

Article

Effects of Curriculum on Environmental Attitudes: A Comparative Analysis of Environmental and Non-Environmental Disciplines

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Abstract: To satisfy their ever-increasing needs, humans are constantly exerting excessive pressure upon the environment, while now more than ever, the adoption of new development practices to halt environmental degradation is becoming necessary. Graduates from all disciplines should have environmental awareness, because their decisions as future professionals may affect the environment. If, however, we assume that environmental science graduates possess environmental knowledge, it is worth investigating whether this knowledge affects their environmental attitudes. Hence, the aim of this study is to compare the environmental attitudes of students attending environmental and non-environmental studies. To this end, a comparative study on environmental attitudes was conducted between students majoring in forestry and students majoring in literature studies at one of the largest universities in Greece. That is, the environmental attitudes of students whose discipline was closely related to the environment were compared to the attitudes of students whose discipline was unrelated to the environment. The results showed that students from both disciplines had positive environmental attitudes, but forestry students exhibited a discernibly higher level of environmental awareness, which can be ascribed to their participation in environmentally relevant courses. The insights gains from this study could be particularly useful to education policymakers and curriculum practitioners, since they provide evidence for the potential of curriculum content to shape pro-environmental attitudes.

Keywords: sustainable education; environmental awareness; environmental attitudes; undergraduate students; higher education curricula; questionnaire survey



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1. Introduction

Humanity has to deal with severe environmental issues threatening the survival of the planet and adversely affecting quality of life. Climate change, global warming, depletion of natural resources, and water and air pollution are only some of the problems that stem from human activities. Environmental protection does not only belong to the sphere of state action, but also depends on active citizen participation in solutions to environmental problems. In this context, there have been substantial efforts directed towards shaping environmentally active and aware citizens. Even though environmental knowledge was initially thought to induce interest in the environment [1], it has been proposed that it is not always sufficient for shaping pro-environmental behaviors. At the same time, education for sustainable development is the foundation for novel approaches, because it can create a new culture in education that may enable people to acquire the skills necessary to help them live and act in sustainable ways. It has also been globally acknowledged that education for sustainable development is an element of high-quality education. Education for sustainability, therefore, holds hope for developing an understanding of environmental

problems, and may act as a motive for active participation in environmental protection and improvement [2].

Education for sustainability addressed to citizens or specific groups is neither an easy process nor an outcome of exclusive information provision through environmental education programs [3,4]. It has previously been assumed that knowledge drives behavior and acts as its precursor, but subsequently this notion has attracted strong criticism. In other words, although it cannot be denied that knowledge is an important aspect of efforts to raise environmental awareness, it does not always translate into environmentally responsible behaviors [5]. Hence, it is necessary to pay more attention to the investigation of factors contributing to the transformation of knowledge into attitudes which, in turn, may drive behaviors [6,7]. According to Zsóka et al. [8], there is a correlation between the level of environmental education and students' environmental knowledge, with the second being an intermediate variable, which, if combined with environmental attitudes, can define human behavior. In this way, environmental education has the potential to become a fundamental tool for shaping the environmental awareness of citizens. In addition, environmental education is an influential factor for the reinforcement of students' environmental knowledge, the cultivation of environmental values and attitudes, which, in turn, strengthen students' awareness and encourage their personal motivation to change behaviors [8]. Another possible outcome would be to take action for the environment [9]. At the same time, positive environmental attitudes are a determining factor for environmentally responsible behavior [10], and can underlie individuals' willingness to live and act in ways that protect the natural environment [6]. For this reason, information must be provided at all levels of education.

Younger generations will be affected by environmental problems resulting from present actions, and thus need to be aware of environmental problems and have skills to develop sustainable solutions [11,12]. In this respect, higher education has a pivotal role to play in shaping pro-environmental behavior and solutions, while its objective should not only be to train future professionals, but also to create responsible, competent individuals with knowledge, skills and values that will contribute to an environmentally sustainable, improving world [11,13]. Building on this, graduates from all disciplines, and not just environmental ones, should possess environmental awareness, because their decisions as future professionals may affect the environment. Hence, the aim of this study is to compare the environmental attitudes of students attending environmental and non-environmental studies. To that end, a comparative study is conducted between students majoring in environmental and non-environmental disciplines. Specifically, the first respondent group involved students attending the Department of Forestry and Natural Resources (DFNR), while the second group comprised students of the Department of Italian Language and Literature (DILL) of the Aristotle University of Thessaloniki, Greece. The choice of departments was based on our intention to examine the differences and similarities between students from environmental and non-environmental disciplines in order to determine the effect of curriculum content. In particular, the curriculum of the Department of Italian Language and Literature does not involve any courses related to environmental protection, whereas the curriculum of the Department of Forestry and Natural Resources has a large number of courses focusing on the natural environment and its protection. The analysis of environmental attitudes can help detect whether future graduates will be able to support sustainable development, as well as to understand whether higher education needs to make changes in curricula to promote higher standards in environmental knowledge and behaviors.

2. Factors Affecting the Formation of Environmental Attitudes

Environmental attitudes form the foundation of citizens' choices and decisions. Attitudes towards the environment drive decisions about the kind of environment people want to live in, but also affect people's satisfaction or dissatisfaction with the quality of the environment. In the same vein, perceptions regarding energy production and consumption,

as well as emotions related to environmental protection, result from attitudes towards the environment. Therefore, environmental attitudes have been examined in conjunction with the satisfaction that people derive from the environment, as well as with regard to preferences for certain environmental characteristics, perceptions of the 'ideal' environment, and the future [14].

Previous studies have proposed that environmental knowledge can drive individuals' interest in nature and environmental issues [1]. This proposition has since been challenged by newer research findings showing that increasing individuals' knowledge does not suffice to produce environmentally friendly behaviors, because the relationship between attitude and behavior is neither certain nor direct under all circumstances [15]. There is, therefore, a composite relationship between environmental knowledge and behavior change, because knowledge defines behaviors under appropriate conditions, and only when various factors allow for it [1]. Environmental knowledge is an intermediate variable that, when combined with environmental attitudes, can affect human behavior [8].

Research has also shown that certain variables affect environmental attitudes and behaviors. These variables involve, *inter alia*, sociodemographic and social characteristics. Analytically speaking, there is no clear evidence indicating that gender affects pro-environmental behavior among younger individuals. It is assumed, however, that girls present a higher level of dedication in terms of their environmental behavior compared to boys. A possible explanation for this lies in the differences in the process of socialization between girls and boys. In western societies, girls learn from a very young age to be giving and cooperative, and to develop a higher level of empathy [16]. In other words, girls often assume the roles of caretakers in their family, and consequently exhibit a greater level of sensitivity and concern regarding environmental issues in comparison to boys [10]. A study on the connection between nature and environmental behavior among Australian children and adolescents concluded that girls had higher willingness to protect the environment and had a closer emotional connection to nature than boys [17]. On the other hand, the study of Liefländer and Bogner [18] on Bavarian students from various schools showed that gender differences were slight when the curricula were appropriately structured. The same conclusion was drawn in a later study, where it was observed that, even though girls exhibited more positive environmental attitudes, it was not impossible for boys to also form pro-environmental attitudes in the long run, thereby indicating that there were no substantial gender differences [10].

In terms of age, there is a lack of longitudinal studies in the relevant literature that could help in the identification of age groups that are more susceptible to environmental education regarding the formation of attitudes and behavior. Moreover, there is a paucity of research on whether the passing of time contributes to the consolidation of any behavioral changes achieved during children's participation in environmental education programs. However, childhood seems to be an important period during which humans develop a close connection to nature that becomes stronger over time and is difficult to change as children grow [19]. More specifically, adolescents between the ages of 14 and 16 showed comparatively lower levels of environmental knowledge, attitudes and behaviors, probably because, at these ages, adolescents exhibit tendencies towards autonomy and shape their own personal profile. It is also during this period that adolescents tend to doubt any form of guidance that concerns certain ways of thinking and acting in relation to crucial social matters, including environmental issues [20]. At this point, it is worth mentioning the findings of a longitudinal study on 118 students in New York. The study examined students from the age of 7 until the early years of adulthood, and the main conclusion was that environmental attitudes and behaviors increased from the age of seven until ten, and consolidated until the age of 14 years, before decreasing until the age of 18 years [21].

Regarding place of residence, children living in rural places exhibit more positive environmental attitudes [22]. Specifically, young rural dwellers seem to be more connected to nature, have a higher degree of concern, and exhibit increased awareness about environmental problems. This results from the fact that growing up close to nature enables an

understanding of natural systems through the experience of problems due to natural disasters such as floods, forest fires or pollution [10]. Given that green spaces in cities are limited, children there have fewer opportunities to interact with nature, and are consequently less connected to nature in comparison to children in rural places [17].

Family is individuals' first socialization circle, meaning that the value system of families, including parents' attitudes and behaviors, directly affects children's formation of attitudes and behaviors. Parents act as examples of behavior, both generally and in terms of environmental behavior. For this reason, the role of parents defines children's future development. According to the theory of social learning, humans learn by imitating other people's behavioral patterns, and the newly formed behaviors become solid through stimuli present in children's environment [23]. Through this effect, individuals learn acceptable and unacceptable actions by observing and imitating others [24]. The degree to which children imitate their parents depends on how children perceive their parents' behavior, as well as on whether such behaviors are visible to children [25]. It appears that there is a positive correlation between families' socioeconomic status, cultural goods (such as number of books in the house) and the attitude towards the environment [22].

As for peers' influence on the formation of environmental attitudes and behaviors, findings from the relevant literature are conflicting. On the one hand, there is the perception that children are affected by the behavior of their peers, because humans generally have the tendency to imitate individuals they perceive to be close or similar to themselves [23]. A relevant study on students aged between nine and thirteen years in Madrid led to the conclusion that peers did indeed affect environmental behaviors, with girls being more affected than boys [16]. However, a more recent study on students in the ages between 7–13 in China concluded that peers did not exert a substantial influence, at least for this age group, while peers' negative behavior patterns in relation to the environment did not affect children's environmental behavior [26].

3. Environmental Education in Higher Education

In recent years, many universities around the world have got involved in environmental education. The role of higher education is critically important, particularly when one considers that the purpose of universities is to educate undergraduate students so that they can perform important social roles efficiently. Hence, undergraduate students can also be regarded as future decision makers, scientists, consumers, and entrepreneurs in a multitude of fields. From this perspective, if future graduates are able to take decisions favoring the environment, society is more likely to transition to a sustainable future.

A study performed on undergraduate students majoring in preschool studies showed that the attitude and the level of interest in topics related to pollution, environmental protection and biodiversity had a positive effect on the undergraduates' attitude towards recycling [27]. Meanwhile, another study revealed that, although the students had increased interest in acquiring knowledge about environmental sustainability, they lacked the willingness to participate in relevant actions [28].

In terms of environmental education, even though it has been proposed that environmental education results in increased participation in actions and pro-environmental attitudes, more recent studies do not confirm such effects. For instance, environmental students reported the lowest participation in environmental actions, even though their curriculum involved the highest number of courses focusing on the environment [29]. This finding was corroborated by another study that indicated that students' daily habits and attitudes were not compatible with their level of knowledge about environmental problems and their solutions. This also suggests that the discipline and, specifically, the curriculum does not necessarily affect students' interest in and knowledge of the environment [12,30]. That being said, a study on students attending courses on sustainability and participating in environmental actions showed that these students had a greater interest in green projects on campus compared to students who refrained from such activities [31]. This could be ascribed to other factors that discourage participation in such actions. Specifically, it was

observed that, although students have positive environmental values and wish to adopt pro-environmental habits, their behavior is not what would be expected, due to external limiting factors such as lack of recycling bins, a feeling of powerlessness to change things, and so on [32]. It can thus be seen that knowledge and interest in the environment do not affect the attitude and behavior of individuals in all cases, especially as far as daily habits are concerned [30]. For instance, training on recycling should take into account attitudes, emotions, personal identity and participation [33]. On a general note, effective education aiming at solving environmental problems should focus not only on knowledge provision, but also on participation in actions.

In terms of feeling responsible for the environment and its problems, students do not always acknowledge that their own actions have an impact [34]. In order to instill responsibility in students, it is necessary to integrate and connect every discipline with sustainability. In this way, students will be able to offer sustainable solutions for environmental problems in their professional capacity, regardless of the relation of that profession to the environment [35]. As an example, a study examining the views of engineering students showed that most respondents held engineers responsible for the issue of electronic waste [36].

Another study on the reasons for which students adopt environmental behavior showed that 59% of students try to save energy, whereas 29.5% of them need a motive to adopt pro-environmental practices. In addition, 59.5% perceived that energy saving was mostly to the benefit of the university, and not their own [37]. Moreover, students' willingness to take part in environmental or ecological activities within campus is affected by students' opinion on whether their university is responsible and capable of contributing to environmental issues [38]. Finally, students reported that an economic motive could induce them to participate in environmental actions [39].

4. Materials and Methods

To collect the required data for this study, a structured questionnaire containing close-ended and open-ended questions was designed. The questionnaire consisted of 19 questions, with six of them covering respondents' sociodemographic characteristics and the remaining questions examining respondents' awareness of the environment and environmental protection. This paper presents only the results related to the respondents' sociodemographic characteristics and environmental attitudes. Most questions were answered on a five-point Likert scale ranging from 'strongly disagree' to 'strongly agree', or 'not at all' to 'very much', while one question was answered on a scale from 'very difficult' to 'very comfortable'. It should also be noted that the study was approved by the Research Ethics Committee of the Democritus University of Thrace (DUTH/CER/26322/160-21/12/2020).

The population under study consisted of undergraduate students whose major was at the Department of Forestry and Natural Resources or at the School of Italian Language and Literature. In this study, a two-stage sampling design was applied, where the first stage was the academic year, and the second stage were the courses in each department. To that end, students attending each course were censused. The study was conducted during the first semester of academic year 2021 (from the beginning of January 2021 until the end of July 2021) and, in that period, the total number of undergraduate students in DFNR was 1555 and in SILL was 1109. In this study, 433 students participated, but after checking the questionnaires, it was observed that eight respondents had not marked their department. These questionnaires were excluded from the study, and thus, in total, 425 questionnaires were included in the analysis. In particular, 234 undergraduate students (corresponding to 15.05% of the total number of students) from DFNR and 191 undergraduate students (corresponding to 17.22% of the total number of students) from SILL participated in this questionnaire study. The collected data were analyzed using the Statistical Package for the Social Sciences (IBM SPSS v.25), as well as Microsoft Excel v.13. First, all data from questionnaires were coded in Microsoft Excel software and exported to IBM SPSS for

further analysis. Specifically, Cronbach's alpha reliability index, descriptive statistics, factor analysis, the non-parametric Friedman and the non-parametric Mann–Whitney tests were performed. The non-parametric Friedman test is highly useful, as it can perform comparisons among the values of three or more correlated groups of a variable. The Friedman criterion has a distribution of χ^2 , with $DF = k - 1$ degrees of freedom. Here, k is the number of groups or samples. In essence, the values of the variables for each subject are classified separately, and the mean rank of the classified values for every variable are calculated. Factor analysis is a statistical method that aims to examine the existence of common factors within a group of variables. More specifically, principal component analysis was used here, which is based on the spectral analysis of the variance (correlation) matrix. The criterion used for the significance of the principal components was the one recommended by Guttman and Kaiser, according to which the limit for obtaining the required number of principal components is defined by the number of eigenvalues that are equal to or greater than one. We concluded with a matrix rotation of the principal components using Kaiser's varimax rotation method in order to obtain better results. In addition to the Friedman test and factor analysis, the Mann–Whitney test was also conducted. The Mann–Whitney test is able to compare differences between two independent groups in cases where the dependent variable is ordinal or continuous, but not normally distributed. In contrast to the independent-samples t -test, the Mann–Whitney test enables researchers to reach different conclusions about the distribution of their data. Such conclusions can not only help to discern whether two populations are different, but can also help determine whether groups' medians exhibit any differences.

5. Results

Table 1 displays respondents' sociodemographic characteristics. In the sample ($n = 425$), 55.1% of students were attending the Department of Forestry and Natural Resources and 44.9% were attending the School of Italian Language and Literature, with both departments belonging to the Aristotle University of Thessaloniki, Greece. Most respondents were fifth-year students (by 28.6%), whereas 21.1% were first-year students. In terms of gender, female students outnumbered their male peers, with a percentage of 70.4%. Regarding students' permanent residence, 70.8% reported being city residents, whereas as few as 14.8% and 14.4% reported living in small towns and villages, respectively. In terms of parental occupation, students' fathers were mainly freelancers (26.3%) and public servants (25.6%), while considerable proportions of mothers were homemakers (25.5%) and public servants (23.6%). Finally, in terms of education level, most students' fathers were university graduates (25.5%) and high school graduates (23.7%). Likewise, most mothers were high school graduates (29.8%) and university graduates (22.4%).

Table 1. Frequency and percentage units regarding respondents' sociodemographic characteristics.

Department				
Forestry and Natural Resources		Italian Language and Literature		
55.1%		44.9%		
Academic year				
1st 21.1%	2nd 18.9%	3rd 16.8%	4th 14.6%	5th 28.6%
Gender				
Male 29.6%	Female 70.4%			

Table 1. *Cont.*

Place of permanent residence				
City	Small town	Village		
70.8%	14.8%	14.4%		
Economic status				
Very difficult	Difficult	Moderate	Comfortable	Very comfortable
3.7%	18.1%	52.2%	25.1%	0.9%
Fathers' occupation				
Public servant	Private employee	Freelancer	Homemaker	Crop or livestock farmer
25.6%	15.4%	26.3%	0.2%	7.1%
Unemployed	Pensioner	Other		
3.9%	18.3%	3.2%		
Mothers' occupation				
Public servant	Private employee	Freelancer	Homemaker	Crop or livestock farmer
23.6%	14.5%	11.3%	25.5%	4.2%
Unemployed	Pensioner	Other		
8.2%	10.8%	1.9%		
Fathers' education level				
Primary school	Lower secondary school	Upper secondary school	Vocational training school	Technical school
9.1%	10.3%	23.7%	12.7%	14.1%
University	Master's degree	Doctoral degree	Other	
25.7%	2.6%	2.6%	2.2%	
Mothers' education level				
Primary school	Lower secondary school	Upper secondary school	Vocational training school	Technical school
8.1%	10.2%	29.8%	8.6%	11.7%
University	Master's degree	Doctoral degree	Other	
22.3%	5.5%	1.4%	2.4%	

Next, the non-parametric Friedman test was performed to rank students' environmental attitudes, and on the basis of the results, it can be observed that the students from the two departments did not differ considerably (Table 2). More specifically, forestry students obtained the highest ranking for the practice concerning covering short distances on foot (mean rank 10.66). This was followed by the practices of switching off the lights when leaving a room or using energy-efficient light bulbs (mean rank 10.28) and reducing water consumption (mean rank 10.18). The lowest-ranked practice was that of using the bicycle (mean rank 4.71).

Much like their peers in the forestry department, Italian literature students also gave the highest ranking to the practice of covering short distances on foot (mean rank 11.32). However, the second most highly ranked practice was reusing old clothes or giving them to the needy (mean rank 10.49) and the third most highly ranked practice was switching off the lights when leaving a room or using energy-efficient light bulbs (mean rank 10.31). Conversely, participation in environmental protection actions such as coastal cleanups was ranked in the last position (mean rank 4.00).

Table 2. Rankings of the non-parametric Friedman test regarding respondents' environmental attitudes.

Willing to:	Forestry and Natural Resources	Italian Language and Literature
Turn off the lights when leaving a room and/or use energy-efficient light bulbs	10.28	10.31
Recycle domestic waste	9.53	10.20
Re-purpose old clothes or give them to the needy	9.59	10.49
Purchase products that do not travel long distances	6.28	6.18
Purchase organic products	5.19	5.00
Limit the use of tap water (e.g., when brushing teeth or shaving)	10.18	9.05
Reduce the consumption of meat and cured meat products	7.49	8.80
Cover short distances on foot	10.66	11.32
Use the bicycle	4.71	4.58
Prefer using public transport to car	6.82	7.99
Turn the thermostat down to 18 °C	5.05	4.37
Buy products contained in recycled packages or products produced in environmentally harmless ways	7.39	6.21
Adopt environmentally benign energy technologies (such as solar energy)	6.30	6.50
Participate in environmental protection actions (such as coastal cleanups)	5.52	4.00
χ^2 (df = 13, N = 230) = 918.909, $p < 0.005$		χ^2 (df = 13, N = 182) = 1031.909, $p < 0.005$

Next, Principal Component Analysis with Varimax rotation was performed on each student group to identify underlying patterns. Regarding the sample of forestry students, before conducting the analysis, Bartlett's test of sphericity (χ^2 (df = 78, N = 234) = 669.092, $p < 0.005$), Cronbach's alpha value (0.777) and the Kaiser–Meyer–Olkin index (0.784) were used to verify the suitability of the data for the analysis. In Table 3, it can be seen that four factors were loaded, which explained 57.48% of the total variance. The variables “Adopt environmentally benign energy technologies (such as solar energy)”, “Buy products contained in recycled packages or products produced in environmentally harmless ways”, “Purchase organic products”, “Purchase products that do not travel long distances”, “Participate in environmental protection actions (such as coastal cleanups)” and “Turn the thermostat down to 18 °C” fell under the first factor. Due to the content of these variables, PC1 can be labeled “Environmentally friendly energy and products”.

The second factor includes only the variables “Recycle domestic waste” and “Re-purpose old clothes or give them to the needy”, and can thus be named “Repurposing and recycling”. Variables explicitly related to transport fell under the third factor (“Cover short distances on foot” and “Prefer using public transport to car”) and can therefore be labeled “Environmentally friendly transport”. Finally, the fourth factor contains the variables “Limit the use of tap water (e.g., when brushing teeth or shaving)”, “Use the bicycle” and “Turn off the lights when leaving a room and/or use energy-efficient light bulbs”. However, the variable “Use the bicycle” has a negative value, meaning that this variable is related in the opposite direction with the factor. Due to the variables it contains, PC4 can be labeled “Saving water and electricity at home”.

Table 3. Rotated factor loadings for the environmental attitudes of students attending the Department of Forestry and Natural Resources.

Willing to:	PC 1	PC 2	PC 3	PC 4
Adopt environmentally benign energy technologies (such as solar energy)	0.780			
Buy products contained in recycled packages or products produced in environmentally harmless ways	0.761			
Purchase organic products	0.694			
Purchase products that do not travel long distances	0.578			
Participate in environmental protection actions (such as coastal cleanups)	0.546			
Turn the thermostat down to 18 °C	0.533			
Recycle domestic waste		0.751		
Re-purpose old clothes or give them to the needy		0.734		
Cover short distances on foot			0.777	
Prefer using public transport to car			0.674	
Limit the use of tap water (e.g., when brushing teeth or shaving)				0.687
Use the bicycle				−0.599
Turn off the lights when leaving a room and/or use energy-efficient light bulbs				0.574

Principal Component Analysis was also performed for students attending the School of Italian Language and Literature and the analysis gave three factors (Table 4). Prior to the application of the analysis, the Bartlett's test of sphericity (χ^2 (df = 91, N = 191) = 1255.761, $p < 0.005$), the Cronbach's alpha value (0.892) and the Kaiser–Meyer–Olkin index (0.873) confirmed that the data were suitable for factor analysis. In Table 4, it can be seen that three factors were loaded, accounting for 63.88% of total variance. The first factor contains the highest number of variables: "Participate in environmental protection actions (such as coastal cleanups)", "Turn the thermostat down to 18 °C", "Purchase organic products", "Buy products contained in recycled packages or products produced in environmentally harmless ways", "Purchase products that do not travel long distances", "Adopt environmentally benign energy technologies (such as solar energy)" and "Use the bicycle". Hence, PC1 can be named "Participation in environmental actions and preference for environmentally friendly products and lower heating".

The second factor involves the variables "Re-purpose old clothes or give them to the needy", "Turn off the lights when leaving a room and/or use energy-efficient light bulbs", "Recycle domestic waste", "Limit the use of tap water (e.g., when brushing teeth or shaving)" and "Reduce the consumption of meat and cured meat products". Due to the content of the variables, PC2 can be labeled "Recycling and resources saving". Finally, the third factor consists of only two variables explicitly related to transport ("Prefer using public transport to car" and "Cover short distances on foot" and, thus, can be named "Environmentally friendly transport".

In order to examine whether there were statistical differences between the two student samples in terms of their environmental attitudes, the non-parametric Mann–Whitney test was next conducted (Table 5). The results pointed to significant differences for most of the examined variables. Specifically, students majoring in forestry studies had more positive environmental attitudes, as they expressed higher willingness to switch off the lights, recycle domestic waste, buy organic products, products travelling shorter distances or products contained in recyclable packages, save tap water, use the bicycle, turn the thermostat down to 18 °C, adopt environmentally friendly energy sources and participate in environmental protection actions compared to their peers attending the School of Italian Language and Literature. On the other hand, the two student groups did not display significant differences in terms of their attitudes towards repurposing old clothes, reducing meat and cured meat consumption, and preferring mass transport over cars.

Table 4. Rotated factor loadings for the environmental attitudes of students attending the School of Italian Language and Literature.

Willing to:	PC 1	PC 2	PC 3
Participate in environmental protection actions (such as coastal cleanups)	0.802		
Turn the thermostat down to 18 °C	0.799		
Purchase organic products	0.723		
Buy products contained in recycled packages or products produced in environmentally harmless ways	0.714		
Purchase products that do not travel long distances	0.689		
Adopt environmentally benign energy technologies (such as solar energy)	0.657		
Use the bicycle	0.626		
Re-purpose old clothes or give them to the needy		0.779	
Turn off the lights when leaving a room and/or use energy-efficient light bulbs		0.735	
Recycle domestic waste		0.728	
Limit the use of tap water (e.g., when brushing teeth or shaving)		0.633	
Reduce the consumption of meat and cured meat products		0.515	
Prefer using public transport to car			0.817
Cover short distances on foot			0.732

Table 5. Results of the Mann–Whitney test regarding the differences in the environmental attitudes between the two student groups.

Willing to:	Discipline	N	Mean	<i>p</i>
Turn off the lights when leaving a room and/or use energy-efficient light bulbs	Forestry and Natural Resources *	233	4.34	0.000
	Italian Language and Literature	191	3.89	
	Total	424		
Recycle domestic waste	Forestry and Natural Resources *	232	4.11	0.005
	Italian Language and Literature	190	3.82	
	Total	422		
Re-purpose old clothes or give them to the needy	Forestry and Natural Resources	232	4.13	0.149
	Italian Language and Literature	190	4.02	
	Total	422		
Purchase products that do not travel long distances	Forestry and Natural Resources *	233	3.13	0.000
	Italian Language and Literature	191	2.59	
	Total	424		
Purchase organic products	Forestry and Natural Resources *	233	2.83	0.000
	Italian Language and Literature	191	2.30	
	Total	424		
Limit the use of tap water (e.g., when brushing teeth or shaving)	Forestry and Natural Resources *	233	4.25	0.000
	Italian Language and Literature	191	3.50	
	Total	424		
Reduce the consumption of meat and cured meat products	Forestry and Natural Resources	233	3.52	0.282
	Italian Language and Literature	191	3.40	
	Total	424		
Cover short distances on foot	Forestry and Natural Resources	233	4.41	0.085
	Italian Language and Literature	190	4.27	
	Total	423		
Use the bicycle	Forestry and Natural Resources *	232	2.45	0.001
	Italian Language and Literature	190	2.03	
	Total	422		

Table 5. Cont.

Willing to:	Discipline	N	Mean	p
Prefer using public transport to car	Forestry and Natural Resources	233	3.23	0.523
	Italian Language and Literature	190	3.14	
	Total	423		
Turn the thermostat down to 18 °C	Forestry and Natural Resources *	233	2.75	0.000
	Italian Language and Literature	188	2.01	
	Total	421		
Buy products contained in recycled packages or products produced in environmentally harmless ways	Forestry and Natural Resources *	233	3.48	0.000
	Italian Language and Literature	191	2.65	
	Total	424		
Adopt environmentally benign energy technologies (such as solar energy)	Forestry and Natural Resources *	233	3.12	0.001
	Italian Language and Literature	190	2.69	
	Total	423		
Participate in environmental protection actions (such as coastal cleanups)	Forestry and Natural Resources *	234	2.89	0.000
	Italian Language and Literature	191	1.88	
	Total	425		

* Student group that has more positive environmental attitudes.

6. Discussion

The aim of this study was to investigate the contribution of higher education curricula to the formation of environmental attitudes. To that end, it was considered meaningful to compare the environmental attitudes between undergraduate students with majors in environmental and non-environmental fields. Specifically, respondents were pursuing undergraduate studies at the Department of Forestry and Natural Resources, which offers high-level environmental courses, and at the School of Italian Language and Literature, which lacks any courses with an environmental focus. The reason for choosing to perform the study on students from these two utterly different disciplines was that insights into their environmental attitudes could help draw conclusions as to whether curriculum content can contribute to pro-environmental attitudes. The aim of the study was achieved, since participation in environmental and non-environmental curricula was found to have an influence on respondents' environmental attitudes. That being said, students pursuing non-environmental studies can also, at least to some degree, form pro-environmental attitudes, but it is the continuous engagement with environmental courses that results in a greater level of environmental attitudes.

There have been conflicting findings on whether environmental knowledge contributes to the formation of pro-environmental attitudes and behaviors. On the one hand, there have been studies showing that the provision of environmental knowledge drives individuals' interest in nature [1,31]; but, on the other hand, there have also been studies showing that environmental knowledge does not necessarily translate into pro-environmental attitudes [12,30]. In other words, environmental knowledge can lead to pro-environmental attitudes only in conjunction with other factors and under the appropriate conditions [1,15]. For instance, in the study of Muderrisoglu and Altanlar [29], environmental students reported the lowest participation in environmental actions, despite having attended significantly more environmentally relevant courses. In the present study, forestry students expressed a discernibly stronger willingness to adopt pro-environmental practices concerning recycling, resources consumption, environmentally friendly consumer behavior and transport. In addition, they were more willing to participate in environmental actions compared to their peers attending literature studies. In other words, forestry students had stronger environmental attitudes than their counterparts attending literature studies. Hence, this study provides evidence that higher education curricula contribute to the formation of environmental attitudes, and, if the curricula are related to the environment, then individuals are more likely to form positive environmental values. This finding

corroborates the findings of Zhao et al. [1] and Choi et al. [31], whereas it contradicts those of Oguz et al. [12], Muderrisoglu and Altanlar [29] and Yazici and Babalik [30]. Possible explanations for the different effects of curricula on environmental attitudes reported in these studies can perhaps be found in factors related to sociodemographic and psychographic characteristics.

Environmental attitudes have been acknowledged as the foundational element of citizens' environmental choices and decisions. To put this differently, environmental attitudes can manifest as actual behaviors, which, in turn, have an impact on the environment [6,10]. Building on this effect, citizens with pro-environmental attitudes tend to adopt responsible habits and behaviors that contribute to environmental sustainability [35]. At the same time, undergraduate students are young people who are not economically dependent yet, but who attend higher education in order to become so. During this stage, it is important to pay more attention to the formation of their attitudes, as they can define their future decisions and behaviors. In this regard, the key to sustainability may also lie in the ability of higher education curricula to form pro-environmental attitudes. In this study, students attending literature studies exhibited an adequate level of pro-environmental attitudes, although it was considerably lower than that of the forestry students. As the participation in environmentally related courses was found to have an influence on attitudes, it is recommended that such courses also be included in the curricula of non-environmental departments. In this way, students from non-environmental disciplines are likely to shape pro-environmental attitudes and contribute to sustainability later either in a professional capacity or merely as citizens.

There is also another reason for which the inclusion of courses focusing on the environment and environmental protection in higher education curricula of non-environmental departments could be effective. Longitudinal research has shown that even though children shape a connection to nature and are more susceptible to the positive outcomes of environmental education, these pro-environmental attitudes may be fragile or decrease at around the age of 18 [21]. For this reason, the inclusion of environmentally related courses in higher education curricula could be a strategic opportunity to strengthen students' previously formed attitudes or help shape pro-environmental attitudes so that more individuals are environmentally responsible in their later life.

Finally, there are certain study limitations that ought to be stated. Most notably, the Department of Forestry and Natural Resources of the Aristotle University of Thessaloniki is not the only environmental department in Greece that offers such a high number of courses specialized in environmental topics, while the School of Italian Language and Literature of the Aristotle University of Thessaloniki is also not the only non-environmental department that lacks courses with a focus on the environment. Moreover, it is possible that the greater extent of forestry students' environmental attitudes is due to their participation in environmental courses. To ascertain this effect, it is recommended that a study be performed comparing the environmental attitudes of first-year forestry students and students from higher academic years in the Forestry Department. Furthermore, a future study on attitude formation could include more factors, beyond the content of higher education curricula. Some other factors could include the economic crisis, rising living costs, the occurrence of pandemics, and psychographic characteristics.

7. Conclusions

The main contribution of this study is that it detected a discernible positive effect of environmentally related curricula on the formation of environmental attitudes. In this way, the findings from this research strengthen the conclusions of previous studies showing that environmental knowledge, in conjunction with other conditions, can underlie pro-environmental attitudes. This conclusion raises certain implications for education policymakers and curriculum practitioners. Most importantly, our results strengthen the argument that higher education offers a valuable opportunity to cultivate positive environmental attitudes among students in both environmental and non-environmental fields

before they assume their roles in society and begin their careers. From this perspective, it is recommended to examine the ways in which curricula may serve such purposes. Non-environmental departments, for instance, which are totally unrelated to the environment and thus cannot include environmentally focused courses in their curricula, could reinforce students' pro-environmental attitudes by leveraging interdisciplinary pedagogical approaches towards the solution of concrete environmental problems. Moreover, in order to achieve a high level of pro-environmental attitudes, it may be necessary to combine knowledge with experiential activities, so that young people experience nature and regard themselves as an integral part of nature. Such activities could involve, inter alia, visits to protected areas and Natura 2000 sites, visits to recycling units, and perhaps taking part in special campaigns.

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