

## RAISE: Raising environmental knowledge & awareness through an innovative virtual environment



### Del-03-PR3: Result Analysis

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<b>Authors (per partner, if more than one partner provide it together)</b>	Maria Manuel Sá (ISMAI/Maiêutica) Marta Maria Mota (ISMAI/Maiêutica) Reviewer 1 Michalis Xenos (UPatras) Reviewer 2		
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## Executive Summary

The RAISE project: Raising environmental knowledge & awareness through an innovative virtual environment is an ERAMUS+ project in action KA220-SCH Cooperation partnerships in school education, coordinated by Panepistimo Patron, Greece, and with the following partner organizations Maiêutica Cooperativa de Ensino Superior CRL, Portugal, Arseiko Lyceum of Patra, Greece, Agrupamento de Escolas D. Afonso Sanches, Portugal and Liceo Manin, Italy.

The motivation of this project lies in the growing necessity of spreading environmental awareness and environmental knowledge as it is expressed in the European Green Deal, where the role of education and training in the transition to more sustainable futures possess a central role, as well as in the Sustainable Goals (SDGs). Thus, one of the objectives of the RAISE project is to identify the Environmental Knowledge and Awareness (EK&A) level in schools to prepare the outcomes for 3D virtual world learning environment subsequently.

Thus, to identify the EK&A level a survey was designed consisting of 3 blocks of questions that assess students' knowledge, attitudes and behaviors toward climate change. The questionnaire was given online to 347 students (43.5% Italian, 38.9% Portuguese, and 17.6% Greek), being the female group predominant with 66.9% of the students. Regarding feelings about climate change, the results show that 68.0% of students were worried, 36.7% were sad, 35.7% were anxious and 28.5% were fearful. When comparing the three countries, worry is the feeling with the highest percentage for all three nationalities. Approximately 25% of the students from the three countries are optimistic or hopeful. 25% of the Greek students say they are indifferent to climate change, with statistically significant differences compared to the Portuguese and the Italians. The results indicate that girls are more sensitive to environmental issues than boys.

To be able to compare the students from the three countries, i.e. to have 3 groups of students more similar, students aged between 15 and 17 years old were selected, obtaining 3 groups from each country (101 Italians, 92 Portuguese and 60 Greeks). The results indicate that Greek students show lower percentages of pro-environmental knowledge, attitudes and behavior. Girls were found to have more pro-environmental knowledge, attitudes and behavior than boys.

Based on the gaps found in the students' knowledge, attitudes and behavior, possible scenarios were proposed for the 3D virtual learning environment namely in the areas of waste management; water; renewable energies; importance of ecosystems and in particular forests; sustainable agriculture; sustainable cities; good environmental practices; empowerment tools.

## List of abbreviations

EK&A - Environmental Knowledge and Awareness

3D VWLE - 3 Dimension Virtual World Learning Environment



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## **1. Project Characterization**

### **1.1 Context**

The RAISE project: Raising environmental knowledge & awareness through an innovative virtual environment is an ERAMUS+ project in action KA220-SCH Cooperation partnerships in school education, coordinated by Panepistimo Patron, Greece, and with the following partner organizations Maiêutica Cooperativa de Ensino Superior CRL, Portugal, Arsakeio Lyceum of Patra, Greece, Agrupamento de Escolas D. Afonso Sanches, Portugal and Liceo Manin, Italy.

The RAISE project aims to identify and compare the level of Environmental Knowledge and Awareness (EK&A) in schools in the partner countries; develop a new Virtual World Learning Environment (3D VWLE) as a teaching/learning tool and promote EK&A in school students, thus increasing EK&A in school students. Thus, the main objective of the project will be to develop the knowledge, awareness and inevitably attitudes and values, to learn and exercise their responsibilities both in school and in their community. This is crucial for creating a sense of inclusion; and necessary for the cultivation of active citizenship from an early age. Given the social differences between countries, each State must follow this direction accordingly. Thus, it is necessary to identify the level of EK&A in schools, indicate the differences in results between partner countries and prepare the results for the 3D virtual world learning environment.

### **1.2 Objectives**

One of the objectives of the project is to identify the EK&A level in schools to prepare the outcomes for the 3D virtual world learning environment. Thus, an environmental survey was carried out to perceive the students' knowledge, attitudes and behaviors and, in this way, to indicate the differences among the various results from the partner countries. The results obtained will serve as a basis for the development of pedagogical content and the creation of 3D VWLE scenarios.

## 2. Literature Review

### 2.1 Man's relationship with the environment and the need for sustainable development

In the late 1960s and early 1970s, the world's population became aware of the impact of human intervention on the environment through a series of environmental disasters that had occurred years earlier (Pott and Estrela, 2017). Examples of these disasters are the release of dimethylmercury into Minamata Bay in Japan, resulting in the poisoning, disability, and death of animals and thousands of people who lived there; the commercialization of thalidomide, a drug prescribed to pregnant women to alleviate pregnancy nausea, but with teratogenic effects, as a result of which thousands of babies around the world were born with several irreversible congenital malformations; the use of DDT (dichlorodiphenyltrichloroethane), a pesticide used on a large scale after the Second World War, with harmful effects on human health and other animals, as demonstrated by the American biologist Rachel Carson in her book "Silent Spring" released in 1962; the discovery of the ozone hole in the 1970s and many others.

All these successive environmental disasters served as a catalyst for the first major meeting dedicated to improving man's relationship with the environment, the United Nations Conference on the Human Environment in Stockholm, Sweden, in 1972, with 113 countries present. However, environmental disasters continued, the release of toxic products into the environment in Seveso, Italy (1976) and Bhopal, India (1984), the nuclear disaster in Chernobyl (1986), the Exxon Valdez oil spill (1989), are some examples among many others.

As a result of these events and the realization of the repercussions on the environment and human health, in 1992 the United Nations Conference on Environment and Development took place in Rio de Janeiro (Eco-92), where representatives from 178 countries around the world debated the world's environmental problems. At this summit, it was realized that environmental issues were intrinsically linked to social and economic issues and so the concept of sustainability was introduced, encompassing the three dimensions (environmental, social, and economic) and the priority of world leaders became sustainable development.

In 2003, the United Nations General Assembly (UNGA, 2003) published resolution 57/254, designating UNESCO to lead the United Nations Decade of Education for Sustainable Development, from 2005 to 2014. One of the aims of this resolution was to reformulate the syllabus of education, from pre-school to university, so that young people would have knowledge and learn values and behaviors conducive to a lifestyle compatible with a sustainable future. Education is considered indispensable for achieving sustainability goals. However, qualitative case studies in higher education institutions in seven countries (Brazil, Serbia, Latvia, South Africa, Spain, Syria, and the United Kingdom) revealed that the concept of education for sustainable development had not been sufficiently integrated into the academic curricula of these higher education institutions, revealing the need to develop educational programs aimed at raising people's environmental awareness (Leal-Filho et al., 2018).

On 1 January 2016, the United Nations (UN, 2016) resolution "Transforming our world: 2030 Agenda for Sustainable Development" came into force, consisting of 17 goals, broken down into 169 targets.

Of these 17 goals, 7 are related to environmental issues: 6 - Clean water and sanitation; 7 - Renewable and affordable energy; 11 - Sustainable cities and communities; 13 - Climate action; 14 - Protect marine life; 15 - Protect terrestrial life; affirming once again that it is imperative to use the resources necessary for our survival and that of future generations, without damaging the environment. This collective awareness imposes on every country, every organization, and every individual the need and responsibility to live sustainably.

At 2023, Education, Youth, Culture and Sport Council, EU ministers emphasized the role of young people as key players in implementing the 2030 Agenda for Sustainable Development (European Council, 2023). The European Council highlighted the need to promote opportunities for educators and youth workers to develop knowledge, skills, and competences to address issues of sustainable development, empowering young people to act as agents of change for sustainable development. The teaching/learning process must integrate all environmental and sustainability issues to strengthen citizens' ability to face imminent and unpredictable problems and find long-term solutions to them in many different situations throughout their lives (Santosh, 2017).

## 2.2 Young people & Sustainability consciousness

Currently, in European countries, the percentage of young people aged between 10 and 24 is between 10 and 19 percent, and this same range is projected until 2050 (UNFPA, 2014). According to data from PORDATA (2023), in 2021 the percentage of the population of Portugal, Italy, and Greece, the three partner countries of the RAISE project, in the 2nd and 3rd cycle of basic education and secondary education was respectively 7.1% in Portugal; 7.9% in Italy and 6.5% in Greece (Table 1).

Table 1 – Percentage of the population of Portugal, Italy, and Greece in primary, and secondary education in 2021.

Country	Population	(% of the population)	
		Second stage of basic education	Secondary education
Portugal	10 325 147	3,3	3,8
Italy	59 133 173	3,0	4,9
Greece	10 569 207	3,2	3,3

A sustainability consciousness is an outcome of Education for Sustainable Development, which was launched by UNESCO (2014). It is, therefore, necessary to assess whether young people are aware of the causes of climate change, strategies to protect biodiversity, the importance of water as an essential resource for life, whether they have attitudes towards responsible consumption and production, waste reduction, whether they adopt behaviors aimed at preserving natural resources. In other words, it is necessary to assess the sustainability consciousness and the environmental literacy of young people in schools.

There are few validated instruments for measuring sustainability consciousness and the environment literacy. Michalos et al. (2012) developed a questionnaire to measure the knowledge, attitudes and behaviors regarding the sustainable development of tenth-grade students aged between 15 and 16 years. This questionnaire was applied and validated with Canadian students. Gericke et al. (2017)

developed another sustainability consciousness questionnaire, based on the previous one, with two versions, one short and the other longer, but for young people aged between 18 and 19, and this time applied and validated with Swedish students.

As sustainability consciousness is a relatively recent concept, the literature is even scarcer on the results and conclusions of this assessment. Lestari et al. (2022) applied the Gericke et al. (2017) questionnaire before and after a RADEC (Read, Answer, Discuss, Explain, and Create) learning model-orientated education for sustainable development on students' sustainability consciousness. The authors observed that the average sustainability consciousness of students after being given the RADEC learning model was higher than before, with statistical significance, recommending this teaching model as an effective way of developing students' sustainable awareness skills.

A qualitative study by Ziesemer et al (2021) on a sample of 55 young Germans aged between 14 and 24 found that they displayed anti-consumption practices (buying only the goods they need, borrowing objects instead of buying them, and avoiding unaffordable purchases) not for reasons of the planet's sustainability but for personal benefits such as financial security and individual freedom and autonomy. This shows a weak/weak sustainability consciousness, even though reducing consumption is a beneficial behaviour for sustainable living.

However, young people have played an important role in the fight against climate change with the international Fridays for Future movement drawing the attention of political decision-makers to issues of environmental sustainability. A movement initiated and led by Greta Thunberg, an activist with a high level of environmental awareness.

### 3. Materials and Methods

This is a quantitative study. Next, the characterization of the sample and the research method used will be presented, namely the participants and respective selection criteria, the instrument used to collect data on the variables under study, and the procedures.

#### 3.1 Participants

Students from Arsakeio Lyceum of Patra from Greece, Agrupamento de Escolas D. Afonso Sanches from Portugal, and Liceo Manin from Italy. The criteria for the selection of participants were defined according to the characteristics and objectives of the study. The criteria defined for the inclusion of participants in the sample were: (a) age between 9 and 19 years and school attendance between 5th and 11th grade; (b) female and male gender; (c) acceptance to participate voluntarily in the study with the informed consent of the parents.

The distribution of participants by country, gender, age, and school year is as follows. Most of the students (43.5%) are from Italy (Table 2 Table 2 and Figure 1).

Table 2 - Distribution of participants by country.

	n	%
<b>Portugal</b>	135	38,9
<b>Greece</b>	61	17,6
<b>Italy</b>	151	43,5
<b>Total</b>	347	100,0

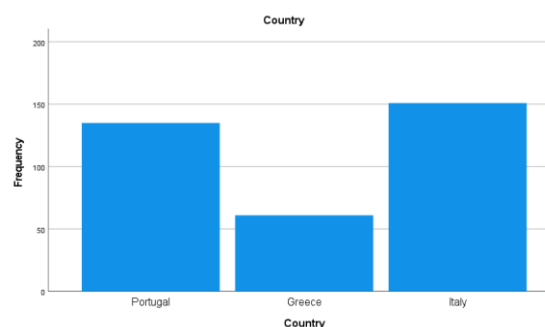


Figure 1 - Distribution of participants by country.

Most students (60,9%) were female. Female gender is predominant in all three countries (Table 3).

Table 3 - Distribution of participants by gender.

	Total		Portugal		Greece		Italy	
	n	%	n	%	n	%	n	%
<b>Female</b>	232	66,9	75	55,6	35	57,4	122	80,8
<b>Male</b>	114	32,9	59	43,7	26	42,6	29	19,2
<b>Other</b>	1	0,3	1	0,7	-	-	-	-
<b>Total</b>	347	100,0	135	100,0	61	100,0	151	100,0

The age distribution of the students is shown in Table 4. For better visualization of the distribution, the same information is in the graph of Figure 2. As can be seen, the students are aged between 9 and 19 years, presenting a mean and standard deviation of age 15.1 and 1.7, respectively.

Table 4 - Distribution of participants by age.

Age (years)	n	%
9	1	,3
10	4	1,2
11	20	5,8
12	16	4,6
14	41	11,8
15	104	30,0
16	102	29,4
17	47	13,5
18	10	2,9
19	1	,3
<b>Total</b>	<b>346</b>	<b>99,7</b>
<b>Missing</b>	<b>1</b>	<b>,3</b>

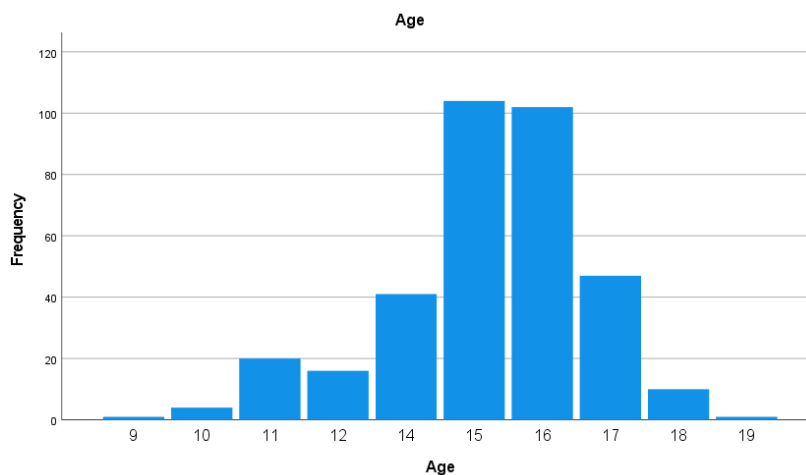


Figure 2 - Distribution of participants by age

The students are in a schooling level between grades 5<sup>th</sup> to 11<sup>th</sup> (Table 5). As evidenced in Figure 3, the sample to the degree of schooling is not uniformly distributed.

Table 5 - Distribution of participants by school year.

School Year	n	%
5th	74	21,3
6th	65	18,7
7th	36	10,4
8th	19	5,5
9th	5	1,4
10th	106	30,5
11th	42	12,1
<b>Total</b>	<b>347</b>	<b>100,0</b>

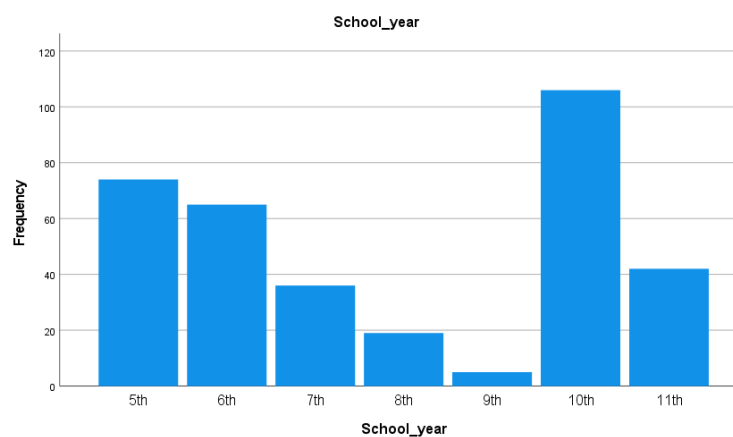


Figure 3 - Distribution of participants by school year.

### 3.2 Instrument

Data and information were collected through an online survey (see Annex I). The survey consists of a sociodemographic questionnaire and an Environment Questionnaire. The sociodemographic questionnaire aims to collect information for the characterization of the participants. In this case was constructed for the purpose including the variables age, gender, country, school year.

The questions of the environment questionnaire were elaborated by the team from University of Maia, with the contribution of the remaining partners. Initially, the team of ISMAI presented a first version, after consulting international scientific articles on the topic (Michalos et al., 2012; Gericke et al. 2018; Lestari et al. 2022). Like Michalos et al. (2012), Gericke et al. (2018) and Lestari et al. (2022), the questions were divided into three major groups: Knowledge, Attitudes and Behaviors. Although these authors only used questions with a Likert scale response, the project team chose to also pose multiple choice questions and questions with optional answers. Thus, the Knowledge block consists of 21 questions with optional answers and one multiple choice question; the Attitudes block consists of 4 questions with optional answers and 6 questions on a Likert scale (from 1 Strongly disagree to 5 Strongly agree); the Behavior block consists of 24 questions with Likert scale answers (from 1 Never to 5 Often).

The questionnaire was carried out in the software Lime Survey and can be found in Annex A, in English, Greek, Portuguese and Italian versions.

### 3.3 Procedures

The sampling procedure and subsequent data collection were based on the participants' selection criteria and took place in school settings in the three schools mentioned: Lyceum of Patra, Greece, Agrupamento de Escolas D. Afonso Sanches, Portugal, and Liceo Manin, Italy. To this end, a request for permission to implement the study in school settings was submitted to the Directorate-General of Education of each country, and data collection was carried out after approval. Data collection relied on the collaboration of the project partners, who were responsible for the sampling procedure and data collection in the different schools. Once the approval of the schools represented by the Board of Directors was obtained, Informed Consent (see Annex II) was given to the parents and guardians of the students who voluntarily agreed to participate in the study. The request for voluntary collaboration was thus made and a brief explanation about the nature of the study was presented, with the guarantee of maintaining the confidentiality of the answers, and the identity of the student and the school, as indicated in the informed consent. The study was presented to the students as an investigation of environmental knowledge & awareness, carried out by an Erasmus+ project with the participation of 5 entities from 3 countries. One or two weeks later, the data collection instruments were administered to the students online via the schools' computers. The questionnaires were previously validated by a group of 10 students in each school to identify opportunities for improvement or difficulties in interpreting the questions. As no issues to be changed were identified, the questionnaires were then disseminated to a larger group of students.

The administration of the instruments took place according to the following procedure:

- 1) Instruction for filling in the instruments: a review of the confidentiality rules; request to read carefully each item of each questionnaire; appeal to fill in completely each instrument;
- 2) Individual completion of the questionnaires, supervised by each responsible researcher (e.g. clarification of doubts; verification of the complete filling in of the instruments).

The sampling and data collection process took place between the 1st and 31st of March at the project's partner schools: Arsakeio Lyceum of Patras, Greece, Agrupamento de Escolas D. Afonso Sanches, Portugal, and Liceo Manin, Italy.

### 3.4 Statistical Analysis Methodology

Data were processed using version 28.0 of the Statistical Program for Social Sciences (IBM SPSS). Descriptive statistics (e.g., frequency/percentage, mean, and standard deviation) were used for the socio-demographic characterization of the sample, as well as for the first analysis of the results from the environmental questionnaire.

To analyze the environmental questionnaire, initially descriptive statistics (e.g., frequency/percentages) were used. Subsequently, parametric and non-parametric statistical tests were used to analyze the relationship between sociodemographic variables (country, gender, and age/age groups) and the qualitative variables of the environmental questionnaire: the non-parametric Chi-square test and the parametric One-way ANOVA test were used to compare the three countries, and the post hoc Bonferroni test (two-sided test) if significant differences were found.

To compare the two genders, we used the parametric t-2 independent samples test and the non-parametric Chi-square test; to compare the five age groups we used the parametric One-way ANOVA test and post hoc, if in the presence of significant differences, the Bonferroni test (two-sided test) for multiple comparisons.

Results with a significance level below .05 ( $p < .05$ ) were considered statistically significant.



## 4. Results

### 4.1 Overall Results of Survey

For the first question of multiple responses about how they felt when they think about climate change, 68,0% of students were worried, 36,7% were sad, 35,7% were anxious and 28,5% were fearful, as can be seen in Table 6 and Figure 4.

Table 6 - Feelings of students when they think about climate change.

Feelings	Responses		% of cases (347 students)
	n	%	
Sadness	127	12,4	36,6
Anxious	124	12,1	35,7
Fear	99	9,8	28,5
Guilty	86	8,4	24,8
Hopelessness	40	3,9	11,5
Powerless	80	7,8	23,1
Anger	63	6,2	18,2
Worry	238	23,3	68,6
Powerless	12	1,2	3,5
Optimistic	35	3,4	10,1
Hopeful	63	6,2	18,2
Indifferent	54	5,3	15,6
	1022	100	

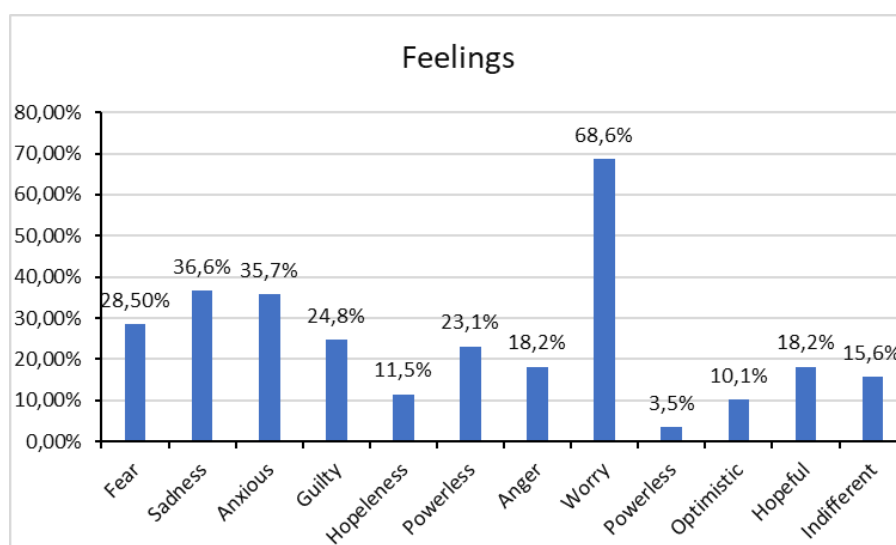


Figure 4 - Feelings of students when they think about climate change.

## Section A – Knowledge

Tables 7 to 28 present the number of responses (n) and the respective percentage of the different answers for each question in the knowledge section. The correct answer is shaded in green.

### Waste and recycling

Table 7 - Responses to the question “Name the materials which correspond to the green, blue and yellow recycling bins”.

Answers	Total	
	n	%
Plastic, glass and paper	32	9,2
Glass, paper and plastic	258	74,4
Paper, glass and plastic	26	7,5
I don't know	31	8,9
Total	347	100,0

Table 8 - Responses to the question “What is the 5 R's policy?”

Answers	n	%
Refuse, Reduce, Reuse, Repurpose, Recycle	130	37,5
Repair, Reduce, Reuse, Rot, Recycle	113	32,6
I don't know	104	30,0
Total	347	100,0

Table 9 - Responses to the question “Which item cannot be recycled?”

Answers	n	%
Bottle cap	29	8,4
Used newspaper	11	3,2
Used paper napkin	212	61,1
Used plastic bucket	50	14,4
I don't know	45	13,0
Total	347	100,0

With regard to the questions in the Knowledge Section (Waste and recycle): 74.4% of students have knowledge about the colors of containers; only 37.5% know what is the 5R's policy; 61.1% know that a used paper napkin cannot be recycled.

## Conserve water

Table 10 - Responses to the question “According to the UN (United Nations) what is the average daily consumption of water per person (counting hygiene and drinking)?”

Answers	n	%
50 l/day	43	12,4
200 l/day	32	9,2
110 l/day	107	30,8
150 l/day	82	23,6
I don't know	83	23,9
Total	347	100,0

Table 11 - Responses to the question “Water is an important resource for maintaining the ecosystem and life. A human being can go without eating food for 1 to 2 months, but without drinking can only go”.

Answers	n	%
3 to 7 days	285	82,1
1 day	41	11,8
30 days	6	1,7
I don't know	15	4,3
Total	347	100,0

Table 12 - Responses to the question “What is the percentage of potable water on earth?”

Answers	n	%
20%	60	17,3
3%	140	40,3
Less than 1%	110	31,7
I don't know	37	10,7
Total	347	100,0

With regard to the questions in the Knowledge Section (Conserve water): 30,8% of students know the average daily consumption per person; 82,1% know that a human being without water can only go 3-7 days; 31,7% know the percentage of potable water on earth.

## Pollution

Table 13 - Responses to the question “Which material decomposes most quickly in nature?”

Answers	n	%
Paper	202	58,2
Fabric cloth	11	3,2
Metal	3	,9
Wood	95	27,4
I don't know	36	10,4
Total	347	100,0

Table 14 - Responses to the question “Which of these materials takes the longest to decompose in nature?”

Answers	n	%
A soft drink can	114	32,9
Food scraps	9	2,6
Disposable nappy	87	25,1
Glass	109	31,4
I don't know	28	8,1
Total	347	100,0

With regard to the questions in the Knowledge Section (Pollution): 58,2% of students know that paper decomposes more quickly than metal, wood, or fabric cloth; 31,4% know that glass takes longer to decompose than food, drink cans, or disposable nappy.

## CO<sub>2</sub>/greenhouse gases

Table 15 - Responses to the question “What is the greenhouse effect?”

Answers	n	%
Certain gases in the atmosphere trap heat (infrared radiation) and warm the earth.	273	78,7
The sun is emitting more energy in recent years.	16	4,6
Certain gases in the atmosphere that protect us from ultraviolet radiation.	36	10,4
I don't know	22	6,3
Total	347	100,0

Table 16 - Responses to the question “Which activities are the largest contributors of greenhouse gases?”

Answers	n	%
Deforestation	53	15,3
Electricity generation	13	3,7
Industry	179	51,6
Transportation	38	11,0
Agriculture	29	8,4
I don't know	35	10,1
Total	347	100,0

Table 17 - Responses to the question “Carbon dioxide (CO<sub>2</sub>) is:”

Answers	n	%
Caused by human activities (industry and transports)	66	19,0
Caused by forest fires	19	5,5
Released by volcanoes	4	1,2
All of the above	239	68,9
I don't know	19	5,5
Total	347	100,0

Table 18 - Responses to the question “Which of the following gases does not contribute to the greenhouse effect?”

Answers	n	%
Carbon dioxide	18	5,2
Nitrogen	78	22,5
Water vapor	165	47,6
Methane	37	10,7
I don't know	49	14,1
Total	347	100,0

Table 19 - Responses to the question “Fires release carbon stored in plants and contribute to the greenhouse effect.”

Answers	n	%
True	232	66,9
False	58	16,7
I don't know	57	16,4
Total	347	100,0

Table 20 - Responses to the question “The earth's plants have absorbed carbon dioxide that humans released into the atmosphere over the past few decades by approximately:”

Answers	n	%
25%	75	21,6
50%	83	23,9
75%	72	20,7
100%	9	2,6
I don't know	108	31,1
Total	347	100,0

With regard to the questions in the Knowledge Section (CO<sub>2</sub>/greenhouse gases):

78.7% of students know what the greenhouse effect is; only 11% consider transport as the largest contributor to greenhouse gases.

68.9% know that carbon dioxide comes from various sources and activities; only 22.5% know that nitrogen is a gas that does not contribute to the greenhouse effect.

66.9% know that forest fires contribute to the greenhouse effect; 47% of students consider that plants absorb more CO<sub>2</sub> than they actually absorb and 31.1% don't even know how much they absorb.

## Climate Change

Table 21 - Responses to the question “The risk of soil desertification, of arid and semi-arid areas, is more serious in Southern Europe (Portugal, Spain, Italy and Greece) than in Northern Europe.”

Answers	n	%
True	236	68,0
False	51	14,7
I don't know	60	17,3
Total	347	100,0

Table 22 - Responses to the question “One consequence of climate change is the increase of forest fires.”

Answers	n	%
True	280	80,7
False	34	9,8
I don't know	33	9,5
Total	347	100,0

Table 23 - Responses to the question “What are the consequences of the ascent of the middle sea level?”

Answers	n	%
Coastal erosion	32	9,2
Under water coastal towns	88	25,4
Worsen freshwater quality	15	4,3
All of the above	173	49,9
I don't know	39	11,2
Total	347	100,0

With regard to the questions in the Knowledge Section (Climate change): 68% of the students know that the risk of soil desertification is more serious in Southern Europe than in Northern Europe; 88,8% know the consequences of the ascent of the middle sea level.

## Biodiversity

Table 24 - Responses to the question “Desertification leads to loss of biodiversity (fewer plants and animals).”

Answers	n	%
True	270	77,8
False	43	12,4
I don't know	34	9,8
Total	347	100,0

Table 25 - Responses to the question “Wildfires affect biodiversity.”

Answers	n	%
True	286	82,4
False	19	5,5
I don't know	42	12,1
Total	347	100,0

With regard to the questions in the Knowledge Section (Biodiversity): 77,8% of the students know that desertification leads to loss of biodiversity (fewer plants and animals); 82,4% know that wildfires affect biodiversity.

## Sustainable Agriculture

Table 26 - Responses to the question “Ladybugs can replace the use of chemical insecticides in agriculture.”

Answers	n	%
True	141	40,6
False	79	22,8
I don't know	127	36,6
Total	347	100,0

Table 27 - Responses to the question “Which kind of agriculture is more sustainable?”

Answers	n	%
Intensive subsistence agriculture	13	3,7
Organic agriculture	294	84,7
Commercial agriculture	10	2,9
I don't know	30	8,6
Total	347	100,0

With regard to the questions in the Knowledge Section (Biodiversity): 77,8% of the students know that desertification leads to loss of biodiversity (fewer plants and animals); 82,4% know that wildfires affect biodiversity.

## Save energy

Table 28 - Responses to the question “Which renewable energy sources do you know? (Choose all you know).”

Renewable Energy	n	%	% of cases (347 students)
Solar energy	329	21,3%	95,1%
Wind energy	319	20,7%	92,2%
Geothermal energy	247	16,0%	71,4%
Hydropower	279	18,1%	80,6%
Biomass energy	180	11,7%	52,0%
Ocean energy	189	12,2%	54,6%
Total	1543	100%	-

With regard to the questions in the Knowledge Section (Save energy): the renewable energy most known to students is solar energy (95.1%) followed by wind energy (92.2%). The least known renewable energy is biomass (52%) followed by ocean energy (54.6%).



## Section B - Attitudes

Tables 29 to 32 present the number of responses (n) and the respective percentage for the different answers for each question. The correct one is shaded in green.

### Conserve water

Table 29 - Responses to the question “What uses the least amount of water?”

Answers	n	%
Doing the dishes by hand	138	39,8
Doing the dishes in the dishwasher	177	51,0
I don't know	32	9,2
Total	347	100,0

Table 30 - Responses to the question “Which of these is not sustainable?”

Answers	n	%
Washing the car with a bucket	21	6,1
Re-using rainwater	15	4,3
Dumping cooking oil down the drain.	267	76,9
I don't know	44	12,7
Total	347	100,0

### Save energy

Table 31 - Responses to the question “What can we do to save electricity?”

Answers	n	%
Take a long bath	6	1,7
Leave the fridge door open	9	2,6
Turn off the light when leaving a room	312	89,9
I don't know	20	5,8
Total	347	100,0

Table 32 - Responses to the question “Which one of these increases the level of carbon dioxide in our atmosphere?”

Answers	n	%
Cutting down trees	39	11,2
Traveling by plane	15	4,3
Producing energy with fossil fuels	50	14,4
All of the above	203	58,5
I don't know	40	11,5
Total	347	100,0

Table 33 shows the respondents' agreement with environmental attitudes on a Likert scale.

Table 33 - Percentage of answers in each item of the attitude related question.

Likert scale: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree.

	%				
	1	2	3	4	5
<b>Support local food:</b>					
B51. I think that growing our own fruits and vegetables is a great way to support sustainable agriculture and reduce your carbon footprint.	2,0	2,6	12,1	51,3	32
B52. I think that plant a garden can help support local ecosystems.	0,6	4,9	17,9	51,6	25,1
<b>Join a local environmental group:</b>					
B53. Joining a group can be a great way to make a positive impact and meet like-minded people.	3,5	5,5	26,5	43,8	20,7
B54. I think it is important to speak up and advocate for environmental issues	2,0	2,9	15,6	42,7	36,9
B55. I think it is important to choose products from companies that prioritize sustainability and environmental protection	1,4	3,2	13,5	45,2	36,6
<b>Conserve water:</b>					
B56. I think it is OK that each one of us uses as much water as we want.	34,9	34,0	16,7	9,5	4,9

To better visualise the above answers, on a Likert scale, a coloured graph was made where red is “Strongly disagree” and green is “Strongly agree”.

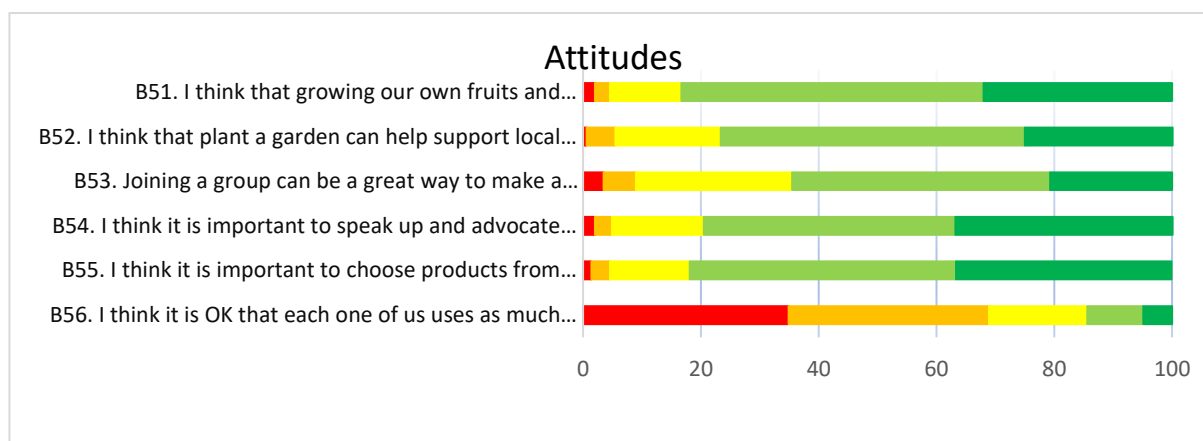


Figure 5 - Percentage of answers in each item of the attitude related question.

Legend: Red: strongly disagree; Orange: disagree; Yellow: neither agree nor disagree; Light green: agree; Dark green: strongly agree.

Concerning questions on environmentally-friendly attitudes: 68.9% of the students think that it is not right for everyone to use as much water as they want. In general, students are aware of the water scarcity that affects some countries. Other attitudes are generally environmentally friendly, with percentages between 76% and 83%.

Note that the last question B56 is inverted, strongly disagree (red) reflects the best attitude.

## Section C – Behaviour

Table 34 shows the percentages of answers in each item of the behaviour-related questions.

Table 34 - Percentage of answers in each item of the behaviour-related questions.

5-point Likert scale: (1) Never; (2) Rarely; (3) Sometimes; (4) Often; (5) Always.

<b>Reduce, reuse, and recycle:</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
C1. I reduce my waste by using reusable water bottles and lunch containers.	8,1	11,2	23,3	36,6	20,7
C2. I recycle my waste.	4,6	8,6	16,7	28,8	41,2
C3. I encourage my friends and family to reduce their consumption of single-use plastics.	16,1	17,0	28,2	24,8	13,8
C4. I encourage my friends and family to recycle.	11,5	14,4	27,1	27,4	19,6
C5. I avoid products with excessive packaging.	11,2	19,0	37,2	20,5	12,1
<b>Save energy:</b>					
C6. I turn off lights and electronics when not in use.	3,2	4,0	13,0	25,9	53,9
C7. I encourage others turn off lights and electronics when not in use.	4,9	11,0	18,7	28,0	37,5
C8. I encourage my friends and family to switch to energy-efficient light bulbs and appliances.	27,1	21,6	23,3	16,4	11,5
C9. My family tries to use renewable energy sources.	8,6	11,8	27,4	32,9	19,3
<b>Conserve water:</b>					
C10. I turn off the faucet when brushing my teeth.	4,9	5,5	8,1	14,7	66,9
C11. I take shorter showers.	10,1	19,3	32,3	21,9	16,4
C12. I fix or ask others to fix any leaky faucets.	13,3	9,8	21,0	24,5	31,4
C13. In my house we store rainwater for uses that do not require drinking water.	57,6	13,0	13,3	8,1	8,1
<b>Support local food:</b>					
C14. I get involved in activities related to gardening and growing fruit and vegetables.	28,5	25,1	24,8	13,0	8,6
C15. I do my shopping in local stores.	6,3	15,6	31,1	27,4	19,6
<b>Join a local environmental group:</b>					
C16. I collaborate in an environmental group that works to protect the environment and promote sustainability.	58,5	14,1	16,1	5,2	6,1
C17. I get involved with nature conservation organisations, supporting their efforts through donations or volunteering.	46,1	18,4	23,1	8,1	4,3
C18. I try to consume unprocessed food as much as possible.	11,8	17,3	30,5	27,1	13,3
<b>CO2/greenhouse gases</b>					
C19. I use to walk, bike, take public transportation.	3,7	7,8	21,6	36,6	30,3
C20. When I go to school, I share the car with friends or neighbours.	31,4	15,3	15,6	19,3	18,4
C21. I buy or encourage my family to buy environmentally-friendly products (such as recycled paper and non-toxic cleaning products).	18,2	17,3	27,7	23,1	13,8

Advocate for change:					
C22. I have already taken part in a protest action in defence of the environment.	61,1	11,8	13,3	8,6	5,2
C23. I publish posts in my social media about environmental causes.	60,5	18,7	11,5	5,2	4,0
C24. I participate in environmental projects at my school.	22,5	19,9	29,1	15,6	13,0

As before, to better visualise the above responses, on a Likert scale, a colour chart was drawn up where red corresponds to "Never" and dark green to "Always".

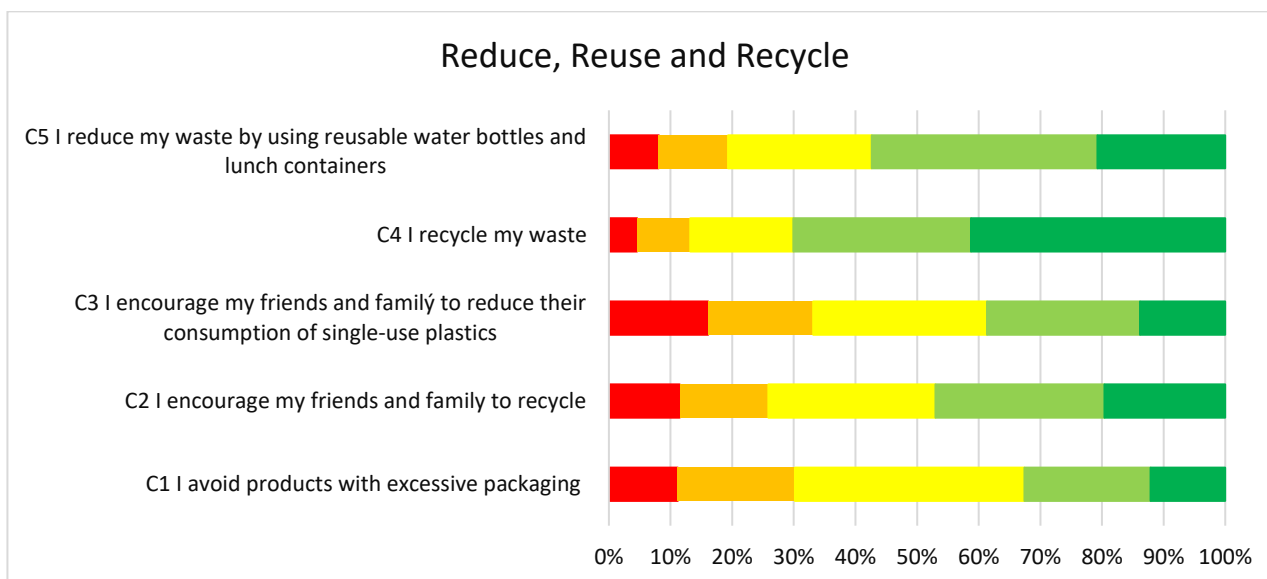


Figure 6 - Percentage of answers in each item of the behaviour (reduce, reuse and recycle) related question.

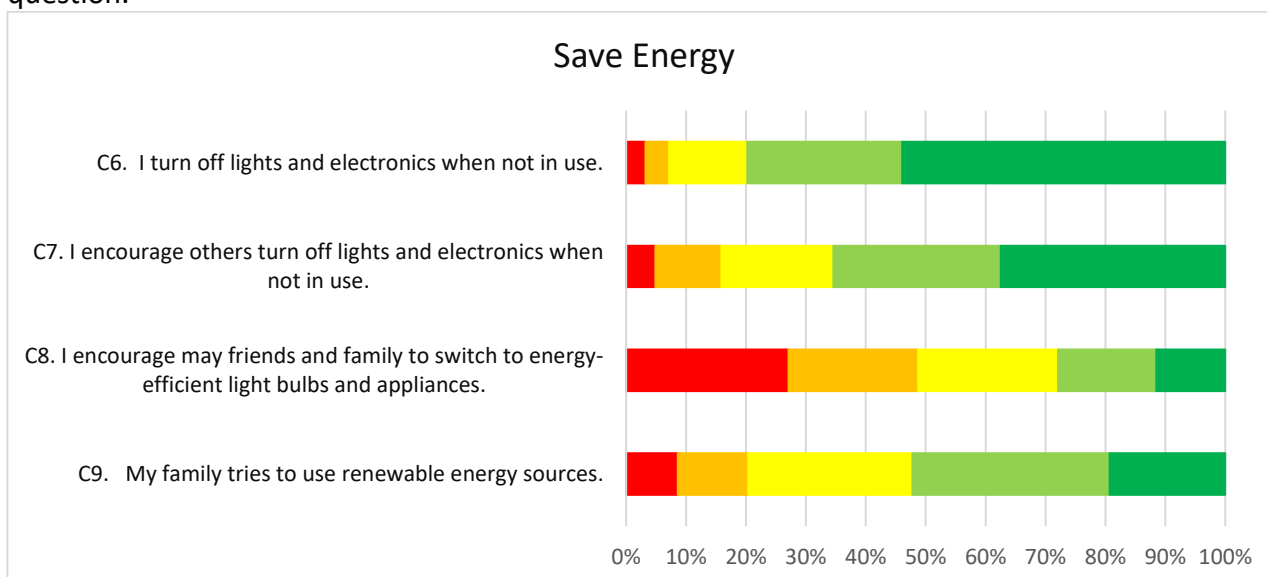


Figure 7 - Percentage of answers in each item of the behaviour (save energy) related question.

Legend: Red: strongly disagree; Orange: disagree; Yellow: neither agree nor disagree; Light green: agree; Dark green: strongly agree.

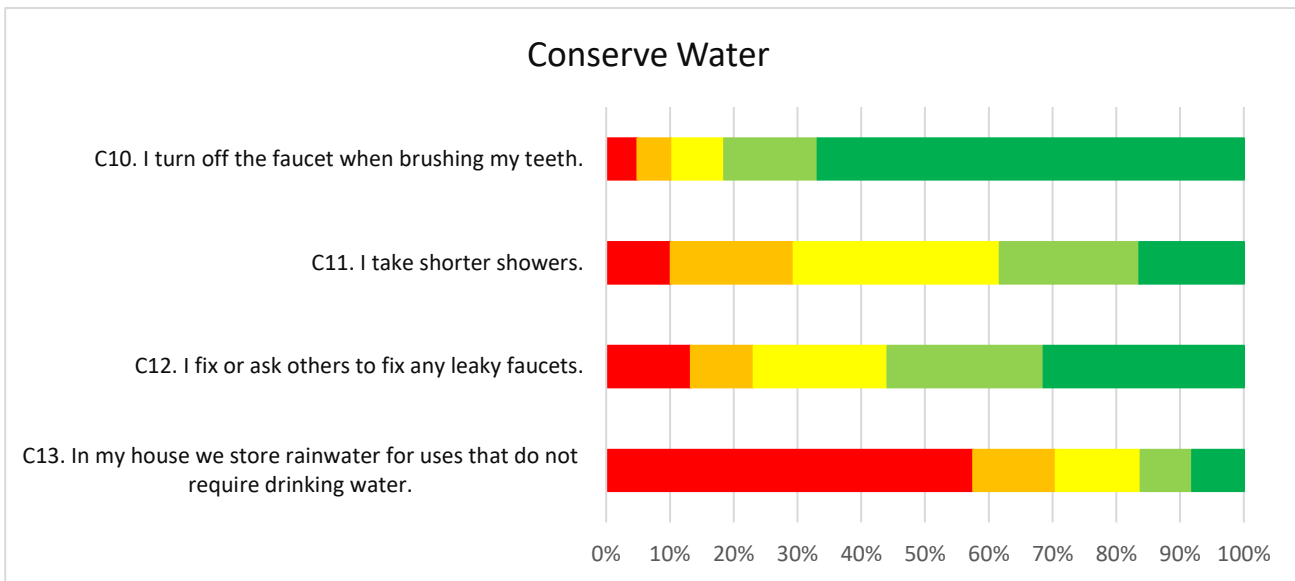


Figure 8 - Percentage of answers in each item of the behaviour (conserve water) related question.

Legend: Red: strongly disagree; Orange: disagree; Yellow: neither agree nor disagree; Light green: agree; Dark green: strongly agree.



Figure 9 - Percentage of answers in each item of the behaviour (support local food) related question.

Legend: Red: strongly disagree; Orange: disagree; Yellow: neither agree nor disagree; Light green: agree; Dark green: strongly agree.

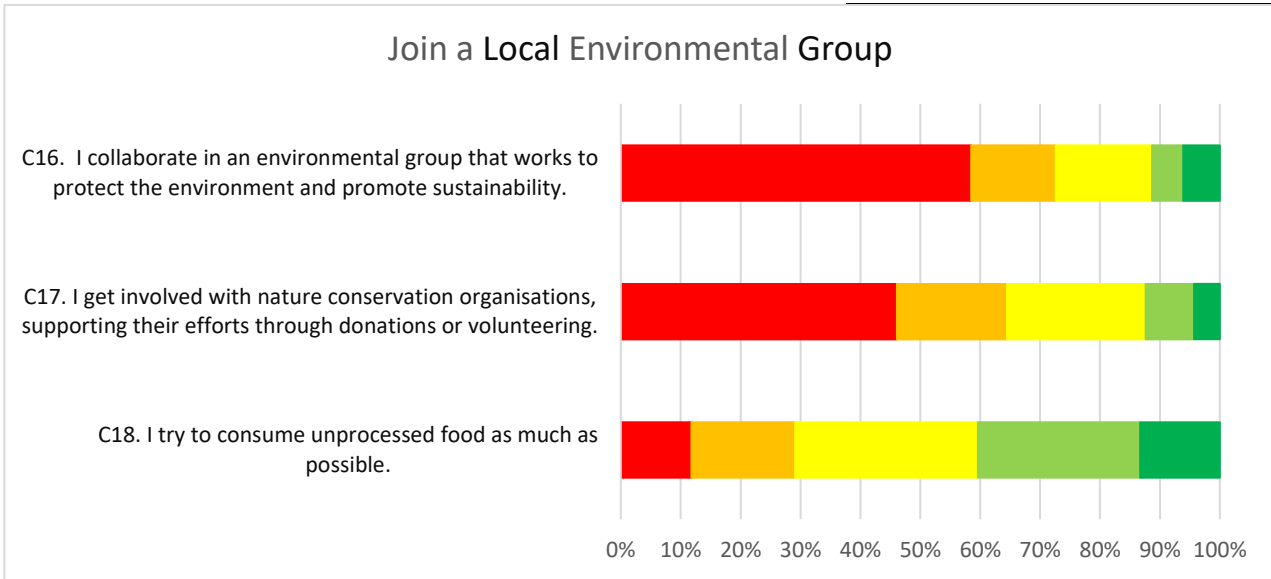


Figure 10 - Percentage of answers in each item of the behaviour (join local environmental group) related question.

Legend: Red: strongly disagree; Orange: disagree; Yellow: neither agree nor disagree; Light green: agree; Dark green: strongly agree.

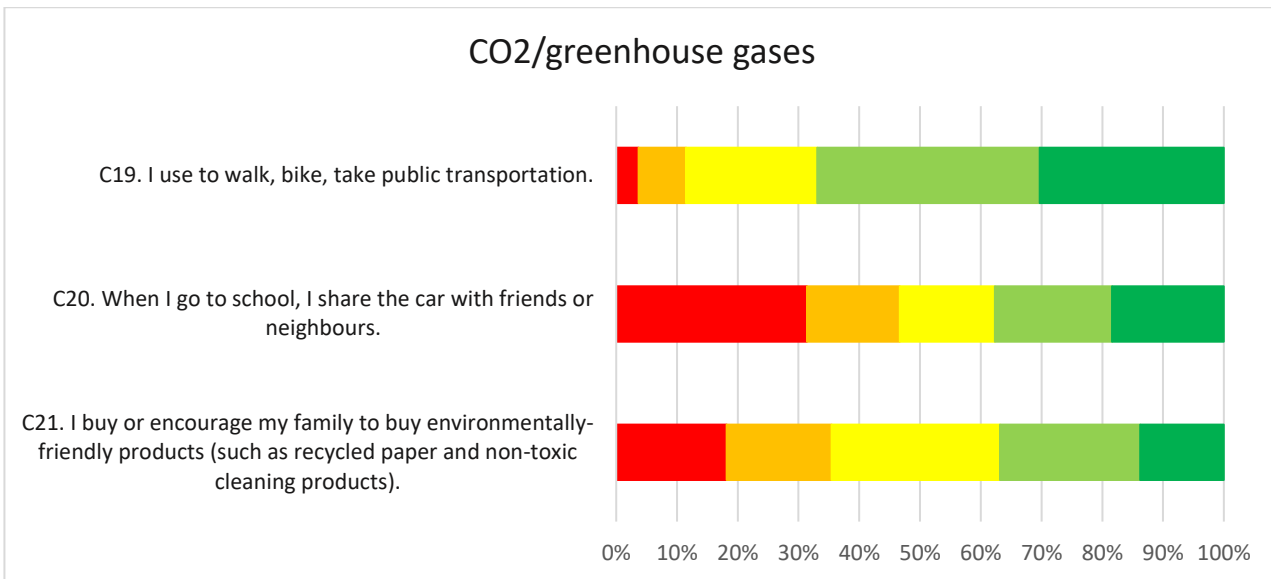


Figure 11 - Percentage of answers in each item of the behaviour (CO<sub>2</sub> / greenhouse gases) related question.

Legend: Red: strongly disagree; Orange: disagree; Yellow: neither agree nor disagree; Light green: agree; Dark green: strongly agree.

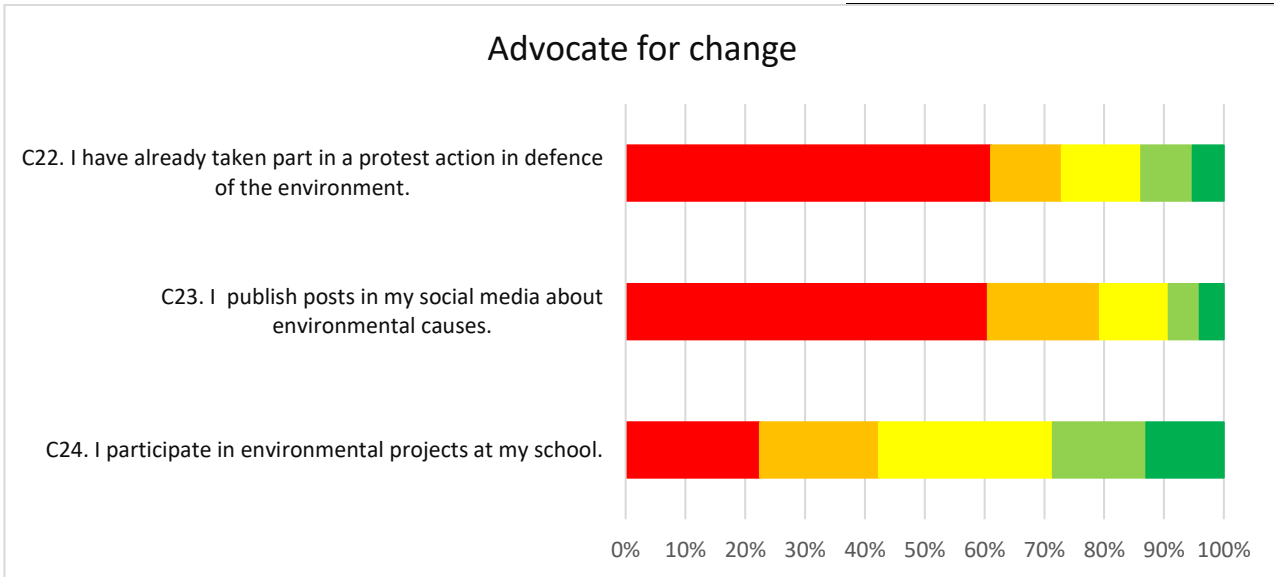


Figure 12 - Percentage of answers in each item of the behaviour (advocate for change) related question.

Legend: Red: strongly disagree; Orange: disagree; Yellow: neither agree nor disagree; Light green: agree; Dark green: strongly agree.

Regarding the Behavior section, in general, students recycle and engage in energy-saving behavior. However, 15 to 20% do not encourage their family and/or friends to do the same. Also, more than 50% of the students never or rarely get involved in activities related to gardening and growing fruits and vegetables.

Only 16.2% of the students store rainwater in the house for uses that do not require drinking water. Thus, young people should be encouraged to reuse water.

Although students consider it a positive attitude to join an environmental group, 58.5% of students never collaborate with an environmental group that works to protect the environment and promote sustainability.

Only 37,7% of participants always or often share the car with friends or neighbors. 61,1% of the participants have never taken part in a protest action in defence of the environment. Given that today's youth are extremely connected to social networks it is strange that 79,2% have never or rarely published posts on social media about environmental causes.



## 4.2 Students' responses by country (Students aged 15-17 only)

Cross tabulations (country vs. school year; country vs. age; age vs. year of schooling) show that the samples from the three countries are very heterogeneous in terms of age and education (Tables 35 to 37). Thus, it does not make much sense to compare all responses from the three countries. To compare the responses from the three countries, it would be better to select the age group 15-17 years.

Table 35 - Cross table country vs. school year.

	School_year							Total
	5th	6th	7th	8th	9th	10th	11th	
<b>Portugal</b>	11	29	-	-	-	75	20	<b>135</b>
<b>Greece</b>	4	-	-	-	4	31	22	<b>61</b>
<b>Italy</b>	59	36	36	19	1	-	-	<b>151</b>
<b>Total</b>	<b>74</b>	<b>65</b>	<b>36</b>	<b>19</b>	<b>5</b>	<b>106</b>	<b>42</b>	<b>347</b>

Table 36 - Cross table country vs. age.

	Age*							Total
	n.a.	9-12	14	15	16	17	18-19	
<b>Portugal</b>	1	40	1	38	50	4	1	<b>135</b>
<b>Greece</b>	-	1	-	19	24	17	-	<b>61</b>
<b>Italy</b>	-	-	40	47	28	26	9	<b>151</b>
<b>Total</b>	<b>1</b>	<b>41</b>	<b>41</b>	<b>104</b>	<b>102</b>	<b>47</b>	<b>10</b>	<b>347</b>

Table 37 - Cross table age vs. year of schooling.

Age	School_year							Total
	5th	6th	7th	8th	9th	10th	11th	
<b>9</b>	-	1	-	-	-	-	-	<b>1</b>
<b>10</b>	4	-	-	-	-	-	-	<b>4</b>
<b>11</b>	6	13	-	-	-	1	-	<b>20</b>
<b>12</b>	1	15	-	-	-	-	-	<b>16</b>
<b>14</b>	40	-	-	-	-	-	1	<b>41</b>
<b>15</b>	19	29	-	-	2	53	1	<b>104</b>
<b>16</b>	4	7	20	-	2	43	26	<b>102</b>
<b>17</b>	-	-	16	10	-	8	13	<b>47</b>
<b>18</b>	-	-	-	9	-	-	1	<b>10</b>
<b>19</b>	-	-	-	-	1	-	-	<b>1</b>
<b>Total</b>	<b>74</b>	<b>65</b>	<b>36</b>	<b>19</b>	<b>5</b>	<b>105</b>	<b>42</b>	<b>346</b>

From the analysis of the three tables above, there is some doubt as to whether the years of schooling actually represent the same level for the three countries.

Table 38 presents the distribution of pupils, aged 15 to 17, across the three countries.

Table 38 - Distribution of students, aged 15-7 years, by country.

Country	n	%
Portugal	92	36,4
Greece	60	23,7
Italy	101	39,9
Total	253	100,0

To test if there are statistically significant differences between countries regarding the question "How do you feel, when you think about climate change", the non-parametric Chi-square test was used. This test compares the proportion of responses for a given item, and there are statistically significant differences when  $p < 0.05$ . Results are based on two-sided tests (Bonferroni correction) for comparisons of country proportions.

Table 39 presents the proportion of students from each country with the sentiment mentioned in the first column. In the last column are the countries for which there are differences with statistical significance. To better visualize, the differences with statistical significance are marked in green and the highest proportion is indicated in bold.

Table 39 - Proportion of students from each country with the identified sentiment.

Feelings	Proportion			p<.05
	Portugal A	Greece B	Italy C	
Fear	.29	.27	.38	
Sadness	.45	.30	.36	
Anxious	.26	<b>.52</b>	.38	(B,A)
Guilty	.26	.17	.31	
Hopelessness	.14	<b>.18</b>	.06	(B,C)
Powerless	.11	.22	<b>.38</b>	(C,A)
Anger	.20	.13	.15	
Worry	<b>.82</b>	.53	.79	(A,B) (A,C)
Powerful	.05	.02	.03	
Optimistic	.11	<b>.18</b>	.03	(B,C)
Hopeful	.14	.07	<b>.21</b>	(C,B)
Indifferent	.17	<b>.25</b>	.06	(B,A) (B,C)

Greek students are more anxious than Portuguese about climate change and there are differences with statistical significance. Similarly, Greek students show more hopelessness, with statistically significant differences compared to Italian students. Approximately 25% of the students from the three countries are optimistic or hopeful. 25% of the Greek students say they are indifferent to climate change, with statistically significant differences compared to the Portuguese (17%) and to the Italians (6%).

## Section A – Knowledge

The non-parametric independence Chi-square test was also used to compare if the response was independent of the country. Table 40 only shows the questions where there are statistically significant differences in responses ( $p < .05$ ). The country with the highest proportion of correct answers is indicated in bold.

Table 40 - Proportion of correct answers for the three countries (P: Portugal; G: Greece; I: Italy)

Questions	Proportion		
	P	G	I
A1. Name the materials which correspond to the green, blue and yellow recycling bins:	<b>.94</b>	.20	.83
A2. What is the 5 R's policy?	.23	.07	<b>.66</b>
A3. Which item cannot be recycled?	<b>.78</b>	.65	.47
A4. According to the UN (United Nations) what is the average daily consumption of water per person (counting hygiene and drinking)?	<b>.51</b>	.20	.28
A5. Water is an important resource for maintaining the ecosystem and life. A human being can go without eating food for 1 to 2 months, but without drinking can only go:	<b>.92</b>	.70	.79
A6. What is the percentage of potable water on earth?	<b>.58</b>	.27	.23
A7. Which material decomposes most quickly in nature?	<b>.74</b>	.40	.55
A8. Which of these materials takes the longest to decompose in nature?	<b>.48</b>	.32	.20
A9. What is the greenhouse effect?	<b>.87</b>	.62	<b>.87</b>
A10. Which activities are the largest contributors of greenhouse gases?	<b>.15</b>	.08	.12
A11. Carbon dioxide (CO <sub>2</sub> ) is:	<b>.88</b>	.55	.73
A12. Which of the following gases does not contribute to the greenhouse effect?	<b>.40</b>	.15	.18
A13. Fires release carbon stored in plants and contribute to the greenhouse effect.	.69	.58	<b>.79</b>
A15. The risk of soil desertification, of arid and semi-arid areas, is more serious in Southern Europe (Portugal, Spain, Italy and Greece) than in Northern Europe.	<b>.80</b>	.53	.74
A16. One consequence of climate change is the increase of forest fires.	<b>.90</b>	.65	.87
A17. What are the consequences of the ascent of the middle sea level?	<b>.70</b>	.45	.46
A18. Desertification leads to loss of biodiversity (fewer plants and animals)	.61	<b>.68</b>	.93
A19. Wildfires affect biodiversity.	<b>.97</b>	.67	.80
A20. Ladybugs can replace the use of chemical insecticides in agriculture.	<b>.51</b>	.30	.47
A21. Which kind of agriculture is more sustainable?	.92	.63	<b>.95</b>

Greek students show lower percentages of knowledge. This might be due to differences in the syllabus on environmental issues in schools.

To test if there are statistically significant differences between countries regarding the of multiple answer question "Which renewable energy sources do you know? (Choose all you know)", the non-parametric Chi-square test was used. This test compares the proportion of responses for a given item, and there are statistically significant differences when  $p < 0.05$ . Results are based on two-sided tests (Bonferroni correction) for comparisons of country proportions.

Table 41 shows the percentage of students in each country who know about the energy mentioned in the first column. In the last column are the countries for which there are differences with statistical significance. To better visualize, the differences with statistical significance are marked in green and the highest proportion is indicated in bold.

Table 41 - Percentage of students in each country who say they know about renewable energy mentioned.

Energy kind	Country			p<.05
	P (A)	G (B)	I (C)	
Solar energy	<b>99</b>	85	<b>98</b>	(A,B) (C,B)
Wind energy	96	90	<b>97</b>	
Geothermal energy	<b>80</b>	68	76	
Hydropower	<b>77</b>	71	<b>94</b>	(C,A) (C,B)
Biomass energy	46	48	<b>60</b>	
Ocean energy	<b>65</b>	38	58	(C,B)(A,B)

There are statistically significant differences between countries regarding the knowledge of the following types of energy: solar energy - Portugal and Italy have a higher percentage than Greece; hydropower - Italy has a higher percentage than Portugal and Greece; Ocean Energy - Portugal and Italy have a higher percentage than Greece.

## Section B – Attitudes

The non-parametric independence Chi-square test was also used to compare if the response was independent of the country. Table 42 only shows the questions where there are statistically significant differences in responses ( $p < 0.05$ ). The country with the highest proportion of correct answers is indicated in bold.

Table 42 - Proportion of correct answers for the three countries.

Questions	Proportion		
	P	G	I
Which of these is not sustainable?	<b>.88</b>	.53	.79

What can we do to save electricity?	.96	.67	<b>.97</b>
Which one of these increases the level of carbon dioxide in our atmosphere?	<b>.75</b>	.43	.66

For the Likert scale responses, the mean value for each item/question was determined. The One-way ANOVA test with Bonferroni multiple comparisons (two-sided test) was used to compare the means of the three countries. Table 43 presents the mean values for each country and the last column shows the countries with statistically significant differences ( $p < 0.05$ ). The highest mean is also indicated in bold.

Table 43 - Mean values and indication of countries where there are differences with statistical significance.

Questions	mean			p<.05
	P	G	I	
I think that growing our own fruits and vegetables is a great way to support sustainable agriculture and reduce your carbon footprint.	<b>4.52</b>	3.40	4.11	(P,G,I)
I think that plant a garden can help support local ecosystems.	<b>4.37</b>	3.45	4.03	(P,G,I)
Joining a group can be a great way to make a positive impact and meet like-minded people.	<b>4.16</b>	3.57	3.56	(P,G) (P,I)
I think it is important to speak up and advocate for environmental issues.	<b>4.37</b>	3.82	4.03	(P,I) (P,G)
I think it is important to choose products from companies that prioritize sustainability and environmental protection.	4.29	3.68	<b>4.30</b>	(I,G) (P,G)
I think it is OK that each one of us uses as much water as we want.	2.12	2.65	<b>2.02</b>	(I,G) (P,G)

In the Attitude section, there were 9 questions with statistically significant differences between countries: with higher scores (proportion or mean) was Portugal with 6 questions, Italy with 3 and Greece with zero. Greek students show less pro-environmental attitudes than Portuguese and Italian students.

## Section C - Behavior

Again, for the Likert scale responses, the mean value for each item/question was determined. The One-way ANOVA test with Bonferroni multiple comparisons (two-sided test) was used to compare the means of the three countries. Table 44 presents the mean values for each country and the last column shows the countries with statistically significant differences ( $p < 0.05$ ). The highest mean is also indicated in bold.

Table 44 - Mean values and indication of countries where there are differences with statistical significance.

Questions	mean			p<0,05
	P	G	I	
I reduce my waste by using reusable water bottles and lunch containers.	<b>3.97</b>	2.80	3.43	(P,G,I)
I recycle my waste.	3.97	3.48	<b>4.03</b>	(P,G) (I,G)
I turn off lights and electronics when not in use.	4.34	3.62	<b>4.37</b>	(P,G) (I,G)
I encourage others turn off lights and electronics when not in use.	<b>4.14</b>	3.32	3.87	(P,G) (I,G)
I encourage my friends and family to switch to energy-efficient light bulbs and appliances.	<b>2.87</b>	2.60	2.41	(P,I)
I turn off the faucet when brushing my teeth.	<b>4.72</b>	3.77	4.39	(P,G) (I,G)
I take shorter showers.	<b>3.26</b>	2,72	2.92	(P,G)
I fix or ask others to fix any leaky faucets.	<b>3.95</b>	2.87	3.39	(P,G,I)
In my house we store rainwater for uses that do not require drinking water.	<b>2.18</b>	1.92	1.66	(P,I)
I collaborate in an environmental group that works to protect the environment and promote sustainability.	1.85	<b>2.08</b>	1.54	(G,I)
I use to walk, bike, take public transportation.	3.98	3.30	<b>4.02</b>	(P,G) (I,G)

Concerning Behavior, 11 out of 24 questions had differences with statistical significance: Highest scores (mean): Portugal with 7 questions; Italy with 3 questions and Greece with 1 question.

### 4.3 Students responses by gender (Students aged 15-17 only)

To analyze by gender, "other gender" was excluded because the sample was too small, only one student. This way only the two genders were analyzed and compared: female and male. The gender distribution of the students aged between 15 and 17 years old is presented in Table 45.

Table 45 - Distribution of students, aged 15-17 years, by gender.

Gender	n	%
Female	175	69,2
Male	78	30,8
Total	253	100,0

To test if there were statistically significant differences between the two genders regarding the question "How do you feel, when you think about climate change", the non-parametric Chi-square test was used. This test compares the proportion of answers and there are statistically significant differences when  $p < 0.05$ . Results are based on two-sided tests (Bonferroni correction) for comparisons of country proportions. Table 46 presents the proportion of students of each gender with the feeling mentioned in the first column. In the last column it is indicated if there are differences with statistical significance ( $p < 0.5$ ). The feelings with differences with statistical significance are also shaded in green and highest proportion is indicated in bold.

Table 46 - Proportion of students from each gender with the identified sentiment.

Feelings	Proportion		
	Female	Male	
Fear	<b>.36</b>	.23	$p < .05$
Sadness	<b>.46</b>	.19	$p < .05$
Anxious	<b>.42</b>	.24	$p < .05$
Guilty	<b>.29</b>	.18	-
Hopelessness	<b>.13</b>	.09	-
Powerless	<b>.26</b>	.19	-
Anger	<b>.19</b>	.09	$p < .05$
Worry	<b>.81</b>	.60	$p < .05$
Powerful	.03	<b>.05</b>	-
Optimistic	.06	<b>.17</b>	$p < .05$
Hopeful	.14	<b>.21</b>	-
Indifferent	.05	<b>.36</b>	$p < .05$

In relation to gender, girls are more worried, sad, anxious, fearful and angry than boys. There are statistically significant differences of these feelings in both genders. On the other hand, boys are more indifferent and optimistic than girls, and there are also differences with statistical significance. This result is in line with those found by UNESCO (2022) girls are less confident in dealing with climate change based on what they have learned at school than boys.

## Section A – Knowledge

The non-parametric Chi-square test was used to compare the responses of the two genders. Table 47 only shows the questions where there are statistically significant differences in responses ( $p < .05$ )

Table 47 - Proportion of correct answers for the two genders.

Questions	proportion	
	F	M
A2. What is the 5 R's policy?	<b>.41</b>	.26
A6. What is the percentage of potable water on earth?	.32	<b>.46</b>
A7. Which material decomposes most quickly in nature?	<b>.62</b>	.50
A12. Which of the following gases does not contribute to the greenhouse effect?	.21	<b>.37</b>
A14. The earth's plants have absorbed carbon dioxide that humans released into the atmosphere over the past few decades by approximately:	<b>.29</b>	.15
A16. One consequence of climate change is the increase of forest fires.	<b>.87</b>	.74
A18. Desertification leads to loss of biodiversity (fewer plants and animals)	<b>.80</b>	.65

In the Knowledge section, there were 7 questions with statistically significant gender differences: in 5 questions female have a higher proportion of correct answers than men and only in 2 questions do male have a higher proportion than women.

## Section B - Attitudes

The non-parametric Chi-square test was also used. Table 48 only shows the question where there is statistically significant difference ( $p < 0,05$ ).

Table 48 - Proportion of correct answers for both genders on the question where there is a difference with statistical significance.

Question	proportion	
	F	M
B3. What can we do to save electricity?	<b>.93</b>	.81

For the Likert scale responses, the mean value for each item/question was determined. Then the independent T test was used to compare the means for the two gender. Only questions where there are statistically significant differences are presented in Table 49.



Table 49 - Means for both genders on the questions where there are differences with statistical significance.

Questions	Mean	
	Female	Male
B54. I think it is important to speak up and advocate for environmental issues.	<b>4.25</b>	3.78
B55. I think it is important to choose products from companies that prioritize sustainability and environmental protection.	<b>4.31</b>	3.79
B56. I think it is OK that each one of us uses as much water as we want.	<b>2.05</b>	2.56

In the Attitude section, there were 4 questions with statistically significant differences between the two genders; the female group has a higher proportion of correct answers than the male group in all 4 questions.

## Section C - Behavior

The independent T test was used to compare the responses for the two gender. Only questions where there are statistically significant differences are presented in Table 50.

Table 50 - Mean values for both genders.

Question	Mean	
	Female	Male
C1. I reduce my waste by using reusable water bottles and lunch containers.	<b>3.67</b>	3,04
C3. I encourage my friends and family to reduce their consumption of single-use plastics.	<b>3.27</b>	2.54
C4. I encourage my friends and family to recycle.	<b>3.49</b>	2.78
C5. I avoid products with excessive packaging.	<b>3.10</b>	2.67
C6. I turn off lights and electronics when not in use.	<b>4.34</b>	3.81
C7. I encourage others turn off lights and electronics when not in use.	<b>4.01</b>	3.45
C17. I get involved with nature conservation organizations, supporting their efforts through donations or volunteering.	<b>2,12</b>	1.81
C21. I buy or encourage my family to buy environmentally-friendly products (such as recycled paper and non-toxic cleaning products).	<b>3.13</b>	2.60
C24. I participate in environmental projects at my school.	<b>2.99</b>	2.49

In the Behavior section, there were 9 questions with statistically significant differences between the two genders: the female group presents a mean of all questions greater than the male group.

## 4.4 Students responses by five age groups

As the sample has few students aged 9, 10, 18 and 19, in order to be able to compare the students by age or age group, they were grouped into 5 groups as follows: from 9 to 12 years; 14 years; 15 years; 16 years and from 17 to 19 years. The distribution of students by age groups is as shown in Table 51.

Table 51 - Distribution of students by five age groups.

Age (years)	n	%
9-12	41	11,8
14	41	11,8
15	104	30,1
16	102	29,5
17-19	58	16,8
Total	346	100,0

Table 52 presents the proportion of students in a given age group with the sentiment mentioned in the first column. The highest proportion is indicated in bold.

Table 52 - Proportion of students from each age group with the identified sentiment.

Feelings	Age (years)				
	9-12 (A)	14 (B)	15 (C)	16 (D)	17-19 (E)
<b>Fear</b>	.05	.32	<b>.36</b>	.28	.31
<b>Sadness</b>	.29	.34	<b>.41</b>	.34	.38
<b>Anxious</b>	.34	.32	<b>.43</b>	.33	.29
<b>Guilty</b>	.17	.24	.27	.22	<b>.31</b>
<b>Hopeleness</b>	.12	.07	<b>.13</b>	.11	.10
<b>Powerless</b>	.02	<b>.37</b>	.29	.19	.24
<b>Anger</b>	<b>.29</b>	.17	.21	.11	.17
<b>Worry</b>	.46	.61	.69	<b>.77</b>	.72
<b>Powerless</b>	<b>.05</b>	.00	<b>.05</b>	.01	<b>.05</b>
<b>Optimistic</b>	.15	.07	<b>.13</b>	.04	.12
<b>Hopeful</b>	.12	<b>.32</b>	.18	.10	.26
<b>Indifferent</b>	<b>.22</b>	.10	.17	.09	<b>.22</b>

To test whether there are statistically significant differences between the age groups with regard to the question 'How do you feel, when you think about climate change', the non-parametric Chi-square test with Bonferroni correction was used. This test compares the proportion of responses between groups, and statistically significant differences were recorded when  $p < 0,05$ .

Table 53 presents the groups for which there are differences with statistical significance, presented the p value in parentheses.

Table 53 - Comparisons of column proportions, based on two-sided tests, using Bonferroni correction. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion.

Feelings	Age (years)				
	9-12 (A)	14 (B)	15 (C)	16 (D)	17-19 (E)
Fear		A(.017)	A(.002)	A(.020)	A(.014)
Sadness					
Anxious					
Guilty					
Hopelensess					
Powerless		A(.001)	A(.005)		A(.030)
Anger					
Worry				A(.003)	
Powerful		1			
Optimistic					
Hopeful		D(.013)			
Indifferent					

<sup>1</sup> This category is not used in comparisons because its column proportion is equal to zero.

## Section A – Knowledge

The non-parametric chi-square test of independence was also used to compare whether the answers to each question are independent of age group. Table 54 shows the questions where there are statistically significant differences ( $p < .05$ ) and other questions where it is not possible to apply the chi-square test because some age groups do not meet one of the requirements of that test (all categories of a variable must have an expected frequency greater than or equal to 5). When the requirement is not fulfilled in the last column it is marked with a).

Table 54 - Proportion of correct answers for the five age groups and p-value.

Questions	Age (years)					p
	9-12	14	15	16	17-19	
A1. Name the materials which correspond to the green, blue and yellow recycling bins	.90	.76	.76	.75	.59	a)
A2. What is the 5 R's policy?	.12	<b>.66</b>	.43	.27	.45	<.001
A3 Which item cannot be recycled?	.63	.56	.62	.68	.50	a)
A4. According to the UN (United Nations) what is the average daily consumption of water per person (counting hygiene and drinking)?	.34	.12	.42	.30	.22	a)
A5. Water is an important resource for maintaining the ecosystem and life. A human being can go without eating food for 1 to 2 months, but without drinking can only go:	.83	.85	.85	.79	.81	a)
A6. What is the percentage of potable water on earth?	.27	.10	.42	.35	.24	a)
A7 Which material decomposes most quickly in nature?	.76	.42	.61	.62	.48	a)

A8. Which of these materials takes the longest to decompose in nature?	.42	.10	.31	.38	.29	a)
A9. What is the greenhouse effect?	.61	.83	.83	.77	.86	a)
A10. Which activities are the largest contributors of greenhouse gases?	.02	.10	.14	.10	.14	a)
A11. Carbon dioxide (CO <sub>2</sub> ) is:	.44	.66	.79	.74	.62	a)
A12. Which of the following gases does not contribute to the greenhouse effect?	.10	.17	.22	.30	.22	a)
A13. Fires release carbon stored in plants and contribute to the greenhouse effect.	.49	.68	<b>.76</b>	.65	.67	<.001
A14. The earth's plants have absorbed carbon dioxide that humans released into the atmosphere over the past few decades by approximately:	.07	.20	.26	.27	.17	a)
A15. The risk of soil desertification, of arid and semi-arid areas, is more serious in Southern Europe (Portugal, Spain, Italy and Greece) than in Northern Europe.	.49	.68	.74	<b>.76</b>	.59	<.001
A16. One consequence of climate change is the increase of forest fires.	.71	.83	.88	.84	.69	a)
A17. What are the consequences of the ascent of the middle sea level?	.37	.39	.58	.51	.52	a)
A18. Desertification leads to loss of biodiversity (fewer plants and animals).	.81	.90	.76	.72	.83	a)
A19. Wildfires affect biodiversity.	.88	.76	.87	.85	.72	a)
A20. Ladybugs can replace the use of chemical insecticides in agriculture.	.27	.32	<b>.54</b>	.42	.31	<.001
A21. Which kind of agriculture is more sustainable?	.83	.83	<b>.94</b>	.83	.74	<.001

a) the statistical test cannot be applied, since the test requirements are not met.

The table 55 presents the percentage of pupils in a given age group who know the kind of renewable energy presented in the first column. Again, the highest percentage is indicated in bold.

Table 55 - Percentage of students in each age group who say they know about renewable energy mentioned.

Renewable	Age (years)				
	9-12 (A)	14 (B)	15 (C)	16 (D)	17-19 (E)
Solar energy	93%	95%	93%	96%	<b>97%</b>
Wind energy	73%	90%	94%	95%	<b>97%</b>
Geothermal energy	37%	76%	77%	<b>78%</b>	69%
Hydropower	61%	85%	86%	76%	<b>88%</b>
Biomass energy	32%	<b>63%</b>	54%	50%	57%
Ocean energy	34%	<b>63%</b>	62%	52%	53%

To test whether there are statistically significant differences between the age groups with regard to the question "Which renewable energy sources do you know? (Choose all you know)", the non-parametric Chi-square test with Bonferroni correction was used. This test compares the proportion of responses between groups, and statistically significant differences were recorded when  $p < 0.05$ .

The table 56 presents the groups for which there are differences with statistical significance, presented the p value in parentheses.

Table 56 - Comparisons of column proportions, based on two-sided tests, using Bonferroni correction. For each significant pair, the key of the category with the smaller column proportion appears in the category with the larger column proportion.

Renewable	Age (years)				
	9-12 (A)	14 (B)	15 (C)	16 (D)	17-19 (E)
Solar energy					
Wind energy			A( ,002)	A( ,002)	A( ,007)
Geothermal energy		A( ,004)	A( ,000)	A( ,000)	A( ,014)
Hydropower			A( ,007)		A( ,018)
Biomass energy		A( ,040)			
Ocean energy			A( ,023)		

The 9-12 group is the least aware of the different types of renewable energy: only 32% know about biomass energy; 34% about ocean energy and 37% about geothermal energy; 61% about hydropower and 73% about wind energy. This group presents lower percentages of knowledge of renewable energy than the other groups, with statistical significance.

## Section B – Attitudes

It is not possible to apply the chi-square test to questions with response options because some age groups do not meet one of the requirements of this test (all categories of a variable must have an expected frequency greater than or equal to 5).

For the Likert scale responses, the mean value for each item/question was determined. The One-way ANOVA test with Bonferroni multiple comparisons (two-sided test) was used to compare the means of the age groups. Table 57 presents the mean values for each age group and the last column shows the age groups with statistically significant differences ( $p < 0.05$ ). The highest mean is also indicated in bold.

Table 57 - Mean values and indication of age groups where there are differences with statistical significance.

Questions	Age (years)					P<.05
	9-12 (A)	14 (B)	15 (C)	16 (D)	17-19 (E)	
B52. I think that plant a garden can help support local ecosystems.	3.88	3.61	4.04	<b>4.09</b>	3.86	(B,C) (B,D)

## Section C – Behavior

As before, in the Likert scale responses, the mean value for each item/question was determined. The One-way ANOVA test with Bonferroni multiple comparisons (two-sided test) was used to compare the means of the age groups. Table 58 presents the mean values for each age group and the last column shows the age groups with statistically significant differences ( $p < 0.05$ ). The highest mean is also indicated in bold.

Table 58 - Mean values and indication of ages groups where there are differences with statistical significance.

	9-12 (A)	14 (B)	15 (C)	16 (D)	17-19 (E)	P<.05
C1. I reduce my waste by using reusable water bottles and lunch containers.	<b>3.78</b>	3.54	3.55	3.57	3.09	(A,E)
C4. I encourage my friends and family to recycle.	<b>3.73</b>	3.05	3.04	3.46	3.28	(A,C)
C11. I take shorter showers.	<b>4.07</b>	3.24	2.92	3.16	2.81	(A,B) (A,C) (A,D) (A,E)
C16. I collaborate in an environmental group that works to protect the environment and promote sustainability.	<b>2.59</b>	1.49	1.68	1.88	1.84	(A,B) (A,C) (A,D) (A,E)
C17. I get involved with nature conservation organisations, supporting their efforts through donations or volunteering.	<b>2.56</b>	1.78	1.92	2.10	2.03	(A,B) (A,C) (A,D)
C22. I have already taken part in a protest action in defence of the environment.	<b>2.46</b>	1.66	1.63	1.86	1.86	(A,B) (A,C)

There are 6 questions that show differences with statistical significance, with the youngest group, 9-12 years old, showing a highest mean in all six behaviors. The 9-12 age group is the one with the most environmentally friendly behaviors.

## 5. Discussion and Conclusions

There were 347 answers from students to the environmental questionnaire (43,5% from Italy, 38,9% from Portugal and 17,6% from Greece). Most students (60,9%) were female. Female gender is predominant in all three countries. The students are aged between 9 and 19 years, being the mean and standard deviation of the age 15,1 and 1,7 respectively. The level of education is from 5th to 11th.

The student samples from the three countries are very heterogeneous in terms of age and education. Thus, to compare the answers by gender and by country 253 students were selected, in the age range 15 to 17 years, obtaining 3 homogeneous samples.

Regarding feelings about climate change, 68,0% of students were worried, 36.7% were sad, 35.7% were anxious and 28.5% were fearful. When comparing the three countries, worry is the feeling with the highest percentage for all three nationalities. Greek students are more anxious than Portuguese about climate change and there are differences with statistical significance. Similarly, Greek students show more hopelessness, with statistically significant differences compared to Italian students. Approximately 25% of the students from the three countries are optimistic or hopeful. 25% of the Greek students say they are indifferent to climate change, with statistically significant differences compared to the Portuguese (17%) and to the Italians (6%).

With regard to gender, girls are more worried, sad, anxious, fearful and angry than boys, with differences of statistical significance. On the other hand, boys are more indifferent and optimistic than girls, also with statistical significance.

Looking at 5 age groups: 9-12, 14, 15, 16 and 17-19. Statistical tests indicate that:

- the 9-12 age group feels less fear than the other groups, with statistical significance;
- the 9-12 group feels less powerless than groups 14, 15 and 17-19, with statistical significance; - the 16 group is the most worried, the 10-12 group the least worried and there are differences with statistical significance between the two groups;
- group 14 is the most hopeful and group 16 is the least hopeful, with statistically significant differences between the two groups.

With regard to the questions in the Knowledge Section:

- Waste and recycle - 74.4% of students have knowledge about the colors of containers; 37.5% know what is the 5R's policy; 61.1% know that a used paper napkin cannot be recycled;
- Conserve water - 30,8% of students know the average daily consumption per person; 82,1% knows that a human being without water can only go 3-7 days; 31,7% knows the percentage of potable water on earth;
- Pollution - 58,2% of students know that paper decomposes more quickly than metal, wood or fabric cloth; 31,4% know that glass takes longer to decompose than food, drink cans or disposable nappy;
- CO<sub>2</sub>/greenhouse gases - 78.7% of students know what is the greenhouse effect; only 11% consider transport as the largest contributors of greenhouse gases; 68.9% know that carbon dioxide comes from various sources and activities; only 22.5% know that nitrogen is a gas that does not contribute to the greenhouse effect; 66.9% know that forest fires contribute to the greenhouse effect; 47% of students consider that plants absorb more CO<sub>2</sub> than they actually absorb and 31.1% don't even know how much they absorb;

Climate change - 68% of the students know that the risk of soil desertification is more serious in Southern Europe than Northern Europe; 88,8% know the consequences of the ascent of the middle sea level;

- Biodiversity - 77,8% of the students know that desertification leads to loss of biodiversity (fewer plants and animals); 82,4% know that wildfires affect biodiversity;

- Sustainable Agriculture - only 40,6% of students know that ladybugs can replace the use of chemical insecticides in agriculture; 84,7% that organic agriculture is the most sustainable kind of agriculture;

- Save energy - the renewable energy most known to students is solar energy (95.1%) followed by wind energy (92.2%). The least known renewable energy is biomass (52%) followed by ocean energy (54.6%)

Concerning questions on environmentally friendly attitudes: 68.9% of the students think it is not OK that each one uses as much water as he/she wants. In general students aware of the water shortage that some countries are suffering from. Attitudes are generally pro-environment: 76% to 83% ; 65% to 81% think that joining a local environmental group is positive.

Regarding the Behavior section, in general, students recycle and engage in energy-saving behavior. However, 15 to 20% do not encourage their family and/or friends to do the same. Also, more than 50% of the students never or rarely get involved in activities related to gardening and growing fruit and vegetables. Only 16.2% of the students store rainwater in house for uses that do not require drinking water. Thus, young people should be encouraged to reuse water. Although students consider it a positive attitude to join an environmental group, 58.5% of students never collaborate with an environmental group that works to protect the environment and promote sustainability.

Only 37,7% of participants always or often share the car with friends or neighbors. 61,1% of the participants have never taken part in a protest action in defense of the environment. Given that today's youth are extremely connected to social networks it is strange that 79,2% have never or rarely published posts on social media about environmental causes.

#### Comparing the countries

Greek students show lower percentages of knowledge. This might be due to differences in the syllabus on environmental issues in schools. In the Attitude section: there were 9 questions with statistically significant differences between the countries: with higher scores (proportion or mean) was Portugal with 6 questions, Italy with 3 and Greece with zero. Concerning Behavior, 11 out of 24 questions had differences with statistical significance: Highest scores (mean): Portugal with 7 questions; Italy with 3 questions and Greece with 1 question.

#### Comparing the genders

The results indicate that girls are more sensitive to environmental issues than boys. In the Knowledge section, there were 7 questions with statistically significant differences between the two genders: females had a proportion of correct answers greater than males in 5 questions; only in 2 questions did males have a higher proportion than females. In the Attitude section, there were 4 questions with statistically significant differences between the 2 genders; the female group had a proportion of correct answers greater than the male group in all questions. In the Behavior section, there were 9 questions with statistically significant differences between the two genders: the female group presented a mean of all questions greater than the male group.

#### Comparing the different age groups



The 9-12 group is the least aware of renewable energy types: only 32% know about biomass energy; 34% ocean energy and 37% about geothermal energy; 61% hydropower and 73% about wind energy. This group shows lower percentages of knowledge of renewable energies than the other groups, with statistical significance.

However, it is group 9-12 which has more environmentally friendly behaviors. This group presents differences with statistical significance from the other groups in 6 behaviors.

The results obtained per country, derive from a single school's response to the survey and reflect the particular conditions of that school. Schools with more pro-environmental measures are expected to have better results.

For a more robust and sustained statistical analysis, it would be necessary to extend the sample to a wider and more diverse set of schools, which could be representative of the country's student population. In the analysis presented in this study, the concept of population refers to the population of the educational establishment surveyed, given that the sample is representative only of the population of each one of the schools.

In conclusion, regarding the feelings towards climate change, concerns prevail, especially among the female gender, while male individuals are more indifferent and optimistic across the three countries. The results show that young people are aware of environmental problems and are receptive to tools that increase knowledge about them, help them adopt best practices and tools that empower them to deal with change.

Regarding knowledge, students have basic knowledge about recycling (3Rs) but fail in the 5Rs and in the treatments used, which refer to topics such as composting, biological treatments, and reuse circuits.

In relation to water, the survey shows opportunities in knowledge. Although respondents are aware of the importance of water for human life and life on earth in general, they are unaware of its daily expenditure and the percentage of drinking water available. They are also unaware of ways to store and save water.

With regard to greenhouse gases, the level of knowledge is high but some origins are undervalued, such as transport, while the role that plants can play as carbon sinks appears exacerbated.

Young respondents perform well in the survey but also present opportunities to improve their behavior, attitudes and knowledge regarding the topics covered. Although attitudes score excellent in most cases, the actions do not always accompany them, so tools to support better performances and greater interventions are desirable.

Based on the results obtained, we propose the creation of educational scenarios in the following areas: waste management; water; renewable energies; importance of ecosystems and in particular forests; sustainable agriculture; sustainable cities; good environmental practices; and empowerment tools.

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## **Annex I - Environment Survey**

**English version**  
**Greek version**  
**Portuguese version**  
**Italian version**



English version

**Thank you for answering this questionnaire.**

**Please answer all questions, even you are not quite sure.**

**The questionnaire is intended to create an online game for environmental education and your contribution is very important.**

**Enjoy your work!**

**Student identification:**

Age:

Gender:

Country:

School year: (Options: 5<sup>th</sup> 6<sup>th</sup> 7<sup>th</sup> 8<sup>th</sup> 9<sup>th</sup> 10<sup>th</sup>)

0. How do you feel, when you think about climate change? (Choose all you feel)

- a) Fear
- b) Sadness
- c) Anxious
- d) Guilty
- e) Hopelessness
- f) Powerless
- g) Anger
- h) Worry
- i) Powerful
- j) Optimistic
- k) Hopeful
- l) Indifferent

### A - Knowledge

(choose only one answer)

#### Waste and recycling:

A1. Name the materials which correspond to the green, blue and yellow recycling bins

(Different colours in Portugal, Greece and Italy)

- a) Plastic, glass and paper
- b) Glass, paper and plastic
- c) Paper, glass and plastic (or a photograph with the items in order)
- d) I don't know

A2. What is the 5 R's policy?

- a) Refuse, Reduce, Reuse, Repurpose, Recycle



- b) Repair, Reduce, Reuse, Rot, Recycle
- c) Refuse, Reduce, Reuse, Rot, Recycle
- d) I don't know

A3. Which item cannot be recycled?

- a) Bottle cap
- b) Used newspaper
- c) Used paper napkin
- d) Used plastic bucket
- e) I don't know

#### Conserve water:

A4. According to the UN (United Nations) what is the average daily consumption of water per person (counting hygiene and drinking)?

- a) 50 l/day
- b) 200 l/day
- c) 110 l/day
- d) 150 l/day
- e) I don't know

A5. Water is an important resource for maintaining the ecosystem and life. A human being can go without eating food for 1 to 2 months, but without drinking can only go:

- a) 3 to 7 days
- b) 1 day
- c) 30 days
- d) I don't know

A6. What is the percentage of potable water on earth?

- a) 20%
- b) 3%
- c) less than 1%
- d) I don't know

#### Pollution

A7. Which material decomposes most quickly in nature?

- a) paper
- b) fabric cloth
- c) metal
- d) wood
- e) I don't know

A8. Which of these materials takes the longest to decompose in nature?

- a) A soft drink can
- b) food scraps
- c) disposable nappy



- d) glass
- e) I don't know

### CO<sub>2</sub>/greenhouse gases

#### A9. What is the greenhouse effect?

- a) Certain gases in the atmosphere trap heat (infrared radiation) and warm the earth.
- b) The sun is emitting more energy in recent years.
- c) Certain gases in the atmosphere that protect us from ultraviolet radiation.
- d) I don't know

#### A10. Which activities are the largest contributors of greenhouse gases?

- a) Deforestation
- b) Electricity generation
- c) Industry
- d) Transportation
- e) Agriculture
- f) I don't know

#### A11. Carbon dioxide (CO<sub>2</sub>) is:

- a) Caused by human activities (industry and transports)
- b) Caused by forest fires
- c) Released by volcanoes
- d) All of the above
- e) I don't know

#### A12. Which of the following gases does not contribute to the greenhouse effect?

- a) Carbon dioxide
- b) Nitrogen
- c) Water vapor
- d) Methane
- e) I don't know

#### A13. Fires release carbon stored in plants and contribute to the greenhouse effect.

- a) True
- b) false
- c) I don't know

#### A14. The earth's plants have absorbed carbon dioxide that humans released into the atmosphere over the past few decades by approximately:

- a) 25%
- b) 50%
- c) 75%
- d) 100%
- e) I don't know

### Climate Change



A15. The risk of soil desertification, of arid and semi-arid areas, is more serious in Southern Europe (Portugal, Spain, Italy and Greece) than in Northern Europe

- a) True
- b) false
- c) I don't know

A16. One consequence of climate change is the increase of forest fires.

- a) True
- b) False
- c) I don't know

A17. What are the consequences of the ascent of the middle sea level?

- a) coastal erosion
- b) under water coastal towns
- c) worsen freshwater quality
- d) all of the above
- e) I don't know

### Biodiversity

A18. Desertification leads to loss of biodiversity (fewer plants and animals)

- a) true
- b) false
- c) I don't know

A19. Wildfires affect biodiversity.

- a) True
- b) False
- c) I don't know

### Sustainable Agriculture

A20. Ladybugs can replace the use of chemical insecticides in agriculture.

- a) true
- b) false
- c) I don't know

A21. Which kind of agriculture is more sustainable?

- a) intensive subsistence agriculture
- b) organic agriculture
- c) commercial agriculture
- d) I don't know

### Save energy:

A22. Which renewable energy sources do you know? (Choose all you know)

- a) Solar energy
- b) Wind energy
- c) Geothermal energy
- d) Hydropower
- e) Biomass energy





- f) Ocean energy
- g) I don't know

**B - Attitudes**

**Conserve water:**

- B1. What uses the least amount of water?
- a) Doing the dishes by hand
  - b) Doing the dishes in the dishwasher
  - c) I don't know
- B2. Which of these is not sustainable?
- a) Washing the car with a bucket
  - b) Re-using rainwater
  - c) Dumping cooking oil down the drain.
  - d) I don't know

**Save energy:**

- B3. What can we do to save electricity?
- a) Take a long bath
  - b) Leave the fridge door open
  - c) Turn off the light when leaving a room
  - d) I don't know
- B4. Which one of these increases the level of carbon dioxide in our atmosphere?
- a) Cutting down trees
  - b) Traveling by plane
  - c) Producing energy with fossil fuels
  - d) All of the above
  - e) I don't know

**5-point Likert scale: (1) Strongly disagree; (2) Disagree; (3) Neither agree nor disagree; (4) Agree; (5) Strongly agree.**

**Support local food:**

- B51. I think that growing our own fruits and vegetables is a great way to support sustainable agriculture and reduce your carbon footprint.
- B52. I think that plant a garden can help support local ecosystems.

**Join a local environmental group:**

- B53. Joining a group can be a great way to make a positive impact and meet like-minded people.
- B54. I think it is important to speak up and advocate for environmental issues
- B55. I think it is important to choose products from companies that prioritize sustainability and environmental protection

**Conserve water:**

- B56. I think it is OK that each one of us uses as much water as we want.

## **C – Behaviour-**

**5-point Likert scale: (1) Never; (2) Rarely; (3) Sometimes; (4) Always; (5) Often.**

### **Reduce, reuse, and recycle:**

- C1. I reduce my waste by using reusable water bottles and lunch containers
- C2. I recycle my waste
- C3. I encourage my friends and family to reduce their consumption of single-use plastics
- C4. I encourage my friends and family to recycle.
- C5. I avoid products with excessive packaging.

### **Save energy:**

- C6. I turn off lights and electronics when not in use
- C7. I encourage others turn off lights and electronics when not in use
- C8. I encourage my friends and family to switch to energy-efficient light bulbs and appliances.
- C9. My family tries to use renewable energy sources

### **Conserve water:**

- C10. I turn off the faucet when brushing my teeth.
- C11. I take shorter showers.
- C12. I fix or ask others to fix any leaky faucets.
- C13. In my house we store rainwater for uses that do not require drinking water

### **Support local food:**

- C14. I get involved in activities related to gardening and growing fruit and vegetables.
- C15. I do my shopping in local stores.

### **Join a local environmental group:**

- C16. I collaborate in an environmental group that works to protect the environment and promote sustainability.
- C17. I get involved with nature conservation organisations, supporting their efforts through donations or volunteering.
- C18. I try to consume unprocessed food as much as possible.

### **CO<sub>2</sub>/greenhouse gases**

- C19. I use to walk, bike, take public transportation.
- C20. When I go to school, I share the car with friends or neighbours.
- C21. I buy or encourage my family to buy environmentally-friendly products (such as recycled paper and non-toxic cleaning products).

### **Advocate for change:**

- C22. I have already taken part in a protest action in defence of the environment.
- C23. I publish posts in my social media about environmental causes.
- C24. I participate in environmental projects at my school.

Greek version

Σας ευχαριστούμε που απαντήσατε σε αυτό το ερωτηματολόγιο. Απαντήστε σε όλες τις ερωτήσεις, ακόμα κι αν δεν είστε σίγουροι. Το ερωτηματολόγιο έχει σκοπό να δημιουργήσει ένα διαδικτυακό παιχνίδι περιβαλλοντικής εκπαίδευσης και η συνεισφορά σας είναι πολύ σημαντική.

Απολαύστε τη δουλειά σας!

**Ταυτότητα μαθητή:**

Ηλικία:

Φύλο:

Χώρα:

Σχολική χρονιά:

0. Πώς νιώθετε όταν σκέφτεστε την κλιματική αλλαγή; (Επιλέξτε όλα όσα νιώθετε)

- α) Φόβο
- β) Θλίψη
- γ) Άγχος
- δ) Ένοχος/η
- ε) Απελπισία
- στ) Ανίσχυρος/η
- ζ) Θυμός
- η) Ανησυχία
- θ) Ισχυρός/η
- ι) Αισιόδοξος/η
- ια) Ελπιδοφόρος
- ιβ) Αδιάφορος/η

**A - Γνώση**

(επιλέξτε μια μόνο απάντηση σε κάθε ερώτηση)

**Απόβλητα και ανακύκλωση :**

A1. Ονομάστε τα υλικά που αντιστοιχούν στους πράσινους, μπλε και κίτρινους κάδους ανακύκλωσης (Διαφορετικά χρώματα σε Πορτογαλία, Ελλάδα και Ιταλία)

- α) Πλαστικό, γυαλί και χαρτί
- β) Γυαλί, χαρτί και πλαστικό
- γ) Χαρτί, γυαλί και πλαστικό (ή φωτογραφία με τα αντικείμενα στη σειρά)
- δ) Δεν γνωρίζω

A2. Ποια είναι η πολιτική του 5 R (Refuse, Reduce, Reuse, Repurpose, Recycle) ;

- α) Απόρριψη, Μείωση, Επαναχρησιμοποίηση, Επαναχρησιμοποίηση, Ανακύκλωση
- β) Επισκευή, Μείωση, Επαναχρησιμοποίηση, Σάπισμα, Ανακύκλωση
- γ) Απόρριψη, μείωση, επαναχρησιμοποίηση, σήψη, ανακύκλωση
- δ) Δεν γνωρίζω

A3. Ποιο αντικείμενο δεν μπορεί να ανακυκλωθεί;

- α) Καπάκι μπουκαλιού
- β) Μεταχειρισμένη εφημερίδα
- γ) Μεταχειρισμένη χαρτοπετσέτα
- δ) Μεταχειρισμένος πλαστικός κάδος
- ε) Δεν γνωρίζω

#### Εξοικονόμηση νερού:

A4. Σύμφωνα με τον ΟΗΕ (Ηνωμένα Έθνη) ποια είναι η μέση ημερήσια κατανάλωση νερού ανά άτομο (μετρώντας την υγιεινή και την κατανάλωση);

- α) 50 l/ημέρα
- β) 200 l/ημέρα
- γ) 110 l/ημέρα
- δ) 150 l/ημέρα
- ε) Δεν γνωρίζω

A5. Το νερό είναι σημαντικός πόρος για τη διατήρηση του οικοσυστήματος και της ζωής. Ένας άνθρωπος μπορεί να μείνει χωρίς να φάει φαγητό για 1 έως 2 μήνες, αλλά χωρίς να πειει μόνο:

- α) 3 έως 7 ημέρες
- β) 1 ημέρα
- γ) 30 ημέρες
- δ) Δεν γνωρίζω

A6. Ποιο είναι το ποσοστό του πόσιμου νερού στη γη;

- α) 20%
- β) 3%
- γ) λιγότερο από 1%
- δ) Δεν γνωρίζω

#### Ρύπανση

A7. Ποιο υλικό αποσυντίθεται πιο γρήγορα στη φύση;

- α) ένα χαρτί
- β) υφασμάτινο ύφασμα
- γ) μέταλλο
- δ) ξύλο
- ε) Δεν γνωρίζω

A8. Ποιο από αυτά τα υλικά χρειάζεται περισσότερο χρόνο για να αποσυντεθεί στη φύση;

- α) Ένα κουτάκι αναψυκτικού
- β) υπολείμματα τροφίμων
- γ) πάνα μιας χρήσης
- δ) γυαλί
- ε) Δεν γνωρίζω

#### CO<sub>2</sub>/αέρια θερμοκηπίου



A9. Τι είναι το φαινόμενο του θερμοκηπίου;

- α) Ορισμένα αέρια στην ατμόσφαιρα παγιδεύουν θερμότητα (υπέρυθρη ακτινοβολία) και θερμαίνουν τη γη.
- β) Ο ήλιος εκπέμπει περισσότερη ενέργεια τα τελευταία χρόνια.
- γ) Ορισμένα αέρια στην ατμόσφαιρα που μας προστατεύουν από την υπεριώδη ακτινοβολία.
- ε) Δεν γνωρίζω

A10. Ποιες δραστηριότητες συμβάλλουν περισσότερο στα αέρια του θερμοκηπίου;

- α) Αποψίλωση των δασών
- β) Παραγωγή ηλεκτρικής ενέργειας
- γ) Βιομηχανία
- δ) Μεταφορές
- ε) Γεωργία
- στ) Δεν γνωρίζω

A11. Το διοξείδιο του άνθρακα (CO<sub>2</sub>) :

- α) Προκαλείται από ανθρώπινες δραστηριότητες (βιομηχανία και μεταφορές)
- β) Προκλήθηκε από δασικές πυρκαγιές
- γ) Απελευθερώνεται από ηφαίστεια
- δ) Όλα τα παραπάνω
- ε) Δεν γνωρίζω

A12. Ποιο από τα παρακάτω αέρια δεν συμβάλλει στο φαινόμενο του θερμοκηπίου;

- α) Διοξείδιο του άνθρακα
- β) Άζωτο
- γ) Υδρατμοί
- δ) Μεθάνιο
- ε) Δεν γνωρίζω

A13. Οι πυρκαγιές απελευθερώνουν άνθρακα που είναι αποθηκευμένος στα φυτά και συμβάλλουν στο φαινόμενο του θερμοκηπίου.

- α) Σωστό
- β) Λάθος
- γ) Δεν γνωρίζω

A14. Τα φυτά της γης έχουν απορροφήσει το διοξείδιο του άνθρακα που οι άνθρωποι απελευθέρωσαν στην ατμόσφαιρα τις τελευταίες δεκαετίες κατά περίπου:

- α) 25%
- β) 50%
- γ) 75%
- δ) 100%
- ε) Δεν γνωρίζω

## Κλιματική αλλαγή



A15. Ο κίνδυνος ερημοποίησης του εδάφους, ξηρών και ημίξηρων περιοχών, είναι πιο σοβαρός στη Νότια Ευρώπη (Πορτογαλία, Ισπανία, Ιταλία και Ελλάδα) από ό,τι στη Βόρεια Ευρώπη

- α) Σωστό
- β) Λάθος
- γ) Δεν γνωρίζω

A16. Μία συνέπεια της κλιματικής αλλαγής είναι η αύξηση των δασικών πυρκαγιών.

- α) Σωστό
- β) Λάθος
- γ) Δεν γνωρίζω

A17. Ποιες είναι οι συνέπειες από την άνοδο της μέσης στάθμης της θάλασσας;

- α) διάβρωση των ακτών
- β) κάτω από το νερό παράκτιες πόλεις
- γ) επιδείνωση της ποιότητας του γλυκού νερού
- δ) όλα τα παραπάνω
- ε) Δεν γνωρίζω

#### Βιοποικιλότητα

A18. Η ερημοποίηση οδηγεί σε απώλεια βιοποικιλότητας (λιγότερα φυτά και ζώα)

- α) Σωστό
- β) Λάθος
- γ) Δεν γνωρίζω

A19. Οι πυρκαγιές επηρεάζουν τη βιοποικιλότητα.

- α) Σωστό
- β) Λάθος
- γ) Δεν γνωρίζω

#### Βιώσιμη γεωργία

A20. Οι πασχαλίτσες μπορούν να αντικαταστήσουν τη χρήση χημικών εντομοκτόνων στη γεωργία.

- α) Σωστό
- β) Λάθος
- γ) Δεν γνωρίζω

A21. Ποιο είδος γεωργίας είναι πιο βιώσιμο;

- α) εντατική γεωργία επιβίωσης
- β) βιολογική γεωργία
- γ) εμπορική γεωργία
- δ) Δεν γνωρίζω

#### Εξοικονόμηση ενέργειας:

A22. Ποιες ανανεώσιμες πηγές ενέργειας γνωρίζετε; (Επιλέξτε όλα όσα γνωρίζετε)

- α) Ηλιακή ενέργεια
- β) Αιολική ενέργεια
- γ) Γεωθερμική ενέργεια



- δ) Υδροηλεκτρική ενέργεια
- ε) Ενέργεια βιομάζας
- στ) Ωκεάνια ενέργεια

## **B - Στάσεις**

**(επιλέξτε μια μόνο απάντηση σε κάθε ερώτηση)**

### **Εξοικονόμηση νερού:**

B1. Τι καταναλώνει τη λιγότερη ποσότητα νερού;

- α) Πλύνετε τα πιάτα με το χέρι
- β) Πλύνετε τα πιάτα στο πλυντήριο πιάτων (ή εικόνες)
- γ) Δεν γνωρίζω

B2. Ποιο από αυτά δεν είναι βιώσιμο;

- α) Πλύσιμο του αυτοκινήτου με κουβά
- β) Επαναχρησιμοποίηση του βρόχινου νερού
- γ) Ρίξτε μαγειρικό λάδι στην αποχέτευση
- δ) Δεν γνωρίζω

### **Εξοικονόμηση ενέργειας:**

B3. Τι μπορούμε να κάνουμε για να εξοικονομήσουμε ηλεκτρική ενέργεια;

- α) Κάντε ένα μεγάλο μπάνιο
- β) Αφήστε την πόρτα του ψυγείου ανοιχτή
- γ) Κλείστε το φως όταν βγαίνετε από ένα δωμάτιο
- δ) Δεν γνωρίζω

B4. Ποιο από αυτά αυξάνει το επίπεδο του διοξειδίου του άνθρακα στην ατμόσφαιρά μας;

- α) Κοπή δέντρων
- β) Ταξιδεύοντας με αεροπλάνο
- γ) Παραγωγή ενέργειας με ορυκτά καύσιμα
- δ) Όλα τα παραπάνω
- ε) Δεν γνωρίζω



**Κλίμακα Likert 5 βαθμών:**

**(1) Διαφωνώ κάθεται. (2) Διαφωνώ. (3) Ούτε συμφωνώ ούτε διαφωνώ. (4) Συμφωνώ. (5) Συμφωνώ απόλυτα.**

**Υποστηρίξτε το τοπικό φαγητό:**

B51. Νομίζω ότι η καλλιέργεια των δικών μας φρούτων και λαχανικών είναι ένας πολύ καλός τρόπος για να υποστηρίξουμε τη βιώσιμη γεωργία και να μειώσουμε το αποτύπωμα άνθρακα.

B52. Νομίζω ότι η φύτευση ενός κήπου μπορεί να βοηθήσει στην υποστήριξη των τοπικών οικοσυστημάτων.

**Εγγραφείτε σε μια τοπική περιβαλλοντική ομάδα:**

B53. Η συμμετοχή σε μια ομάδα μπορεί να είναι ένας πολύ καλός τρόπος για να έχετε θετικό αντίκτυπο και να συναντήσετε ομοϊδεάτες.

B54. Πιστεύω ότι είναι σημαντικό να μιλάμε και να υποστηρίζουμε τα περιβαλλοντικά ζητήματα

B55. Πιστεύω ότι είναι σημαντικό να επιλέγουμε προϊόντα από εταιρείες που δίνουν προτεραιότητα στη βιωσιμότητα και την προστασία του περιβάλλοντος

Εξοικονόμηση νερού:

B56. Νομίζω ότι είναι εντάξει ο καθένας μας να χρησιμοποιεί όσο νερό θέλει.

**Γ – Συμπεριφορά-**

**Κλίμακα Likert 5 βαθμών: (1) Ποτέ; (2) Σπάνια. (3) Μερικές φορές? (4) Πάντα. (5) Συχνά.**

**Μειώστε, επαναχρησιμοποιήστε και ανακυκλώστε:**

Γ1. Μειώνω τα απόβλητά μου χρησιμοποιώντας επαναχρησιμοποιούμενα μπουκάλια νερού και δοχεία για μεσημεριανό γεύμα

Γ2. Ανακυκλώνω τα απορρίμματά μου

Γ3. Ενθαρρύνω τους φίλους και την οικογένειά μου να μειώσουν την κατανάλωση πλαστικών μιας χρήσης

Γ4. Ενθαρρύνω τους φίλους και την οικογένειά μου να ανακυκλώνουν.

Γ5. Αποφεύγω προϊόντα με υπερβολική συσκευασία.

**Εξοικονόμηση ενέργειας:**

Γ6. Κλείνω τα φώτα και τα ηλεκτρονικά όταν δεν τα χρησιμοποιώ

Γ7. Ενθαρρύνω τους άλλους να σβήνουν τα φώτα και τα ηλεκτρονικά όταν δεν χρησιμοποιούνται

Γ8. Ενθαρρύνω τους φίλους και την οικογένειά σας να στραφούν σε ενεργειακά αποδοτικούς λαμπτήρες και συσκευές.

Γ9. Η οικογένειά μου προσπαθεί να χρησιμοποιεί ανανεώσιμες πηγές ενέργειας

**Εξοικονόμηση νερού:**

Γ10. Κλείνω τη βρύση όταν βουρτσίζω τα δόντια μου.

Γ11. Κάνω πιο σύντομα ντους.

Γ12. Διορθώνω ή ζητώ από άλλους να διορθώσουν τυχόν βρύσες που παρουσιάζουν διαρροή.

Γ13. Στο σπίτι μου αποθηκεύουμε το νερό της βροχής για χρήσεις που δεν απαιτούν πόσιμο νερό



**Υποστηρίξτε το τοπικό φαγητό:**

Γ14. Εμπλέκομαι σε δραστηριότητες που σχετίζονται με την κηπουρική και την καλλιέργεια φρούτων και λαχανικών.

Γ15. Κάνω τα ψώνια μου σε τοπικά καταστήματα.

**Εγγραφείτε σε μια τοπική περιβαλλοντική ομάδα:**

Γ16. Συνεργάζομαι σε μια περιβαλλοντική ομάδα που εργάζεται για την προστασία του περιβάλλοντος και την προώθηση της αειφορίας.

Γ17. Εμπλέκομαι με οργανώσεις προστασίας της φύσης, υποστηρίζοντας τις προσπάθειές τους μέσω δωρεών ή εθελοντισμού.

Γ18. Προσπαθώ να καταναλώνω ανεπεξέργαστα τρόφιμα όσο το δυνατόν περισσότερο.

**CO<sub>2</sub>/αέρια θερμοκηπίου**

Γ19. Συνηθίζω να περπατάω, να κάνω ποδήλατο, να παίρνω τα μέσα μαζικής μεταφοράς.

Γ20. Όταν πηγαίνω στο σχολείο, μοιράζομαι το αυτοκίνητο με φίλους ή γείτονες.

Γ21. Αγοράζω ή ενθαρρύνω την οικογένειά μου να αγοράσει προϊόντα φιλικά προς το περιβάλλον (όπως ανακυκλωμένο χαρτί και μη τοξικά προϊόντα καθαρισμού).

**Υπέρμαχος της αλλαγής:**

Γ22. Έχω ήδη λάβει μέρος σε δράση διαμαρτυρίας για την υπεράσπιση του περιβάλλοντος.

Γ23. Δημοσιεύω δημοσιεύσεις στα μέσα κοινωνικής δικτύωσης για περιβαλλοντικά αίτια.

Γ24. Συμμετέχω σε περιβαλλοντικά έργα στο σχολείο μου.

*Portuguese version*

**Obrigado por responderes a este questionário.**

**Por favor, responde a todas as perguntas, mesmo que não tenhas bem a certeza.**

**O questionário destina-se a criar um jogo online para a educação ambiental e a tua contribuição é muito importante.**

**Bom trabalho!**

**Identificação do/a aluno/a**

Idade:

Género:

País:

Ano de escolaridade:

0. Como te sentes quando pensas nas alterações climáticas? (Escolhe tudo o que sentes)

- a) medroso
- b) triste
- c) ansioso
- d) culpado
- e) desesperado
- f) Impotente
- g) zangado
- h) preocupado
- i) poderoso
- j) otimista
- k) esperançoso
- l) indiferente

**A – Conhecimento**

(escolha apenas uma resposta)

**Lixo e reciclagem:**

A1. Identifica os materiais que correspondem aos ecopontos verdes, azuis e amarelas

- a) Plástico, vidro e papel
- b) Vidro, papel e plástico
- c) Papel, vidro e plástico (ou uma fotografia com os itens em ordem)
- d) Não sei

A2. Qual é a política dos 5 R's?

- a) Recusar, Reduzir, Reutilizar, Reaproveitar, Reciclar
- b) Reparar, Reduzir, Reutilizar, Reaproveitar, Reciclar



- c) Recusar, Reduzir, Reutilizar, Repensar, Reciclar
- d) Não sei

A3. Qual o item que não pode ser reciclado?

- a) Tapa de garrafa
- b) Jornal usado
- c) Guardanapo de papel usado
- d) Balde plástico usado
- e) Não sei

#### Poupar água:

A4. Segundo a ONU (Organização das Nações Unidas) qual é o consumo médio diário de água por pessoa (incluindo higiene e consumo)?

- a) 50 l/dia
- b) 200 l/dia
- c) 110 l/dia
- d) 150 l/dia
- e) Não sei

A5. A água é um recurso importante para a manutenção do ecossistema e da vida. Um ser humano pode ficar sem comer por 1 a 2 meses, mas sem beber só pode ficar:

- a) 3 a 7 dias
- b) 1 dia
- c) 30 dias
- d) Não sei

A6. Qual é a percentagem de água potável na terra?

- a) 20%
- b) 3%
- c) Menos de 1%
- d) Não sei

#### Poluição:

A7. Qual é o material que se decompõe mais rapidamente na natureza?

- a) Papel
- b) Pano de tecido
- c) Metal
- d) Madeira
- e) Não sei

A8. Qual destes materiais leva mais tempo a decompor-se na natureza?

- a) Lata de refrigerante
- b) restos de comida
- c) Fralda descartável
- d) Vidro
- e) Não sei

#### CO<sub>2</sub>/gases de efeito estufa:

A9. O que é o efeito de estufa?

- a) Certos gases na atmosfera que aprisionam o calor (radiação infravermelha) e aquecem a Terra.
- b) O sol está a emitir mais energia nos últimos anos.
- c) Certos gases na atmosfera que nos protegem da radiação ultravioleta.
- d) Não sei

A10. Quais são as atividades que mais contribuem para o aparecimento dos gases que causam o efeito de estufa?

- a) Desflorestação
- b) Geração da eletricidade
- c) Indústria
- d) Transporte
- e) Agricultura
- f) Não sei

A11. O dióxido de carbono (CO<sub>2</sub>) é causado por:

- a) Atividades humanas (indústria e transportes)
- b) Incêndios florestais
- c) Vulcões
- d) Todas as opções anteriores
- e) Não sei

A12. Qual dos seguintes gases não contribui para o efeito de estufa?

- a) Dióxido de carbono
- b) Azoto
- c) Vapor de água
- d) Metano
- e) Não sei

A13. Os incêndios libertam o carbono armazenado nas plantas e contribuem para o efeito estufa.

- a) Verdadeiro
- b) Falso
- c) Não sei

A14. As plantas da Terra absorveram o dióxido de carbono que os humanos libertaram na atmosfera nas últimas décadas, aproximadamente em:

- a) 25%
- b) 50%
- c) 75%
- d) 100%
- e) Não sei

### Alterações Climáticas:

A15. O risco de desertificação dos solos, das zonas áridas e semiáridas, é mais grave no Sul da Europa (Portugal, Espanha, Itália e Grécia) do que no Norte da Europa

- a) Verdadeiro

- b) Falso
- c) Não sei

A16. Uma das consequências das alterações climáticas é o aumento dos incêndios florestais e rurais.

- a) Verdadeiro
- b) Falso
- c) Não sei

A17. Quais são as consequências da subida do nível médio do mar?

- a) Erosão costeira
- b) Subida do nível da água nas cidades costeiras
- c) Piorar a qualidade da água doce
- d) Todas as opções anteriores
- e) Não sei

#### Biodiversidade:

18. A desertificação leva à perda de biodiversidade (menos plantas e animais)

- a) Verdadeiro
- b) Falso
- c) Não sei

A19. Os incêndios florestais afetam a biodiversidade.

- a) Verdadeiro
- b) Falso
- c) Não sei

#### Agricultura sustentável:

A20. As joaninhas podem substituir o uso de inseticidas químicos na agricultura.

- a) Verdadeiro
- b) Falso
- c) Não sei

A21. Que tipo de agricultura é mais sustentável?

- a) Agricultura intensiva de subsistência
- b) Agricultura biológica
- c) Agricultura comercial
- d) Não sei

#### Poupar energia:

A22. Quais fontes de energia renovável que conheces? (Escolhe as que conheces)

- a) Energia solar
- b) Energia eólica
- c) Energia geotérmica
- d) Energia hidrelétrica
- e) Energia de biomassa
- f) Energia oceânica

**B - Atitudes****Poupar água:**

B1. O que gasta menos água?

- a) Lavar a louça à mão
- b) Lavar a loiça na máquina de lavar loiça
- c) Não sei

B2. Qual destas atividades não é sustentável?

- a) Lavar o carro com balde
- b) Reaproveitamento da água da chuva
- c) Verter óleo no ralo da banca da cozinha.
- d) Não sei

**Poupar energia:**

B3. O que podemos fazer para poupar eletricidade?

- a) Tomar um banho demorado
- b) Deixar a porta do frigorífico aberta
- c) Apagar a luz ao sair de uma divisão
- d) Não sei

B4. Qual destas atividades aumenta o nível de dióxido de carbono na nossa atmosfera?

- a) Cortar árvores
- b) Viajar de avião
- c) Produzir energia com combustíveis fósseis
- d) Todas as opções anteriores
- e) Não sei

**Escala Likert de 5 pontos: (1) Discordo totalmente; (2) Discordo; (3) Não concordo nem discordo; (4) Concordo; (5) Concordo totalmente.**

**Apoiar os alimentos locais:**

B51. Acho que cultivar as nossas próprias frutas e vegetais é uma ótima maneira de apoiar a agricultura sustentável e reduzir a nossa pegada de carbono.

B52. Acho que plantar um jardim/ uma horta pode ajudar a sustentar os ecossistemas locais.

**Associar-se a um grupo ambiental local:**

B53. Participar num grupo pode ser uma ótima maneira de causar um impacto positivo e conhecer pessoas que pensam como tu.

B5.4. Eu acho que é importante falar e defender as questões ambientais.

B5.5 Acho importante escolher produtos de empresas que priorizam a sustentabilidade e a proteção do meio ambiente.

**Poupar água:**

B5.6 Acho que é correto cada um de nós poder usar a quantidade de água que quiser.

**C – Comportamento**

Escala Likert de 5 pontos: Nunca; (2) Raramente; (3) Às vezes; (4) Frequentemente; (5) Sempre.

#### Reduzir, reutilizar e reciclar:

- C1. Reduzo os resíduos que produzo ao usar garrafas de água reutilizáveis e lancheiras
- C2. Reciclo os meus resíduos
- C3. Encorajo os meus amigos e familiares a reduzirem o consumo de plásticos descartáveis
- C4. Encorajo meus amigos e familiares a reciclar.
- C5. Evito produtos com embalagens excessivas.

#### Poupar energia:

- C6. Desligo as luzes e os aparelhos eletrónicos quando não estão em uso.
- C7. Encorajo os outros a apagar as luzes e a desligar aparelhos eletrónicos quando não estiverem em uso.
- C8. Encorajo os muitos amigos e familiares a mudarem para lâmpadas e eletrodomésticos com baixo consumo de energia.
- C9. A minha família tenta usar fontes de energia renováveis.

#### Poupar água:

- C10. Desligo a torneira quando escovo os dentes.
- C11. Tomo banhos mais curtos.
- C12. Conserto ou peço a outros que consertem qualquer torneira com vazamento.
- C13. Na minha casa armazenamos água da chuva para usos que não requerem água potável

#### Apoiar os alimentos locais:

- C14. Envolve-me em atividades relacionadas com a jardinagem e o cultivo de frutas e legumes.
- C15. Faço minhas compras em lojas locais.
- Associar-se a um grupo ambiental local:
- C16. Colaboro com um grupo ambiental que trabalha para proteger o meio ambiente e promover a sustentabilidade.
- C17. Envolve-me em organizações de conservação da natureza, apoiando os seus esforços através de donativos ou voluntariado.
- C18. Tento consumir o máximo possível de alimentos não processados.

#### CO<sub>2</sub>/gases de efeito estufa:

- C19. Costumo andar a pé, de bicicleta, de transporte público.
- C20. Quando vou para a escola, divido o carro com amigos ou vizinhos.
- C21. Eu compro ou incentivo a minha família a comprar produtos ecológicos (como papel reciclado e produtos de limpeza não tóxicos).

#### Ativista da mudança:

- C22. Já participei de ações de protesto em defesa do meio ambiente.
- C23. Faço publicações sobre causas ambientais nas minhas redes sociais.
- C24. Participo em projetos ambientais na minha escola.

*Italian version*

**Grazie di aver accettato di rispondere a questo questionario.**  
**Per favore rispondete a tutte le domande, anche se non siete sicuri.**  
**Il questionario ha lo scopo di creare un gioco online per l'educazione ambientale e il tuo contributo è molto importante.**  
**Divertiti mentre lo fai!**

**Dati dello studente:**

Età:

Sesso:

Paese:

Anno scolastico (prima, seconda, terza, quarta, quinta):

0. Cosa provi, quando pensi al cambiamento climatico? (scegli tutte le opzioni che vuoi)
- a) paura
  - b) tristezza
  - c) ansia
  - d) Senso di colpa
  - e) disperazione
  - f) impotenza
  - g) rabbia
  - h) preoccupazione
  - i) forza
  - j) speranza
  - Indifferenza

**A - CONOSCENZA**

(scegli solo una risposta)

**RIFIUTI E RICICLO**

A1. Indica i materiali che corrispondono ai bidoni verdi, bianchi e gialli

- a) Plastica, vetro e carta
- b) Vetro, carta e plastica
- c) Carta, vetro e plastica (o una foto con gli articoli in ordine)
- d) Non so

A2. Che cos'è la politica delle 5 R?





- a) Rifiuta, riduci, riutilizza, riqualifica, ricicla
- b) Ripara, riduci, riutilizza, decomponi, ricicla
- c) Rifiuta, riduci, riutilizza, decomponi, ricicla
- d) Non so

A3. Quale articolo non può essere riciclato?

- a) Tappo di bottiglia
- b) Giornale usato
- c) Tovagliolo di carta usato
- d) Secchio di plastica usato
- e) Non so

### CONSERVAZIONE DELL'ACQUA:

A4. Secondo le Nazioni Unite qual è il consumo medio giornaliero di acqua pro capite (incluse bevande e igiene)?

- a) 50 litri al giorno
- b) 200 litri al giorno
- c) 110 litri al giorno
- d) 150 litri al giorno
- e) Non so

A5. L'acqua è una risorsa importante per conservare l'ecosistema e la vita. Un essere umano può sopravvivere senza cibo per 1 o 2 mesi, ma senza bere può sopravvivere solo:

- a) Da 3 a 7 giorni
- b) 1 giorno
- c) 30 giorni
- d) Non so

A6. Qual è la percentuale di acqua potabile sulla terra?

- a) 20%
- b) 3%
- c) Meno dell'1%
- d) Non so

A7. Qual è il materiale che si decompone più velocemente in natura?

- a) Carta
- b) Tessuto
- c) Metallo
- d) Legno
- e) Non so

A8. Quale di questi materiali ci mette di più a decomporsi in natura?

- a) Lattina per bibite
- b) Avanzi di cibo
- c) Pannolino usa e getta
- d) Vetro



e) Non so

### ANIDRIDE CARBONICA, GAS SERRA

A9. Che cos'è l'effetto serra?

- a) Alcuni gas dell'atmosfera intrappolano calore (raggi infrarossi) e riscaldano la terra.
- b) Il sole emette più energia negli ultimi anni.
- c) Alcuni gas dell'atmosfera che ci proteggono dalle radiazioni ultraviolette.
- d) Non lo so.

A10. Quali attività contribuiscono maggiormente all'effetto serra?

- a) Deforestazione
- b) Produzione di elettricità
- c) Industria
- d) Trasporti
- e) Agricoltura
- f) Non so.

A11. L'anidride carbonica (CO<sub>2</sub>) è:

- a) Causata dalle attività umane (industria e trasporti)
- b) Causata da incendi boschivi
- c) Rilasciata dai vulcani
- d) Tutti i precedenti
- e) Non so

A12. Quale dei seguenti gas non contribuisce all'effetto serra?

- a) Anidride carbonica
- b) Azoto
- c) Vapore acqueo
- d) Metano
- e) Non so

A13. Gli incendi rilasciano il carbonio immagazzinato nelle piante e contribuiscono all'effetto serra:

- a) Vero
- b) Falso
- c) Non so

A14. Negli ultimi decenni, le piante sulla terra hanno assorbito approssimativamente una percentuale di anidride carbonica rilasciata dagli uomini nell'atmosfera pari al:

- a) 25%
- b) 50%
- c) 75%
- d) 100%
- e) Non so

### CAMBIAMENTO CLIMATICO



A15. Il rischio di desertificazione del suolo, di aree aride o semiaride, è più serio nell'Europa del sud (Portogallo, Spagna, Italia e Grecia) che nell'Europa del nord:

- a) Vero
- b) Falso
- c) Non so

A16. Una conseguenza del cambiamento climatico è l'aumento degli incendi boschivi

- a) Vero
- b) Falso
- c) Non lo so

A17. Qual è la conseguenza dell'innalzamento del livello medio del mare?

- a) Erosione delle coste
- b) Inondazione delle città costiere
- c) Peggior qualità dell'acqua fresca
- d) Tutti i precedenti
- e) Non lo so

#### **BIODIVERSITA'**

A18. La desertificazione porta alla perdita della biodiversità (meno piante e animali)

- a) Vero
- b) Falso
- c) Non so

A19. Gli incendi non controllati influenzano la biodiversità

- a) Vero
- b) Falso
- c) Non so

#### **AGRICOLTURA SOSTENIBILE**

A20. Le coccinelle posso sostituire l'uso di insetticidi chimici in agricoltura

- a) Vero
- b) Falso
- c) Non so

A21. Quale tipo di agricoltura è più sostenibile?

- a) Agricoltura intensiva di sussistenza
- b) Agricoltura biologica
- c) Agricoltura per fini commerciali
- d) Non so

#### **RISPARMIO DI ENERGIA**

A22. Quali fonti di energia rinnovabile conosci? (Scegli tutte quelle che conosci)

- a) Energia solare
- b) Energia eolica

- c) Energia geotermica
- d) Energia idroelettrica
- e) Biomassa
- f) Energia dell'oceano
- g) Non so

## B – ATTEGGIAMENTI

### RISPARMIO DELL'ACQUA

B1. Quale attività utilizza la minor quantità di acqua?

- a) Lavare i piatti a mano
- b) Lavare i piatti in lavastoviglie
- c) Non so

B2. Quale di queste attività non è sostenibile?

- a) Lavare la macchina col secchio
- b) Riutilizzare l'acqua piovana
- c) Versare l'olio di cottura nel tubo di scarico
- d) Non so

B3. Cosa possiamo fare per risparmiare elettricità?

- a) Fare un bagno lungo
- b) Lasciare aperta la porta del frigorifero
- c) Spegnerne la luce quando usciamo da una stanza
- d) Non so

B4. Quale di queste attività aumenta il livello di anidride carbonica nell'atmosfera?

- a) Tagliare gli alberi
- b) Viaggiare in aereo
- c) Produrre energia utilizzando combustibili fossili
- d) Tutti i precedenti
- e) Non so

### SCALA LIKERT – 5 PUNTI

**(1): non sono per niente d'accordo (2): non sono d'accordo (3) non sono né d'accordo né in disaccordo (4) sono d'accordo (5) sono molto d'accordo.**

### SOSTENERE IL CIBO LOCALE

B51. Penso che coltivare la nostra frutta e verdura sia un modo utile per aiutare l'agricoltura sostenibile e diminuire l'impronta carbonica.

B52. Penso che piantare un giardino possa aiutare a sostenere gli ecosistemi locali.

### DIVENTARE SOCIO DI UN GRUPPO AMBIENTALISTA

B53. Diventare socio di un gruppo può essere un modo utile per avere un'influenza positiva e incontrare persone che la pensano come noi.

B54. Penso sia importante far sentire la propria voce per sostenere le questioni ambientali.

B55. Penso sia importante scegliere prodotti di compagnie che hanno come priorità la sostenibilità e la protezione dell'ambiente.

RISPARMIO DELL'ACQUA:

B56. Penso sia accettabile che ognuno di noi usi tutta l'acqua che vuole.

## C – COMPORTAMENTI

(SCALA LIKERT – 5 PUNTI (1): MAI (2): RARAMENTE (3): QUALCHE VOLTA (4): SPESSO (5): SEMPRE)

Valuta i seguenti elementi:

### RIDURRE, RIUTILIZZARE, RICICLARE:

C1. Riduco i miei rifiuti usando bottiglie d'acqua e contenitori per il pranzo riutilizzabili

C2. Riciclo i miei rifiuti

C3. Esorto i miei amici e la mia famiglia a ridurre l'utilizzo di prodotti in plastica usa e getta.

C4. Esorto i miei amici e la mia famiglia a riciclare.

C5. Evito prodotti con imballaggi eccessivi.

### RISPARMIARE ENERGIA:

C6. Spengo le luci e gli apparecchi elettronici quando non li uso

C7. Esorto gli altri a spegnere le luci e gli apparecchi elettronici quando non vengono usati.

C8. Esorto i miei amici e la mia famiglia ad acquistare lampadine e apparecchi elettronici a risparmio energetico

C9. La mia famiglia cerca di utilizzare fonti di energia rinnovabili.

### RISPARMIARE ACQUA:

C10. Chiudo il rubinetto quando mi lavo i denti

C11. Faccio docce più brevi

C12. Aggiusto o chiedo di aggiustare rubinetti con perdite

C13. A casa mia immagazziniamo acqua piovana per usi che non richiedono acqua potabile

Sostenere il cibo locale:

C14. Mi impegno in attività collegate al giardinaggio e alla coltivazione di frutta e verdura

C15. Faccio spesa in negozi locali.

### ISCRIVERSI A UN GRUPPO AMBIENTALISTA LOCALE

C16. Collaboro con un gruppo ambientalista che lavora per proteggere l'ambiente e per promuovere la sostenibilità.

C17. Partecipo alle attività di organizzazioni per la conservazione della natura sostenendo i loro sforzi attraverso donazioni e volontariato.

C18. Cerco di consumare cibo non lavorato il più possibile.

### CO<sub>2</sub>/GAS SERRA

C19. Sono solito camminare, andare in bicicletta, utilizzare mezzi pubblici

C20. Quando vado a scuola, condivido la macchina con amici e vicini

C21. Compero o esorto la mia famiglia a comperare prodotti amici dell'ambiente (per esempio carta riciclata e prodotti per le pulizie non tossici)

### SOSTENERE IL CAMBIAMENTO

C22. Ho già preso parte ad azioni di protesta in difesa dell'ambiente

C23. Pubblico post su cause ambientali sui social media



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C24. Partecipo a progetti ambientali a scuola

## Annex II - Informed Consent to the parents or guardians of the students



Co-funded by the  
Erasmus+ Programme  
of the European Union



### INFORMED AND VOLUNTARY CONSENT FOR A STUDY ON ENVIRONMENTAL EDUCATION AND SUSTAINABILITY

This study aims to gauge the level of environmental education and sustainability of students in schools. An environmental survey will therefore be carried out (using the LimeSurvey platform) to understand students' knowledge, attitudes and behaviours and, in this way, indicate the differences in results between countries. The results obtained will serve as a basis for developing educational content and creating 3D VWLE scenarios. The data collected, using a quantitative methodology, will be subjected to statistical treatment, descriptive and inferential analysis.

I, \_\_\_\_\_, holder of ID card no. \_\_\_\_\_, parent of student \_\_\_\_\_, from \_\_\_\_\_, Class \_\_, N°\_\_\_\_, give my free and informed consent to the collection and processing of my child's data under the following terms and conditions:

- a) The data is intended for the realization of an academic/scientific study, through the completion of a questionnaire on Environmental Education and Sustainability, and is used exclusively for academic and research purposes, always bearing in mind that it will be treated with due confidentiality.
- b) Participation in the study is voluntary;
- c) Personal data will be kept at the University of Maia's premises for a period of 5 years, after which the data will be deleted, respecting the guarantees of secrecy and confidentiality required by the General Data Protection Regulation (GDPR);
- d) I have the following rights as a Parent or Guardian:
  - I. access to them, with the possibility of rectifying or deleting them until the final submission of the questionnaire;
  - II. to withdraw consent at any time without, however, jeopardising the lawfulness of the processing carried out on the basis of the consent previously given and whenever this is necessary for the purposes of fulfilling the obligations of the data controller;
  - III. to be informed of the results of the research
  - IV. to lodge a complaint with the National Data Protection Commission (CNPD);



V. not providing one or more of the data requested in this collection instrument.

e) There are no incentives or compensation for taking part in the study.

f) Only the researcher responsible for processing the data will have access to it.

Signature; \_\_\_\_\_ Date: \_\_\_\_\_

Contacts: telephone/mobile: \_\_\_\_\_

e-mail: \_\_\_\_\_

Contact person responsible for the study XXXXXXXX



Disclaimer: “The material of the project reflects only the author’s views. The European Commission’s support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission or the Hellenic National Agency cannot be held responsible for any use which may be made of the information contained therein.”