Article

The Challenge of Global Environmental Change: Attitudinal Trends in Teachers-In-Training

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Abstract: The aim of our research was to study attitudinal trends in Spanish trainee teachers regarding Global Environmental Change (GEC), in order to identify elements that should be enhanced in their education. The Scale of Global Environmental Change (SGEC) was used as a measurement instrument to explore attitudes on how to deal with GEC. A cluster analysis of the scores of the four SGEC factors (N = 950) was carried out in order to segment the cases into groups of similar response profiles. Two solutions are proposed: one made up of two clusters (Concerned and Disengaged) and the other of four clusters (Egocentric, Indifferent, Sceptical and Committed). Furthermore, we have analysed whether some of the students' characteristics significantly influence their inclusion in one cluster or another. The results of this study show that among trainee teachers there are sceptical, self-centered and indifferent trends, which do not correspond to people capable of promoting the transformation needed to deal with GEC. Therefore, it is necessary to improve their training with new educational models that favour the recognition of the real origin of socio-environmental problems and provide them with skills to promote individual and social responsibility.

Keywords: global environmental change; attitudinal trends; cluster analysis; trainee teachers; education for sustainability

1. Introduction

Warnings about the generation of a Global Environmental Change [1] (hereinafter, GEC) were already being heard at the end of the 20th century. These warnings told of the serious changes that were taking place in the structure and dynamics of the earth system and that were closely linked to the rapid growth of the human population and its activity [2]. As a metaphor for this Global Change, a new geological stage called Anthropocene was coined, marked by human domination of the planet and its capacity to substantially modify it [3,4]. Currently, important sectors of the scientific community are warning of the high risks posed by changes in global land processes, where biochemical flows, biosphere dynamics or climate systems are already seriously disrupted implying unexpected and threatening consequences for the natural environment and human life [5].

Thus, although in the last century there have been unprecedented steps forward in many areas, such as food availability, material well-being and life expectancy, these improvements have come at a great cost to the planet [6], and in a way that has worsened inequalities between rich and poor countries, as well as between different social strata [7]. Despite warnings from the scientific community and recognised international institutions about the environmental and human emergency, every year, the data on resource waste, emissions and inequality worsen, bringing us closer to a point of no return [8–10]. In addition, Climate Change (CC) is a glaring and all-too-close example of how the problems involved in GEC are being addressed, as evidenced by reports from the IPCC [11] or other bodies beyond reproach, such as the World Bank [12], which report on environmental

destruction and the effect on human health, accentuated by the current situation of the COVID-2019 pandemic [13].

The underlying reason is that our development model persists in wrongly linking the idea of progress to economic growth, consumerism and the chimera of technological control [14–17]. All of this forces us to urgently reflect on how to replace this predominant model with one based on Sustainability and Equity [18,19]. Our way of living, buying and producing has to be reoriented towards more conscious and austere positions, based on social and environmental justice and away from excess, which take into account the limits of living on a planet with finite resources [20,21]. In addition, this change must be promoted from within the different spheres of society: political, business and, of course, educational, as reflected in the current 2030 Agenda for Sustainable Development [22].

Thus, the report of the Agenda 2030 in Spain [23] warns of the enormous challenge posed by climate change and other socio-environmental problems in its territory. The research also shows how Spanish citizens, as in other "developed" countries, present high levels of concern for the environment and the adverse effects of human activities [24]. These levels of concern are often influenced by factors such as gender, income level, political ideology or the level of knowledge of socio-environmental problems [25]. The problem is that this great disquiet for socio-environmental problems is generally not being truly transformed into a personal commitment to act [26].

However, to respond to the problems associated with GEC, most of the mitigation and adaptation efforts have been limited to "technical" issues [27]. Therefore, it is necessary to reinforce how we tackle GEC from a human perspective, in ways that help us to understand how people's responses to these problems are produced and improve them [27–29].

Education as a Key Factor

In this framework, one of the main challenges faced by social and educational research is the socio-environmental issue [30,31]. Twenty-first century teaching should be aimed at transforming society by seeking new models far removed from consumerism, unsustainability and inequalities [32]. From this paradigm, education is fundamental to promote the empowerment of people and the development of the necessary skills to carry out social transformation, especially in relation to adaptation and resilience [33]. In addition, here it is essential to consider the value base the knowledge and skills are related to, especially since the Anthropocene challenges are strongly value-dependent [34]. In fact, authorities in the field point out that schools often indoctrinate students to become unquestioning consumers who replicate established patterns or, at best, do little to prepare them for the social and ecological realities they will soon inherit [35].

This challenge specifically concerns teachers, who must be committed to a new transformative educational model as opposed to transmissive models, and based on the development of competences [36], which prepares people to understand the world and rethink it, so as to encourage sustainable lifestyles [37].

Universities, as the providers of teacher training degrees, should offer an education consistent with their role as agents of change oriented towards the new forms of citizenship required by society, where the dimension of Sustainability, among others, should be introduced [38,39]. However, literature shows how teachers are not sufficiently well trained, also presenting difficulties related to the integration of the environmental and human emergency in schools, as justified below. Thus, teachers may also show tendencies that are uncritical and conformist with the system [40].

In fact, numerous research studies show the gaps and problems of this group that affect the way in which GEC is dealt with in the classroom, such as:

- Doubting the anthropogenic causes of environmental problems, such as climate change, and agreeing with negationist theories [41].
- Not considering the exponential growth of the population as a problem [42].
- Promoting misconceptions and limited knowledge of socio-environmental problems e.g., [43,44].

- Giving low priority to the addressing of environmental issues in schools [45,46], providing reasons such as their low priority in school curricula [47].
- Not addressing these problems globally, ignoring their social, political and economic dimensions and the way these dimensions interact systemically [48,49], causing them to focus on promoting individual action, which often leads to feelings of frustration and powerlessness [50,51].

Within this framework, it is necessary to look in depth at how teachers respond to the need to address GEC [1]. In scientific literature, it is difficult to find studies that focus on it (since it is a recently conceived phenomenon), and, even less so, address it from an educational perspective. Thus, the aim of our paper was to study the attitudinal trends in trainee teachers with relation to this serious socio-environmental problem, in order to help us identify the elements that should be enhanced in their education.

2. Materials and Methods

The Scale of Global Environmental Change (SGEC) was used as the measurement instrument Appendix A. It is a 19-item Likert-type scale (5 levels of response) validated by Varela-Losada et al. [1]. Its reliability is adequate (α = 0.817, glb = 0.894, Ω = 0.855). It was chosen because it explores attitudes on how to deal with Global Environmental Change, especially in relation to Climate Change, perhaps the process most recognized by the public as a global environmental problem that is causing changes on a planetary scale. The scale consists of four subscales that reveal a clear factor structure (χ^2/gl = 1.84; AIC = 394.75; CFI = 0.934; RMSEA = 0.042 [0.034 0.050]). These factors are listed in Table 1.

Table 1. Factors of the SGEC [1].

Factor	Number of Items	% Explained Variance	Description
Social Responsibility (SR)	6	25.9	Social responsibility in the adaptation and mitigation of GEC
Need to Cope (NC)	5	8.3	Awareness of the need for change to address GEC
Individual Responsibility (IR)	4	6.5	Individual Responsibility to tackle GEC
Anthropogenic Origin (AO)	4	6.0	Awareness of the anthropogenic origin of GEC, particularly with regard to Climate Change

The instrument also requests information from the participants regarding other topics: age, sex, university of origin, degree course, high school option taken, type of centre where the secondary education was received (public/private, secular/religious), and the educational level of the mother and father.

2.1. Participants

We used a convenience and non-probabilistic sample of 950 trainee teachers from the Infant and Elementary Education levels in three Spanish faculties. In addition, 21.2% were men and 78.8%, women. 45.1% were studying the Infant Education Degree and 53.5% the Elementary Education Degree. The questionnaire was administered in printed format during class hours, and the answers were validated using the optical mark recognition software SDAPS 1.1.7.

2.2. Statistical Analysis

In order to study the attitudinal trends in trainee teachers with regard to GEC, a cluster analysis of the scores for the four factors was carried out, in order to segment the cases into groups of similar response profiles.

This analytical technique involves finding relevant subgroups within a data set. Specifically, the aim is to classify cases into a small number of mutually exclusive groups based on their similarities. In this type of analysis, the groups are not predefined according

to criteria selected by the researchers, but rather the purpose is to identify the clusters. The design of a cluster analysis should address how to classify the data, the selection of solutions, the interpretation of the clusters to understand the characteristics of each one, assign them names that define their nature and validate the selected solutions.

To carry out the cluster analysis, the following steps were followed:

1. Description of variables and testing of cluster analysis assumptions
    a. Calculation of the scores for each subject on the scale factors (SR, NC, IR, AO).
    b. Assessment of the existence of multicollinearity by analysing the matrix of correlations between variables, variance inflation factors and tolerance.
2. Clusters were obtained through hierarchical analysis with Ward's method, checking if significant differences between them existed using ANOVA and Student's t. Preliminary clusters were selected by:
    a. The calculation and graphical representation of the agglomeration coefficients of each cluster.
    b. Dendrogram analysis.
3. Refinement of the clusters obtained in the previous section using non-hierarchical K-means analysis for fine-tuning. The centroids of the clusters obtained with the hierarchical method are used as seeds. Characterization of the profiles. Verification of the existence of significant differences between the means of each cluster.
4. Validation of the solutions obtained using cross classification. After the clusters became available:
5. The proposed solutions were characterized.
6. It was examined whether or not there were significant differences between clusters, taking into account relevant data regarding the participants (sex, age, centre of origin, parents' level of education).

3. Results

3.1. Variables and Assumptions of the Cluster Analysis

Factor scores were calculated. These independent variables were named after the factors: SR, NC, IR and AO. Since all variables are measured on the same scale, no standardization was done.

The sample was large and was considered representative of the population of interest. To assess whether the effects of multicollinearity were important, the matrix of correlations between variables was analysed, finding that all are significant ($p < 0.01$) but not high enough to suspect the existence of collinearity (never exceeding the value of 0.6, the maximum acceptable being 0.8 for Field [52] and Orme and Combs-Orme [53], and 0.9 for Hair et al. [54] and Tabachnik and Fidell [55]).
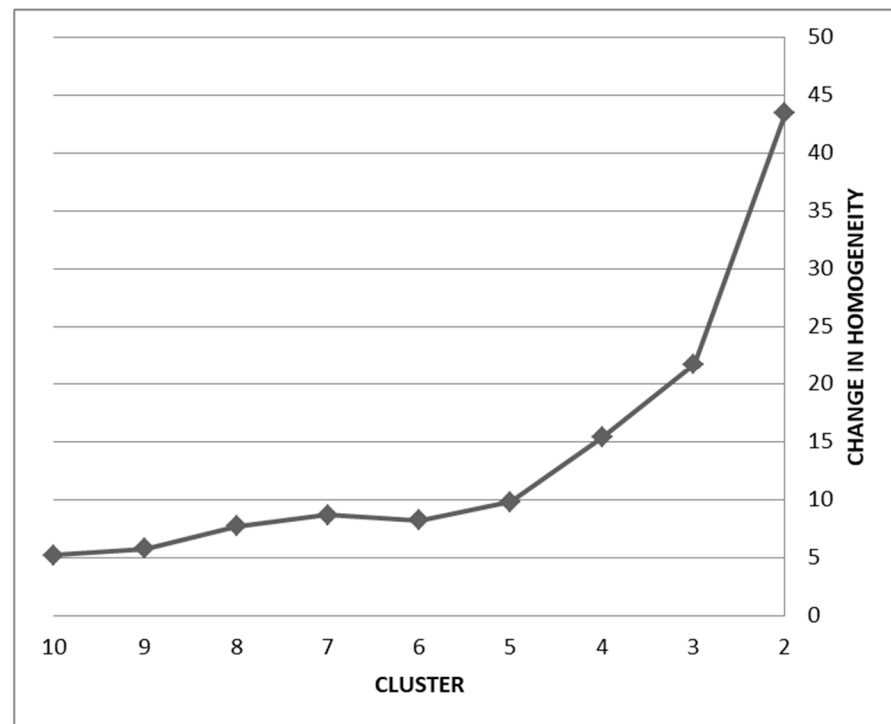
Two statistics were also analysed for the diagnosis of collinearity: variance inflation factors (VIF) and tolerance [56]. The VIF values were between 1.162 and 1.554, and the tolerance values between 0.644 and 0.861, indicating that there were no problems of multicollinearity using the different criteria proposed by Stevens [57], DeMaris [58], Field [52], Orme & Combs-Orme [53] and Hair et al. [54].

3.2. Obtaining Groups through Hierarchical Analysis

Since no specific number of clusters was established a priori and the sample size was moderate, a hierarchical cluster analysis would be performed, using Ward's method to minimize differences within the clusters and to avoid problems of observation chaining [54]. Since the five variables being studied were metric, the Euclidean squared distance was chosen as a measure of similarity. No standardization of the data was performed, since they were measured on the same scale. The different cluster solutions were obtained for between 2 and 10 clusters. In Table 2, the agglomeration coefficients of each cluster and the percentage change in the coefficient of the next level are presented, and, in Figure 1, the values of the first and third columns of the table are charted:

Table 2. Agglomeration coefficients of each cluster and percentage change with respect to the coefficient of the next level.

Cluster Number	Agglomeration Coefficient	Percentage Change in the Coefficient of the Next Conglomerate
10	472.254	5.16
9	496.646	5.76
8	525.239	7.66
7	565.459	8.67
6	614.500	8.18
5	664.777	9.76
4	729.690	15.34
3	841.654	21.67
2	1024.028	43.39
1	1468.369	-

Figure 1. Percentage changes in the homogeneity of the clusters.

As can be seen, the most abrupt relative changes in the homogeneity of the conglomerates are produced by going from two conglomerates to one, from three to two and from four to three. Therefore, in the first instance, two, three and four-cluster solutions are plausible candidates. The analysis of the dendrogram Figure 2 also makes it possible to consider that these solutions may be reasonable, there being two large groups, one of whose branches takes time to bifurcate, and one of these new branches also branches into two again some time later.

On the other hand, when assessing which possible solutions can be useful, it is worth noting that the 4-cluster solution allows a greater richness of interpretation, and the 2-solution cluster facilitates comparisons between groups to see if there are significant differences between them. Therefore, these solutions will be the ones to be examined in the future. The characteristics of these clusters will be described, they will be refined and an assessment made as to whether it is convenient to retain any of these solutions.
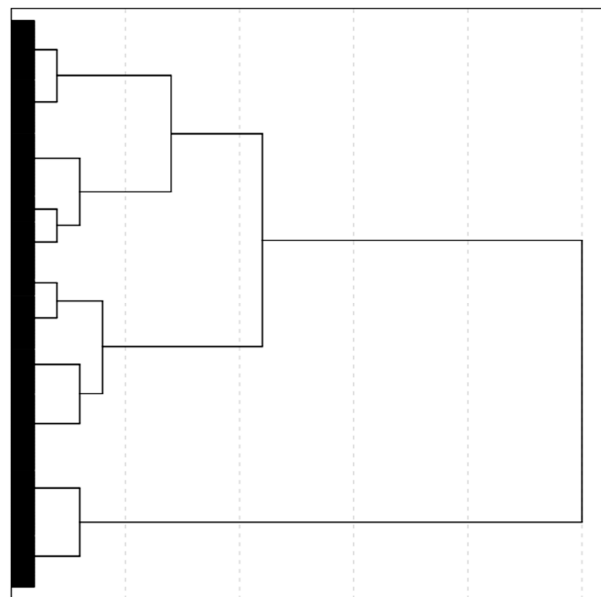
Figure 2. Dendrogram.

3.3. Profiles of Two and Four-Cluster Solutions

Table 3 shows the profiles of the four cluster solution (CH4_1 to CH4_4), and Figure 3 shows the box diagrams in which these profiles are represented.

Table 3. Mean values of variables in the four-cluster solution and cluster size. Hierarchical method.

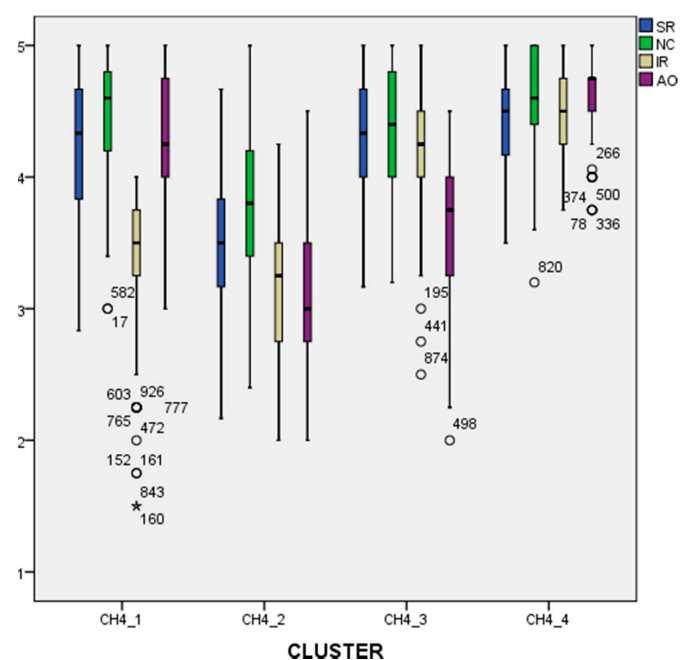|	SR	NC	IR	AO	Students per Cluster
CH4_1	4.24	4.52	3.34	4.29	321
CH4_2	3.49	3.81	3.15	3.09	196
CH4_3	4.28	4.40	4.22	3.65	244
CH4_4	4.47	4.57	4.42	4.63	189

Figure 3. Four-cluster solution profiles. Hierarchical method.

Table 4 shows the profiles of the two-cluster solution (CH2_1 and CH2_2), and Figure 4 the box diagrams in which these profiles are represented.

Table 4. Mean values of variables in the two-cluster solution and cluster size. Hierarchical method.

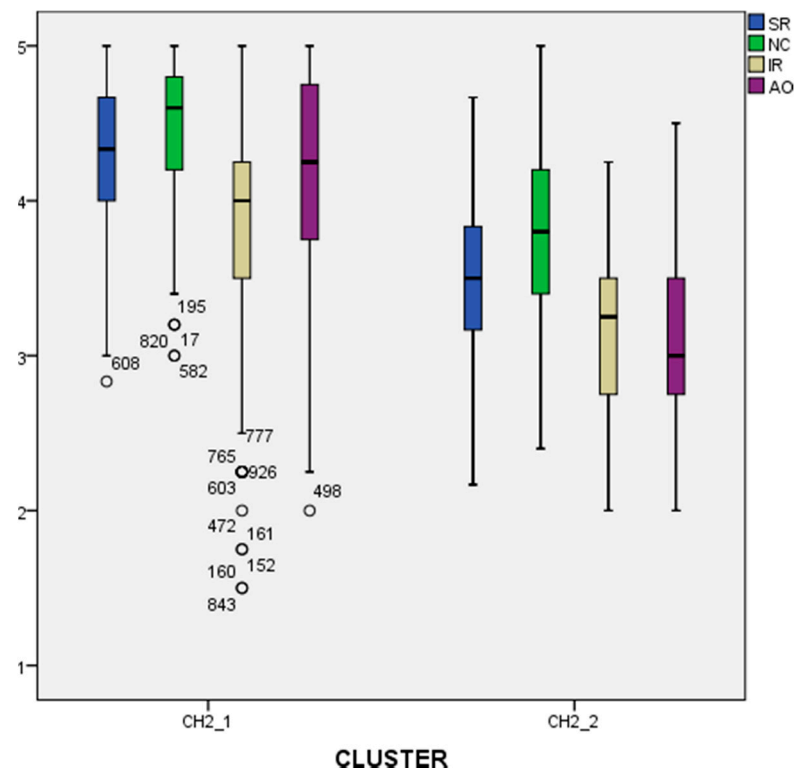|	SR	NC	IR	AO	Students per Cluster
CH2_1	4.31	4.50	3.90	4.17	754
CH2_2	3.49	3.81	3.15	3.09	196

Figure 4. Two-cluster solution profiles. Hierarchical method.

3.4. Characterisation of Solutions and Significance Analysis

To assess whether the differences between the mean scores in each factor are significant, mean comparison tests are performed. The independent variables are the clusters, and the dependent variables the factors SR, NC, IR and AO.

In the case of the two-cluster solution, Levene's test is significant in all cases ($p < 0.01$), and therefore the non-parametric Mann–Whitney test is chosen. There are significant differences ($p < 0.01$) between the mean scores of all factors in the two-cluster solution.

Regarding the four-cluster solution, Levene's test is also significant ($p < 0.01$), and therefore the Kruskal–Wallis test is used, which also shows that there are significant differences ($p < 0.01$) between the factor scores for each of the proposed clusters.

This suggests that the proposed clusters have their own nature. However, it should be noted that, since the clusters have been chosen to maximize differences between cases in different clusters, these tests should be interpreted with caution.

3.5. Non-Hierarchical Cluster Analysis (K-Means) for Fine-Tuning

The hierarchical method used in the previous sections has led to two promising cluster solutions. However, there is a common problem with this type of method: once two cases have been joined in a cluster, there is never a reallocation. The use of Ward's method minimizes the impact of this problem, but, to optimize the solutions found, the hierarchical

K-means method will be used, so that reassignments of cases to clusters are made until maximum homogeneity is obtained within the clusters [54].

The first step is to select seeds for non-hierarchical analysis. We will use for such purpose the centroids of the clusters obtained by using the hierarchical method.

3.5.1. Non-Hierarchical Cluster Analysis (K-Means): 4-Cluster Solution

Table 5 shows the clusters obtained through this procedure for the 4-cluster solution, and Figure 5 shows this information graphically using box diagrams.

Table 5. Clusters obtained using the K-means method for fine-tuning: 4-cluster solution.

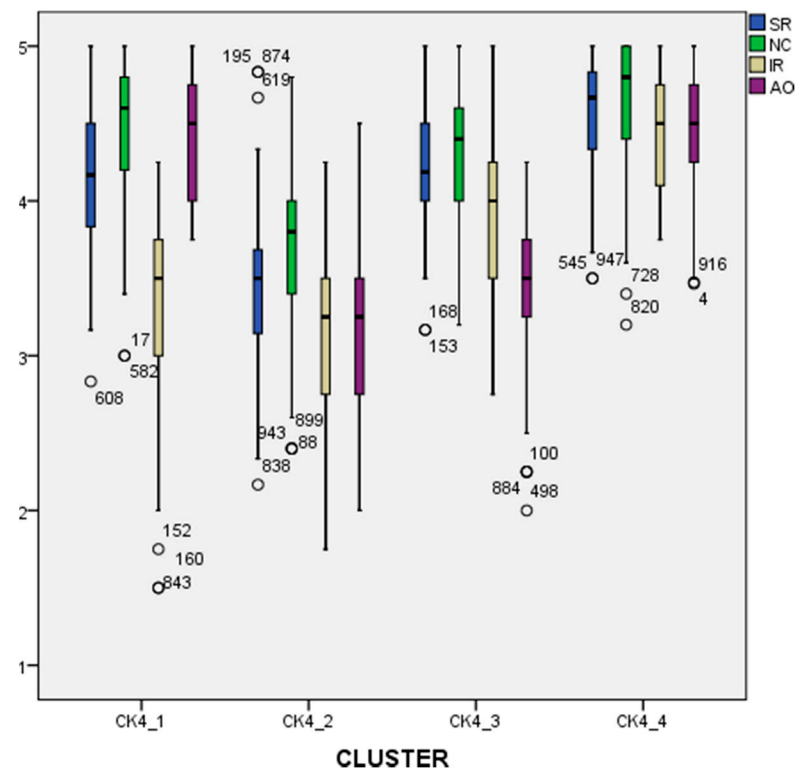|	SR	NC	IR	AO	Students per Cluster
CK4_1	4.14	4.47	3.32	4.39	250
CK4_2	3.42	3.75	3.11	3.19	194
CK4_3	4.25	4.36	3.93	3.43	230
CK4_4	4.56	4.67	4.42	4.51	276

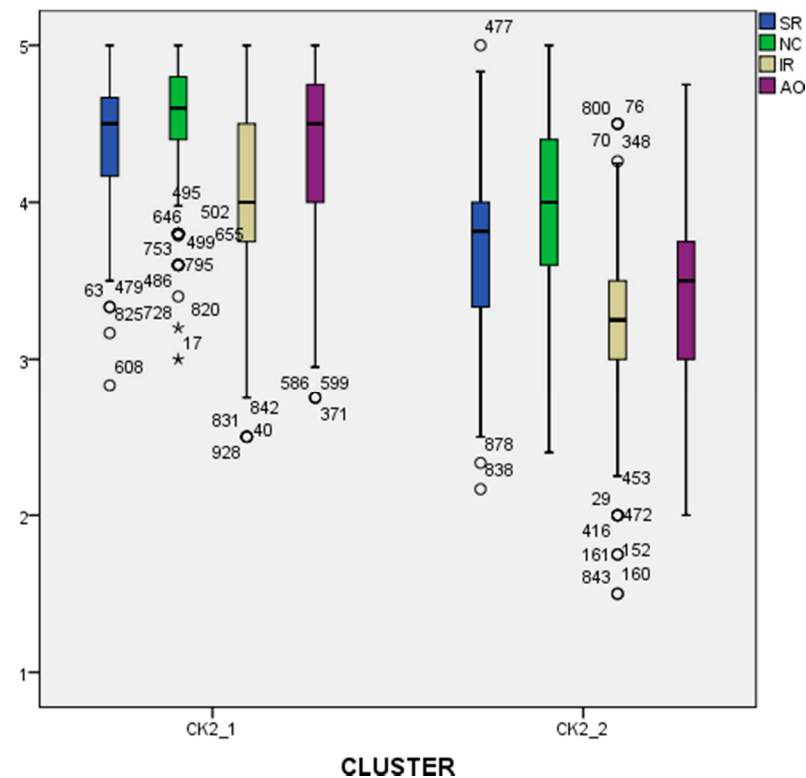**Figure 5.** Solution of four clusters using the K-means method.

As can be seen by comparing the data, the profiles of the 2 and 4-cluster solutions obtained with the non-hierarchical method are very similar to those found with the hierarchical method. The main difference is that the clusters are now somewhat more homogeneous in size.

3.5.2. Non-Hierarchical Cluster Analysis (K-Means): 2-Cluster Solution

Table 6 shows the clusters obtained by this procedure for the 4-cluster solution, and Figure 6 shows this information graphically through box diagrams.

Table 6. Clusters obtained using the K-means method for fine tuning: 2-cluster solution.

	SR	NC	IR	AO	Students per Cluster
CK2_1	4.43	4.60	4.07	4.32	562
CK2_2	3.72	4.00	3.27	3.40	388

Figure 6. Solution of two clusters using the K-means method.

To assess whether the differences between groups are significant, the Mann–Whitney test was performed for the two-cluster solution and the Kruskal–Wallis test for the four-cluster solution. Both show that there are significant differences between the clusters for all factors ($p < 0.01$).

3.6. Validation of Cluster Solutions

Given the exploratory and fundamentally atheoretical nature of the cluster analysis, it is very important to confirm the validity of the solutions obtained, while ensuring that the clusters obtained have practical significance [54]. In this sense, a key strategy is the study of the stability of the cluster solutions, analysing whether the use of different strategies produces clusters similar to those obtained.

For this purpose, a second cluster study was carried out, also using the analysis of K-means clusters, but allowing SPSS software to randomly choose the seed points. After that, a cross classification analysis was carried out, comparing the clusters of the new solutions to those found using the centroids of the clusters obtained through the use of the hierarchical method as seed.

3.6.1. Validation of the 4-Cluster Solution

Table 7 shows the clusters obtained by using the K-means method with random seeds, and Table 8 shows the cross classification analysis.

Table 7. Clusters obtained by the K-means method and random seed points: 4-cluster solution.

	SR	NC	IR	AO	Students per Cluster
CVAL4_1	4.11	4.46	3.31	4.37	251
CVAL4_2	4.25	4.36	3.93	3.42	228
CVAL4_3	3.42	3.74	3.10	3.17	189
CVAL4_4	4.56	4.67	4.41	4.51	282

Table 8. Cross-classification analysis for the 4-cluster solution. Comparison between clusters obtained with the K-means method with random and non-random seeds.

	CVAL4_1	CVAL4_2	CVAL4_3	CVAL4_4	Total
CK4_1	244	0	0	6	250
CK4_2	4	1	189	0	194
CK4_3	3	227	0	0	230
CK4_4	0	0	0	276	276
Total	251	228	189	282	950

For the cross-classification analysis, Table 8 allows us to establish clear correspondences between the clusters obtained using the different methods of obtaining them. Specifically, there are strong similarities between the clusters CK4_1-CVAL4_1, CK4_2-CVAL4_3, CK4_3-CVAL4_2 and CK4_4-CVAL4_4.

Specifically, this analysis shows that 98.5% of the cases have been classified in the same way, which is indicative of the stability of this cluster solution.

3.6.2. Validation of the 2-Cluster Solution

The previous procedure is repeated with the 2-cluster solution Tables 9 and 10.

Table 9. Clusters obtained by the K-means method and random seed points: 2-cluster solution.

	SR	NC	IR	AO	Students per Cluster
CVAL2_1	4.43	4.60	4.07	4.32	562
CVAL2_2	3.72	4.00	3.27	3.40	388

Table 10. Cross-classification analysis for two cluster solutions. Comparison between clusters obtained with the K-means method with random and non-random seeds.

	CVAL2_1	CVAL2_2	Total
CK2_1	0	562	562
CK2_2	388	0	388
Total	388	562	950

The cross comparison shown in Table 10 allows a total correspondence to be established between these clusters and those obtained by defining the centroids. Specifically, there is a biunivocal correspondence between the clusters CK2_1-CVAL2_2 and CK2_2-CVAL2_1.

Therefore, 100% of the cases have been classified in the same way. As in the previous case, this suggests that this solution is very stable.

3.7. Characterisation of the Proposed Final Solutions

In view of the aforementioned, given that the 2 and 4-cluster solutions obtained with the K-means method and centroid seeds calculated through the hierarchical method appear clearly and seem very stable, it was decided that both should be retained. As has already been pointed out, the 4-cluster solution Table 5 and Figure 5 allows for a greater interpretative richness, and the 2-cluster solution Table 6 and Figure 6 facilitates comparisons between groups to see if there are significant differences between them. Both solutions are described below, characterising the profiles derived from them.

3.7.1. Description of the Retained 4-Cluster Solution

In relation to the scores obtained in the different factors of the scale (see Figures 7 and 8), the data show four clusters representing attitudinal trends that can be described as follows:

- **EGOCENTRIST** (cluster CK4_1, N = 250, 26.3%). This group presents high scores in all factors (between 4.14 and 4.47 on average) except IR (3.32). Thus, although they seem to be aware of the anthropogenic origin of environmental problems and the need to address GEC on a social level, the scores obtained in relation to individual responsibility suggest that they are not committed to taking action to deal with problems such as CC or to make changes in their way of living and consumption habits.

- **INDIFFERENT** (cluster CK4_2, N = 194, 20.4%). This group is characterised by recording not very high values in all factors (averages of 3.11 in IR and 3.19 in AO, reaching 3.75 in NC). This part of the sample seems hesitant about the anthropogenic origin of environmental problems and indifferent to the need for individual and social responsibility.

- **SCEPTIC** (cluster CK4_3, N = 230, 24.2%). This group of students presents moderate levels in all factors (between 3.93 and 4.36 on average) except in AO (3.43). Thus, although this group appears to be concerned with addressing GEC, they also appear to be sceptical about the causes of environmental problems. They do not appear to be clear about the origin of CC or the importance of the anthropogenic effect on the variability of conditions on the planet.

- **COMMITTED** (cluster CK4_4, N = 276.29%). These students present high values in all factors (between 4.42 and 4.67), close to the 4.5 average. Thus, these data suggest that this is a group that is very aware of the need for change in order to tackle GEC, which is conscious of its anthropogenic origin and that seems to be involved in tackling GEC on both social and individual levels.
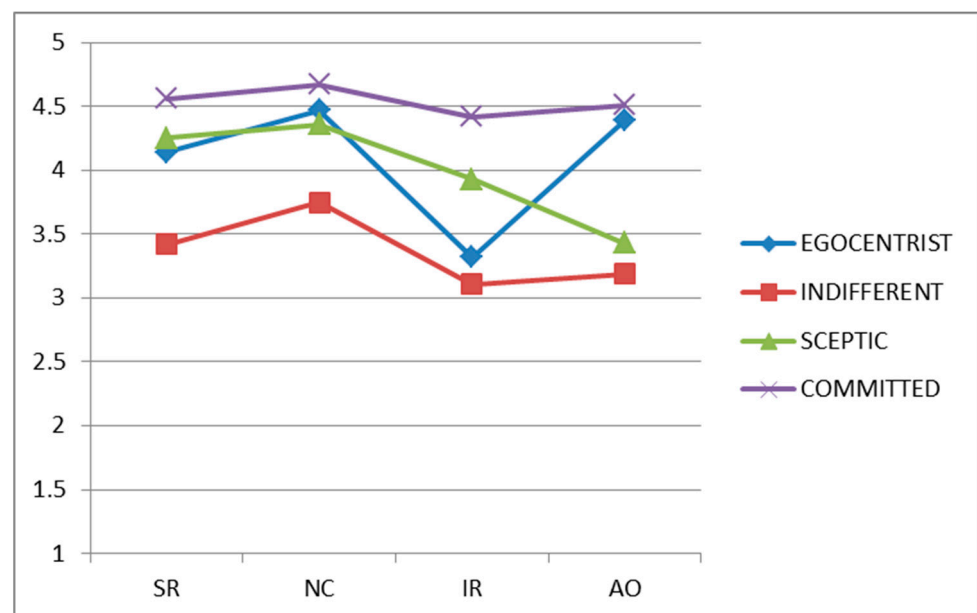

Figure 7. Profiles of the final 4-cluster solution. Average score by factor.
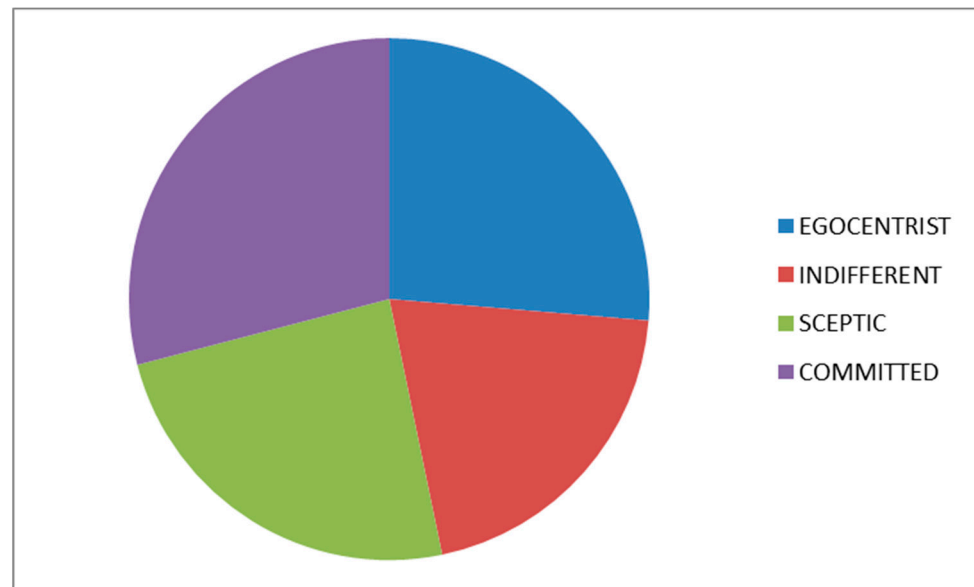
Figure 8. Cluster size (4-cluster solution).

3.7.2. Description of the Retained 2-Cluster Solution

With regard to the 2-cluster solution, it represents two attitudinal trends (Figure 9):

- **CONCERNED** (cluster CK2_1, N = 562.9%). They have high scores in all factors (between 4.07 and 4.60 on average), which seems to indicate that this group is aware of the need to address environmental changes affecting the earth system and show signs of good levels of social and individual responsibility.
- **DISENGAGED** (cluster CK2_2, N = 388.41%). The scores of this section of the sample are clearly lower than the previous ones in all the dimensions analysed (between 3.27 and 4.00 on average), especially in relation to their individual responsibility and their awareness of the anthropogenic origin of GEC.
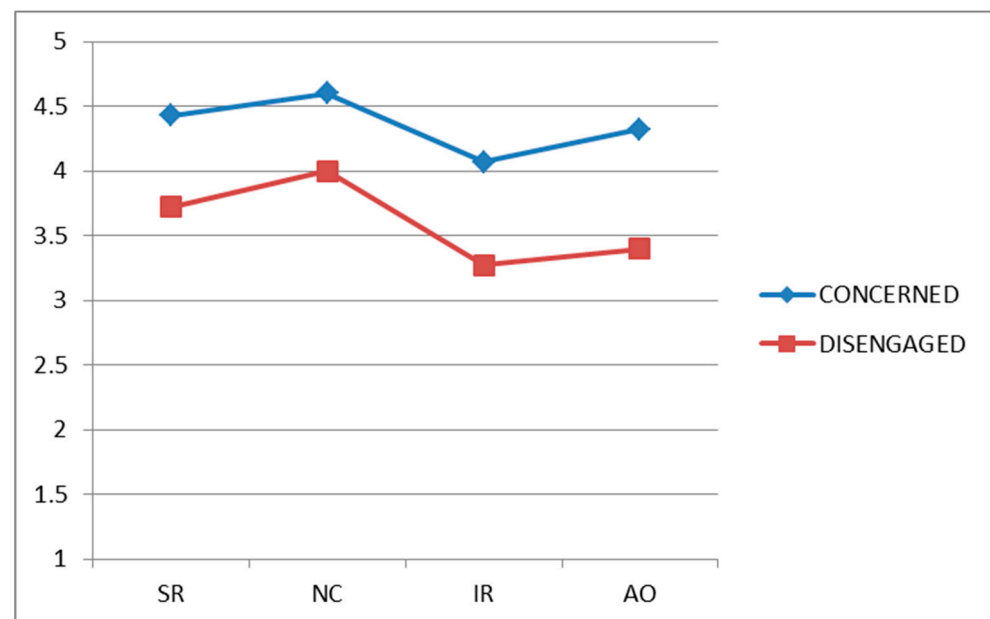

Figure 9. Profiles of the final 2-cluster solution; average score by factor.

Furthermore, we have analysed whether some of the students' characteristics significantly influence their inclusion in one cluster or another. To analyse whether some

variables of interest are related to each subject being included in either the Concerned or Disengaged profiles, chi-squared tests Table 11 were performed with one degree of freedom. In the case of missing values, these were eliminated from the analysis.

Table 11. Percentage of people in the Concerned and Disengaged clusters according to circumstances and personal characteristics.

Variable	Possible Values	Concerned	Disengaged	N	χ^2
Sex	Male Female	50.7% 61.5%	49.3% 39.5%	947	7.632 **
Degree	Infant Education Elementary Education	63.1% 56.1%	36.9% 43.9%	936	4.691 *
Course	1 or 2 3 or 4	58.5% 60.4%	41.5% 39.6%	947	0.327
Subsidy	Public secondary school Private secondary school	60.8% 49.6%	39.2% 50.4%	943	6.132 *
Religiousness	Secular secondary school Religious secondary school	60.9% 45.7%	39.1% 54.3%	943	8.859 **
Age	22 years of age or less Over 22 years of age	58.4% 60.4%	41.6% 39.6%	944	0.359
Baccalaureate	Scientific Non-scientific	59.9% 59.1%	40.1% 40.9%	932	0.045
Mother's educational level	No education or elementary school High school or higher	58.9% 59.5%	41.1% 40.5%	939	0.031
Father's educational level	No education or elementary school High school or higher	59.5% 59.0%	40.5% 41.0%	937	0.021

* $p < 0.05$. ** $p < 0.01$.

As can be seen in Table 11, significant differences have been found in terms of sex, degree, subsidy and religiousness. Specifically, there seems to be greater environmental concern among women, students on the Infant Education Degree course, public centres and secular centres than among men, students on the Elementary Education Degree course, private centres and religious centres, respectively.

4. Discussion

The results obtained on how to approach GEC seem to show that most of the trainee teachers participating in this research are concerned, to a greater or lesser extent, and are aware of the need to address it. However, not all of them seem to be willing to take responsibility and promote changes.

The Sceptical profile (24.2%) suggests the existence of incredulous positions among future teachers, who seem to doubt the human responsibility for the deterioration of the planet. This scepticism in relation to the origin and scope of Climate Change is well documented, in studies with large and transnational Samples [59,60], which is often amplified by the amount of false information and false news that can be found on the Internet [61]. These ways of thinking are problematic not only because their inaccurate or incorrect ideas can be transferred to students, but also because their misunderstanding can be linked to negative emotions about the subject that affect the way in which it is addressed in the classroom [62]. Will this kind of educator be able to teach topics related to environmental problems when they seem not to be confident themselves about the consequences of our socioeconomic model?

The trends suggested by the Egocentric profile (26.3%) are also worrying. These people seem to understand the question, but their responses suggest that they are not willing to make changes at an individual level. Literature points out that, as in so-called "developed" countries, paradigmatic problems of GEC such as Climate Change are perceived with great preoccupation, but this concern does not always lead to a disposition to make

sacrifices to address them [26,63]. With regard to this problem, some studies indicate that the individualistic framework promoted by capitalist systems often causes a feeling of powerlessness when facing global problems [50,64]. Furthermore, people tend to hide behind the responsibility of the business sector and the political sphere in order to avoid getting involved [65], ignoring the fact that, although transformation must come from the social sphere, it is necessary to promote it from personal empowerment [64,66]. Will these teachers be able to promote change starting in the schools when they do not seem to believe in the need to modify their own lifestyles?

However, undoubtedly the most disturbing trend is the Indifferent profile (20%), whose responses seem to reflect indecisive and disengaged attitudes towards the origin of and approach to GEC, suggesting the existence of non-critical and selfish ways of thinking that neo-liberal societies encourage so much [64]. Will these teachers be sufficiently competent to promote the necessary measures at social and individual levels in order to mitigate the problem and adapt to changes?

Thus, only a quarter of the students surveyed, which we include in the Committed profile, seem to display the attitudes necessary to promote a social transformation starting in schools. As Yavetz, Goldman and Pe'er [67] warn, this does not imply that they have the specific training necessary to be able to implement such a transformation in the exercise of their profession.

As such, the results obtained show how it is necessary to continue promoting the training of teachers in relation to socio-environmental issues. In fact, the data collected in this study also show how trainee teachers in the final years of their degree courses do not seem to have more committed attitudes than those in the early years, reflecting the lack of specific training in university degrees, as is also indicated by other studies [38,68].

This research also suggests that the pre-university education of future teachers may also influence their commitment to tackling GEC. Other research also documents the existence of a relationship between the school type and environmental trends. For example, in Turkey, the study by Ercan and Bilen [69] found that students from schools in areas with lower income families appear to have fewer environmental compromise. In Chile, schools in the upper-middle socioeconomic group and private schools showed greater environmental awareness and better pro-environmental behaviour [70]. Agirreazkuenaga's research [45], carried out in Spain, also points out the influence of the type of school, where private school teachers seem to be more involved with Sustainability. Likewise, some studies, such as the one by Stevenson, Peterson, and Bondell [71], suggest that young people from families with a high social status may be more interested in issues of sustainable development and the environment.

These results contrast, however, with those obtained in our study, where people coming from private centres (with a higher economic profile, in general) are more likely to fall within the disengaged trends. This difference in results may be due to the diverse contextual characteristics of each sample. For example, in Spain, it is necessary to take into account the emergence of new right-wing political parties which deny that environmental problems exist and are associated with voters who belong to higher social classes [24]. However, it could also be related to the approach used. Our research is framed within a transformative paradigm that promotes alternatives to the prevailing socioeconomic model [72,73], which may clash with the interests defended by private educational centres.

Our study also shows that the students coming from Catholic religious schools are more inclined to be within the disengaged cluster. This trend has been shown in other studies, such as those by Alkaher and Carmi [42] or Tom [74], which also state that religious values can negatively influence pro-environmental attitudes, especially those belonging to Judaeo-Christian traditions [75].

Gender is also an important factor. Thus, literature indicates that women tend to be more involved with environmental problems [76–78], a trend also shown by the women in this study. Other factors that often influence people's environmental commitment are their

parents' level of education and the type of urban setting in which they live [76,79], but no significant differences were found in our study.

Educational Implications

Fostering the changes needed to mitigate and adapt to GEC implies the integration of sustainable ideas in educational institutions and the promotion of transformative educational models that develop the competence to act and resilience. These must be based on a complex and critical vision of reality, where reflection and critical thinking are encouraged, the analysis of the values ensconced in every daily action, the study of alternatives, participation, autonomous and conscious decision-making and the implementation of collective actions that explore Sustainability and that start from the interrelationship between schools and communities [80–83].

There are interesting proposals for improving the different areas studied here. In order to improve students social responsibility, Aarnio-Linnanvuori [64] suggests that it is necessary to put forward ideas and possibilities for youth environmental action that is realistic to implement at school. To promote social responsibility, this author highlights initiatives such as ecoclubs [84], which can help support student activism and collective environmental action at school. Dyment and Reid [85] also made a valuable reflection on social transformation experiences that should be taken into account. We can also find initiatives that encourage individual responsibility in relation to consumption [86–88], to transport [89] or to energy use [90]. In addition, of course, there are numerous published proposals based on the study of socio-environmental problems that can help fight scepticism and promote awareness of the origin of socio-environmental problems [91–93].

5. Conclusions

In the last few decades, environmental concerns have been increasing as the effects of socio-environmental problems on the planet and on people's lives have multiplied. However, this concern has not led to these problems being addressed socially, perhaps because it involves major alterations to the economic system and important modifications to lifestyles in "developed" countries [16,73].

Teachers have a key role to play in this challenge because of their ability to influence their community and the citizens of the future. The results of this study show that among trainee teachers there are sceptical, self-centred and indifferent trends, which do not correspond to people capable of promoting the transformation needed to tackle GEC. Therefore, it is necessary to improve their training with new educational models that favour the recognition of the real origin of socio-environmental problems and provide them with skills to promote the necessary individual and social responsibility. Our research also suggests that gender and the type of pre-university school can influence their attitudes towards GEC, so these aspects must also be taken into account. The search for a better future should be shared by all people, regardless of gender, background or religion. In addition, for this, it is necessary to promote the commitment of all educational centres.

In assessing the results obtained, it is important to consider the limitations of this research. It focuses on a poorly explored topic, which can be approached in different ways. Thus, we must point out that important aspects could not be addressed on this occasion, such as the values hidden behind each decision or opinion. Furthermore, the sample, although large and diverse, was not obtained randomly. In addition, in relation to the methodology, it should also be considered that the study is merely quantitative, and that it would require an in-depth qualitative study which would allow its results to be triangulated, leaving the possibility of future research open.

In short, this study allows us to explore the trends and shortcomings of future teachers in relation to how GEC is approached, helping us to identify the elements that should be enhanced in their training. We must not lose sight of the fact that the objective must always be to promote resilient communities capable of dealing with present and future problems.

Appendix A

Scale of Global Environmental Change (SGEC) [1].

Item	Item Content
i1	The solution to environmental problems lies in educating communities to find more conscious and austere lifestyles.
i2	Integrating education on Climate Change in schools must be a priority.
i3	Changing fossil fuels for renewable energy sources can halt the global environmental crisis.
i4	Addressing climate challenges requires training specialist scientists in the search for technological solutions to Global Environmental Change.
i5	Protecting the environment must be a priority criterion when voting for a particular political party.
i6	I think that including environmental education in the school curriculum can contribute towards changing the entire community's behaviour.
i7	Climate variations will force us to change our way of life in just a few years.
i8	Pre-school and primary education must prepare pupils for the challenges posed by Global Environmental Change.
i9	It is important to deal with the changes that occur in the chemistry of the oceans.
i10 *	It is possible to reduce social inequalities without changing our current socioeconomic model.
i11	The long-term decisions we make should take into account the future effects of Global Environmental Change.
i12	I will not buy products from companies that pollute the environment.
i13	I have made the decision to mobilise against Climate Change.
i14	I am prepared to make sacrifices in order to fight against Global Environmental Change.
i15 *	I prefer a cheaper product even though I might know that it has been manufactured irresponsibly.
i16 *	It seems to me that people, at an individual level, contribute insignificantly to the increase in greenhouse gases.
i17 *	Climate Change is a natural phenomenon.
i18 *	Human beings do not have an important effect on the variability of the planet's conditions.
i19	Climate Change is directly related to human activity.

* The asterisks indicate that the responses to the item have been re-coded by inverting their order, in such a way that, for example, a score of 1 for a response to a specific question is recoded with a 5.

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