Climate change literacy and commitment in Spanish university students

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Abstract

Purpose – This paper aims to find out if there is a relationship between access to climate change information and student activism.

Design/methodology/approach – Exploratory study focused on the survey of 400 [$n = 400$] students from 10 universities in Spain from April to May 2022. A questionnaire with 19 questions was divided into blocks of knowledge, awareness, and action and bivariate analysis with a margin of error of ±5% and a confidence level of 95%.

Findings – The greater the degree of information received, the greater the activism of university students, who tend to use digital media and social networks to get informed. However, they perceive that the university generates little information and a low number of activities related to climate change. Students demand that universities implement informal, formal, and service-learning environmental education strategies on sustainable consumption.

Research limitations/implications – Given the results of previous studies showing the variable "type of degree" does not show differences at the beginning and end of studies, it has not been considered in this research. Nevertheless, it would be convenient to introduce it in future investigations to confirm if this may have an impact on informational habits.

Practical implications – This paper urges universities to act as sources of environmental education, given the relationship between the information received and the pro-environmental attitudes of students.

Social implications – The universities are powerful social actors that can shape public and political discourses for eco-social transition.

Originality/value – This research adds the variable access to information in studies on pro-environmental attitudes. Furthermore, this research provides data about student perceptions of the university, government, industry, and NGO climate actions.

Keywords Environmental education, Climate change, Climate activism, Youth, Spain, Universities

Paper type Research paper

Introduction

In the context of the environmental crisis, the collective response to the growing changes and vulnerabilities is not only the greatest challenge of our time but also a defining moment for our future as a society. Universities, as educational spaces of diverse disciplines of knowledge, have a fundamental role in educating individuals who will confront these multidisciplinary challenges (Walsh *et al.*, 2015). In addition, they are organizations with the capacity to influence and strategically link with local, national, and international actors, people and organizations at various stages of their formative and productive processes,

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which makes them powerful social and economic actors with the ability to shape public and political discourses (Thaker, 2019). Higher education continues to pay close attention to climate change education, in line with UN recommendations and the 2030 Agenda for the Sustainable Development Goals (SDGs), especially Goal 13: Climate Action. Notwithstanding, relatively little is known about university students' climate teaching, learning, understanding and engagement processes (Li and Liu, 2021). A better understanding of these issues can contribute to the design of environmental literacy and climate change initiatives that provide not only knowledge transfer but also action and engagement from the university community.

Literature review

The influence of the information received by university students and their level of climate literacy and activism has not been explored. Understanding information is not only the one that comes from traditional media but also all the information generated by universities from their educational offerings and management strategies. This paper contributes to deepening the role of universities as a source of edu-communication among university students, from a double perspective: as social subjects that play a role as activists who can perform certain actions in inter-subjective relations and as trainers of professionals who can carry out environmental initiatives in organizational environments that contribute to environmental awareness.

Environmental and climate change education at universities

Environmental education should propose a relationship between human beings, nature, and school, contemplating historical processes that relate to the natural environment, the cultural system, the social organization, and the economic base (Quintana-Arias, 2017). As Theodor W. Adorno stated in his aesthetic theory, the lack of attention that the philosophical tradition has paid to the aesthetic appreciation of nature can be considered one of the causes of the ecological crisis because if human beings do not know how to appreciate nature, they will not be able to protect it either (as cited in Tafalla, 2019, p. 27). In this way, it is important to incorporate questions about history, language, literature, art, economics, politics, geography, and philosophy into the debate on climate change to have a deeper understanding of environmental problems, their causes, possible solutions and awareness strategies (Leichenko and O'Brien, 2020; Albelda *et al.*, 2019; Brigham and Imbertson, 2020).

Effective action to mitigate climate change and increase resilience requires international cooperation, global engagement of all stakeholders and mobilization of multiple areas of expertise. Climate change education aims to give each learner the tools and understanding needed to reduce their impact on the climate, and that of their company or other organizations they are currently involved in or will join. The dimensions of climate change education include mitigation, adaptation and climate science education (Molthan-Hill *et al.*, 2022). Knowledge improves participation in the climate change debate and can enhance a more informed discussion that enables citizen implication and participation (Mckeown and Hopkinks, 2013; Geiger *et al.*, 2017).

A study by Monroe *et al.* (2019) found that only one-third of effective climate change education strategies are carried out at universities; the rest take place in primary or secondary education institutions. The following are some approaches to include environmental and climate change education at universities. This overview is not complete and may never be, given that a multi-causal problem such as the climate crisis may have several and varied mitigation strategies. However, it can provide a useful framework for identifying strategies

that promote knowledge about the natural environment and the environmental crisis, that connect with nearby realities through personal and professional fields of action to promote pro-environmental attitudes that develop more resilient communities.

Formal education

According to the United Nations Specialized Agency for Education, UNESCO (2021), climate change education should be integrated into all levels and disciplines of learning. Despite this, 47% of national curriculum frameworks of 100 countries did not refer to climate change. Molthan-Hill *et al.* (2019) highlight four different possibilities for how universities can integrate climate change education into their curricula: (1) *Piggybacking*: the existing structure is not changed, but climate change education (CCE) is integrated into existing modules and courses, such as the incorporation of "Climate related health effects, CRHE" in the Bachelor of Public Health Studies at the University of Illinois, United States (Lavey, 2019); (2) *Mainstreaming:* is also based on existing structures, but in this case, the university/faculty integrates a broader curriculum like "The food sustainability course" of the Human Nutrition Degree at the University of Otago in New Zealand (Innes *et al.*, 2018); (3) *Specializing:* new frameworks to address a rather narrow curriculum, for instance the Master's Degree in Energy Management and Renewable Energy Sources from Monterrey Institute of Technology (2022), (4) *Connecting:* aims to cover a broad curriculum with a newly designed and interdisciplinary approach, like the open elective course "Climate change and society" for students from different degrees at Rutgers and Oslo Universities in the United States and Norway (Leichenko *et al.*, 2022), and the projects "Resclima", "Descarboniza, que non é pouco!" (Decarbonize, that is not little!) and "Climántica" which added subjects and a whole new pedagogical framework for teaching climate change in the Degrees of Social Education and Primary Education at the University of Santiago de Compostela in Spain (Sóñora-Luna and García-Vinuesa, 2020).

An additional strategy for integrating climate change education into the curriculum can be found in the Responsible Management Education (PRME) initiative. Launched in 2007 by former UN Secretary-General Ban Ki-moon, it is based on the idea that academia can play a strategic role as an agent of change, educating today's and tomorrow's managers by incorporating the values of responsible corporate citizenship into its educational activities (Haertle *et al.*, 2017). It is currently the largest organized platform for collaboration and partnership between representatives of academia, civil society and business at the regional level. It has more than 800 signatories from over 85 countries around the world (PRME, 2019). An example of this approach is the educational initiative carried out in the United Kingdom in the core curriculum at Nottingham Business School, where students carry out a carbon footprint analysis of an organization and recommend measures to reduce the company's greenhouse gas emissions (Molthan-Hill *et al.*, 2020).

Experiential education or service-learning experiences can be provided as part of responsible management. A practical pedagogical strategy widely implemented on university campuses has been the promotion of sustainable consumption. According to Barth *et al.* (2014), this can take place within the curriculum of the educational program as experiential learning or service learning when it is applied to activities or services offered by the educational institution. In the German state project Bank of Educational Institutions and Sustainable Consumption, initiatives such as "The onion swap shop," "Free bookshelf" and "Meat-free cafeteria" were implemented to make more visible the options available for the conscious use of resources in cafeterias, promotion of fair trade coffee and the installation of "free bookshelves" on campuses (Fischer and Rieckmann, 2010).

Strategic communication

Strategic communication plays a constitutive role in the management of climate mitigation in organizations. It is present when various stakeholders come together and issues related to sustainability are conceived, defined, discussed, planned and finally, action is taken according to certain values (Allen, 2016). The United Nations' Sustainable Development Goals (SDGs) delineate a comprehensive framework for addressing global challenges, necessitating the cooperation of a diverse array of stakeholders and the establishment of robust relationships (Canel, 2023).

According to Bayhantopcu and Aymerich Ojea, besides the teaching system, the university's sustainability structure is formed by: development and innovation research activities, sustainability in management structures like governance, ethics, equality, social responsibility, networks and collaborations, sustainability communication and community development. Some examples include the creation of a research promotion plan, knowledge transfer activities and research working groups focused on sustainability, as well as a social responsibility plan to manage and communicate the economic, social and environmental impacts of the university (2023).

In essence, sustainable communication at universities is a dialogic approach where students and staff are the focus of the communication efforts. These tactics include recruiting active participants, building stakeholder bridges across campus, collectively defining sustainability and transparently sharing public progress reports (Carpenter *et al.*, 2016).

Community-based participatory research

There are valuable initiatives that link the university campus, learning and environmental preservation, such as "The Rain Project" at George Mason University in the United States, where a floating wetland was designed and built as part of sustainable stormwater management (Changwoo, 2016). The "Living Laboratory" project at the University of Singapore is for collaborative learning through the planting of trees and their study, collecting data and analyzing them through equations to estimate the carbon biomass and contribute to the reduction of the carbon footprint (Ramchunder and Ziegler, 2021). Finally, community-based participatory research integrates different areas of knowledge and actors for research and local problem solving, as in the "Global Changes and Society Course" at the University of Utah in the United States, in which professionals from different disciplines identified research and ecological preservation needs for the reduction of human impact around Red Buttle Creek, the urban-natural transition zone and the university campus (Walsh *et al.*, 2015).

Informal education and media as information sources

Massive Open Online Courses, MOOCs, stand out for their ability to impact university and non-university communities, reaching a larger number of participants. Examples include the University of Oklahoma's bimodal MOOC: "Managing for a Changing Climate," in which more than 60 pedagogical videos of 3–10 min duration were created [1] in which 35 experts commented on topics related to the climate system and model; climate impacts on social, economic and ecological systems; and climate adaptation strategies (Martin *et al.*, 2020). The MOOC: "Climate Change – A Question of Justice" of Fern Universität and Lund Universities in Germany and Sweden, which through 8 modules with 5 videoconferences each and virtual forums, addressed topics such as climate change science, climate governance, climate change economics, or the impacts of climate change on nature and humanity (Otto *et al.*, 2019).

The media also play a key role in informal education on environmental issues. Social media is a soft power tool that impacts public opinion, with the potential for public opinion to influence policy decisions (Mavrodieva *et al.*, 2019). Research indicates that students are

mainly informed through digital media such as online, internet and social networks (Meira-Cartea *et al.*, 2018) coinciding with the results of Teso-Alonso and Ascencio-Lozano (2022) who state that online media and social networks are the main sources of information about climate change, as well as the results of López-Vidales and Gómez-Rubio (2021) about media usage trends in young people between 18 and 25 years old. In addition, it is identified that when faced with information on climate change, the population manifests feelings of "eco-anxiety" caused by emotions such as anguish, helplessness and sadness (Heras-Hernández *et al.*, 2018; Garcés-Prieto *et al.*, 2022) fear and anger are the emotions that most influence the sharing of climate change news (Pfautsch and Gray, 2017; Segado-Boj *et al.*, 2020). In essence, the management of negative emotions related to information on climate change is an emerging challenge for society.

Climate change literacy and pro-environmental attitudes in university students

Research on climate change literacy among university students has been widely studied through surveys. Studies in Mexico, Finland and Taiwan reported high concern about climate change among their students, who indicated that global warming would significantly harm them personally and that issues such as preconceived notions and opinions coming from their close circles, the media and social debate are the factors that make it most difficult for them to learn. Medical, nursing and nutrition students in countries such as the United States, Germany, Sweden, Spain, Australia, New Zealand and China claim to be highly knowledgeable about climate change but feel unprepared to address health and environmental challenges, in part because few universities integrate this content into their curricula (Munguia *et al.*, 2022; Yli-Panula *et al.*, 2022; Yu *et al.*, 2020; Li and Liu, 2021).

Climate change literacy among university students in Spain has been characterized as medium by Meira-Cartea *et al.* (2018) and deficient by Morote *et al.* (2021) because students tend to attribute as the only causes of climate change to pollution and its consequences to extreme atmospheric phenomena such as floods and droughts. Other approaches have asked whether there are differences in the level of climate literacy in university students according to their studies. Meira-Cartea *et al.* (2018) interviewed students from different universities, identifying that the level of climate literacy among natural sciences and engineering students was 6% points higher compared to the level of social and human sciences students. However, there were no differences between the students' responses at the beginning and the end of the course, so they concluded that the level of climate literacy does not correspond to the area of study, because it would increase as the student advanced in his or her training.

Psychosocial issues such as political orientation, growing up in urban or rural areas, the different structures and environmental services of each country, and being exposed to greater vulnerabilities due to their geographic location are relevant to pro-environmental attitudes (Orr *et al.*, 2020; Munguia *et al.*, 2022; be Muroi and Bertone, 2019). Similarly, self-benefit, efficiency and motivation are indispensable elements of ecological behaviors, surpassing even social norms or self-responsibilities (Godfrey and Feng, 2017; Janmaimool and Chontanawat, 2021). Finally, gender may also be relevant. In women, for example, factors such as motivation, knowledge and perceived consumer efficacy (PCE) are more influential, with women with science studies and high levels of education being more susceptible to climate activism. For men, factors such as attitude, motivation, subjective knowledge and PCE are more decisive (Vicente-Molina *et al.*, 2018).

Methodology

This research aims to complement previous studies on the perceptions of climate change among Spanish university students, providing a new approach that correlates how students

are informed about climate change and their level of knowledge and activism, as well as their opinions on the climate actions being developed by universities in the country. Therefore, a descriptive, exploratory and quantitative study focused on the survey was proposed. A bivariate study of the multiple variables considered was performed. (A copy of the survey is attached).

The following questions have been proposed: what is the perception of Spanish students about climate change and its consequences? What is their opinion on the actions taken by universities? What do they ask from universities? Are the best-informed students the most active? And who do students hold responsible for the climate crisis?

The general objective (GO) is to know the perception that university students in Spain have of climate change, its causes and its consequences. The specific objectives (SO) are:

SO1. To reveal the vision that students have of the climate change actions carried out by universities.

SO2. To find out if there is a relationship between access to information on climate change and student activism.

SO3. To know which actors students hold responsible for the climate crisis.

SO4. To know what actions students ask their university to take to mitigate climate change and what actions they put into practice in their personal lives.

The questionnaire is composed of a total of 19 questions divided into blocks on knowledge, awareness and action, which allow the research objectives to be achieved. According to data from the Government of Spain (SIIU, 2022), in the 2021–2022 academic year, there were 1,589,092 university students in the country: 56.9% women and 43.1% men (n = 1,589,092). Therefore, 385 responses were required for the survey to be reliable, with a margin of error of ± 5% and a confidence level of 95%.

The survey was finally answered by a total of 400 university students during April and May 2022. It was carried out using Google Forms. On the one hand, simple random sampling was used to select the universities, and, convenience sampling was used within each university (Casal and Mateu, 2003). Considering that this is a mixed and not completely probabilistic study, the margin of error is referred to only as an easy-to-interpret number, which demonstrates the precision of the sample. Once the responses had been processed, the SPSS program was used for data analysis, which allowed the results of the study to be extracted and bivariate analysis to be performed.

Results

The survey was answered by 400 university students from the following 10 universities: Autonomous University of Barcelona, Autonomous University of Madrid, University of Alicante, University of Cadiz, University of Malaga, University CEU Cardenal Herrera, University Rey Juan Carlos, University Rovira *y* Virgili, University of Sevilla and University of Vigo. The respondents were 69.8% (279) women and 30.3% (121) men, coinciding with the data provided by the Government of Spain with a higher number of women (56.9%) than men (43.1%) in university students enrolled in the 2021–2022 academic year (SIIU, 2022).

Based on previous Spanish studies such as Meira-Cartea *et al.* (2018) that found no differences between the pro-environmental attitudes of university students at the beginning and at the end of their studies, the age of the respondents was not included. According to our object of study, it was sufficient that the respondents were students enrolled at the university.

Almost 100% (99.5%) of those surveyed say they know what climate change is. The vast majority (87.3%) also consider it to be very important and understand that its consequences

are very serious. In this sense, the consequences that are of most concern are the decrease in drinking water and difficulty in growing food (88%); deforestation and desertification of forests and soils (80%); loss and extinction of animal and plant species (78.8%); global warming (78.5%); increase in sea level and acidification of the oceans (78%); melting of the polar ice caps (77.8%); increase in extreme weather events such as heat waves, hurricanes and floods (71.5%); and, to a lesser extent, increase in climate refugees (61%).

University students fear that climate change will have a significant impact on their lives. Specifically, 52.3% consider that it could have a lot of impacts, and 42% quite a lot of impact, compared to 5.8% who believe that it will have little impact on their lives. The areas in which climate change may have the greatest impact are, according to the students, broad, with 66.3% indicating the option all (in personal life, in the economy, in the subsistence of life on the planet, in the health field, in the social, political and coexistence spheres).

The concept of climate change, information received from the university and environmental activism

The students' views of climate change are different from one to another. The majority option (73.3%) is that climate change is the "changes and alterations in the climate system produced by human activities in the 19th century", but 26.8% consider that it is the "natural changes in temperatures and climatic patterns produced throughout the history of the earth". What they agree on most is that the university provides them with little information: 57% assure that little and 27.5% assure that none. Only 9.8% considered that it was quite a lot and 5.8% thought that it was a lot.

However, it seems that there is no relationship between the two variables (concept of climate change and information received from the university). Both those who consider that climate change is due more to natural causes and those who consider that it is due more to human causes, say in a very large majority that their universities provide them with little information (See Figure 1).

As for the situations in which they receive information at university, the respondents indicate that it is usually motivated by their interest in the subject (44.5%), only 28% state that they receive information during the development of subjects and 20.8% through talks, congresses or events organized by the university.

On the other hand, it has been found that the relationship between having one concept (natural causes) or another (caused by humans) of climate change and participation in activities related to the environment is not relevant. These can be activities organized by the university itself, collaboration with social organizations, or links with environmental activism.

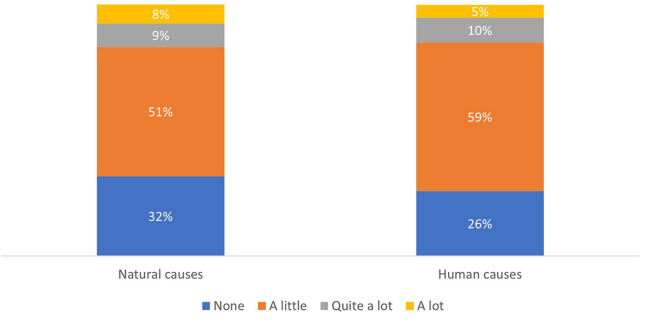

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Figure 1. Perception of the information received from the university according to the concept of climate change

Regarding activities organized by universities, more than half of the respondents say that they do not usually take part in them (51.2%) and more than a third (36.7%) say that their university does not organize such events. Just over 10% sometimes participate or usually participate.

Only 19% collaborate with social organizations. However, it should be borne in mind that it is possible not to collaborate with NGOs but still take part in demonstrations or be a cyber-activist, among other types of action. For this reason, it may be worthwhile to look at the environmental activism of the respondents: almost two-thirds (62.1%) claim to be environmental activists (primarily, volunteering at an environmental NGO, donating money to an environmental NGO, participating in climate protests, being a cyber activist, participating in climate change groups or sharing information about climate change).

No relevant differences were detected in the relationship between the variable's concept of climate change and its linkage with environmental activism (Figure 2). That is, according to the results obtained, the choice of one or the other definition of climate change by the students does not seem to be related to its link with environmental activism.

On the other hand, regarding collaboration with NGOs, students do not usually do so (81%), but those that do choose *Greenpeace* (8.3%), *Worldwide Fund, WWF* (6.7%) and environmental organizations in their local environment (7.1%).

Gender involvement and participation

There are differences concerning gender. While almost half of the men (49%) stated that they were not involved in environmental activism, 67% of the women said they were. If we resort to the chi-square statistic, a value of 0.003 can be observed, so that, with 95% confidence, it can be rejected that the two variables are independent: (x2 (1,387) = chi-square statistic, $p = 0.003$). Therefore, gender does influence the environmental activism of university students (see Figure 3).

Perception of the information received at the university and environmental involvement

University students indicate that their involvement in activism focuses on staying informed (60.9%) and sharing information (44%). Less frequent is attending demonstrations (13.8%), cyberactivism (7.4%), contributing money to an NGO (5.1%) or volunteering in a social organization (4.1%). It should also be noted that more than a third of those surveyed (37.9%) say they are not involved in environmental activism. It is observed that the students who show some connection with activism have the perception that the information offered by their

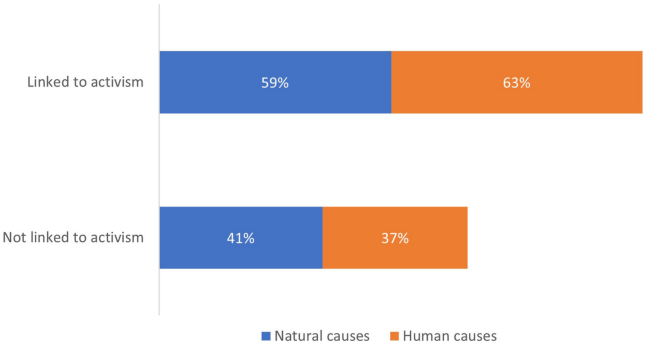

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Figure 2.
Concept of climate change and its link to environmental activism

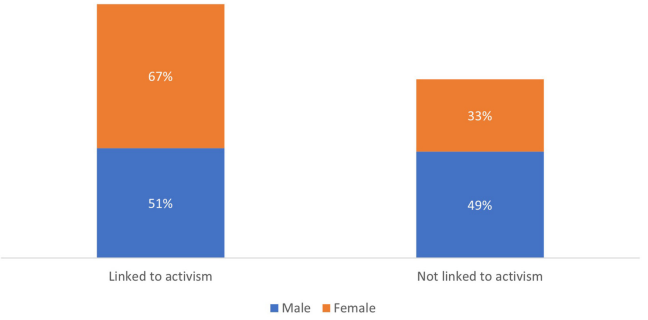

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Figure 3. Link to environmental activism according to gender

university is greater (see Figure 4). Perhaps this is because, as people are more interested in the environment, they have had greater access to information, or have perceived the existence of this information more easily. In any case, when applying Pearson's chi-square statistic, we obtain a value of 0.044, less than 0.05, which, with 95% confidence (x2 (3,391) = chi-square statistic, $p = 0.044$), demonstrates that both variables are independent.

Additionally, it seems that the relationship between the perception of the information received from the university and the demand for activities is not relevant. The perception of the information received does not vary according to the type of activity demanded by the students.

Perception of responsibility according to the level of activism

University students attribute the greatest responsibility in the fight against climate change (*all the responsibility*) to business and industry (65%), as well as governments at the national and international levels (60%). To a lesser extent (*part of the responsibility*) they attributed **it** to environmental groups (70%), local and regional authorities (64%) and citizens (57%) (see Figure 5).

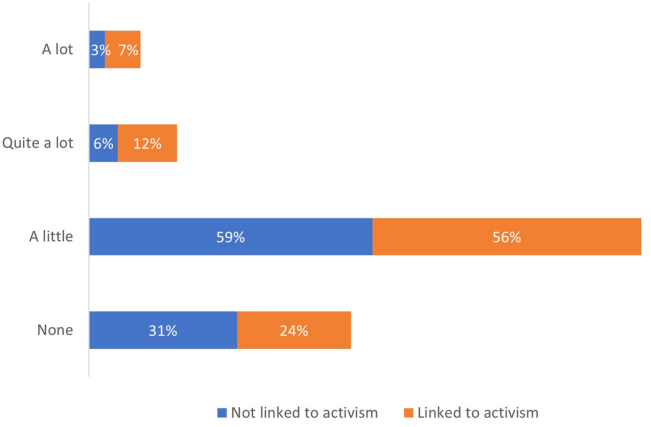

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Figure 4. Perception of the information received from the university and environmental activism

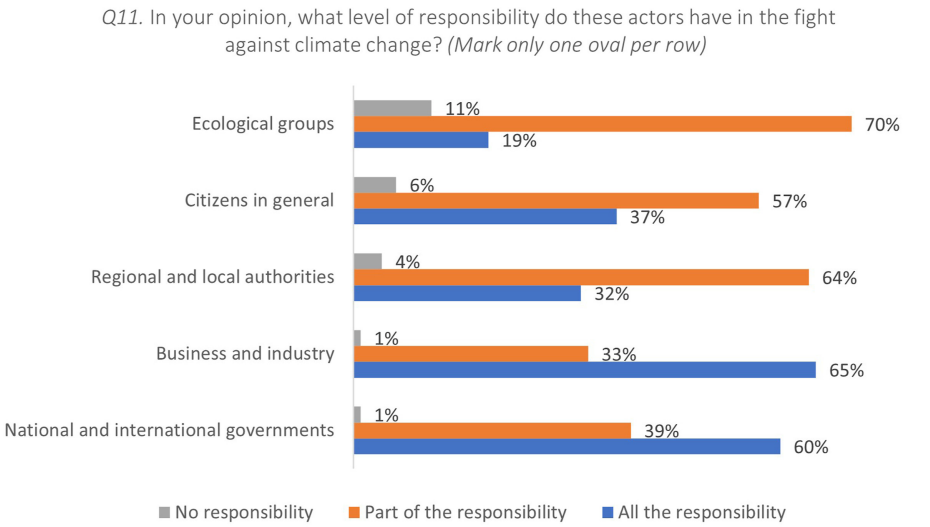

Figure 5.
Level of responsibility attributed to the fight against climate change

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As for the industries causing climate change, more responsibility is attributed to classic industries, such as fossil fuel and energy (75.8%), transportation (70.5%), livestock and food (68.4%) and textiles (56%). Less responsibility is given to other more innovative industries, such as those related to technology (43.5%).

In both cases, when reference is made to the actors responsible for environmental problems and those who cause them, it is found that those who show some degree of involvement in environmental activism confer a greater share of responsibility on actors and industries, compared to those who do not show any involvement. That is to say, the most active university students are those who attribute more responsibility (all the responsibility) to the different actors. Curiously, the opposite happens with the attribution of part of the responsibility, as it is usually those who are less linked to activism who indicate this option.

Students more linked to activism are those who attribute more responsibility to the fossil and energy industry 84.35%, compared to 62.6% of those not linked to activism; or 75.2% of activists compared to 58.5% of non-activists in the case of livestock and food; and so on. Even in the case of the technology industry, which, although less recognized as a cause of environmental problems, is also the one to which students more linked to activism attribute more responsibility (49.6% compared to 34%).

Regarding students' assessment of government action, there is a clear position that the measures adopted are insufficient. The most activist students are the most critical, as 86.8% of them consider the measures taken insufficient. The chi-square test gives a value of 0.000, so that, with a confidence level of 95%, (x2 (3,390) = chi-square statistic, $p = 0.000$), it can be rejected that the link to activism and the demand for the measures taken are independent variables. In other words, a relationship was found between the link with activism and the request for more government action.

Sources of information and level of activism

University students mainly use digital media to stay informed. 52% are frequently informed through social networks in general, 44.3% through websites and social networks of

newspapers, 36.8% through social network accounts of climate activists and websites and/or social networks of NGOs, and 34.3% through websites and/or social networks of specialized media on climate change. It is noteworthy that 37.5% are frequently informed through conversations with friends, colleagues and family. Besides, traditional media such as radio and television seem of little interest to students, since 61.3% of those surveyed say that they never use the radio for information, and 57.5% use television infrequently for information (see Figure 6).

What is detected is that people who are more closely linked to activism inform themselves more frequently than those who are not linked to it. Applying Pearson's chi-square obtained a value of 0.00 (x2 (2,391) = chi-square statistic, p = 0.000), so activism and access to information are independent variables that can be rejected. It is remarkable that 61.3% of those who are linked to activism are very frequently informed, compared to 49.3% of those who are not linked and do so infrequently, as well as 16.2% of those who are not linked who say they never get informed.

Assessment of individual action according to the level of activism

The survey aimed to find out whether the students had a structuralist conception of the world or, on the contrary, a more individualistic one. Therefore, they were asked whether they considered that individual action**s** by people could influence the climate crisis. 86.3% of respondents believe that individual action contributes to solving climate issues. However, when trying to find out if there is a relationship between the valuation of individual action and the level of activism, no relationship between the two variables is perceived (x2 (3,400) = chi-square statistic, p = 0.465). In general, all students, whether active or not, consider that individual action has an impact on the climate crisis.

On the other hand, when crossing the individual action variable with the variable on the perception of the responsibility of the different industrial sectors, it is observed that people who agree little or not at all with the affirmation of the importance of individual action tend to give lower shares of responsibility to the different industrial sectors. Those who value individual action the least give the least responsibility to the industries, while those who value individual action are those who attribute the most responsibility to the industries. Perhaps the people who do not trust the results of individual action and do not place much responsibility on the industry are citizens who are disinterested in the issue or even in disagreement with the environmental struggle.

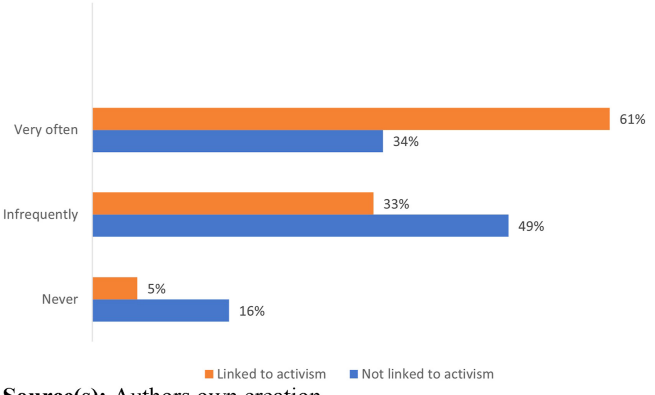

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Figure 6.
Frequency of reporting according to involvement in activism

Actions to mitigate climate change

University students say that to mitigate climate change, they have introduced a series of actions into their daily lives. The most repeated option is to reduce waste and separate it regularly for recycling (88.5%), followed by trying to reduce the consumption of disposable items (73.8%), increasing the use of public transport, cycling, or walking (67.7%) and making moderate use of heating or cooling systems (57.2%).

With less support from students, there are other initiatives to mitigate the effects of the climate crisis. This is the case of carpooling; trying to buy energy-efficient and low-consumption technological devices; consuming local and fair trade products, including local consumer cooperatives; trying to consume less meat and more ecological products; taking shorter showers, collecting rainwater and/or using home methods to save water: considering the carbon footprint when traveling and trying to choose the most environmentally friendly option; proposing the purchase of electric or low-consumption cars; and buying second-hand products such as clothing or technological devices.

Students demand from their universities the use of renewable energies (75.4%), the organization of workshops (62.1%), second-hand sales or exchange stores (56.4%), promoting the use of shared transportation (54.4%), including vegetarian/vegan options in university dining halls (51.5%), and installing urban gardens on campus (51.3%), among others. A considerable 46.2% asked for environmental education to be included in the curricula of the different subjects, and only 2.8% did not want the university to carry out activities related to the environment.

Discussion

This research has revealed the lack of formal and informal training in Spanish universities on climate change education and awareness. Previous research has highlighted this situation (Muroi and Bertone, 2019; Morote *et al.*, 2021). Almost all university students in Spain say they know what climate change is, and the consequences that most concern them are the reduction of drinking water and the difficulty of growing food, as well as deforestation and desertification of forests and soils. Similarly, the majority consider that it affects or may affect them personally, as expressed by university students from other countries such as Mexico, Finland and Taiwan (Munguia *et al.*, 2022; Yli-Panula *et al.*, 2022; Yu *et al.*, 2020; Li and Liu, 2021). In addition, 66.3% of the students were able to identify multiple socioeconomic, psychological, health and political areas in which climate change has an impact, as well as to attribute responsibility of between 43 and 76% to all industries (textile, fossil and energy industry, transportation and technology), which denotes a comprehensive and not limited understanding of the environmental problem, contrary to what is reflected in previous studies by Morote *et al.* (2021) where students tend to attribute as the only causes of climate change to pollution and its consequences to extreme atmospheric phenomena. It is concluded that Spanish university students are highly aware of the climate crisis. Therefore, the general objective (go) has been achieved, which is to know the perception that university students have of climate change and its consequences,

For university students, the concept of climate change is related to human action, although almost a third of those surveyed recognize natural causes of the change. However, it is not decisive whether they have one view or the other, concerning the information they receive from the university. The majority consider that they receive little information: just over a quarter say that they receive information during their studies and a fifth through lectures. Precisely, the specific objective 1 (SO1) was to reveal the vision that students have of the climate change actions carried out by universities, an objective that has been achieved by finding that students perceive that the university generates little information and few activities on climate change.

Regarding gender, the results suggest that women are more linked to activism than men, which supports previous studies by Vicente-Molina *et al.* (2018) and Corrochano *et al.* (2022) that indicate differences concerning this variable. On the other hand, the student body that shows some linkage with activism has the perception that the information offered by their university is greater, so it is found that greater access to information on climate change could influence activism, another specific objective achieved (SO2). In addition, it is the students who are more closely linked to activism who inform themselves more frequently. The student body tends to use digital media for information, especially social networks, using less and less traditional media, such as radio or television. Ratifying the findings of previous research by Meira-Cartea *et al.* (2018), López-Vidales and Gómez-Rubio (2021) as well as Teso-Alonso and Ascencio-Lozano (2022) who state that online media and social networks are the main sources of information on climate change in Spain.

Similarly, it is the most active students who place a greater share of responsibility on environmental actors and industries causing the climate crisis, and it is also the group with pro-environmental attitudes who consider the measures adopted to mitigate the effects of climate change to be insufficient. These conclusions are directly related to a specific objective (SO3), which refers to the actors that students hold responsible for the climate crisis.

All students, whether they are active or not, consider that individual action has an impact on the fight to mitigate the climate crisis. Those who are convinced that individual action contributes are the ones who also attribute more responsibility to industries. The fourth specific objective (SO4) focuses on the actions that students ask their university to take to mitigate climate change and those that they put into practice in their personal lives. In terms of the measures that students say they are putting into practice to minimize the climate crisis, the most important are reducing waste and separating it regularly for recycling, reducing the use of disposable items and increasing the use of public transport, bicycles or walking.

The university is asked to use renewable energies, organize training workshops and extracurricular seminars on environmental education, set up bazaars for the exchange and/or sale of second-hand articles, and implement a greater offer of vegetarian food in the cafeterias of the faculties. A wide range of initiatives are in demand, including formal, informal and experiential education, but especially what Barth *et al.* (2014) call service learning on sustainable consumption through the services offered by the university.

Previous studies by Meira-Cartea *et al.* (2018) showed that the type of degree variable is not a determining factor in the level of environmental literacy in students, since there was no difference at the beginning and at the end of the degrees, which is why it has not been considered in this research. However, once completed, it would be advisable to introduce it in future research to be able to verify whether the sensitivity is the same in science students as in social or humanities students, not so much because of the knowledge acquired during their studies, but because of the reasons that motivated them to choose these areas of study and whether, ultimately, this affects their pro-environmental attitudes. Whatever the case, these motivations are not entirely clear and could be explored in future research.

This paper urges universities to act as sources of environmental edu-communication, given the relationship between the information received and the pro-environmental attitudes of students. After the results obtained, it is pertinent to point out that there are a series of factors necessary to improve the environmental activities of university students. Thus, elements on the cost-benefit of fighting against climate change and the personal advantages of adopting pro-environmental habits such as improvements in health by reducing meat consumption or increasing sustainable mobility such as cycling or walking (Godfrey and Feng, 2017; Jnmaimool and Chontanawat, 2021), the enhancement of socio-educational aspects such as political orientations or growing up close to natural environments (Meira-Cartea *et al.*, 2018), the emotion of the messages appealing to emotions and not only to reason

(Heras-Hernández *et al.*, 2018; Garcés-Prieto *et al.*, 2022) and the interdisciplinary of the solutions to the problem, understanding that a paradigm shift such as the ecological transition requires drastic changes in thinking that must be promoted from educational and cultural scenarios, where both natural sciences and humanities play a key role in the shaping of societies that relate more harmoniously with the ecosystem.

It is a complex problem (Leichenko and O'Brien, 2020; Brigham and Imbertson, 2020) that must be addressed from a multifaceted and interdisciplinary approach (Monroe *et al.*, 2019). Therefore, to improve the cognitive, formative and sensitizing processes, the phenomenon must be faced with a multiplicity of proposals, including formal education, informal and/or experiential education, participatory research with the community and service learning on sustainable consumption and ethical use of resources. Environmental and climate change education requires a focus on the mitigations and initiatives that each field of knowledge can bring to the table, targeting local contexts and problems to communicate the story of the climate crisis closer to students and their communities, where solutions can be seen as possible and not distant.

Finally, it is necessary to emphasize environmental education for an ethical and aesthetic appreciation of nature as the center of its care (Tafalla, 2019). A contemplation outside of its instrumentalization, use as ornamentation or domination, that allows us to reconnect with it, admire it in its difference, richness and beauty, recognizing our eco-dependence and belonging to the animal and natural kingdom.

Note

1. "Managing for a Changing Climate" course, audiovisual public resources: https://bit.ly/3y22rZ1

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Further reading

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