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Secondary School Students' Perceptions and Concerns on Sustainability and Climate Change

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Abstract: This research is framed in Education for Sustainability, aimed at promoting the inclusion of the principles and values of Sustainability in education from a holistic perspective. The study focuses on finding out the concerns and knowledge of secondary school students from Valencia (Spain), who were surveyed during the academic years 2019–2020, 2020–2021 and 2021–2022 about Sustainability and Climate Change. Examining their conceptions, initial ideas, possible shortcomings, and conceptual errors is necessary to build a teaching itinerary with the purpose of adapting and reorienting educational practice to changing situations and different social contexts. The analysis, which is part of a broader research project, focuses on studying what secondary school students know (or rather, what they do not know or are unaware of) about Sustainability and Climate Change, examining their interests and concerns. Our experimental design is based on a wide-ranging questionnaire addressed to students that also promotes initial reflections. The results show that the participating students are concerned about socio-environmental problems, particularly about Climate Change. Nevertheless, they show a limited knowledge of Sustainability. This situation must encourage the involvement of the whole educational community to achieve a greater understanding of the planetary crisis through Education for Sustainability with the final goal of ensuring an effective involvement of the younger generations who are beginning to make their own decisions.

Keywords: sustainability; climate change; secondary school education; education for sustainability; misconceptions

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1. Introduction

Education is one of the most powerful tools at our disposal to tackle the major problems that affect the entire planet and its people. Ensuring an educated society that can understand the reality in a reasoned and critical way will enable informed decision-making and the capacity to influence policymakers on the major problems that affect humanity [1,2].

From an educational perspective, it is important to understand that socio-environmental degradation is due not only to global impacts of human activity but is also a product of the cumulative outcome of multiple small impacts [3]. Therefore, possible measures must entail the addition of individual actions, as well as profound changes in the global behaviour of our species. Such individual changes and the need for citizen participation and action must be promoted through education.

This study is based on an extensive and in-depth research project in the field of Education for Sustainability (ESD) [4–11]. The aim of this part of the research is to work with secondary school students, who already play—and will increasingly play in the future—roles in society that involve participation in informed decision making and have an impact at the individual level but also at a higher scale. The ultimate aim is to help articulate teaching interventions to contribute to the development of effective communities prepared to deal with the serious socio-environmental crisis. Teenagers in secondary

school are at a point in their lives when they begin to make decisions that they expand over time. In Secondary Education, it is possible to work with an approach that is very close to action, to putting into practice, to promote an empowered, reflective and active citizenry. Detecting what concerns youngsters, what they know and what they need to know, is essential to design teaching sequences and reorient them to ensure that they are appropriate and aligned with the transition to Sustainability. Specifically, the aim is to find out whether secondary school students have basic knowledge about Sustainability and specifically about Climate Change, what their main shortcomings and needs are and whether they show interest and motivation towards the topic. The next step would be to intervene collaboratively with teachers, promoting the inclusion of Sustainability in the classroom, taking advantage of the numerous opportunities that the curriculum offers. The evaluation of the results of its implementation allows for reorientation, if necessary, and encourages further research [12–15].

Considering the planetary emergency we are currently facing, described for decades by numerous specialists and international organisations [16–20], the efforts demanded are still insufficient, highlighting the need for quality and transformative education aimed at the commitment of society as a whole to this urgent challenge.

On 25 September 2015, the United Nations General Assembly—after a process of more than three years that involved the broad participation of millions of people, educational and scientific institutions, civic associations, etc., with the support of 193 Member States—adopted the resolution "Transforming our world: the 2030 Agenda for Sustainable Development", a roadmap to implement the Sustainable Development Goals (SDGs) as key elements of this proposal. The SDGs are a strong and universal call to end poverty, protect the planet and improve the lives of all people. Education for Sustainable Development appears explicitly in SDG 4, which aims to ensure quality education for all. Target 4.7 states: "By 2030, ensure that all learners acquire the knowledge and skills necessary to promote sustainable development, including through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and the contribution of culture to sustainable development" [21]. The interrelation of SDG 4 with the other goals is crucial, as quality education is a goal in itself, but also a means to achieve the other SDGs [22].

In response to these international calls, there have been numerous proposals and examples of good practices that aim to address Sustainability at all levels and in all educational contexts. These proposals are the result of numerous research projects that, over more than two decades, have been carried out particularly in science education, both in formal and non-formal education [23–28], as well as in specific areas of science education [29].

Despite the successive aforementioned claims and the efforts of specialists and experts who insist on the implementation of a series of complementary and simultaneous measures (educational, political-normative and technological) for the management of the serious planetary crisis that challenges us, ESD continues to be a pending subject. Several studies have tried to identify the difficulties that might be preventing the educational community from taking committed action to respond to these demands. The difficulties described in the literature refer to a multi-causal effect. One of the factors repeatedly cited is the scant attention paid by science education to the planet's global socio-environmental problems [30]. This situation is reflected in the contents of textbooks, the perceptions of teachers and students, and in educational research itself [31–34]. In the current society, in the context of the socio-environmental crisis that serves as a framework for this work, scientific and technological literacy remains, more than ever, one of the fundamental and priority objectives of education.

In the context of the planetary emergency described above, Climate Change is one of the most serious and urgent problems that we must address. Socio-environmental problems in general, and Climate Change in particular, have characteristics that make them particularly complex due to their strong interactions and connections with each other. They

are cross-cutting in their relationships, with effects that are not always clearly identified and are sometimes described from apocalyptic positions that distance us from them [35].

Research has highlighted the lack of awareness of this problem, as well as its inadequate contextualisation. This has a direct impact on the lack of citizens' involvement and the lack of response to the successive international appeals that have been made [36].

Several research studies carried out in recent years have tried to detect and analyse the knowledge and understanding of trainee teachers, as well as of students at different educational levels, about socio-environmental imbalances and the process of accelerated Climate Change [36–48].

How Climate Change is addressed in education is influenced by a series of spontaneous or erroneous conceptions that must be tackled, as they can hinder the understanding of this phenomenon and the involvement in the actions needed to overcome it [49]. This has been the aim of several research studies carried out in recent years, including those based on the study and analysis of textbooks [50] and those developed from the Didactics of Experimental Sciences, a field to which this work belongs [51,52].

In order to facilitate the work of teachers in addressing Climate Change, the Intergovernmental Panel on Climate Change (IPCC) published a special report in 2018: Global Warming of 1.5 °C—Summary for Teachers [53]. There are also numerous UNESCO documents and publications that can help to address Climate Change in education, such as, "Country progress on climate change education, training and public awareness: an analysis of country submissions under the United Nations Framework Convention on Climate Change" [54].

Various studies carried out in the European Union indicate significant changes in public opinion in recent years [55–60]. The younger generations are sensitive to socio-environmental issues in general and Climate Change in particular and assume that these imbalances are caused by human behaviour; however, they hold little responsibility for this situation, placing the main responsibility on public administrations and governments.

While we have increasingly educated and informed generations about the planetary imbalances we need to address, they are still very reluctant to change lifestyles. They are willing to undertake concrete actions, such as saving water and energy and separating waste, but not more profound changes in attitudes and daily habits (reducing the consumption of goods and services, changes in the food model) [60–65].

In this context, UNESCO has published the results of a survey conducted in May 2020, which aimed to obtain information on the challenges people around the world are facing and the solutions they consider necessary [66]. Climate Change and biodiversity loss were by far the biggest challenges, chosen by 67% of respondents (a total of 15,000 participants). In second place, respondents highlighted education as the most important solution to almost all the challenges raised.

The concern and interest in Sustainability and Climate Change [67] of the younger generations already, integrated into society in an autonomous and participatory way, as well as the lack of competences and capacities necessary to align appropriate behaviours in the context of the current planetary emergency, is a fact repeatedly pointed out in previous works and research, some of the most recent, as we have already pointed out, coordinated by UNESCO [66] and by the Spanish Government [68].

Research in the field of Education for Sustainability in Science Education, cited above, leads us to formulate the following starting hypothesis: "Although there is general interest in Sustainability among secondary school students, its treatment in the classroom is insufficient and, as a result, there is little training and a lack of commitment on the part of the students".

2. Materials and Methods

The research intervention presented here has been carried out in collaboration with fourteen schools, seven of them public Secondary Education Schools and seven state-subsidised/private schools located around the city of Valencia (Spain). Schools and teachers

were chosen through a process of selection by convenience (non-probabilistic and non-random sampling), considering the ease of access and the availability of teachers and students to take part in an intervention. This should ensure a commitment to collaborative work for at least one academic year.

The experimental design proposed is based on a questionnaire that was validated by researchers in the field of Science Education and Education for Sustainability. Pilot tests were also carried out, both with secondary school students and with pre-service teachers.

The general objectives of the questionnaire are as follows:

- To find out the specific interests, concerns, and motivations of students.
- To highlight alternative conceptions, ideas, or associations of the students, as a result of the information they have received on Sustainability and, specifically, on Climate Change.
- To encourage initial reflection on the problem.

The survey is anonymous, consists of 27 items and is divided into two units. The first is designed to collect socio-demographic data (age, gender and educational level) and the second focuses on different aspects related to Sustainability and Climate Change, organised into seven thematic blocks.

The questionnaire was prepared to be filled in via the Google platform, so that it could be completed using any electronic device, and the results were received immediately. It was completed in regular sessions with the teachers who were going to participate in the subsequent teaching intervention. The questionnaire was thus integrated into the learning–teaching context of the chosen subject.

Students responded to the survey in Spanish, and all the analyses of the answers were also carried out in Spanish, translating into English only the information necessary for this research paper. The complete questionnaire is included in Appendix A. For the analysis of the responses to each of the items, ad-hoc networks were prepared. All of them contain the option I Don't know/No answer (IDK-N/A), where blank, null or unqualifiable answers are included. Each grid presents the following information:

- The analysis criteria for each item, with different response levels, if applicable;
- The number of students included in each response level (N);
- The percentage of students at each level out of the total sample (%);
- The standard deviation (δ)

In this paper, we focus on a selection of some of the 27 items, based on their relevance regarding Sustainability and Climate Change issues, with special emphasis on basic scientific issues (items 1–3, 6–8, 12, 18, 19, 25–27). Tables 1–12 provide the networks used for the analyses.

Table 1. Analysis grid for item 1.

Item 1. What Are the Global Problems That Most Concern You? Why? Explain Your Answer	**N**	**% (δ)**
Level 1: Climate Change is explicitly mentioned		
Level 2: Climate Change is indirectly mentioned		
Level 3: Climate Change is not mentioned, neither directly nor indirectly		
IDK-N/A		

Table 2. Analysis grid for item 2.

Item 2. In What Context Have You Heard about Climate Change?	**N**	**% (δ)**
Level 1: education (formal education) is explicitly mentioned		
Level 2: education (formal education) is not mentioned		
IDK-N/A		

Table 3. Analysis grid for item 3.

Item 3. What Do You Understand by Climate Change? Explain Briefly	**N**	**% (δ)**
Level 1: the four essential aspects on which there is consensus are mentioned: (1) rising temperatures, (2) caused by the increase of GHGs, (3) anthropogenic origin, (4) the burning of fossil fuels is among the most important causes		
Level 2: at least one of the four aspects considered essential is mentioned		
Level 3: none of the four aspects considered essential is mentioned		
IDK-N/A		

Table 4. Analysis grid for item 6.

Item 6. What Do You Think Are the Main Causes of Climate Change? Explain Your Answer	**N**	**% (δ)**
Level 1: thoughtfully crafted response: at least one anthropogenic cause is mentioned		
Level 2: incorrect answer: no anthropogenic causes are mentioned		
IDK-N/A		

Table 5. Analysis grid for item 7.

Item 7. Among the Possible Causes of Climate Change, Choose the Ones That Have More Weight from Your Point of View	**N**	**% (δ)**
Level 1: thoughtfully crafted response: between 4 and 7 causes are mentioned		
Level 2: approximate response: between 2 and 3 causes are mentioned		
Level 3: incomplete response: one or none causes are mentioned		
IDK-N/A		

Table 6. Analysis grid for item 8.

Item 8. What Do You Understand About the Greenhouse Effect? Explain Briefly	**N**	**% (δ)**
Level 1: the three essential concepts on which there is some consensus are mentioned: (1) natural, positive process, essential for life on Earth, (2) keep the average temperature constant, (3) thanks to GHGs		
Level 2: at least one of the aspects highlighted as important is mentioned		
Level 3: none of the aspects highlighted as important is mentioned, or it is referred to as having a negative effect on life on Earth/IDK-N/A		

Table 7. Analysis grid for item 12.

Item 12. What Measures Should Be Adopted to Help Curb It? Please Explain Your Answer	**N**	**% (δ)**
Level 1: the three types of measures identified by experts (political/economic, scientific/technological and educational) are directly or indirectly mentioned		
Level 2: at least one out of the three types of measures indicated by experts is mentioned		
Level 3: none of the measures is mentioned/IDK-N/A		

Table 8. Analysis grid for item 18.

Item 18. What Can You Do?	**N**	**% (δ)**
Level 1: the most frequent response is mentioned: recycle and/or generate less waste		
Level 2: the second most frequent response is mentioned: saving energy and/or resources		
Level 3: the third most frequent answer is mentioned: changing the food model		
Other		
IDK-N/A		

Table 9. Analysis grid for item 19.

Item 19. From the Following List to What Extent (Not at All, a Lot...) Do You Think They Can Contribute to Energy Savings?	**N**	**% (δ)**
Level 1: adequate response. The option "I/me" with "a lot" or "quite a lot" is chosen, i.e. students who refer to what each of us can do		
Level 2: any other answer is chosen		
IDK-N/A		

Table 10. Analysis grid for item 25.

Item 25. What Other Socio-Environmental Problems Are Related to Climate Change, and How Are They Linked? List and Describe Some Examples of Their Linkages.	**N**	**% (δ)**
Level 1: between 8 and 10 of the problems identified by experts are mentioned		
Level 2: between 4 and 7 of the problems identified by experts are mentioned		
Level 3: less than 4 of the problems identified by experts are mentioned		
IDK-N/A		

Table 11. Analysis grid for item 26.

Item 26. Are You Familiar with the 2030 Agenda and the Sustainable Development Goals (SDGs)? What Can You Tell Us about Them, and How Are They Related to Climate Change?	**N**	**% (δ)**
Level 1: knowledge of the SDGs is demonstrated, mentioning at least how they were adopted, the number of SDGs, the existence of targets, and they are able to list at least 7–8 issues they address.		
Level 2: unaware of the SDGs/IDK-N/A		

Table 12. Analysis grid for item 27.

Item 27. Please Indicate Which Topics You Would Like to Learn More About in Relation to the Problems Humanity Is Facing	**N**	**% (δ)**
Climate Change is mentioned		
Measures to be taken to manage socio-environmental problems are mentioned		
Environmental degradation and the future of the planet are mentioned		
Pollution and waste are mentioned		
Poverty and social inequalities are mentioned		
Politics and economics are mentioned		
Health is mentioned		
Others		
IDK-N/A		

3. Results and Discussion

This section shows the results of the quantitative and qualitative analysis of the items selected from the questionnaire completed by the students, opening the discussion on whether socio-environmental problems in general and Climate Change in particular are among their concerns. We have also evaluated whether a clear interest in this issue is accompanied by sufficient knowledge and training to participate efficiently in the implementation of the required measures.

The sample consists of 944 students belonging to the fourteen secondary schools above-mentioned, 471 females and 445 males, most of them in the fourth year of Compulsory Secondary Education (ESO, in its Spanish acronym) (492) and in the first year of High School (362), i.e., students aged 15–17. There was a similar number of male and female participants (Table 13).

Table 13. Characteristics of the student sample.

Dimensions		Response Number	Percentage
Course	4° Compulsory Secondary Education	492	52.1%
	1° High School	362	38.3%
	Other	90	9.5%
	Total	944	100.0%
Age	15	379	39.2%
	16	363	38.5%
	17	77	8.2%
	Other	134	14.2%
	Total	944	100.0%
Gender	Women	471	49.9%
	Men	445	47.1%
	IDK-N/A	28	3.0%
	Total	944	100.0%

A total of 40 teachers from the different schools involved, from various teaching departments, have also collaborated in the project. Further work is being carried out with them in relation to the implementation of educational interventions for the attention to Sustainability and Climate Change.

Some of the results of the selected items (1–3, 6–8, 12, 18, 19, 25–27) are shown below.

Regarding Item 1, Climate Change is among the concerns and interests of almost 70% of the students surveyed (Table 14), converging with the hypothesis formulated. Two thirds of the respondents mention Climate Change explicitly or implicitly, results in line with other studies carried out with adolescents [58,69,70].

Table 14. Students mentioning Climate Change as a global concern.

Item 1. What Are the Global Problems That Most Concern You? Why? Explain Your Answer	N = 944	% (δ)
Level 1: Climate Change is explicitly mentioned	541	54.1 (0.2)
Level 2: Climate Change is indirectly mentioned	122	12.9 (0.1)
Level 3: Climate Change is not mentioned, neither directly nor indirectly	261	27.6 (0.2)
IDK-N/A	50	5.3 (0.1)

Examples of some responses are shown, where other concerns mentioned can be observed; some include the reasons for their concern.

Examples of Level 1 responses:

"Climate change, in general, with all that it entails. That is, climate change should concern us because there is now extreme global warming, with an impressive loss of biodiversity and a lot of natural disasters".

"Climate change because it is what affects our planet and without our planet we cannot live".

Examples of Level 2 responses:

"Heat waves and forest fires".

"I am worried about people not recycling and over-consuming and because of this the world will end badly, the sea level will rise excessively, and big cities will disappear…"

Almost 90% of students report having worked on content related to Climate Change in the educational sphere (Table 15). This fact should translate into knowledge and competences converging with this treatment. To find out whether this is indeed the case, we need to continue analysing the rest of the items.

Table 15. Context in which participating students have heard of Climate Change.

Item 2. In What Context Have You Heard about Climate Change?	**N = 944**	**% (δ)**
Level 1: education (formal education) is explicitly mentioned	829	87.8 (0.3)
Level 2: education (formal education) is not mentioned	115	12.2 (0.1)
IDK-N/A	0	-

None of the surveyed students answered adequately, showing insufficient knowledge of Climate Change, and 1/3 (357 students) answered incompletely (Table 16). This is consistent with other studies and research [71,72]. These results are convergent with the second part of the hypothesis, which suggests that the students lack the necessary knowledge of Sustainability and Climate Change. The students' assessments are in general quite incidental, which hinders them from properly involving with the necessary actions.

Table 16. Students' ideas on Climate Change.

Item 3. What Do You Understand by Climate Change? Explain Briefly	**N = 944**	**% (δ)**
Level 1: the four essential aspects on which there is consensus are mentioned: (1) rising temperatures, (2) caused by the increase of GHGs, (3) anthropogenic origin, (4) the burning of fossil fuels is among the most important causes	0	-
Level 2: at least one of the four aspects considered essential is mentioned	357	37.8 (0.2)
Level 3: none of the four aspects considered essential is mentioned	551	58.4 (0.2)
IDK-N/A	36	3.8 (0.06)

Examples of Level 2 responses:

"The global rise in temperature caused by human action".

"That the planet is changing e.g. it is getting warmer, it is raining less, the climate is constantly changing, animals are dying, places are flooding, etc...".

Most of the students mentioned in their answers causes of anthropogenic origin (Table 17). It is noteworthy that a large majority of the students, when referring to these causes, mention pollution and waste management, converging with other studies' results [73].

Table 17. Causes of Climate Change reported by students.

Item 6. What Do You Think Are the Main Causes of Climate Change? Explain Your Answer	**N = 944**	**% (δ)**
Level 1: Thoughtfully crafted response: at least one anthropogenic cause is mentioned	760	80.5 (0.3)
Level 2: Incorrect answer: no anthropogenic causes are mentioned.	184	19.5 (0.1)
IDK-N/A		

A very frequent error is detected among students, namely the identification of CO_2 as a pollutant gas. In fact, some authors insist on the need to avoid linking CO_2 with air pollution as it may perpetuate the failure to differentiate between "the residence time of common air pollution (which they dramatically overestimated) and carbon dioxide (which they dramatically underestimated). Such a belief in a short residence time could lead people to the false conclusion that if and when the effects of climate change ever get serious, those effects could be reversed in just a few decades or less by reducing emissions of CO_2" [74].

Examples of Level 1 responses:

"Pollution, forest fires and excessive use of oil."

"Polluting transport, buildings in need of energy retrofitting, industry as a cause of climate change, excessive waste generation, agriculture and livestock: unsustainable food system, energy waste, deforestation, excessive use of raw materials"

Examples of Level 2 responses:

"That we humans do not take care of the planet".

"The irresponsibility of humans".

The answers show that more than half of the students do not relate certain problems to the causes of accelerated Climate Change (Table 18). They are also unaware of the interrelationships between the different causes and lack a holistic view of the current socio-environmental crisis. This is related to the second part of the hypothesis and validates the idea that their knowledge is insufficient to understand and adequately address Climate Change, as pointed out by Lee et al. in 2020 [75].

Table 18. Weight assigned by students to the causes of Climate Change.

Item 7. Among the Possible Causes of Climate Change, Choose the Ones that Have More Weight from Your Point of View	**N = 944**	**% (δ)**
Level 1: thoughtfully crafted response: between 4 and 7 causes are mentioned	246	26.1 (0.2)
Level 2: approximate response: between 2 and 3 causes are mentioned	569	60.3 (0.2)
Level 3: incomplete response: one or no causes are mentioned	129	13.7 (0.1)
IDK-N/A	0	-

Regarding the greenhouse effect (item 8), very few answers to this open-ended question (barely 2%) show adequate knowledge of its characteristics and can therefore be classified as correct (Table 19). More than 50% of the students were unaware of what the greenhouse effect is or even indicated it as something negative and not as essential. It is worth noting that one of the hard-to-understand aspects is that the greenhouse effect is a process without which life would not be possible on our planet as we know it, but that it is being enhanced by human activities. As research shows, understanding Climate Change, its impacts and mitigation options requires that all citizens have a basic understanding of the atmospheric greenhouse effect process [76].

Table 19. Students' ideas on the greenhouse effect.

Item 8. What Do You Understand About the Greenhouse Effect? Explain Briefly	**N = 944**	**% (δ)**
Level 1: the three essential concepts on which there is some consensus are mentioned: (1) natural, positive process, essential for life on Earth, (2) keep the average temperature constant, (3) thanks to GHGs	21	2.2 (0.05)
Level 2: at least one of the aspects highlighted as important is mentioned	335	35.5 (0.2)
Level 3: none of the aspects highlighted as important is mentioned, or it is referred to as having a negative effect on life on Earth—IDK-N/A	588	62.3 (0.3)

Focusing on item 12, the answers were classified as political/economic, scientific/technological or educational (Table 20). Almost 90% of the students identified at least one measure that could be considered to curb Climate Change. Any measure mentioned, no matter how simple it may seem, was considered. Those of an educational nature stand out, suggested by 652 students. Research suggests that education and science literacy are most closely related to student awareness of Climate Change and its impacts [72].

Table 20. Climate Change actions identified by students.

Item 12. What Measures Should Be Adopted to Help Curb It? Please Explain Your Answer	**N = 944**	**% (δ)**
Level 1: the three types of measures identified by experts (political/economic, scientific/technological and educational) are directly or indirectly mentioned	6	0.6 (0.03)
Level 2: at least one out of the three types of measures indicated by experts is mentioned	823	87.2 (0.3)
Level 3: none of the measures is mentioned—IDK-N/A	115	12.2 (0.1)

Examples of Level 2 responses:

"We could use less personal vehicles that use less fuel, use less plastic and more recycled materials, not eat meat or reduce consumption in order to reduce greenhouse gases."

"One of the most important steps is to switch from petrol to electric cars. Another habit that will help to stop it is not to consume meat, as its production is harmful to our planet. We should also be aware of recycling, not consuming so much and reusing."

Item 18 (Table 21) refers more specifically to the measures we can take to properly manage the climate crisis, both as a collective and as individuals.

Table 21. Measures that students identify as those that they can implement on an individual basis.

Item 18. What Can You Do?	**N = 944**	**% (δ)**
Level 1: the most frequent response is mentioned: recycle and/or generate less waste	565	59.9 (2.1)
Level 2: the second most frequent response is mentioned: saving energy and/or resources	426	45.1 (2.2)
Level 3: the third most frequent answer is mentioned: changing the food model	94	10.0 (1.5)
Other	91	9.6 (1.3)
IDK-N/A	198	21.0 (1.7)

The most frequent answers refer to waste management and the energy model.

On the other hand, 20% of students are not able to identify which actions can be adopted to mitigate Climate Change nor the weight they have in a comparative scenario. This is in line with the conclusions of previous items and converges with the second part of the hypothesis, confirming a lack of the necessary knowledge to implement measures to effectively face the planetary emergency.

The aim of item 19 is to analyse the extent to which students feel involved in implementing measures that contribute to overcoming the global emergency situation. This guides the whole questionnaire, focusing on energy issues.

Accordingly, 576 students answered that, as individuals, they can do a lot or a fair amount to contribute to energy saving, one of the main actions that contribute to mitigating global warming (Table 22). It is possible to conclude that they feel generally involved in this issue, which converges with the hypothesis formulated.

Table 22. Degree of individual commitment expressed by students to the socio-environmental crisis.

Item 19. From the Following List, to What Extent (Not at All, a Lot...) Do You Think We Can Contribute to Energy Savings?	**N = 944**	**% (δ)**
Level 1: adequate response. The option "I/me" with "a lot" or "quite a lot" is chosen, i.e. students who refer to what each of us can do	576	61.0 (0.2)
Level 2: any other answers is chosen	368	39.0 (0.2)
IDK-N/A	0	-

The aim of item 25 is to analyse the extent to which students are able to refer to all the problems that contribute to the socio-environmental crisis. It also aims to bring out their ability to relate these problems to each other.

For the analysis, we have drawn on converging studies in the field of ESD on the problems we must face in order to move towards a sustainable present and future, adapted for this research [28]. Among others, the following have been selected as relevant: (1) increasing urbanisation, (2) environmental pollution, (3) increase in the greenhouse effect and Climate Change, (4) depletion and destruction of resources, (5) degradation of ecosystems, (6) destruction of cultural diversity, (7) over-consumption, (8) population growth, (9) social imbalances and inequalities, (10) conflicts and violence.

From their responses, we can conclude that students know few of these serious problems and that they are not able to relate them to each other (Table 23). Therefore, and coinciding with the results of numerous studies cited above, we can point out that they lack a global, holistic vision of the global emergency scenario, which confirms the difficulty of their involvement in the adoption of measures that contribute to the transition towards more sustainable societies [32,64,75].

Table 23. Socio-environmental problems that students are able to mention and relate to one another.

Item 25. What Other Socio-Environmental Problems Are Related to Climate Change and How Are They Linked? List and Describe Some Examples of Their Linkages.	**N = 944**	**% (δ)**
Level 1: between 8 and 10 of the problems identified by experts are mentioned	0	-
Level 2: between 4 and 7 of the problems identified by experts are mentioned	7	0.7 (0.03)
Level 3: less than 4 of the problems identified by experts are mentioned	381	40.4 (0.2)
IDK-N/A	556	58.9 (0.2)

Item 26 was included in the questionnaire because of its relevance from the point of view of its universal nature and the global vision to which it contributes, showing links between SDG 13, for example, related to Climate Change, with SDG 12 (responsible consumption) and SDG 7 (sustainable energy), etc. It is very significant that, according to their responses, almost 100% of the participating students are generally unaware of the SDGs and their importance, despite the attention that is being paid to them from different educational and political spheres [77]. This indicates that the attention given to them is still insufficient and has not managed to attract their attention (Table 24).

Table 24. Knowledge of participating students of the SDGs.

Item 26. Are You Familiar with the 2030 Agenda and the Sustainable Development Goals (SDGs)? What Can You Tell Us About Them, and How Are They Related to Climate Change?	**N = 944**	**% (δ)**
Level 1: knowledge of the SDGs is demonstrated when mentioning at least how they were adopted, the number of SDGs, the existence of targets, and they are able to list at least 7–8 issues they address.	4	0.4 (0.02)
Level 2: unaware of the SDGs/IDK-N/A	940	99.6 (0.3)

This question, after the reflection on global problems and Climate Change, aims to find out their interest in other possible topics related to those that have appeared (item 27). The pupils pointed out scattered problems which they do not seem to relate to one another (Table 25). Specifically, 384 students did not know or did not answer this question, which seems to contradict the interest in the subject that they reported in other items, also due to the attention given to this issue in the school context that they state exists.

Table 25. Topics in which the participating students would be interested in going into more depth.

Item 27. Please Indicate Which Topics You Would Like to Learn More About in Relation to the Problems Humanity Is Facing	**N = 944**	**%**
Climate Change is mentioned	135	14.3
Measures to be taken to manage socio-environmental problems are mentioned	116	12.3
Environmental degradation and the future of the planet are mentioned	74	7.8
Pollution and waste are mentioned	76	8.1
Poverty and social inequalities are mentioned	103	10.9
Politics and economics are mentioned	48	5.1
Health is mentioned	32	3.4
Others	92	9.7
IDK-N/A	384	40.7

4. Conclusions

The transition to Sustainability, with the adoption of the required measures to tackle the serious global problems, such as Climate Change, is one of the most important challenges for current and future societies. Although this has been addressed for a long time at different educational levels, the worsening of the situation requires urgent and greater impulse and involvement of all the actors. To contribute to this challenge, this study proposes, as a starting point for the involvement of teachers and students, to carry out an analysis of students' interests and motivations, evaluating their knowledge of Sustainability and, in particular, of Climate Change. The aim is to provide an initial reflection that will enable the subsequent implementation—with the involvement of their teachers—of the necessary teaching interventions in Secondary Education classrooms. A questionnaire was drawn up for the participating students to find out whether their concerns and interests include Sustainability in general and Climate Change in particular. In addition, the aim was to find out whether they have the required competences in this area to enable them to make conscious decisions and to engage and commit to the serious socio-environmental situation described consistently in numerous scientific studies.

The analysis of the results derived from this experimental design, in which 944 secondary school students participated, led to the following general conclusions.

- 67.0% of the students surveyed include Climate Change among their concerns. This is mentioned explicitly or implicitly through its causes and/or consequences.
- 87.8% of the students report having approached the topic of Climate Change in the school context.

- This approach should be reflected in convergent knowledge, something that is not confirmed by the questionnaire. Knowledge of Climate Change and the global situation in which it is contextualised is minimal, unconnected and reductionist.
- In line with the previous point, none of the respondents show an adequate idea of what Climate Change is, neglecting some of its most important aspects (increase in temperature caused by the increase in GHGs, anthropogenic causes with special emphasis on the burning of fossil fuels, etc.). Only 37.8% gave an approximate response, mentioning some of the key related concepts.
- More than half of the students (62.3%) do not know what the greenhouse effect is. There is a general perception of it as a negative effect and not essential, ignoring the fact that the problem is its intensification because of human activity. This misconception could have effects in the adoption of appropriate measures to tackle Climate Change.
- Only one third of the respondents can list causes and consequences of Climate Change. Additionally, they are not able to relate certain processes to the origin of the climate crisis and its effects. When it comes to the measures or actions needed to combat and mitigate Climate Change, they do not have a global and holistic view of Sustainability and in particular of the climate problem.
- When asked about the measures needed to combat Climate Change, only 1% of participants are able to identify the three main types of measures needed, set out by the experts: political-economic, technological and educational.
- When asked about the responsibility of each person to participate in the necessary measures, 61% of the students answer that, as individuals, they can do a lot or quite a lot to contribute to e.g. energy saving because energy consumption is one of the main causes of global warming.
- It is possible to conclude that despite the shortcomings detected, students generally feel involved in this issue, which is an important first step towards a determined and constant commitment of society.

In summary, the results show a limited knowledge in Sustainability and Climate Change among the participating students, the coexistence of different and sometimes incongruent conceptions of Sustainability, deficiencies in the inclusion of the social dimension and a holistic approach and reductionism and disconnection of the different problems that make up the complex reality of the socio-environmental crisis addressed in this work.

However, the results also show that the participating secondary school students show interest in Sustainability and Climate Change, are concerned and, at the same time, show an encouraging involvement in the implementation of measures at an individual level. This should contribute to overcoming the weaknesses detected in their knowledge of the problem and of the required measures to be adopted by addressing them in depth with the involvement of the teachers, through interventions designed for this purpose within the framework of Education for Sustainability. An ESD that helps to increase understanding of the planetary crisis as an essential step towards the effective involvement of the younger generations who are beginning to make their own decisions.

Successive calls from experts emphasise the need to make people understand the importance of the individual actions of many millions of people, which have a decisive impact on the evolution of this crisis. It is common to transfer the responsibility to external factors, politicians, companies, etc. However, the correct individual decision-making is of key importance in the face of global problems, and it is therefore necessary to identify, on the basis of an adequate knowledge of reality, what each individual can do.

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Appendix A. Questionnaire

1. What are the global problems that most concern you? Why? Explain your answer.
2. In what context have you heard about Climate Change?
3. What do you understand by Climate Change? Explain briefly.
4. Which of the following statements do you agree with the most?
    a. Current Climate Change exists, but it is part of the natural cycles of our planet. Humans have no influence.
    b. Current accelerated Climate Change is real, it is happening and we humans are causing it.
    c. No Climate Change is currently occurring.
    d. I have not heard of Climate Change. I don't know what you mean.
    e. Other (make the statement that you think best answers the question)
5. What degree of scientific consensus (agreement) do you think there is on the existence of current, global, human-caused Climate Change?
    a. There is no consensus; it is still under discussion.
    b. There is a certain consensus, but not a majority. There continue to be many scientists who doubt.
    c. Consensus is high. Scientists agree.
    d. Other (elaborate the statement that you think best answers the question)
6. What do you think are the main causes of Climate Change? Explain your answer.
7. Among the possible causes of Climate Change, choose the ones that have more weight from your point of view.
8. What do you understand by greenhouse effect? Explain briefly.
9. What consequences do you think Climate Change may have on a general level? (Tick all the options that you think are effects of Climate Change)
    a. The number of deserts in the world will increase.
    b. Sea levels will rise.
    c. The ice at the poles will melt.
    d. Ocean circulation could change or be disrupted.
    e. Invasive species will increase.
    f. Many corals will die.
    g. Tropical diseases will become more prevalent in other parts of the world.
    h. Biodiversity will be affected.
    i. Extreme weather events will increase.
    j. Nothing will change.
    k. It will lead to an increase in migration.
    l. It will increase poverty and imbalances between human groups.
    m. Other.
10. On the impact of Climate Change, will it affect only some areas of the planet?
    a. Yes, particularly the North Pole and the South Pole.
    b. No, it will affect the whole planet but with different intensity depending on the area.
    c. No, it will affect all places equally.

d. Other.

11. What consequences do you think Climate Change could have for the Valencian Community? Mark all the options you consider appropriate.
    a. It will not affect it
    b. Sea level rise.
    c. Tourism will decrease.
    d. Problems with agriculture.
    e. Rainfall and drought patterns will change.
    f. Other.
12. What measures should be adopted to help curb it? Please explain your answer.
13. Do you know of any proposals at the international level to combat Climate Change? Describe it/them.
14. Do you think that using renewable energies would reduce the effects of Climate Change? Give reasons for your answer.
15. Tick all the options from the list below that you think are renewable energy sources: Solar, Nuclear, Hydroelectric, Wind, Natural Gas, Biomass, Coal, Geothermal, Biomass, Tidal, Oil.
16. Please, indicate to what extent the following actions contribute to reducing Climate Change:
    a. Do not travel by plane.
    b. Eat less meat.
    c. Hire electricity from renewable sources.
    d. Self-consumption: solar panels.
    e. Ride public transport (bus/train).
    f. Separate and recycle.
    g. Energy-efficient appliances.
    h. Drink tap water.
    i. Other.
17. What do you think can be done at the school and academic level to reduce the impact of Climate Change and mitigate its effects?
18. What can you do?
19. From the following list, to what extent (not at all, a lot...) do you think they can contribute to energy savings?
    a. Politicians and policies.
    b. Industries and factories.
    c. Shops and businesses.
    d. Older people.
    e. People like me.
    f. Others.
20. Rank the following statements according to your degree of agreement:
    a. Protecting the environment is necessary, even if it means less economic growth.
    b. Priority should be given to economic growth, even if it means some deterioration of the environment and social cohesion.
    c. Even if a company is polluting, maintaining jobs is the most important thing.
    d. In times of economic crisis, environmental and social cohesion policies are as much a priority as education, health or employment.
    e. Technological progress will solve all environmental problems without us having to reduce our standard of living too much.
    f. We must reduce our current standard of living if we want our descendants to have similar environmental conditions to our own.

21. Have you ever received/participated in (tick as many options as you consider appropriate):
    a. A class on global warming or Climate Change.
    b. A course on global warming or Climate Change.
    c. A workshop on global warming or Climate Change.
    d. An environmental NGO.
    e. A protest against global warming or Climate Change.
    f. None.
22. Are you familiar with the FridaysForFuture movement?

    If yes, please explain briefly what it is and what you think about it.
23. Would you be willing to get involved in this movement? Please give reasons for your answer.
24. What other movements or initiatives do you know of in relation to Climate Change?
25. What other socio-environmental problems are related to Climate Change, and how are they linked? List some examples and describe their linkages.
26. Are you familiar with the 2030 Agenda and the Sustainable Development Goals (SDGs)? What can you tell us about them, and how are they related to Climate Change?
27. Please indicate which topics you would like to learn more about in relation to the problems humanity is facing.

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