participate in social activities organised by my educational institution	313	24.9	219	17.42	414	32.94	254	20.21	57	4.53	1257	100	.039	.000	.023
I am actively involved in activities at my educational institution	321	25.54	266	21.16	430	34.21	185	14.72	55	4.38	1257	100	.000	.000	.039
I participate in environmental activities organised by my educational institution	365	29.04	216	17.18	403	32.06	205	16.31	68	5.41	1257	100	.042	.000	.000

Note: 1 – Strongly disagree; 2 – Disagree; 3 – Nor agree, nor disagree; 4 – Agree; 5 – Strongly agree

Women's perceptions of activities organised by the HEI in the SD area were higher than men's (women participate more and are more actively involved). The 27 and over age group participates less in their institution's environmental activities than the 17-19 age group and their participation in social activities organised by HEIs also differ (the 17-19 age group participate the most). Turning to behaviour, the groups' active involvement in activities at the educational institution varies and the youngest groups participate most. There are also statistically significant differences between the various scientific areas regarding SD activities organised by the HEI. The students from the natural and environmental sciences were more proactive and actively involved, notably in environmental activities. The students from life and health sciences courses are also proactive in social activities

organised by HEIs. The students from exact sciences and engineering participate the least in these HEI activities.

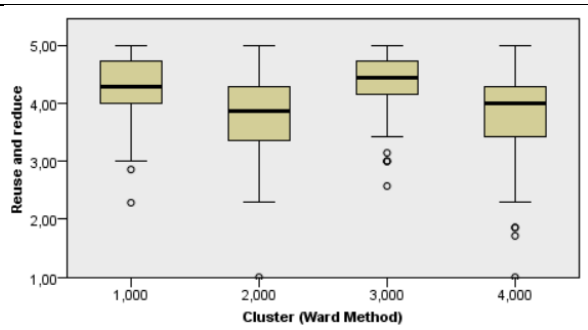
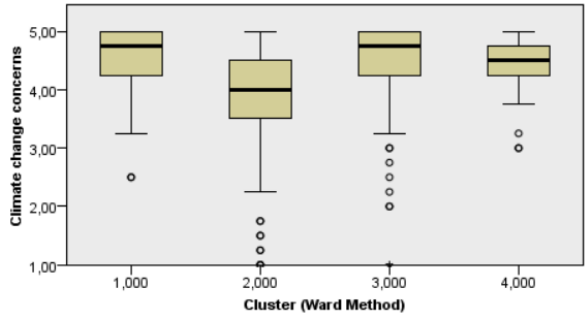
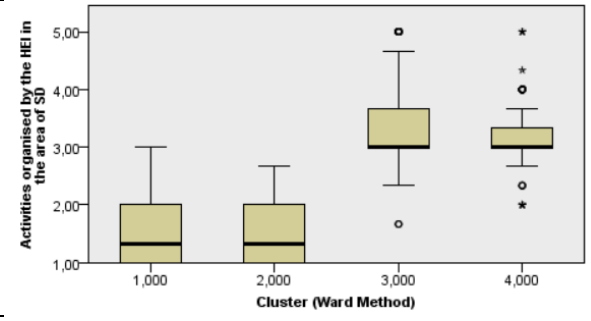
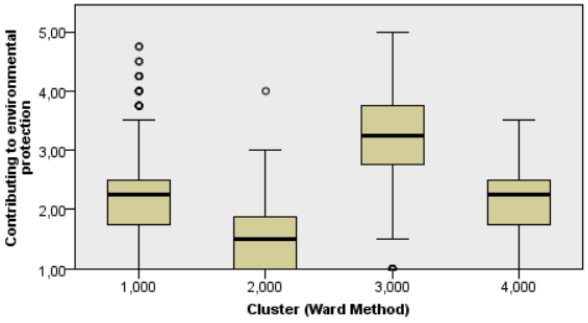
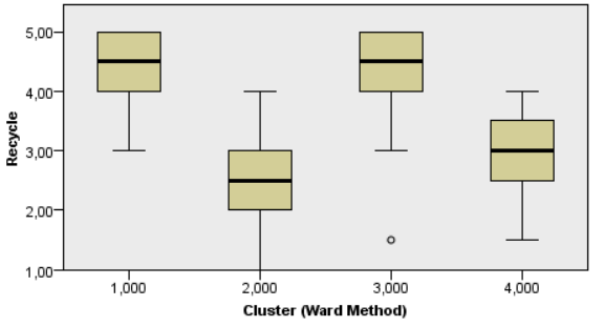
4.7 Cluster analysis of students' perceptions

In light of the the students' perceptions, the analysis now investigates whether there are different clusters of students, as has been done in previous work (Lambrechts et al., 2018; Zsóka et al., 2013), representing distinct behaviours and habits in the area of SD. A hierarchical cluster analysis was performed with the five factors identified in Table 1. Through the observation of the Dendrogram, four clusters were identified. The characteristics and differences in the clusters were then examined. As these variables do not follow a normal distribution within each group, the clusters are compared by applying the non-parametric Kruskal-Wallis Test (Figure 1; see also in this figure boxplots by factor and cluster). The clusters can be characterised as:

- Cluster 1 (N: 431; 34.4% of the total) includes students who frequently reuse and reduce the consumption of material, promote recycling and are very concerned about climate change, but contribute little to environmental protection and hardly participate in SD activities organised by HEIs. This cluster includes students who are concerned about SD and who contribute to SD with individual practices.
- Cluster 2 (N: 104; 8.3%) includes students with the weakest perceptions of SD and least frequent SD related practices. This group, the smallest of the four clusters, encompasses students who reuse, reduction and recycle least often, are the least concerned about climate change, contribute very little to environmental protection and seldom participate in HEIs' SD-related activities. This cluster is made up of students with little concern for SD and describe contributing to it with incipient practices.
- Cluster 3 (N: 560; 44.6%) includes the students with the strongest SD perceptions and practices, report frequently reusing, reducing and recycling, are very concerned about climate change, and participate the most in activities that contribute to environmental protection, including activities organised by HEIs. This cluster encompasses students who are the most concerned about SD and who refer to many individual and organised practices.
- Cluster 4 (N: 162; 12.9%) is made up of students with less consistent SD perceptions and practices. On the one hand, they express great concerns about climate change and even participate in SD activities organised by HEIs, but they reuse, reduce, recycle and separate waste less frequently than the other students, and also contribute very little to environmental

protection. This cluster includes students whose concern about SD is not yet expressed in concrete practices.

Figure 1 – Independent-Samples Kruskal-Wallis Tests by Factor and Cluster

Factor	Boxplot by Factor and Cluster	Kruskal-Wallis Test	Pairwise comparisons of clusters
Factor 1: Reuse and reduce		H(3)=198.38 p=.000	Significant differences between clusters (adj. sig): Cluster 1 – Cluster 2 (p=.000) Cluster 2 – Cluster 3 (p=.000) Cluster 1 – Cluster 4 (p=.000) Cluster 3 – Cluster 4 (p=.000) Cluster 1 – Cluster 3 (p=.000) No significant differences between clusters (adj. sig): Cluster 2 – Cluster 4 (p=1.000)
Factor 2: Climate change concerns		H(3)=113.82 p=.000	Significant differences between clusters (adj. sig): Cluster 2 – Cluster 4 (p=.000) Cluster 1 – Cluster 2 (p=.000) Cluster 2 – Cluster 3 (p=.000) Cluster 1 – Cluster 4 (p=.000) Cluster 3 – Cluster 4 (p=.000) No Significant differences between clusters (adj. sig): Cluster 1 – Cluster 3 (p=1.000)
Factor 3: Activities organised by the HEI in the SD area		H(3)=918.98 p=.000	Significant differences between clusters (adj. sig): Cluster 2 – Cluster 4 (p=.000) Cluster 2 – Cluster 3 (p=.000) Cluster 1 – Cluster 4 (p=.000) Cluster 1 – Cluster 3 (p=.000) No Significant differences between clusters (adj. sig): Cluster 1 – Cluster 2 (p=1.000) Cluster 3 – Cluster 4 (p=.200)
Factor 4: Contributing to environmental protection		H(3)=504.91 p=.000	Significant differences between clusters (adj. sig): Cluster 2 – Cluster 4 (p=.000) Cluster 1 – Cluster 2 (p=.000) Cluster 2 – Cluster 3 (p=.000) Cluster 3 – Cluster 4 (p=.000) Cluster 1 – Cluster 3 (p=.000) No Significant differences between clusters (adj. sig): Cluster 1 – Cluster 4 (p=1.000)
Factor 5: Recycle		H(3)=551.25 p=.000	Significant differences between clusters (adj. sig): Cluster 1 – Cluster 2 (p=.000) Cluster 2 – Cluster 3 (p=.000) Cluster 1 – Cluster 4 (p=.000) Cluster 3 – Cluster 4 (p=.000) Cluster 1 – Cluster 3 (p=.000) No Significant differences between clusters (adj. sig): Cluster 2 – Cluster 4 (p=.163)

5 DISCUSSION

This study presents the results of a questionnaire applied to Portuguese higher education students about their perceptions and practices on issues related to SD. The questionnaire contains questions from three bibliographic references (Chuvieco et al., 2018; Dagiliūtė, 2018; National Union of Students, 2018) and provides a clearer picture of the students' perceptions and future expectations for SD and their concerns about climate change. It is important to note that although the questionnaire did not intend to identify whether students had a scientifically correct notion of SD, students in some courses, notably from the natural and environmental scientific area, have a clear understanding. This result is consistent with that observed by Zsóka et al. (2013): there is a correlation between environmental education and the knowledge and attitudes of students, namely those in higher education.

In general, the results show that students from Portuguese public HEIs have some knowledge about the environmental dimension of sustainability issues. This result confirms other studies, for example Aleixo, Leal, et al. (2018), García-González et al. (2020), and Kagawa (2007). It is also possible to infer that students are extremely interested in SD; they want to learn more about it and for their HEIs to act more decisively in favour of SD. Students also recognise the action taken by their HEI to address its negative impact on SD and the influence of their studies on their personal ability to contribute to change. When asked about their future decisions as professionals, students show a desire to work for companies with a strong SD performance and a strong demand for action on climate change. In Cebrián et al. (2019), students consider themselves to have a medium level of sustainability competences, knowledge and practical skills that allow them to respond to sustainability challenges in their future working life. They also place importance on government action in environmental issues and climate change and express their commitment to vote for governments that address these concerns. As in the work of Callejas et al. (2018), students emphasised the exercise of political power as an effective tool for climate change mitigation. Moreover, Lambrechts et al. (2018) highlights governments' responsibility for the transition to sustainability societies.

The emergence of the ecofeminism movement over the years alongside the growing number of SD and climate change mitigation initiatives has associated feminism to ecology and enhanced the importance of women as the predominant caregivers of nature. The publication of Silent Spring (Carson, 1962) by Rachel Carson exemplifies this kind of movement in feminism. Although these movements have been active since the 1970s, the importance of the role women can play in fostering SD is not yet fully recognised. As noted in other studies (e.g., Bahaee et al., 2014; Chaplin & Wyton, 2014) women are more sensitive to SD issues. Chaplin and Wyton (2014) also note that females tend

to be more interested in sustainability and participate in pro-environment behaviours. In the present study, statistically significant differences in sustainable habits and behaviours are found between genders. In general, women are more sensitive and have stronger perceptions or report more frequent SD practices. However, while some other studies note that males are more familiar with the SD and sustainability concept (Kagawa, 2007), others find no differences between gender regarding the perception of their own energy usage (Yuan & Zuo, 2013), and no differences of level of awareness of various sustainability issues (Cotton et al., 2016). Lambrechts et al. (2018) argue that individual characteristics are more decisive than demographic characteristics or study programmes in the process of building attitudes towards sustainability.

It is also noted that while some higher education degree courses at different levels offer subjects related to SD and SDGs, participation and involvement is still low. In this scope, Zsóka et al. (2013) defend the relationship between environmental education and pro-environmental behaviours, that is, that environmental education will reflect pro-environmental behaviours. Eagle et al. (2015) argue that changes in students' sustainability knowledge, attitudes and behaviours tend to occur as they advance in their studies.

In the present study, about 21% of students reported that SD is never addressed in the course and 28% reported that it is covered only sporadically. It is therefore urgent to introduce SD education in all curricula; however, the introduction of compulsory course units is the students' least preferred option. They would rather HEIs offer free courses or workshops, promote practical SD actions or encourage volunteering in the community. In this scope, Cebrián et al. (2019) pointed out that a holistic integration of sustainability in HEIs should focus on interdisciplinary and innovative practices, which implies a cultural change. In addition, HEI should encourage on-campus voluntary actions and Cebrián et al. (2019) believes the campus should be a living laboratory and contribute to students' active participation and research into sustainability; Forster et al. (2020) share this vision of the about campus as a living laboratory. Another possible approach is to implement service-learning programmes more frequently (Keen & Baldwin, 2004). The campus as a living laboratory and service-learning programmes would also lead to greater student involvement in sustainability practices, as recommended by Dagiliūtė et al. (2018).

Wyness and Dalton (2018) advocated the value of problem-based learning in education for sustainability in undergraduate accounting, and found that students recognised that this developed employability-related skills in problem-solving, collaborative working, conflict resolution, report writing, presentations and research more visibly than specific accounting-related skills; they also perceived knowledge of sustainability issues to be more important to boosting their employability than skill acquisition. For Leal Filho et al. (2019), the HEI community's lack of involvement, notably

its failure to transfer habits from homelife (e.g., recycling, turning off light, etc.) is one of the problems for the planning and implementation of SD. Both the involvement of community stakeholders and internal and external communication are important to develop community engagement (Leal Filho et al., 2019).

García-González et al. (2020) defend "glocalisation" - investigation into local problematic issues to then reach a global level - , as a way of allowing students to develop a systemic vision, influencing their knowledge of social and environmental problems and improving their scientific literacy. Estrada-Vidal and Tójar-Hurtado (2017) recommend that HEIs cover all aspects of sustainability education, that is, social and economic aspects in addition to the environment. The study by Sidiropoulos (2018) argues that SD units should be introduced not only to complement specific disciplinary approaches but also to acknowledge and value divergent epistemological perspectives on knowledge and problem solving that will build a more holistic and integrative view of SD.

Senior management should therefore recognise that incorporating sustainability throughout the HEI system is important to the institution and its main stakeholders, notably teachers, and that curricula should be changed to address SDGs. According to Pérez-Foguet and Lazzarini (2019), the integration of SD in engineering courses has a positive effect on both the students' knowledge and competencies for sustainability and on their vision as future professionals, as well as on teaching practices. Hence, HEIs should identify and break down all barriers and resistance to an innovative process through faculty incentives, as well as encourage and support the integration of formal and informal SD principles across all HEI systems. Albareda-Tiana et al. (2018) argue that HEIs should promote a culture of sustainability by incorporating education on sustainable development and SDGs in curriculum for human rights and integral human development. Boca and Saraçlı (2019) claim that environmental education and education for the environment is the best path towards sustainability, and typified four forms of environmental education (i) education in the environment (adaptation of curricula to encourage students to take an interest in environmental education); (ii) education for the environment (encourage students on the HEI campus); (iii) education about the environment (create activities to discuss environmental problems), and (iv) education to respond to the environment (encourage students to form opinions about how to respond to environmental problems).

Overall, this study corroborates the findings of others, such as Chuvieco et al. (2018), and demonstrates that a greater understanding is required of the factors linked to environmentally friendly attitudes and behaviours. In Chuvieco et al. (2018), the authors show that environmental disciplines or courses should not only provide knowledge for SD but also influence students' attitude to sustainability and their practical behaviour. According to Dagiliūtė et al. (2018), as HEIs help form the students' personal identity, worldview and values, curricula and course plans are particularly

important. Indeed, HEIs are vital to the creation of sustainability society; however, studies that reflect on the importance of students' participation and involvement (e.g., Dagiliūtė et al., 2018; Disterheft et al., 2016) in this process are still scarce. In the words of Hay et al. (2019), "there is a need for an integrated programme that stresses salience, legitimacy and credibility in order to motivate individuals and communities to consider the likely effects of climate change in their lives".

However, students' behaviours and attitudes may vary according to their profile. Our results corroborate what has been observed in previous studies (e.g., Lambrechts et al., 2018; Zsóka et al., 2013), which showed that students can be placed into different segments/clusters in line with their relationship with sustainability. Although based on different methodologies and approaches from those of Lambrechts (2018) and Zsóka (2013), our four clusters are similar: (a) our cluster 1 includes students who are concerned about SD but are less active than cluster 3 students, which is comparable with Zsóka's (2013) 'familiar cluster' and partly with Lambrechts' (2018) 'moderate problem solvers'; (b) our cluster 2, which is made up of students with little concern for SD and incipient or no practices, comes very close to Zsóka's (2013) 'hedonist' and 'careless' clusters and with Lambrechts' (2018) 'pessimistic non-believers'; (c) our cluster 3 encompasses students who are the most concerned about and active in SD, which could be compared with Zsóka's (2013) 'active cluster' and to some extent with Lambrechts' (2018) 'optimistic realists'; and (d) our cluster 4 includes students who are concerned about SD but not very or not at all active, which present similarities with Zsóka's (2013) 'techno-optimist cluster' and partly with Lambrechts' (2018) 'convinced individualists'. Despite these similarities, we do not propose that the clusters obtained are equivalent. Our study shows a higher percentage of students with knowledge of and positive attitudes towards SD and, on the other hand, a smaller proportion of students who are sceptical about SD. These results may be influenced by the students' background (Lambrechts et al., 2018), level of education (Zsóka et al., 2013) or even cultural issues (Ng & Burke, 2010); future studies should therefore investigate whether the smaller proportion of sceptical students now obtained is due primarily to SD education, background, personal or cultural values or, for instance, students' current awareness of climate change. Nevertheless, HEIs and governments should not take a one-size-fits-all approach to SD education but should bear in mind that students have different levels of maturity in their knowledge of and attitudes towards SD. The different studies underline the role played by HEI in fostering SD. For example, Kalsoom and Khanam (2017) defend that awareness of sustainability issues would be increased if HEI adopted the strategy of incorporating SD in all its activities; Lambrechts et al. (2018) points out that "a one-size-fits-all approach in acquiring sustainability competences is not feasible" (p.561).

6 CONCLUSION

This work provides an exploratory and descriptive study on the perceptions and behaviours of higher education students in the area of SD, and on how the topic is being addressed by Portuguese HEIs.

Data suggest that almost all students agree that HEIs should actively incorporate and promote SD, namely in their training offer. However, currently only about 25% of students feel that the topic of SD is widely covered in their course, with 21% reporting that it is not covered at all in the course they attend. The vast majority of students (94%) feel that HEIs could do more to equip students with SD skills. Students would prefer these skills to be developed through free courses, workshops, practical actions on SD or by encouraging volunteering; the introduction of compulsory curricular units was the least chosen option. When asked about the SDGs, half of the students state that they know what they are, but 34% having heard of them but do not know what they are, and 16% have never heard of them. This shows that although HEIs are already developing SD competences, they still have a role to play in the training of students in the area of SDGs.

The social and environmental performance of companies interests students when it comes to finding a job, and they are even willing to accept a lower salary, at least in some circumstances. Over 90% of students are concerned about climate change and feel that it will have a negative impact on their lives, and feel that governments should do more to tackle it.

The vast majority of students say that they adopt behaviours to reuse and reduce the consumption of materials; they also, separate waste for recycling, but less frequently than their reuse and reduction practices. As regards environmental volunteering activities, students (37%) have never taken part in them and only a small number (approximately 20%) have participated in environmental or social activities promoted by their HEI; this could be explained either by activities not being organised and/or being poorly publicised.

The above results vary in line with the students' profile. In general, women participate more, have a clearer perception or are more sensitive to the topic of SD.

The students' age also influences some results, notably:

a) the oldest students (27 years or more) are more aware of the SDGs;
b) the youngest students (aged 17-19) are more willing to earn up to 15% less to work in a company with a good social and/or environmental performance;
c) the youngest students are most concerned about the effects of climate change;
d) the oldest students who are more likely to say that they buy energy-efficient equipment, avoid printing documents and contribute more often to recycling;

e) the youngest students participate more often in volunteering actions aimed at nature conservation or in social or environmental activities organised by HEIs.

In other words, in general, while the 27 or over age group has more sustainable behaviours, participation in different actions is more evident in the 17 to 19 age group.

The scientific area of training of the student also influences the results, namely:

a) students from natural and environmental sciences have a better perception of SD and adopt more related practices; they also know the SDGs better, feel their studies can help them promote positive changes in the environmental area, and are more concerned about the effects of climate change;
b) students in the exact sciences and engineering are the least aware of the SDGs, and the least willing to accept a lower salary to work in a job that promotes social and environmental change.

Statistically significant differences are also found for the various scientific areas when students describe more sustainable habits and behaviours. The students from the natural and environmental sciences were more proactive with the following: leaving the waste in the correct place, reusing things that can be useful, separating the garbage, respecting the environment, planning holidays with the environmental interest in mind, participating in environmentally friendly actions, reading blogs and participating in social networks related to environmental protection, volunteering in nature conservation activities, and participating in environmental activities organised by the HEIs. The students from life and health sciences courses are also proactive in the following two domains: reusing things that can be useful and participating in social activities organised by HEIs. The students from exact sciences and engineering courses are the least sensitive when it comes to printing (e.g., printing double-sided documents to save paper).

A cluster analysis also revealed that students can be grouped into four clusters in line with their SD perceptions, practices and behaviours. At this level, it was observed that:

a) the largest cluster (about 45%) includes students who are more concerned about climate change, reduce, reuse and recycle more frequently and often participate in organised activities promoting SD;
b) the second most dominant cluster (around 34%) is made up of students concerned about climate change and seeking to contribute with individual practices (reduction, reuse and recycling);

c) the second least dominant cluster (13%) encompasses students who are concerned about climate change but contribute very little with concrete practices to improve society and the environment;
d) the smallest cluster (around 8%) includes students who are largely sceptical about climate change and seldom contribute to reduction, reuse and recycling or participate in organised activities promoting SD.

This study is the first that aims to identify how the students in Portuguese HEIs feel about their institutions' commitment to SD and the SDGs. The results presented herein seek to characterise the Portuguese higher education system in terms of how students perceive the inclusion of SD at their institution by reflecting on which SD issues the HEIs promote and the students' sensitivity to them. There is still much to do to improve education for SD through the active participation and involvement of these and other stakeholders both in Portugal and HEIs around the world.

The findings confirm that students' undergraduate education and their life experiences condition their knowledge and the adoption of more sustainable behaviour and habits. Therefore, all courses and levels of education, particularly higher education, should not only further knowledge about the environmental dimension of sustainability but also that of other dimensions by means of both formal and informal curricula. On-campus sustainability can also foster students' involvement in SD issues as they would see that their HEI's commitment is not just a formality (signing declarations etc) but that the institution actively pursues sustainability and strives to become a Sustainable Higher Education's Institution, as defined by Nejati and Nejati (2013). HEIs continue to give SD insufficient importance perhaps because, as yet, few studies have clearly shown how HEIs' perceived sustainability impacts the institution's image among their main stakeholders, namely students.

As defended by Leal Filho et al. (2019), social scientists, natural scientists and engineers must come together to plan the incorporation of sustainability throughout the system. Moreover, Salovaara et al. (2021) state that education and educational institutions should identify key actors for change in sustainability.

Given the national scope of the study, the results are only applicable to the Portuguese context. In future research, more institutional actors within the faculty should be included in the analysis. Given the changes we are seeing in the world due to the COVID-19 pandemic, it would also be fruitful to repeat the study a year from now to understand how these changes have impacted students' perceptions. Moreover, as stated by Salovaara et al. (2021), the importance of taking an interconnected approach to the transition to sustainability is highlighted by the distress the world is currently experiencing, notably due to the COVID-19 pandemic. Future studies can also be designed to assess students' perceptions on specific SDG topics. The students' scientific background may

influence their knowledge and perceptions of SDGs such as 1 (poverty), 3 (health), 5 (gender), 6 (water), 13 (climate action) or 15 (life on land), to mention just a few. Although the questionnaire used in the present study was elaborated based on Chuvieco et al. (2018), Dagiliūtė et al. (2018), and National Union of Students (2018), it does not address all SD domains or all the SDGs. The following works can be used to develop a more holistic tool to study students' perceptions of sustainability in greater depth: Lambrechts et al. (2018), Lazzarini et al. (2018), Ribeiro et al. (2021), Zsóka et al. (2013), Wang et al. (2020). On the other hand, future studies could be complemented by qualitative or mixed approaches to provide a better understanding of how HEIs can introduce SD and SDG teaching more effectively, namely given that a one-size-fits-all approach is not appropriate.

This paper contributes to the literature by providing a vision of HEI students' perception of SD and their engagement. Moreover, it supports the growing importance of encouraging sustainability behaviours among HEIs' internal stakeholders in a bottom-up approach. It also provides valuable insights for the future implementation of processes to integrate sustainability in HEIs.

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