Psychometric Properties of the Climate Change Anxiety Scale in a Sample from Mexico

Propiedades psicométricas de la Escala de Ansiedad por el Cambio Climático en una muestra de México

Propriedades psicométricas da Escala de Ansiedade em Relação às Mudanças Climáticas em uma amostra do México

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Abstract

In recent years, the effects of climate change on mental health have been acknowledged. Among the most prominent consequences is anxiety associated with climate change. Behavioral and cognitive impairments have been mapped within the Climate Change Anxiety Scale (CCAS). The international community has widely used this psychological instrument to explore prevalence across different populations worldwide. The factor structure has been shown to vary by culture. Although the scale has been translated into Spanish, its factor structure has not yet been assessed in Mexico. The current pre-registered study investigated the psychometric properties of the CCAS in a northwestern Mexican community sample using confirmatory factor analysis (CFA). It also assessed convergent and divergent validity using average variance explained (AVE) and its square root (SAVE) compared with self-report climate change coping strategies. Internal consistency was further assessed using Cronbach's alpha, McDonald's omega, and the average interitem correlation. Finally, using data from the present study and a previously published sample, consistency across samples was evaluated using the Tucker congruence index. Both one- and two-factor models showed acceptable goodness of fit after excluding three items (2, 7, and 12). This 10-item version additionally exhibited acceptable reliability coefficients. Finally, the northern Mexican sample showed congruence with a separate student sample from central Mexico. The present study provides initial evidence of the validity of a 10-item version of the CCAS in a northwestern Mexican sample.

Keywords: climate change anxiety; eco-anxiety; northern and central Mexico; validation; factor structure

Resumen

En años recientes, se han reconocido los efectos del cambio climático en la salud mental, entre ellos, la ansiedad asociada a este fenómeno. La Escala de Ansiedad por el Cambio Climático (CCAS, por sus siglas en inglés) evalúa las respuestas cognitivas y conductuales relacionadas con esta preocupación y ha sido utilizada en diferentes poblaciones. Sin embargo, su estructura factorial puede variar según el contexto cultural. Aunque la escala ha sido traducida al español, su estructura factorial no se ha evaluado en México. El presente estudio investigó las propiedades psicométricas de la CCAS en una muestra del noroeste de México mediante un Análisis Factorial Confirmatorio (AFC). Adicionalmente, la validez convergente y divergente fue evaluada utilizando la Varianza Media Explicada (AVE) y su raíz cuadrada (SAVE) en comparación con las estrategias de afrontamiento. La consistencia interna se evaluó con mayor detalle utilizando el alfa de Cronbach, el omega de McDonald y la Correlación Inter-ítem Promedio. Usando datos del presente estudio y de una muestra previamente publicada, se evaluó la consistencia entre muestras usando el índice de congruencia de Tucker. Los modelos uni- y bifactoriales mostraron índices de ajuste aceptables después de excluir tres ítems (2, 7 y 12). Esta versión de 10 ítems exhibió fiabilidad aceptable. La muestra del norte de México mostró congruencia con una muestra del centro de México. Este estudio proporciona evidencia de validez inicial de una versión de 10 ítems de la CCAS en una muestra del noroeste de México.

Palabras clave: ansiedad por el cambio climático; eco-ansiedad; norte y centro de México; validación; estructura factorial

Resumo

Nos últimos anos, os efeitos das mudanças climáticas na saúde mental têm sido reconhecidos, entre eles, a ansiedade associada a esse fenômeno. A Escala de Ansiedade em Relação às Mudanças Climáticas (CCAS, na sigla em inglês) avalia as respostas cognitivas e comportamentais relacionadas a essa preocupação e tem sido utilizada em diferentes populações. No entanto, sua estrutura fatorial pode variar de acordo com o contexto cultural. Embora a escala tenha sido traduzida para o espanhol, a sua estrutura fatorial ainda não foi avaliada no México. O presente estudo investigou as propriedades psicométricas da CCAS numa amostra do noroeste do México, utilizando Análises Fatoriais Confirmatórias (CFA). Além disso, a validade convergente e divergente foi avaliada utilizando a Variância Média Explicada (AVE) e a sua raiz quadrada (SAVE), em comparação com estratégias de enfrentamento. A consistência interna foi ainda avaliada utilizando o alfa de Cronbach, o ómega de McDonald e a correlação média entre itens. Com base nos dados do presente estudo e numa amostra publicada anteriormente, a consistencia entre amostras foi avaliada utilizando o índice de congruência de Tucker. Tanto o modelo de um fator como o de dois fatores apresentaram um bom ajuste aceitável após a exclusão de três itens (2, 7 e 12). Esta versão de 10-itens apresentou uma fiabilidade aceitável. A amostra do norte do México revelou congruência com uma amostra do centro do México. Este estudo fornece evidências iniciais da validade de uma versão de 10 itens da CCAS numa amostra do noroeste do México.

Palavras-chave: ansiedade climática; eco-ansiedade; norte e centro do México; validação; estrutura fatorial

Climate change and its consequences represent one of the greatest challenges of the 21st century (IPCC, 2023). In recent years, a growing body of research has examined how perceptions of climate change may affect mental health (Charlson et al., 2021; Manning & Clayton, 2018). One area of focus is the behavioral and cognitive challenges people experience in response to the current and impending effects of global climate change (Boluda-Verdú et al., 2022; Coffey et al., 2021; Soutar & Wand, 2022). Previous research has documented how different populations express concern about climate change threats, including threats to access to resources such as water, food, and housing. In turn, concerns over resource scarcity may trigger distress responses (Soutar & Wand, 2022). The term "climate change anxiety" (CCA) was coined to encapsulate this phenomenon (Clayton, 2020).

CCA refers to distress responses that an individual may experience in response to perceived threats and consequences related to climate change (Clayton, 2020). Systematic reviews have shown that this type of anxiety consistently demonstrates a range (low to high) of positive correlations with stress, depression, and anxiety symptoms (Cosh et al., 2024). Additionally, negative associations with various measures of emotional well-being have been reported (Gago et al., 2024). However, CCA may help foster sustainability (Crandon et al., 2024). For instance, a cross-cultural study reported a positive correlation between CCA and pro-environmental behaviors (Ogunbode et al., 2022). Further studies on this relationship show that individuals with moderate levels of CCA have a greater intention to engage in pro-environmental behavior than those reporting high levels (Chapman & Peters, 2024; Maduneme, 2024).

Clayton and Karazsia (2020) developed a CCAS to measure anxiety-related outcomes in response to fears about climate uncertainty. The scale was originally theorized to have four factors, but evidence indicated that the data fit a two-factor model better. The first factor, "cognitive-emotional impairment," comprises eight items and captures how climate change affects concentration and emotions. The second factor, "functional impairment," consists of five items and assesses whether climate change-related psychological distress has led to problems in an individual's daily functioning. Behavioral engagement and experience were initially considered factors but were excluded based on factor analysis.

Identifying an appropriate factor structure for psychological instruments is essential to verify that the items align with the theoretical constructs they were intended to measure. Given the importance of evaluating the effects of global warming on mental health outcomes (Clayton, 2020; Crane et al., 2022) and the potential application of the CCA construct in research and practice (Morris et al., 2025), it is essential to evaluate the psychometric properties of instruments measuring it. Factor analysis and subsequent validation analyses provide evidence on whether the scale measures the construct of interest by assessing test-content quality and mapping its correlational network. They also support cross-cultural prevalence comparisons by ensuring some degree of equivalence between constructs and avoiding contextual biases. Finally, a valid and reliable CCA evaluation helps design interventions to reduce climate-related distress by identifying vulnerable populations and translating their anxiety experiences into sustainable solutions (Butler, 2025; Kühner et al., 2025; Morris et al., 2025; Tam et al., 2023).

The CCAS has undergone multiple validation efforts across diverse cultural contexts, reflecting growing interest in its cross-cultural applicability (Tam et al., 2023). These studies have examined different factor structures in diverse samples and reported variations in dimensionality across countries. Table 1 summarizes the factor structures identified in previous research and provides an overview of how the scale has been operationalized in different cultural settings. Although some researchers agree that the measure has a two-factor structure (Clayton & Karazsia, 2020; Tam et al., 2023), others suggest the factor structure may depend on cultural context (see Table 1). A recent paper that included an Italian sample showed that the data may fit better into a one-dimensional model (Innocenti et al., 2021). Studies conducted using samples from Canada and Poland found that the data fit a three-factor structure better (Larionow et al., 2022; Lukacs et al., 2023). Finally, another study using a German sample found poor goodness of fit for one- and two- factor models (Wullenkord et al., 2021).

Recent theoretical models have identified "climate change coping strategies" as a distinct yet related variable to CCA. Crandon et al. (2024) propose a sequential, bidirectional relationship in which CCA activates cognitive and behavioral coping processes. These processes are theorized to lie along a continuum of adaptability, which ultimately determines the functional impact on the individual. Crucially, the model delineates two separate, albeit interacting, components: (1) affect, which includes anxious emotions and physiological symptoms; and (2) coping, which encompasses cognitive appraisals and behavioral responses.

Table 1.
Factor Structure of the Climate Change Anxiety Scale in Previous Studies

Study	Country sample	Accepted factor structure
Clayton & Karazsia (2020)	United States	Two-factor
Cruz & High (2022)	United States	One-factor and two-factor
Fekih-Romdhane et al. (2024)	Lebanon	Two-factor
Innocenti et al. (2021)	Italy	One-factor
Jang et al. (2023)	South Korea	Two-factor
Larionow et al. (2022)	Poland	Two-factor and three-factor
Lukacs et al. (2023)	Canada	Three-factor
Mouguiama-Daouda et al. (2022)	France, Belgium, Switzerland, Gabon, and other French-speaking territories	Two-factor
Plohl et al. (2023)	Slovenia	Two-factor
Simon et al. (2022)	Philippines	Two-factor
Tam et al. (2023)	China, India, Japan, and the United States	Two-factor
Wullenkord et al. (2021)	Germany	No accepted structure

Source: Own elaboration.

Van Valkengoed & Steg (2024) reinforce this conceptual separation. While CCA is conceptualized as a distressing affective state, individuals respond to it through a broader repertoire that includes emotional reactions, cognitive evaluations, and behavioral tendencies. Within this broader response repertoire, coping strategies constitute a specific subset of responses explicitly oriented toward regulating emotional distress and managing perceived threat, rather than merely reflecting affective or attitudinal reactions to climate change.

These constructs are theoretically related yet fundamentally distinct: CCA refers to the core affective experience, whereas coping refers to subsequent regulatory processes. Classic stress models, such as Lazarus and Folkman (1984), support this distinction. According to their model, anxiety and coping strategies are similar yet distinct psychological processes. An acceptable measure of CCA should tap into the emotional experience of anxiety itself, not the strategic responses to it. Consequently, we hypothesize that the CCAS will diverge from climate change coping strategies in a discriminant validity test. This would confirm that the CCAS instrument captures the emotional core of anxiety rather than its regulatory counterparts.

Most research on climate change anxiety has relied on samples from Global North countries (Jarrett et al., 2024). For a more nuanced understanding of this phenomenon, research must be conducted in Global South regions (Ghai, 2021; Henrich et al., 2010). This includes Mexico, which, because of its geography and economy, is among the most vulnerable nations to climate change worldwide (Murray-Tortarolo, 2021; Nolasco & López-Portillo, 2019).

Climate change has had a significant environmental impact in Mexico, which can lead to further economic and health consequences. For instance, since the beginning of the 20th century, temperatures have risen by 1.69 °C, exceeding the global average. Rainfall has increased by 3.1 mm per month, yet the number of consecutive dry days has risen from 70 to 80 per year since 2000. In the region surrounding the Gulf of Mexico, sea levels have risen by 2.4 mm per year, surpassing the global average of 1.8 mm per year. Climate variability also favors the life cycles and reproduction of various pathogens, increasing the incidence of diseases such as dengue, Zika, malaria, and leptospirosis in Mexico. Temperature changes are further associated with higher rates of deadly conditions, including chronic lower respiratory diseases and heart disease (PICC & ICACC, 2023).

If climate change is not addressed, Mexico could lose up to 5% of the nation's GDP. This impact stems from multiple factors, including declining agricultural production, with potential yield reductions ranging from 5% to 20% and possibly up to 80% in the coming decades (PICC & ICACC, 2023). Coastal tourist resorts would also be affected by more intense storms and rising sea levels (Nava Escudero, 2017). In rural areas, where most income depends on agriculture, extreme temperature fluctuations and irregular rainfall patterns will further reduce crop and livestock production (USAID, 2023).

Moreover, many regions of Mexico have seen the expansion of large-scale extractive projects (e. g., mines or dams), which have contributed to environmental degradation and intensified socio-environmental conflicts. In response, numerous ecological collectives have emerged to protect local ecosystems and advocate for environmental justice. However, these communities and activists often face intimidation, forced displacement, scarcity of natural resources, and even death threats, conditions that may exacerbate CCA (Gravante & Poma, 2016; Poma, 2018; Poma & Gravante, 2024). Given the effects of climate change in Mexico and the lack of research on the factor structure and other evidence of validity, the present study aims to investigate the psychometric properties of the CCAS in a sample of participants from northwestern Mexico.

Methods

Participants and Sampling

The study used non-probability convenience sampling. Following Moshagen and Musch (2014), we aimed to recruit at least 300 participants and collected 460 responses online via Qualtrics. We recruited participants through social media (Instagram and WhatsApp) and in person in university classrooms at northwestern Mexican universities (State of Sonora). All participants provided informed consent before taking part in the study. This research project was approved by the Committee on Research Ethics Involving Human Subjects at the Universidad Nacional Autónoma de México (#02/2026).

Participants were college students and community members. We excluded 85 participants from the total sample using listwise deletion (81 did not complete the questionnaire, and 4 completed it in less than 2 minutes). The final sample consisted of 375 participants aged 18–86 years (M = 24.21,

SD = 8.77). Most participants self-identified as female (233, 62.13%), with 138 (36.8%) identifying as male, three preferring to self-describe (0.08%), and one choosing not to report gender (0.03%).

Measures

Climate change anxiety. We used the Spanish translation (Ramírez-López et al., 2023) of the Clayton and Karazsia (2020) scale, which had been used in Mexico. The original version consists of two factors. The first is the cognitive-emotional impairment factor, comprising eight items (e. g., "Thinking about climate change makes it difficult for me to concentrate"). The second is the functional impairment factor, comprising five items (e. g., "My concerns about climate change undermine my ability to work to my potential"). The complete list of the Spanish items used is provided in Supplementary Table 1. Participants responded on a five-point Likert scale (1 = Never, 5 = Almost always). The original study (Clayton & Karazsia, 2020) reported acceptable internal consistency ($\alpha \geq 0.80$).

Climate change coping strategies. We used Ojala's (2013) scale. This measure comprises three factors: "problem-focused coping" with three items (e. g., "I talk with my family and friends about what one can do to help"; $\alpha = 0.77$), "de-emphasizing coping" with five items (e. g., "I can't be bothered to care about climate change"; $\alpha = 0.82$), and "meaning-focused coping" with six items (e. g., "More and more people have started to take climate change seriously"; $\alpha = 0.73$). Respondents rated items on a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree). The measure was translated and back-translated (Supplementary Table 2), and CFA indicated satisfactory fit indices (Supplementary Figure 1).

Data Analysis

We analyzed the data using JASP v.0.19.3.0 (JASP Team, 2025). The following analyses were conducted in accordance with our pre-registration plan. First, we conducted a confirmatory factor analysis (CFA) to evaluate the factor structure (one- and two-factor) of the CCAS. We used the chi-square (χ^2) test to assess model fit. Because χ^2 is highly sensitive to sample size, we relied on the relative χ^2, a common measure in structural equation modeling (SEM), to evaluate how well the hypothesized model fits the sample data. It is calculated by dividing the χ^2 statistic by its degrees of freedom. Ratios between 2.0 and 5.0 are considered acceptable (Hooper et al., 2008).

We also used practical indices of goodness of fit, including the comparative fit index (CFI), Bentler-Bonett normalized fit index (NFI), and Tucker-Lewis index (TLI), all of which should exceed 0.90 (Bentler, 2007). In addition, we used the root mean square error of approximation (RMSEA), which must be less than 0.08 (Browne & Cudeck, 1992). Reliability was evaluated using Cronbach's alpha (α), McDonald's omega (ω), and the average interitem correlation (AIC) to assess the instrument's internal consistency. It is expected that Cronbach's alpha and McDonald's omega be equal to or higher than 0.60 and 0.65, respectively (Kalkbrenner, 2023), while AIC is expected to be between 0.15 and 0.50 (Clark & Watson, 2019).[1]

[1] Preregistered information, data, and materials are available at https://osf.io/pd3qt/overview?view_only=7a5ba9a1ce5b43aeb104e745ff907310

We also conducted the following exploratory (non-preregistered) analyses to further examine the CCA instrument's psychometric characteristics. We performed a χ^2 comparison test across the assessed models and a correlation analysis to evaluate the association between CCA and climate change coping strategies. We assessed convergent validity using the average variance extracted (AVE), which represents the proportion of variance in the observed indicators explained by the latent construct. An AVE greater than 0.50 indicates that the construct explains more than half of the variance in its indicators, providing evidence of convergent validity (Fornell & Larcker, 1981). Discriminant validity was assessed using the square root of the average variance extracted (SAVE), which reflects the correlation between a construct and its indicators. We considered evidence of discriminant validity when the SAVE for each construct exceeded its correlations with theoretically related constructs, in this case, climate change coping strategies (Henseler et al., 2009).

Additionally, we calculated the Tucker congruence index to compare data from the present study's sample with those from another study of students from central Mexico. Tucker congruence scores above 0.85 indicate consistency between samples (Lorenzo-Seva & Ten Berge, 2006). We also used these two Mexican samples to test measurement invariance (configurational, metric, and scalar) to determine whether the scale measures the same construct in a similar way across both samples. Following the recommended invariance cutoff criteria (Chen, 2007), a CFI decrease greater than 0.005, an RMSEA increase greater than 0.01, and an increase in the standardized root mean square residual (SRMR) greater than 0.025 indicate a lack of invariance and lead to rejection of the more restrictive model.

Results

Before conducting CFA, we tested the multivariate normality assumption using Mardia's test. Our data violated this assumption, as multivariate skewness (χ^2 [2922] = 2922, $p < .001$) and multivariate kurtosis (z [52.71], $p < .001$) were statistically significant. Therefore, we used maximum likelihood with robust standard errors (MLR) for estimation. Table 2 presents the goodness-of-fit indices.

Table 2.
Goodness-of-Fit Indices for One- and Two-Factor Structure Solutions

Factor structure	χ^2	*Df*	Relative χ^2	CFI	NFI	TLI	RMSEA [CI]	SRMR
Original 13-item version								
One-factor	199.726	65	3.07	0.89	0.84	0.86	0.074 [0.06–0.83]	0.05
Two-factor	173.775	64	2.71	0.91	0.86	0.89	0.067 [0.07–0.10]	0.06
10-item version								
One-factor	80.045	35	2.28	0.94	0.90	0.93	0.058 [0.04–0.07]	0.04
Two-factor	71.287	34	2.09	0.95	0.91	0.94	0.054 [0.03–0.06]	0.04

Source: Own elaboration.

The original 13-item version, in both its unifactorial and bifactorial models, showed unacceptable goodness-of-fit. We excluded items 2, 7, and 12 from the model (see Supplementary Table 1 for the complete list of items). Item 2 was excluded because of its high residual covariance with item 1 (Modification index [MI] = 44.91 in the one-factor model and 38.61 in the two-factor model). Likewise, item 12 was excluded because of its high residual covariance with item 11 (*MI* = 44.91 in the one-factor model and 30.76 in the two-factor model). Item 7 was excluded for conceptual reasons, as its semantic content appeared to reflect a coping behavior rather than CCA.

As shown in Table 2, both the one- and two-factor 10-item solutions yielded acceptable fit indices. We also compared the 10-item model with the original 13-item version by examining the change in chi-square values. Both the one-factor ($\Delta\chi^2 = 119.681$, $\Delta df = 30$, $p < 0.001$) and two-factor ($\Delta\chi^2 = 102.488$, $\Delta df = 30$, $p < 0.001$) models showed better fit for the 10-item version. We then conducted subsequent analyses using the 10-item version. All factor loadings exceeded the minimum recommended threshold (Figures 1 and 2). In the two-factor model, the cognitive-emotional impairment and functional impairment factors had a covariance of 0.91.

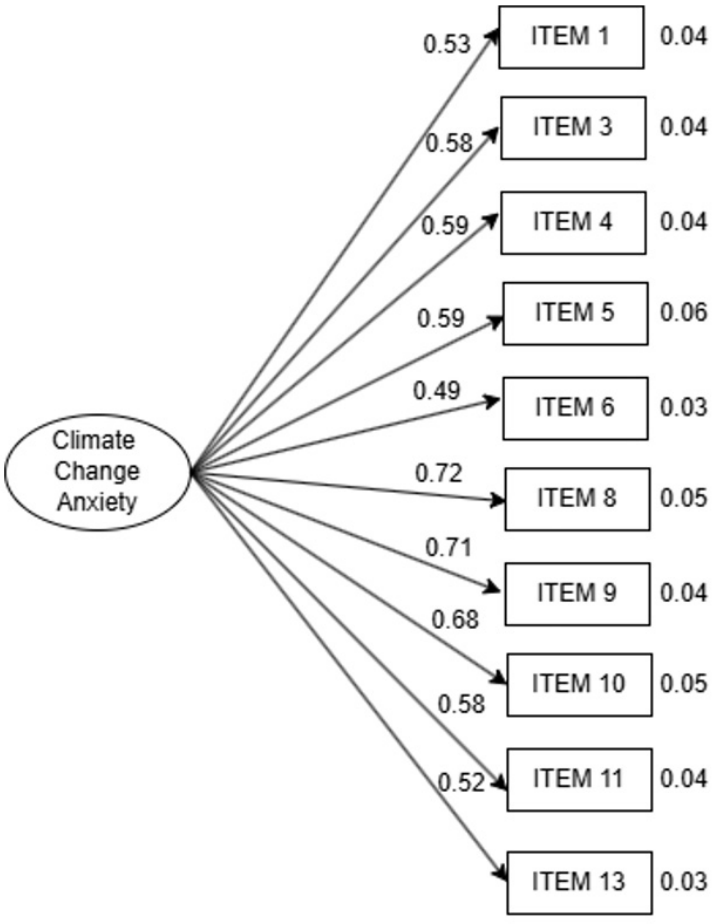


Figure 1. One-Factor Model of the Climate Change Anxiety Scale

Source: Own elaboration.

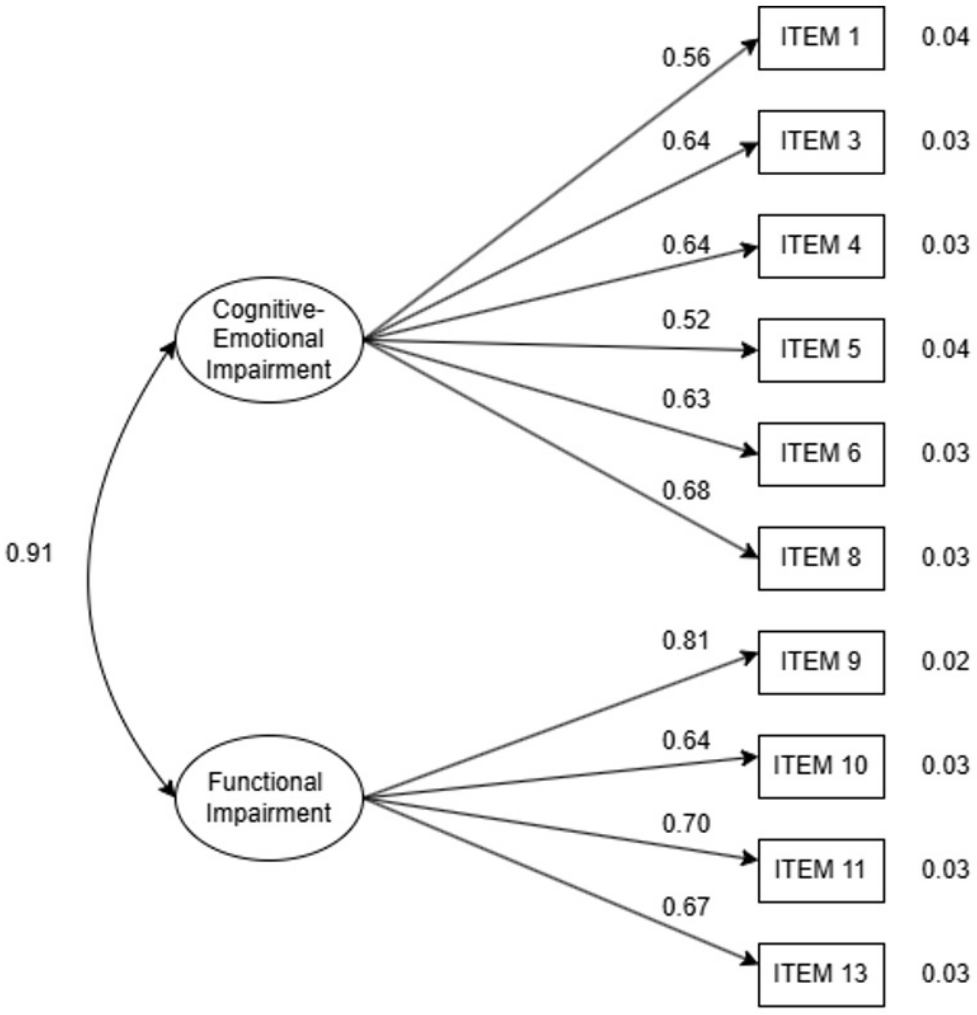


Figure 2. Two-Factor Model of the Climate Change Anxiety Scale

Source: Own elaboration.

Table 3 presents descriptive statistics and psychometric characteristics for the CCAS one- and two-factor structures. Internal consistency reliability was acceptable for both models. The one-factor model yielded satisfactory indices ($\alpha = 0.86$, $\omega = 0.86$, AIC = 0.40). The subscales also demonstrated acceptable reliability (cognitive-emotional impairment; $\alpha = 0.78$, $\omega = 0.77$, AIC = 0.38; functional impairment factors: $\alpha = 0.78$, $\omega = 0.80$, AIC = 0.49). Normality was assessed by inspecting skewness and kurtosis, with values within ±1 considered acceptable. Results indicate that the one-factor model and the functional impairment factor fall outside the traditional normality threshold.

Table 4 presents Pearson's correlation analysis. General CCA was positively associated with climate change coping strategies ($r = 0.15$, $p < 0.05$) and with problem-focused coping ($r = 0.32$, $p < 0.001$). Cognitive-emotional impairment was associated with climate change coping strategies ($r = 0.44$, $p < 0.001$), meaning-focused coping ($r = 0.64$, $p > 0.001$), de-emphasizing coping ($r = -0.15$, $p < 0.05$), and problem-focused coping ($r = 0.39$, $p < 0.001$). Functional impairment

was correlated with climate change coping strategies ($r = 0.11$, $p < 0.05$) and with problem-focused coping ($r = 0.25$, $p < 0.001$).

We calculated AVE to assess convergent validity (see Table 5). None of the proposed factor structures met the recommended minimum threshold (> 0.50).

Table 3.
Descriptive Statistics, Reliability, and Normality Test of the Climate Change Anxiety Scale

Factor structure	N Items	*M*	*SD*	α	ω	AIC	Skewness	Kurtosis
One-factor	10	1.77	0.65	0.86	0.86	0.40	1.26	1.91
Two-factor	-	-	-	-	-	-	-	-
Cognitive-emotional impairment	6	2.43	0.53	0.78	0.77	0.38	0.34	0.99
Functional impairment	4	1.61	0.71	0.78	0.80	0.49	1.51	2.44

Source: Own elaboration.

Table 4.
Correlation Between Climate Change Anxiety and Climate Change Coping Strategies

	1	2	3	4	5	6	7
1. Climate change anxiety	—						
2. Cognitive-emotional impairment	0.64**	—					
3. Functional impairment	0.89**	0.55**	—				
4. Climate change coping strategies	0.15*	0.44**	0.11*	—			
5. Meaning-focused coping	0.06	0.64**	0.09	0.69**	—		
6. De-emphasizing coping	-.0	-0.15*	-0.07	0.59**	-0.04	—	
7. Problem-focused coping	0.32**	0.39**	0.25**	0.65**	0.32**	0.13*	—

Note: * = $p < 0.05$; ** = $p < 0.001$.
Source: Own elaboration.

Table 5.
Average Variance Extracted (AVE) and Square Root of the Average Variance Extracted (SAVE) of the Climate Change Anxiety Scale

Factor structure	AVE	SAVE
One-factor	0.402	0.634
Two-factor		
Cognitive-emotional impairment	0.378	0.614
Functional impairment	0.498	0.705

Source: Own elaboration.

Table 6 presents differences in SAVE values across the tested factor structures and their correlations with the climate change coping strategies scale. Across all tested structures, SAVE exceeded the corresponding correlation coefficients, except for the difference between the cognitive-emotional impairment factor in the two-factor model and the meaning-focused coping strategy.

Table 7 presents the invariance analyses for the one- and two-factor models in samples 1 and 2. We found no evidence of metric or scalar invariance because the changes in fit indices exceeded the recommended thresholds (ΔCFI > -0.005, ΔRMSEA > 0.010, and ΔSRMR > 0.025) for both factor structures. Consequently, only configural invariance is supported.

Table 6.
Differences Among the Climate Change Anxiety Factors and Their Correlations With Climate Change Coping Strategies

Factor	Difference SAVE - Correlations
One-factor	
One-factor - Meaning-focused coping	0.570
One-factor - De-emphasizing coping	0.627
One-factor - Problem-focused coping	0.313
Cognitive-emotional impairment	
Cognitive-emotional impairment - Meaning-focused coping	-0.030*
Cognitive-emotional impairment - De-emphasizing coping	0.464
Cognitive-emotional impairment - Problem-focused coping	0.224
Functional impairment	
Functional impairment - Meaning-focused coping	0.612
Functional impairment - De-emphasizing coping	0.631
Functional impairment - Problem-focused coping	0.448

Note: * SAVE is lower than the correlation.
Source: Own elaboration.

Table 7.
Congruence Coefficients Between Two Mexican Samples

	One-factor model	Two-factor model	
		Cognitive-emotional impairment	Functional impairment
Sample 1 vs. Sample 2	0.993**	0.984**	0.990**

Note: * Fair factor similarity (> 0.85).
** Strong factor similarity (> 0.95).
Source: Own elaboration.

Table 8 presents the invariance analyses for the one- and two-factor models in samples 1 and 2. We found no evidence of metric or scalar invariance, as changes in fit indices exceeded the recommended thresholds for both factor structures. Consequently, only configural invariance is supported.

Table 8.
Fit Indices for the Invariance Test

Factor structure	χ^2 ($\Delta\chi^2$)	*df*(Δdf)	CFI (ΔCFI)	RMSEA [CI] (ΔRMSEA)	SRMR (ΔSRMR)
One-factor					
Configural	181.067 (-)	70 (-)	0.949 (-)	0.061 [0.05 - 0.07] (-)	0.041 (-)
Metric	216.392 (35.325)	79 (9)	0.937 (-0.012)	0.064 [0.05 - 0.07] (0.03)	0.072 (0.031)
Scalar	344.870 (128.478)	88 (9)	0.883 (-0.054)	0.083 [0.09 - 0.11] (0.019)	0.093 (0.021)
Two-factor					
Configural	146.338 (-)	68 (-)	0.964 (-)	0.052 [0.04 - 0.06] (-)	0.037 (-)
Metric	177.570 (31.232)	76 (8)	0.953 (-0.011)	0.056 [0.04 - 0.06] (0.004)	0.065 (0.028)
Scalar	313.396 (135.286)	84 (8)	0.895 (-0.058)	0.080 [0.07 - 0.08] (0.024)	0.090 (0.025)

Source: Own elaboration.

Discussion

The present study evaluated the psychometric properties of the CCAS. Findings indicate that both the one- and two-factor models demonstrated acceptable psychometric properties after removing three items. However, some validity indicators, such as the AVE, did not meet the recommended threshold. Both models showed cross-sample congruence, providing preliminary evidence that the 10-item version stably represents CCA, regardless of whether it is conceptualized as a one- or two-factor construct.

Although the scale showed adequate indicators in the factor analysis, achieving the final model required removing several items (items 2, 7, and 12). We initially removed these items based on statistical evidence. For instance, we excluded item 2 because of its high residual covariance with item 1, and we removed item 12 due to its high residual covariance with item 11. Additional evidence for their exclusion comes from conceptual considerations. For items 2 and 12, content overlap with other items (item 1 and 11, respectively) may be present, as they are written in a similar fashion. For instance, items 1 and 2 share almost identical phrasing ("Thinking about climate change makes it difficult for me to…"), and the same occurs with items 11 and 12, both beginning with "My concerns about climate change..." This overlap between items 11 and 12 has already been flagged as problematic in a recent meta-analysis (Morris et al., 2025). Similarly, Cruz and High (2022) reported items 2 and 12 as problematic and excluded them to achieve acceptable model fit. Item 7 was excluded because of its semantic content ("I write down my thoughts about climate change and analyze them"). Previous studies suggest that it reflects a coping behavior rather than discomfort (Larionow et al., 2022).

This interpretation is supported by evidence showing that certain forms of writing can help reduce emotional distress (Guo et al., 2023).

Our study found a large covariance between the *cognitive-emotional impairment* and *functional impairment factors* in the two-factor model. Previous studies have reported this strong interrelation, with coefficients ranging from 0.73 to 0.91 (Cruz & High, 2022; Fekih-Romdhane et al., 2024; Larionow et al., 2022; Mouguiama-Daouda et al., 2022; Plohl et al., 2023; Simon et al., 2022). This large association may be problematic, as it could indicate multicollinearity and suggest that the two factors lack sufficient empirical distinction (Kashdan et al., 2008; Kyriazos & Poga, 2023). Future research should further examine this issue using approaches such as Exploratory Structural Equation Modeling (ESEM), which may yield more realistic estimates of factor intercorrelations (Joshanloo, 2016).

The reliability analysis results support the internal consistency of both the one- and two-factor structures of the CCAS. Specifically, the one-factor model demonstrated strong reliability, with Cronbach's alpha and McDonald's omega substantially exceeding the recommended benchmarks (Kalkbrenner, 2023). Furthermore, its AIC fell optimally within the suggested range (Clark & Watson, 2019), indicating a well-balanced set of items without excessive redundancy. The two-factor solution also maintained strong reliability, with both subscales showing solid internal consistency; the cognitive-emotional and functional subscales exceeded the established threshold. Notably, the slightly higher AIC for the functional impairment subscale suggests that its items share a strong common core, potentially reflecting a more narrowly defined or behaviorally specific aspect of CCA. Collectively, these reliability indices confirm that the scale items cohere robustly, whether treated as a unidimensional construct or as a two-factor structure. This is consistent with previous validation studies that reported acceptable internal consistency indices (Innocenti et al., 2021; Larionow et al., 2022; Mouguiama-Daouda et al., 2022; Wullenkord et al., 2021).

Following non-preregistered analysis, AVE values for both factor structures ranged from 0.37 to 0.49, below the recommended 0.50 cutoff (Fornell & Larcker, 1981). This suggests that, although the items were expected to capture a common underlying construct, their shared variance was insufficient to empirically demonstrate convergence on the same latent dimension. However, lower AVE values can be justified when the scale demonstrates high reliability and adequate factor loadings (Moral de la Rubia, 2019). In this study, both factors exhibited strong internal consistency, with reliability coefficients of 0.77 to 0.86, exceeding the recommended threshold (Kalkbrenner, 2023). Moreover, most standardized factor loadings were > 0.50, reinforcing the adequacy of the measurement model. Thus, although the AVE did not reach the conventional cutoff, the scale's strong reliability and satisfactory factor loadings provide some support for its convergent validity within a more integrative validation framework (Moral de la Rubia, 2019).

Our study supported divergent validity for the one-factor model, as the SAVE was higher than all correlations. For the two-factor model, the SAVE exceeded the correlations in 5 of 6 comparisons. This pattern suggests that, overall, the scale factors are adequately distinct from the coping strategies scale, although one dimension showed limited differentiation. Consistent with this pattern of divergent validity, the observed associations between CCA and coping strategies were generally small to moderate, aligning with prior empirical findings. For example, Daeninck et al. (2023) reported weak

and often non-significant correlations between CCA and coping subscales. Similarly, Chen et al. (2025) found an almost null association between overall CCA and climate change coping strategies scores. Taken together, this convergence across studies reinforces the interpretation that CCA and coping strategies are related yet empirically distinct constructs, supporting the scale's discriminant validity.

Using the sample collected in this study, which consisted of students and community members from northwestern Mexico, and a sample of university students from central Mexico (Ramírez-López et al., 2023), it was possible to obtain the congruence coefficient. This showed strong similarity between the samples (> 0.95) (Lorenzo-Seva & Ten Berge, 2006), suggesting factor stability in the instrument. This finding was supported by subsequent evidence of configural invariance. However, our study found no evidence of metric or scalar invariance, which differs from previous similar studies (Larionow et al., 2022; Tam et al., 2023). These results are exploratory and should be interpreted with caution; nevertheless, they offer useful indications for future studies to refine the scale, reassess its dimensionality, and further evaluate its psychometric properties across diverse samples.

Limitations

This research is not without limitations. Most of the sample was composed of female participants (62.13%). Although this bias is common in psychological studies (Richmond et al., 2015), future studies should aim for a more gender-balanced sample. Our study used non-probabilistic sampling, which may limit the generalizability of the results. To address this, future studies should use random sampling methods. Because complete reliance on self-report measures could lead to mono-method bias, subsequent research should include additional CCA measures, such as image-rating tasks (Lehman et al., 2019).

This study did not include invariance analyses by gender or age. Because these variables relate to CCA (Kühner et al., 2025), future research may incorporate such analyses. Removing three items from the scale may limit the study's results. Therefore, subsequent studies should attempt to replicate this 10-item model in different samples. The study did not record information on participants' recruitment source (community or university students), preventing subgroup analyses. Future research should address this limitation by documenting recruitment sources. Another limitation is that the present study's validity analysis relied solely on statistical tests (CFA, AVE, and SAVE). Future research should also incorporate additional forms of validity, such as qualitative validity (content and face validity), as well as more complex types of quantitative validity, including nomological and predictive validity (Lim, 2024). Integrating these complementary approaches may help address the limitations identified here, particularly the lack of convergent validity.

Following preregistration, our research focused exclusively on testing whether the data fit a one- or two-factor structure better, which is the approach most studies have used (Tam et al., 2024). However, some recent work has suggested a three-factor structure. For instance, Larionow et al. (2022) proposed that the CCAS may comprise three dimensions: intrusive symptoms, reflections on climate change, and functional impairment. This structure was later supported by a meta-analysis conducted

by Morris et al. (2025). Therefore, future studies should evaluate this newly proposed factor structure to determine whether it better represents the construct. Because all participants were from a northwestern region of Mexico, our findings should be interpreted with caution. Future endeavors should aim to collect data from other regions of Mexico and Latin America to ensure its valid use in other Spanish-speaking regions.

Conclusion

Given that Mexico is among the countries most affected by climate change (Murray-Tortarolo, 2021), it is essential to have a psychometric instrument capable of assessing the psychological distress responses triggered by this phenomenon. In Mexico, CCA often manifests through grassroots environmental activism, especially in self-organized collectives that resist large megaprojects, such as mines, dams, or infrastructure developments, that threaten local ecosystems and territories (Gravante & Poma, 2016; Poma, 2018; Poma & Gravante, 2024). The present study contributes to this goal, as the adapted instrument demonstrated adequate validity. Therefore, this version of the scale may be particularly useful for designing interventions aimed at alleviating climate-related distress and promoting effective strategies to cope with such discomfort (Bingley et al., 2022; Crandon et al., 2024).

Authors' contributions

Angel Sánchez-Zavala: Conceptualization, data curation, formal analysis, investigation, methodology, software, validation, visualization, writing – original draft.

Marisela Acosta Hernández: Data curation, software, validation.

M. Yancy Lucas: Project administration, writing – review & editing.

Martha Frías-Armenta: Conceptualization, methodology, project administration, writing – review & editing.

Víctor Corral-Verdugo: Project administration, writing – review & editing.

Marcos Rosetti: Writing – review & editing.

Nadia S. Corral-Frías: Conceptualization, formal analysis, methodology, project administration, writing – review & editing.

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Ethical considerations

The present study was reviewed and approved by the Committee on Research Ethics Involving Human Subjects at the National Autonomous University of Mexico (Universidad Nacional Autónoma de México [UNAM]) (#02/2026).

Use of AI

The authors used DeepL to improve the manuscript's writing.

Conflict of interest

The authors declare no conflict of interest.

Data availability statement

All data and materials used in this article are publicly available at https://osf.io/pd3qt/overview?view_only=7a5ba9a1ce5b43aeb104e745ff907310.

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Supplementary material for "Psychometric Properties of the Spanish Climate Change Anxiety Scale in a Sample From Mexico"

Supplementary Table 1. Spanish Version of the Climate Change Anxiety Scale

Items
1. Pensar en el cambio climático me hace difícil concentrarme.
2. Pensar en el cambio climático hace que me cueste dormir.*
3. Tengo pesadillas sobre el cambio climático.
4. Lloro por temas relacionados con el cambio climático.
5. Pienso: ¿Por qué no puedo manejar mejor el cambio climático?
6. Me aíslo de la gente y pienso por qué me siento así en relación con el cambio climático.
7. Escribo y analizo mis pensamientos sobre el cambio climático.*
8. Pienso: ¿Por qué reacciono ante el cambio climático de esta manera?
9. Mis preocupaciones sobre el cambio climático me hacen difícil divertirme con mis amigos o mi familia.
10. Me cuesta encontrar un equilibrio entre el cuidado del medio ambiente y las necesidades de mis amigos o familia.
11. Mis preocupaciones ante el cambio climático me afectan a la hora de hacer las tareas del colegio o del trabajo.
12. Mis preocupaciones ante el cambio climático disminuyen mi capacidad de trabajar al 100% de mi potencial.*
13. Mis amigos dicen que pienso demasiado en el cambio climático.

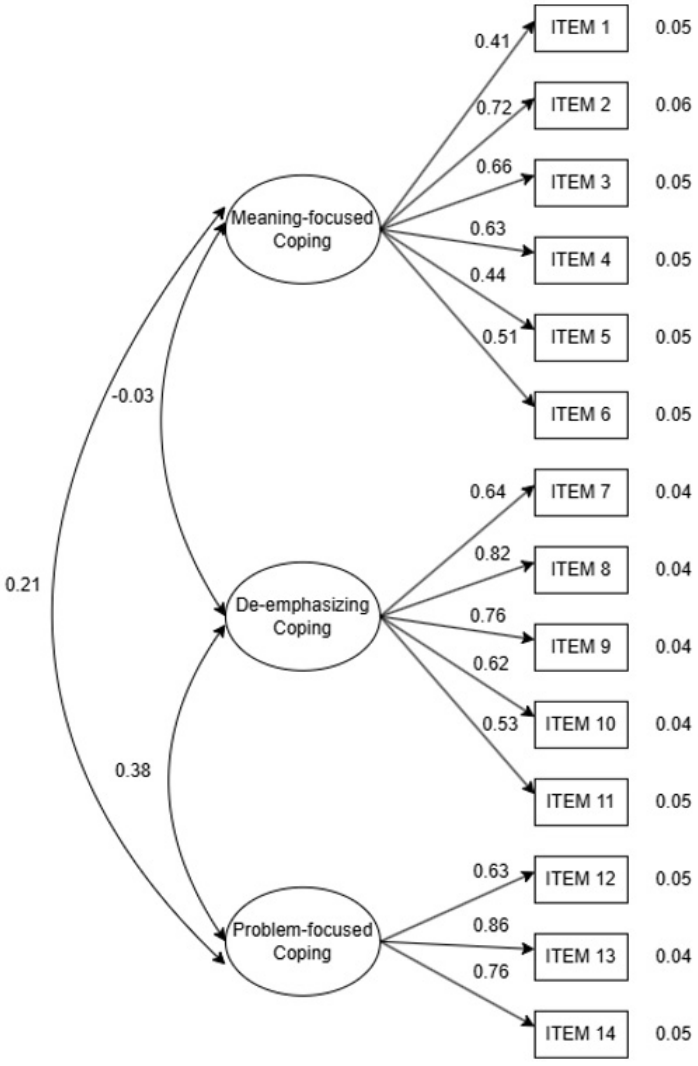
Note: * Deleted item. Cognitive-emotional impairment = Items 1–8; Functional impairment = 9–13.
Source: Own elaboration.

The instrument was translated and adapted from English to Spanish by a Spanish speaker with a high level of English proficiency. It was then back-translated into English by another Spanish speaker with native English proficiency. A third evaluator, a native English speaker with advanced Spanish proficiency, compared both versions and served as a referee. The three translators agreed that the versions were accurate. Minor contextual adaptations were made to improve comprehension among the Mexican population. For example, in the item "Climate change does not concern those of us living in Sweden," "Sweden" was replaced with "my country." The item "I search for information about what I as a child can do" was adapted to "Busco información sobre lo que puedo hacer" ("I look for information about what I can do") to be applicable to a general sample. Finally, the item "Climate change is something positive because the summers will get warmer" was removed because its Global North-specific contextual connotations could create ambiguities in the Global South (see Supplementary Table 2).

Supplementary Table 2. Back translation of the Climate Change Coping Strategies scale

Original	Spanish translation	Back translation
More and more people have started to take climate change seriously.	Cada vez más personas comienzan a tomar en serio el cambio climático.	Every day more people are starting to take climate change seriously.
I have faith in humanity; we can fix all problems.	Tengo fe en la humanidad; podemos solucionar todos los problemas.	I have faith in humanity; we can solve all problems.
I trust scientists to come up with a solution in the future.	Confío en que los científicos/as vendrán con una solución en el futuro.	I trust that scientists will come up with a solution in the future.
I have faith in people engaged in environmental organizations.	Tengo fe en las personas involucradas en organizaciones ambientales.	I have faith in people involved in environmental organizations.
I trust the politicians.	Confío en los políticos (personas que ocupan cargos de liderazgo político).	I trust in politicians.
Even though it is a big problem, one has to have hope.	A pesar de que es un gran problema, uno debe tener esperanza.	Despite it being a great problem, we need to have hope.
I think that the problem is exaggerated.	Creo que el problema está siendo exagerado.	I think the problem is being exaggerated.
I don't care since I don't know much about climate change.	No me importa, ya que no sé mucho sobre el cambio climático.	I don't care, given that I don't know much about climate change.
Climate change is something positive because the summers will get warmer.	Item removed	Item removed
I can't be bothered to care about climate change.	No me interesa preocuparme por el cambio climático.	I am not interested in worrying about climate change.
Nothing serious will happen during my lifetime.	Nada serio ocurrirá durante mi vida.	Nothing serious will happen within my lifetime.
Climate change does not concern those of us living in Sweden.	El cambio climático no es algo que deba preocupar a los que viven en mi país.	Climate change is not something people in my country should worry about.
I think about what I myself can do.	Pienso en lo que yo mismo puedo hacer.	I think about the things I can do myself.
I search for information about what I as a child can do.	Busco información sobre lo que puedo hacer.	I look for information about what I can do.
I talk with my family and friends about what one can do to help.	Hablo con mi familia y amistades sobre qué puede hacer uno para ayudar.	I talk to my family and friends about what could be done to help.

Source: Own elaboration.



Supplementary Figure 1. Confirmatory Factor Analysis of the Climate Change Coping Strategies Scale

Note: X^2 = 195.163 [*df* = 74; *p* = < 0.001], SRMR = 0.080, RMSEA = 0.066, 90% CI [0.055–0.077]; TLI = 0.90, CFI = 0.91. df: degrees of freedom; CFI: comparative fit index; CI: confidence interval; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual; TLI: Tucker-Lewis index.

Source: Own elaboration.

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