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An Approach to Environmental Knowledge of Undergraduates in Engineering (Spain): Effect of Environmental Subjects

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Abstract: An approach to the effect of environmental subjects on the environmental knowledge of undergraduates in Engineering was examined in this work. Two subjects, common to five different Engineering degrees (Industrial, Electric and Electronic, Mechanic, Industrial Chemistry and Automatic), taught at University of Oviedo, were selected for this study: "Environmental Engineering" (6 ECTS credits), a compulsory subject corresponding with the third year, and "Ecodesign" (6 ECTS credits), an optional subject corresponding with the fourth year. Twenty-three students between 20 and 23 years old and twenty-five students between 21 and 24 years old who took "Environmental Engineering" and "Ecodesign", respectively, participated in the study. The students' knowledge was evaluated prior and once the subjects had been taught by the same questionnaire using a 5-point Likert scale. Results showed that, considering the initial knowledge, the students were aware of the current environmental problems and, furthermore, their knowledge improved after taking the subjects. Additionally, women showed a better initial perception of environmental issues than men, whereas students living in rural areas exhibited a better knowledge about environmental problems than those living in urban areas. Even though this study is limited, it may still offer important insights regarding the environmental perception of Engineering undergraduates. It is an issue of great interest, since many of them will become the professionals that would have to face environmental challenges in the future. Certainly, this work stresses the importance of additional research on this complex issue.

Keywords: undergraduates; engineering degree; environmental knowledge; environmental education; environmental subjects

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1. Introduction

Anthropogenic activities are directly or indirectly responsible for the global environmental problems, namely, pollution, global warming, ozone depletion, acid rain, depletion of natural resources, overpopulation, waste disposal, deforestation and loss of biodiversity. Almost all these processes are the result of the use of natural resources in an unsustainable manner [1]. These environmental issues need to be solved in the next few years to keep the world as an accurate habitat for living species (including humans).

Sustainability, a concept that began to draw public attention in the 1990s, means that human society should grow in a manner that ensures a secure life for future generations. To achieve such growth, mankind should change its view about growth and ways of living [2].

Nowadays, in the third decade of the 21st century, the UN's 2030 Agenda for Sustainable Development, a global plan of action to face the environmental challenges, aims to achieve within ten years a fairer, more prosperous and more environmentally respectful world. The scientific community claims that these measurements run late, and the question now is if there is still time to save the planet [3].

Sharing scientific research with decision makers is not enough to solve complex environmental and conservation issues. In this context, education is an essential tool

that can enhance environmental training throughout all areas of the society [4]. Certainly, environmental education (EE) is the main approach to address global change. This strategy develops and improves environmental attitudes, values and knowledge, preparing people to collaboratively undertake informed action on behalf of the environment [5,6]. Hence, EE facilitates opportunities for scientists, decision makers, community members and other stakeholders to converge in positive environmental actions.

EE can be classified as heterogeneous and diverse, since it pertains from basic primary education to higher education, regardless of the area of knowledge [7]. Environmental education is relevant throughout the life course, from infancy through senior citizenship, in formal and non-formal venues [5]. EE provides a common, clear and defined core, as it raises the need to promote a change in behaviour in relation to the environment, apart from the approach or the didactic strategy that is used [7]. A report published by UNESCO makes it essential to ensure that EE takes the relevance that it deserves and that it is a basic component in the school curriculum throughout the world in order to achieve the objectives of the 2030 Agenda [8].

Over recent decades, there has been an increase in interest from universities in the environmental management performance and in sustainability implementation, with experiences such as courses and curricular activities [9]. In universities, EE must guide students to know their environment, both in human actions and acts of nature, and know how to generate an action strategy to protect the environment. To make this possible, it is necessary to teach students in a practical, theoretical and innovative way, with actions and tools aimed at improving the environment [7].

In the literature, various works on diverse topics related to the environmental consciousness among students at different education levels can be found. However, very few of these papers, and almost none in high school education, have evaluated the effect of different subjects on the environmental knowledge of students [10]. Additionally, it has been reported that the integration of sustainability in Engineering education is a key aspect for future engineers [11].

The aim of this work was to analyse the effect of two subjects on the environmental knowledge of Engineering undergraduates, so this research will contribute to determining whether the training of future engineers is deficient or appropriate to deal with the current environmental challenges.

2. Materials and Methods

2.1. Subjects

Two subjects, common to five different Engineering degrees (Industrial, Electric and Electronic, Mechanic, Industrial Chemistry and Automatic), taught at University of Oviedo, were selected for this study: "Environmental Engineering" (6 ECTS credits), a compulsory subject corresponding with the third year, and "Ecodesign" (6 ECTS credits), an optional subject corresponding with the fourth year. The competences and contents of these subjects are detailed in Supplementary Materials.

2.2. Research Design and Implementation

The participants were undergraduate students: twenty-three students between 20 and 23 years old and twenty-five students between 21 and 24 years old who took "Environmental Engineering" and "Ecodesign", respectively. It should be noted that the number of students was not the same in the two subjects, since they were from different academic courses. Furthermore, the total number of students who take the course each year depends on two aspects: the number of students who decide to enrol in the subject for the first time and the number of students who did not pass the subject the previous year and, therefore, they will be second enrolment students. In addition, one subject is compulsory, and the other one is optional, which also influences the number of students (not all students take both subjects).

Their initial environmental knowledge and their interest in its conservation were evaluated through a test using a questionnaire. To evaluate the effect of both subjects on environmental knowledge, once the subjects were imparted, the same questionnaire was used to assess the potential changes in environmental attitude caused by the contents of the subjects. A 5-point Likert scale was used to evaluate the responses, i.e., the students specified their level of agreement with different statements, typically using five points: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree [12]. The questionnaire used is shown in Table 1.

Table 1. Statements included in the questionnaire on the knowledge and perception of the environment completed by the students before and after taking the corresponding environmental subject.

General Issues	Specific Issues
"Positive statements"	"Positive statements"
S1: My daily decisions have an effect on the environment at a global level. S2: I choose environmentally friendly products. S3: I am concerned about the planet's situation for future generations. S4: Adopting strategies to protect the environment is urgent and necessary.	S9: Nowadays, products are becoming more complex, whereas their useful life is getting shorter. S10: Ecodesign considers the environmental factor as a requirement of the product, with the same relevance as other factors, such as cost or functionality. S11: "Greenwashing" is a marketing strategy. S12: The "carbon footprint" is an environmental indicator that reflects all the greenhouse gas emissions associated with a product.
"Negative statements"	"Negative statements"
S5: We have the right to use all the advances that technology provides, even if this deteriorates the environment. S6: Environmental damage is a collateral effect that is affordable in economic progress. S7: I would be willing not to be up to date on technological issues if my action entails an environmental benefit. S8: The improvements in the industrial sector to be environmentally responsible only incur an economic expense.	S13: Better quality of life entails less consumption of resources. S14: Ecodesign aims to increase the productivity to obtain a greater profit margin. S15: The "water footprint" is an environmental indicator that only includes water consumed during the manufacturing process. S16: If a product has a low "carbon footprint", this indicates that its global environmental impact will also be low.

Additionally, the students were also asked about their gender and place of residence in order to study how these factors could affect their environmental perception.

2.3. Data Processing

Results were evaluated by means of Excel software, employing a one-way ANOVA with a 95% confidence interval to analyse the data.

3. Results

3.1. Previous Knowledge

As can be seen in Figure 1a, before taking the "Environmental Engineering" subject, the first specific subject of the degree related to environmental issues, the students showed, in general terms, good prior knowledge and a certain degree of environmental awareness, with some exceptions. Regarding the General issues, the students agreed with three of the four "positive statements" (S1, S3 and S4), whereas they disagreed (average value of 2.74) with S2 ("I choose environmentally friendly products"). This result contrasts with those obtained in S1 and S3, since, in these cases, the students' answers indicated that they were aware that their decisions affect the planet, and they showed concern about the planet's

situation for future generations, but it seems they were not willing to make any sacrifice in their daily lives (Table 2).

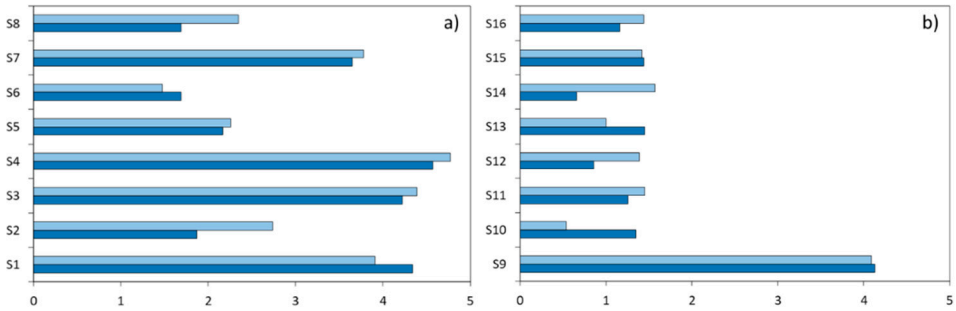

Figure 1. Questionnaire results for General (**a**) and Specific Issues (**b**) before (light blue) and after (dark blue) taking the "Environmental Engineering" subject.

Table 2. Results obtained in the questionnaire before and after taking the subjects. Average values ± SD are shown.

Environmental Engineering					
General Issues			Specific Issues		
"Positive statements"			"Positive statements"		
	Before	After		Before	After
S1	3.91 ± 1.16 [a]	4.34 ± 0.93 [a]	S9	4.09 ± 1.08 [a]	4.13 ± 1.07 [a]
S2	2.74 ± 1.13 [a]	1.87 ± 1.18 [a]	S10	0.54 ± 0.76 [a]	1.35 ± 1.19 [a]
S3	4.39 ± 0.66 [a]	4.22 ± 0.80 [a]	S11	1.45 ± 1.25 [a]	1.26 ± 1.14 [a]
S4	4.70 ± 0.56 [a]	4.57 ± 0.95 [a]	S12	1.39 ± 1.20 [a]	0.86 ± 0.95 [a]
"Negative statements"			"Negative statements"		
	Before	After		Before	After
S5	2.26 ± 0.86 [a]	2.17 ± 0.78 [a]	S13	1.00 ± 1.00 [a]	1.45 ± 1.21 [a]
S6	1.48 ± 0.73 [a]	1.69 ± 0.82 [a]	S14	1.57 ± 1.20 [a]	0.66 ± 0.83 [a]
S7	3.78 ± 1.09 [a]	3.65 ± 1.37 [a]	S15	1.42 ± 1.18 [a]	1.44 ± 1.18 [a]
S8	2.35 ± 1.19 [a]	1.69 ± 0.82 [b]	S16	1.44 ± 1.24 [a]	1.16 ± 1.09 [a]
Ecodesign					
General Issues			Specific Issues		
"Positive statements"			"Positive statements"		
	Before	After		Before	After
S1	4.61 ± 0.63 [a]	4.60 ± 0.65 [a]	S9	4.36 ± 0.83 [a]	4.60 ± 0.58 [a]
S2	2.64 ± 0.78 [a]	2.96 ± 0.61 [a]	S10	4.07 ± 1.09 [a]	4.36 ± 1.11 [a]
S3	4.36 ± 0.78 [a]	4.36 ± 0.76 [a]	S11	3.36 ± 1.03 [a]	4.84 ± 0.47 [b]
S4	4.68 ± 0.55 [a]	4.84 ± 0.47 [a]	S12	4.00 ± 1.02 [a]	4.48 ± 1.08 [a]
"Negative statements"			"Negative statements"		
	Before	After		Before	After
S5	2.50 ± 0.96 [a]	2.24 ± 0.83 [a]	S13	2.32 ± 0.94 [a]	2.28 ± 0.89 [a]
S6	1.86 ± 0.97 [a]	1.48 ± 0.65 [a]	S14	2.47 ± 1.07 [a]	1.20 ± 0.50 [b]
S7	3.03 ± 0.84 [a]	3.28 ± 1.02 [a]	S15	2.39 ± 1.22 [a]	1.56 ± 1.26 [b]
S8	2.00 ± 1.02 [a]	2.04 ± 0.89 [a]	S16	3.11 ± 1.26 [a]	2.88 ± 1.33 [a]

Different superscripts indicate significant differences between the data "before" and "after" taking the subjects ($p < 0.05$).

Regarding the "negative statements" (S5 to S8), the result obtained in S7, which agrees with the result of S2, should be noted. Although the students were aware of the environmental issues, they still did not act according to a sustainability philosophy.

In general, students had good prior knowledge about environmental subjects. These environmental skills could have been developed mainly during childhood, as this period is determinant for developing environmental consciousness [5,6].

It is also important to evaluate the students' knowledge about the Specific issues (Figure 1b). Concerning the "positive statements", with the exception of S9 (average value of 4.09), a strong disagreement was shown (values lower than 1.5). This can be due to misinformation, as they had not yet taken any specific subject on environmental issues. On the contrary, they agreed with the "negative statements", which indicated a good knowledge of the issues considered, despite some of them referring to quite specific topics.

As can be seen in Figure 2, before taking the "Ecodesign" subject, students, generally, agreed with all the "positive statements" (values higher than 4) and disagreed with "negative statements", in both cases, General and Specific issues. This reflects good knowledge and perception on environmental issues. These environmental attitudes could have been cultivated principally during early childhood environmental education, since this is a particularly crucial time for developing environmental literacy [5,6], or they could also have been acquired after taking the "Environmental Engineering" subject. It should be pointed out that the average values were below 4 in the case of S2 and S11. This means that, when the idea of environmental protection directly affects everyday life, it is more difficult for the students to consider the environmental issues as a key factor, i.e., when students had to evaluate the issue "I choose environmentally friendly products", the average value obtained was 2.64 (near to disagree).

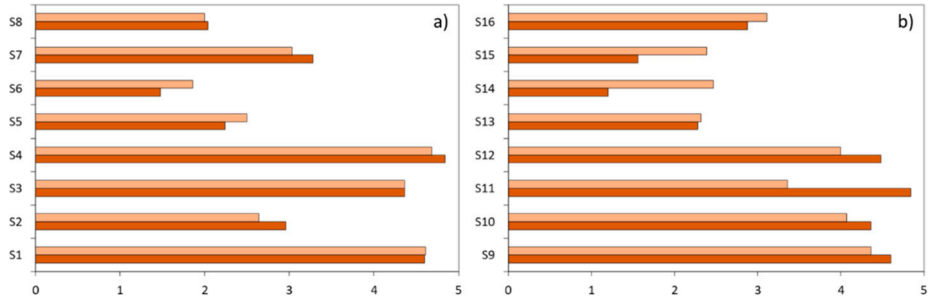

Figure 2. Questionnaire results for General (**a**) and Specific (**b**) Issues before (light orange) and after (dark orange) taking the "Ecodesign" subject.

3.2. Effect of Subjects on Environmental Knowledge

After taking the "Environmental Engineering" subject, there was almost no variation in the General topics, with some exceptions. The result for S2 decreased from a value of 2.74 to 1.87, so the demand for and concern about environmentally friendly products decreased (Figure 1a), which emphasises that the students do not act in an environmental way when their daily lives are compromised. It should also be noted that, after taking the subject, the students began to be aware that environmental actions in industries not only represent an economic expense but also offer certain advantages (S8).

Regarding Specific issues (Figure 1b), it can be seen that the perception of these environmental aspects improved slightly. As "Environmental Engineering" is a general subject, it contributes to improving knowledge from the environmental point of view, but, as might be expected, not on Specific issues.

After taking the "Ecodesign" subject, the perception of students was quite similar in the case of General issues (Figure 2a). On the contrary, there were significant differences between some questions on Specific issues (Figure 2b). In particular, S11, S14 and S15 values changed from 3.36 to 4.84, 2.47 to 1.20 and 2.39 to 1.56, respectively. This clearly indicates that this specific subject contributes to enhancing students' knowledge regarding concrete environmental issues perception (Table 2).

3.3. Effect of the Knowledge Acquired in "Environmental Engineering" on "Ecodesign"

Considering that "Environmental Engineering" is a general compulsory subject taken prior to "Ecodesign" (optional subject taught in the fourth year), it is important to check whether the knowledge acquired in "Environmental Engineering" subject is maintained over time. As can be seen in Figure 3, regarding General issues, it can be said that, both in the positive and negative statements, the opinions of the students were similar after taking "Environmental Engineering" and before taking "Ecodesign". However, it is necessary to pay attention to the results obtained in the Specific issues, since there is a clear improvement in environmental knowledge over the time elapsed between the moment when the students had completed "Environmental Engineering" and the beginning of "Ecodesign". This change in environmental perception may be due to the fact that, although the knowledge acquired in the first of the subjects had not yet been consolidated by the students, their interest regarding environmental topics could have increased, hence, they decided to take the specific subject. So, over the time after taking "Environmental Engineering" and prior to taking "Ecodesign", they were probably actively searching for more specific information about environmental issues.

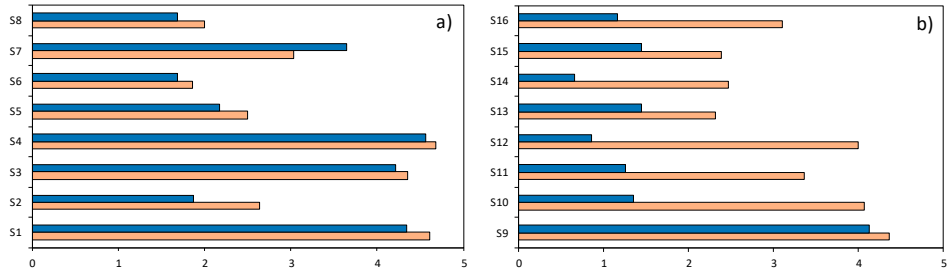

Figure 3. Comparison of knowledge after taking "Environmental Engineering" (dark blue) and before taking "Ecodesign" (light orange). (**a**) General Issues and (**b**) Specific Issues.

3.4. Influence of Gender and Place of Residence

It has been reported that attitudes towards the environment depend on different factors, such as gender or place of residence [13]. Thus, the students were also asked about their gender and whether they lived in a rural or urban environment in order to study whether these aspects could affect their environmental perception.

As can be seen in Figure 4, there were some gender differences in students' previous knowledge, in both cases, General and Specific issues (Table 3). Regarding General issues, women generally showed greater environmental awareness and best knowledge of the topics included in the questionnaire (S1, S2, S3, S5 and S7). Regarding the Specific issues, the differences were less noticeable, but it is true that greater knowledge in the case of women was shown again (S9, S10, S11, S12, S13 and S16).

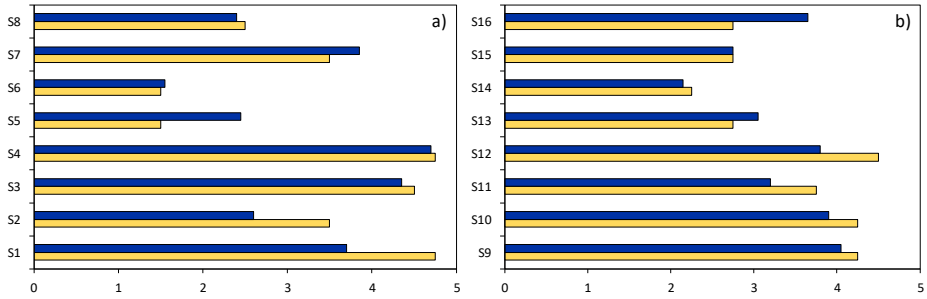

Figure 4. Effect of gender on environmental knowledge before taking the subjects: men (blue) and women (yellow), (**a**) General Issues and (**b**) Specific Issues.

Table 3. Results obtained in the questionnaire before and after taking the subjects regarding gender. Average values ± SD are shown.

Before					
General Issues			Specific Issues		
"Positive statements"			"Positive statements"		
	Men	Women		Men	Women
S1	3.70 ± 1.17 [a]	4.75 ± 0.50 [a]	S9	4.05 ± 1.10 [a]	4.25 ± 0.96 [a]
S2	2.60 ± 1.10 [a]	3.50 ± 1.00 [a]	S10	3.90 ± 0.72 [a]	4.25 ± 0.96 [a]
S3	4.35 ± 0.67 [a]	4.50 ± 0.58 [a]	S11	4.05 ± 1.10 [a]	4.25 ± 0.96 [a]
S4	4.70 ± 0.57 [a]	4.75 ± 0.50 [a]	S12	3.80 ± 1.20 [a]	4.50 ± 1.10 [a]
"Negative statements"			"Negative statements"		
	Men	Women		Men	Women
S5	2.45 ± 0.76 [a]	1.50 ± 1.00 [b]	S13	3.05 ± 0.89 [a]	2.75 ± 1.50 [a]
S6	1.55 ± 0.83 [a]	1.50 ± 0.58 [a]	S14	2.15 ± 1.31 [a]	2.25 ± 0.96 [a]
S7	3.85 ± 0.93 [a]	3.50 ± 1.73 [a]	S15	2.75 ± 1.21 [a]	2.75 ± 1.71 [a]
S8	2.40 ± 1.23 [a]	2.50 ± 1.29 [b]	S16	3.65 ± 1.23 [a]	2.75 ± 0.96 [a]
After					
General Issues			Specific Issues		
"Positive statements"			"Positive statements"		
	Men	Women		Men	Women
S1	4.30 ± 0.82 [a]	4.80 ± 0.41 [a]	S9	4.60 ± 0.70 [a]	4.60 ± 0.51 [a]
S2	3.00 ± 0.82 [a]	2.93 ± 0.46 [a]	S10	4.70 ± 0.67 [a]	4.13 ± 1.30 [a]
S3	4.20 ± 0.92 [a]	4.47 ± 0.64 [a]	S11	4.70 ± 0.67 [a]	4.93 ± 0.26 [a]
S4	4.80 ± 0.42 [a]	4.87 ± 0.52 [a]	S12	4.20 ± 1.13 [a]	4.67 ± 1.04 [a]
"Negative statements"			"Negative statements"		
	Men	Women		Men	Women
S5	2.30 ± 0.95 [a]	2.20 ± 0.77 [a]	S13	2.30 ± 0.67 [a]	2.27 ± 1.03 [a]
S6	1.60 ± 0.70 [a]	1.40 ± 0.73 [a]	S14	1.30 ± 0.67 [a]	1.13 ± 0.35 [a]
S7	3.10 ± 1.10 [a]	3.40 ± 0.99 [a]	S15	1.60 ± 1.07 [a]	1.53 ± 1.41 [a]
S8	2.10 ± 1.10 [a]	2.00 ± 0.76 [a]	S16	2.90 ± 1.56 [a]	2.87 ± 1.19 [a]

Different superscripts indicate significant differences between the data "before" and "after" taking the subjects ($p < 0.05$).

Once the students had taken both subjects, the results tended to be more homogeneous between women and men; only small differences could be observed for S1, S3, S6 and S11 and S12 (better results regarding an environmental perspective for women) and S7 and S10 (better results regarding an environmental perspective for men).

The results concerning the gender effect are in accordance with those reported by Mohai [14] who analysed gender differences among five environmental issues: (1) resource conservation, (2) nature preservation, (3) pollution, (4) global environmental problems and (5) neighbourhood environmental problems. The former author found that women expressed greater concern than men over most dimensions, although the differences were modest. Lee at al. [15] showed that female adolescents scored significantly higher in environmental attitude, environmental concern, perceived seriousness of environmental problems, perceived environmental responsibility, peer influence and green purchasing behaviour than male adolescents in Hong Kong. Additionally, Momsen [16] indicated that it has been asserted that women have a special relationship with the environment. More recently, Corrochano et al. [17] claimed that women have modestly stronger pro-environmental values, beliefs and attitudes than men.

This higher concern about environmental problems of women than men is based, in part, on the argument that from childhood, women are socialised to be family nurturers and caregivers [17,18]. On the contrary, Eze [19], who examined students' and teachers'

awareness of climate change and their willingness to adopt pro-environmental behaviour in Nigeria reported that males showed a higher level of climate change awareness and willingness to engage in pro-environmental behaviour than females. Nevertheless, it has also been reported that women express greater concern about climate change than men [17].

Nurhidayati et al. [20], when studying the environmental knowledge of senior high school students, found that, in general, female students' environmental knowledge was better than that showed by male students, in accordance with the results found here. More recently, Yusuf et al. [21] have also reported that women have a better environmental sensitivity than men. Dhenge et al. [22] compared the gender attitude towards environmental protection based on personal, psychological and sociocultural variables and concluded that female respondents were more conscious about environmental protection than male respondents. Moreover, the former authors indicated that there is an urgent need for qualitative studies to recognise the underlying reasons for these results.

In addition, studies on gender influence from an environmental consciousness point of view are key today, since new perspectives have to be considered. In this context, Gough and Whitehouse [23] highlighted the need to address the climate emergency and the biodiversity crisis in an intersectional ecological-feminist approach. Indeed, these same authors claimed that it is time for gender to be much higher on the agenda of environmental education researchers and of journals to achieve not only gender equality but also education on sustainability.

It was also evaluated whether living in a rural or urban environment influenced the students' previous knowledge (Figure 5). In this case, no great differences were observed in the General issues (Table 4). The results obtained in the case of students living in urban environments were higher for the statements S1, S3, S4; meanwhile, the results were higher in the case of students living in rural environments for the statements S2, S6 and S7. S5 and S8 showed similar results. However, in the case of General issues, the environmental knowledge was higher in the case of students from a rural environment, since their knowledge was the best in all cases, with the exception of S10.

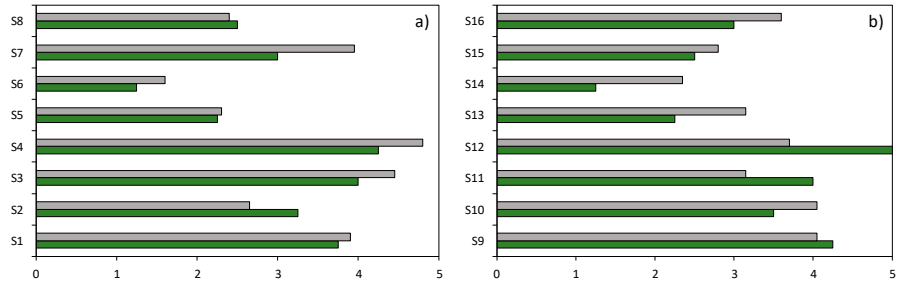

Figure 5. Effect of place of residence on environmental knowledge before taking the subjects: urban (grey) and rural (green), (**a**) General Issues and (**b**) Specific Issues.

After taking both subjects, students living in a rural environment showed a better environmental perception both in the General and Specific issues, although differences in Specific issues were slightly smaller between students living in rural and urban environments.

The obtained results agree with those reported by Berenguer et al. [24] who found that people living in the rural context presented more attitudes of environmental responsibility and greater consistency in expressing behavioural intentions compatible with the protection of the environment. In contrast, Liu and Mu [25] found that the urban residents in China were more concerned with environment protection than the rural Chinese. Cuadrado et al. [26] indicated that, regarding energy-saving behaviour, people who lived in urban areas reported more pro-environmental behaviours than rural people. In addition, these authors concluded that further research on the relationship between environmental values and place of residence should be carried out in order to obtain more representative results.

Table 4. Results obtained in the questionnaire before and after taking the subjects regarding place of residence. Average values ± SD are shown.

Before					
General Issues			Specific Issues		
"Positive statements"			"Positive statements"		
	Rural	Urban		Rural	Urban
S1	3.75 ± 1.25 [a]	3.90 ± 1.16 [a]	S9	4.25 ± 0.96 [a]	4.05 ± 1.10 [a]
S2	3.25 ± 1.26 [a]	2.65 ± 1.09 [a]	S10	3.50 ± 0.58 [a]	4.05 ± 0.76 [a]
S3	4.00 ± 0.82 [a]	4.45 ± 0.60 [a]	S11	4.00 ± 1.15 [a]	3.15 ± 1.23 [a]
S4	4.25 ± 0.50 [a]	4.80 ± 0.52 [a]	S12	5.00 ± 0.00 [a]	3.70 ± 1.17 [b]
"Negative statements"			"Negative statements"		
	Rural	Urban		Rural	Urban
S5	2.25 ± 0.96 [a]	2.30 ± 0.86 [a]	S13	2.25 ± 0.96 [a]	3.15 ± 0.93 [a]
S6	1.25 ± 0.50 [a]	1.60 ± 0.82 [a]	S14	1.25 ± 0.50 [a]	2.35 ± 1.27 [a]
S7	3.00 ± 1.15 [a]	3.95 ± 1.00 [a]	S15	2.50 ± 1.73 [a]	2.80 ± 1.20 [a]
S8	2.50 ± 1.29 [a]	2.40 ± 1.23 [b]	S16	3.00 ± 1.83 [a]	3.60 ± 1.10 [a]
After					
General Issues			Specific Issues		
"Positive statements"			"Positive statements"		
	Rural	Urban		Rural	Urban
S1	4.62 ± 0.52 [a]	4.59 ± 0.71 [a]	S9	4.75 ± 0.46 [a]	4.53 ± 0.62 [a]
S2	3.13 ± 0.83 [a]	2.88 ± 0.49 [a]	S10	4.25 ± 1.39 [a]	4.41 ± 1.00 [a]
S3	4.88 ± 0.35 [a]	4.82 ± 0.53 [a]	S11	4.88 ± 0.35 [a]	4.82 ± 0.53 [a]
S4	4.80 ± 0.42 [a]	4.87 ± 0.52 [a]	S12	4.75 ± 0.71 [a]	4.35 ± 1.22 [a]
"Negative statements"			"Negative statements"		
	Rural	Urban		Rural	Urban
S5	2.13 ± 0.83 [a]	2.29 ± 0.85 [a]	S13	2.38 ± 1.19 [a]	2.24 ± 0.75 [a]
S6	1.25 ± 0.46 [a]	1.59 ± 0.71 [a]	S14	1.13 ± 0.35 [a]	1.24 ± 0.56 [a]
S7	2.88 ± 0.64 [a]	3.47 ± 1.12 [a]	S15	1.38 ± 1.06 [a]	1.65 ± 1.37 [a]
S8	1.75 ± 1.04 [a]	2.18 ± 0.81 [a]	S16	2.88 ± 1.13 [a]	2.88 ± 1.45 [a]

Different superscripts indicate significant differences between the data "before" and "after" taking the subjects ($p < 0.05$).

4. Discussion

In this work, the environmental knowledge of students prior to taking any environmental subject was evaluated. Students initially showed a good knowledge of General issues but a lower knowledge of Specific issues.

After taking both subjects ("Environmental Engineering" and "Ecodesign"), an improvement in environmental perception was observed in the general terms, showing a greater notion about Specific issues after taking the "Ecodesign" subject.

It should be noted that there was also an increase in the students' environmental perception over the time elapsed between completing the "Environmental Engineering" subject and starting "Ecodesign", which may be due either to a "slow" assimilation of the knowledge acquired and/or to an increase in students' interest in environmental topics after having studied the first of the subjects. Kopnina and Cocis [27], who evaluated the environmental attitudes of higher education students, have also reported this phenomenon. The former authors indicated that the "sinking" was not likely to occur immediately after the course, as it involves deeper alteration in the cognitive and affective attitudes, which further evolve through continuous learning.

Regarding gender, in general, women showed a better perception of environmental issues before taking the subjects, whereas after taking "Ecodesign", the results between women and men were more homogeneous. With respect to place of residence, students

living in rural areas showed a better knowledge about environmental problems, although differences with those results obtained from students living in urban areas decreased after taking the subjects. Due to the contradictions found in the literature regarding the gender and place of residence effects on different environmental concerns, it has to be pointed out that further research on these topics should be carried out in the future.

Education is the most effective method to prevent or at least minimise many environmental problems before they appear, and teachers have an important responsibility to raise the environmental awareness of students [28]. To sum up, undergraduate students showed to be an interesting instrument to measure the effect of environmental teaching activity on future professionals of the Engineering field. Despite the fact that this study entails some limitations, mainly due to the sample size, the results presented here are still of interest. In fact, it seems clear that environmental subjects improved the perception of environmental issues of university students, which underscores the importance of enhancing environmental education to address global change. This work emphasises the need for further research on this matter to strengthen the findings and widen the knowledge regarding this topic.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/educsci12080501/s1, Competences and contents of the subjects selected for this study.

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References

1. Singh, R.L.; Singh, P.K. Global Environmental Problems. In *Principles and Applications of Environmental Biotechnology for a Sustainable Future. Applied Environmental Science and Engineering for a Sustainable Future*; Singh, R., Ed.; Springer: Singapore, 2017. [CrossRef]
2. Kim, S.; Kim, K.H. Reconsidering Education for Sustainable Society: An East Asian Perspective. *REMIE Multidiscip. J. Educ. Res.* **2013**, *3*, 1–18. [CrossRef]
3. UN (The United Nations). Available online: https://www.un.org/en/ (accessed on 29 January 2022).
4. Samperiz, A.; Herrero, J. Evaluation of a summer camp environmental education program in Spain. *Appl. Environ. Educ. Commun.* **2018**, *17*, 79–90. [CrossRef]
5. Ardoin, N.M.; Bowers, A.W. Early childhood environmental education: A systematic review of the research literature. *Educ. Res. Rev.* **2020**, *31*, 10035. [CrossRef] [PubMed]
6. Ardoin, N.M.; Bowers, A.W.; Gaillard, E. Environmental education outcomes for conservation: A systematic review. *Biol. Conserv.* **2020**, *241*, 108224. [CrossRef]
7. Castellanos, P.M.A.; Queiruga-Dios, A.; Encinas, A.H.; Acosta, L.C. Environmental Education in Environmental Engineering: Analysis of the situation in Colombia and Latin America. *Sustainability* **2020**, *12*, 7239. [CrossRef]
8. UNESCO (The United Nations Educational, Scientific and Cultural Organization). Learn for Our Planet: A Global Review of How Environmental Issues are Integrated in Education. Available online: https://unesdoc.unesco.org/ark:/48223/pf0000377362 (accessed on 29 January 2022).
9. Villalba, L.; Useche, E. Methodological approach for the construction of environmental management indicators in universities. *Clean. Environ. Syst.* **2021**, *2*, 100016. [CrossRef]
10. Sánchez-Llorens, S.; Agulló-Torres, A.; Del Campo-Gomis, F.J.; Martinez-Poveda, A. Environmental consciousness differences between primary and secondary school students. *J. Clean. Prod.* **2019**, *227*, 712–723. [CrossRef]
11. Sanganyado, E.; Nkomo, S. Incorporating Sustainability into Engineering and Chemical Education Using E-Learning. *Educ. Sci.* **2018**, *8*, 39. [CrossRef]

12. Preedy, V.R.; Watson, R.R. (Eds.) *Handbook of Disease Burdens and Quality of Life Measures*; Springer: New York, NY, USA, 2010. [CrossRef]
13. Grodziéska-Jurczak, M.; Stepska, A.; Nieszporek, K.; Bryda, G. Perception of environmental problems among pre-school children in Poland. *Int. Res. Geogr. Environ. Educ.* **2006**, *15*, 62–76. [CrossRef]
14. Mohai, P. Gender differences in the perception of most important environmental problems. *Race Gend. Cl.* **1997**, *5*, 153–169. Available online: http://www.jstor.org/stable/41674853 (accessed on 29 January 2022).
15. Lee, K. Gender differences in Hong Kong adolescent consumers' green purchasing behavior. *J. Consum. Mark.* **2009**, *26*, 87–96. [CrossRef]
16. Momsen, J.H. Gender differences in environmental concern and perception. *J. Geogr.* **2000**, *99*, 47–56. [CrossRef]
17. Corrochano, D.; Ferrari, E.; López-Luengo, M.A.; Ortega-Quevedo, V. Educational Gardens and Climate Change Education: An Analysis of Spanish Preservice Teachers' Perceptions. *Educ. Sci.* **2022**, *12*, 275. [CrossRef]
18. Momsen, J.H. Gender differences in environmental concern and perception in the Caribbean. In *La Caraïbe, Données Environnementales*; Karthala Editions: Paris, France, 2006; pp. 127–148.
19. Eze, E. Sociographic analysis of climate change awareness and proenvironmental behaviour of secondary school teachers and students in Nsukka Local Government Area of Enugu State, Nigeria. *Int. Res. Geogr. Environ. Educ.* **2020**, *29*, 89–105. [CrossRef]
20. Nurhidayati, S.; Susantini, E.; Safnowandi, S.; Rachmadiarti, F.; Khaeruman, K. The Uncovering Environmental Knowledge of Senior High School Students about the Local Potential Area Based on Reviewed from Gender and Grade. In Proceedings of the 2nd International Conference on Education and Technology (ICETECH 2021), Kanigoro, Indonesia, 26–27 August 2021; Atlantis Press: Dordrecht, The Netherlands, 2021; pp. 215–220.
21. Yusuf, R.; Yunus, M.; Maimun, M.; Fajri, I. Environmental Education: A correlational study among Environmental Literacy, Disaster Knowledge, Environmental Sensitivity, and Clean-Living Behavior of post tsunami disaster in Aceh Communities, Indonesia. *Pol. J. Environ. Stud.* **2022**, *31*, 411–425. [CrossRef]
22. Dhenge, S.A.; Ghadge, S.N.; Ahire, M.C.; Gorantiwar, S.D.; Shinde, M.G. Gender attitude towards environmental protection: A comparative survey during COVID-19 lockdown situation. *Environ. Dev. Sustain.* **2022**, *729*, 1–46. [CrossRef]
23. Gough, A.; Whitehouse, H. Centering gender on the agenda for environmental education research. *J. Environ. Educ.* **2019**, *50*, 332–347. [CrossRef]
24. Berenguer, J.; Corraliza, J.A.; Martin, R. Rural-urban differences in environmental concern, attitudes, and actions. *Eur. J. Psychol. Assess.* **2005**, *21*, 128–138. [CrossRef]
25. Liu, X.; Mu, R. Public environmental concern in China: Determinants and variations. *Glob. Environ. Change* **2016**, *37*, 116–127. [CrossRef]
26. Cuadrado, E.; Macias-Zambrano, L.H.; Carpio, A.J.; Tabernero, C. The moderating effect of collective efficacy on the relationship between environmental values and ecological behaviors. *Environ. Dev. Sustain.* **2022**, *24*, 4175–4202. [CrossRef]
27. Kopnina, H.; Cocis, A. Environmental Education: Reflecting on Application of Environmental Attitudes Measuring Scale in Higher Education Students. *Educ. Sci.* **2017**, *7*, 69. [CrossRef]
28. Urbańska, M.; Charzyński, P.; Gadsby, H.; Novák, T.J.; Şahin, S.; Yilmaz, M.D. Environmental Threats and Geographical Education: Students' Sustainability Awareness—Evaluation. *Educ. Sci.* **2022**, *12*, 1. [CrossRef]