Analysis of the structure and factorial invariance of the Multidimensional Environmental Concern Scale (MECS)

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Abstract

Background: Most studies focused on measuring environmental attitudes consider a one-dimension measure of pro/anti-environmentalism, such as NEP scale. Nevertheless, more recent research has shown that it seems more adequate to use a multidimensional approach when assessing complex relations among people and the natural environment, particularly on cultural basis. This paper aims to test the psychometric properties of the Multidimensional Environmental Concern Scale (MECS) and, in particular, its factorial invariance. **Method:** Two studies were conducted. The first one assessed factorial invariance using two different approaches (multiple group confirmatory factor analysis – MGCFA, and alignment method) in a sample of 907 undergraduate students from Argentina, India, and Spain. A second study was conducted with 557 adults from Mexico and Spain, which also evaluated the criterion validity of the MECS' scores. **Results:** The results obtained allowed to assure an acceptable degree of invariance of the MECS among all countries, and in terms of gender (Studies 1 and 2), age and education level (Study 2). **Conclusions:** Results provide support for a multidimensional approach when studying the environmental concern, showing that the environmentalism presents different associations depending on the analysed country. A deep analysis on different conceptualization of environmentalism will be promoted.

Keywords: Environmental concern, multiple group confirmatory factor analysis, alignment method, multidimensional approach.

Resumen

Análisis de la estructura e invarianza factorial de la Escala Multidimensional de Ambientalismo (EMA). **Antecedentes:** la mayoría de los estudios que miden actitudes ambientales utilizan una medida unidimensional de pro/anti-ambientalismo como la escala NPE. Sin embargo, investigaciones recientes han mostrado la adecuación de enfoques multidimensionales al medir las relaciones complejas entre las personas y el entorno natural, particularmente sobre una base cultural. Este trabajo tiene como objetivo probar las propiedades psicométricas de la Escala Multidimensional de Ambientalismo (EMA) y, en particular, su invarianza factorial. **Método:** se realizaron dos estudios. El primero evaluó la invarianza a través de dos enfoques diferentes (análisis factorial confirmatorio multigrupo y método de alineamiento) en una muestra de 907 estudiantes universitarios de Argentina, India y España. El segundo estudio, llevado a cabo en México y España con 557 adultos de la población general, evaluó además la validez de criterio sobre las puntuaciones obtenidas con la EMA. **Resultados:** se obtiene un nivel de invarianza aceptable de la EMA entre los países considerados y según género (estudios 1 y 2), edad y nivel educativo (estudio 2). **Conclusiones:** los resultados apoyan un enfoque multidimensional de las actitudes ambientales, mostrando que el interés ambiental presenta distintas asociaciones según el país analizado. Ello permitirá estudiar en profundidad las diferentes conceptualizaciones del ambientalismo.

Palabras clave: ambientalismo, análisis factorial confirmatorio multigrupo, método de alineamiento.

Most traditional studies focused on measuring concerns and attitudes towards the environment consider a one-dimensional measure of pro or anti-environmentalism (Dunlap & Van Liere, 1978; Weigel & Weigel, 1978). The revised New Environmental Paradigm scale (Dunlap, Van Liere, Mertig, & Jones, 2000) offers a well-established worldview measure about environmental issues by evaluating endorsement to the New Ecological Paradigm

(NEP). This measure, based on a one-dimensional approach, might be considered as the starting point to study environmental concern (EC). Nevertheless, other research has shown that it seems more adequate to use a multidimensional approach when measuring complex relations among people and the natural environment. In this regard, Thompson and Barton (1994) suggested that people might hold different motivations to preserve the environment, proposing a measure with three dimensions: ecocentrism, which value nature *per se*; anthropocentrism aimed at maintaining the quality of human life; and apathy, which denote the lack of concern towards the environment. In the same line, environmental attitudes would be represented by dimensions such as preservation and utilization (Milfont & Duckitt, 2010); or the three related concerns: egoistic, socioaltruistic, and biospheric, depending on the adverse

evaluated consequences of environmental problem (Stern, Dietz, & Guagnano, 1995). According to Schultz (2001), the kind of egoistic, socioaltruistic, or biospheric concern is associated with the level of inclusiveness of the other (including nature) in the cognitive definition or representation of oneself. The likelihood of showing biospheric concern would increase as the concept of the self is broadened to include nature.

The multidimensional approach of the EC has gained importance in the last years. However, the NEP scale is still widely accepted when measuring a general belief or worldview about human and its relation to nature (Ajdukovic, Gilibert, & Fointiat, 2019; Dombois, & Funke, 2018). Researchers interested in measuring EC using the NEP scale should take into account Dunlap's (2008) acknowledgment of the lack of consistency when this scale is used in developing countries either East Europe or Latin America. Within the Asiatic context, Chatterjee (2008) questions the Western HEP (Human Exceptionalism Paradigm)-NEP distinction as inappropriate in the Indian background due to the great differences in traditions and worldviews. Hawcroft and Milfont's (2010) meta-analysis suggests a variation in the use of the NEP scale, especially when considering the number of items and the reply options provided to the participants. Some studies in Latin American countries apply a reduced version of NEP scale in order to increase internal consistency (Moyano-Díaz & Palomo-Vélez, 2014; Reyna, Bressán, Mola, Belaus, & Ortiz, 2018). Amburgey and Thoman (2012) suggest the use of the NEP scale considering its five related facets instead of a one-dimensional measurement. The discrepancies among studies focused on the EC and related behaviours, particularly in Latin America and within ethnic minority groups, point out an emphasis in individual factors underestimating social context where these groups live (Medina, DeRonda, Ross, Curtin, & Jia, 2019). According to Stern et al. (1995), social structure (comprised by cultural or normative patterns in which individuals are embedded) shapes the way people perceive nature, creating a worldview about human-nature relationships. This worldview influences proximate psychological variables such as specific beliefs, personal norms, attitudes, intentions or behaviours related to particular actions.

Schultz's work on the inclusion of nature in the concept of self (see Schultz, 2002 for a more exhaustive review) refers to a cognitive consideration of the self as having been integrated into life as a whole, and the belief that the individual forms part of the natural environment by being immersed in it. The Schultz's inclusion model provides a flexible framework to analyse human-nature interactions where different dimensions of EC mentioned above can be integrated. Besides and unlike NEP worldview, it has into account the different self-construals depending on cultural patterns (Markus & Kitayama, 1991). In response to the need to delve deeper into these issues through the contributions made by the studies analysed above, Amérigo, Aragonés, and García (2012) propose a conceptual model that integrates different aspects that the literature has revealed on EC matters. Based on the Schultz's inclusion model, this proposal is composed by four related dimensions, defined considering a continuum of inclusion of nature into the self-concept: from the independence between the nature and the self (Environmental Apathy) to the complete fusion of both elements in a transactional perspective (Emotional Affinity towards Nature). According to these authors, intermediate positions imply a conception of interdependence between self and nature, whether to improve human quality of life (Anthropocentrism) or to maintain the balance needed to preserve the ecosystem (Connectedness). In order to prove the model, the authors designed an instrument, the *Multidimensional Environmental Concern Scale* (MECS), which gather most traditional attitudinal measures of the EC found in literature, including the NEP scale. This measure has been tested in different countries in Latin America such as Brazil or Chile (Amérigo, García, & Côrtes, 2017; Amérigo, Palavecinos, García, Román, & Trizano-Hermosilla, 2017). Results show that the MECS reflects the four proposed dimensions of the EC; but studies testing factorial invariance are needed in order to provide a well-founded instrument. Additionally, more research should be conducted to confirm the dimensions in other developing countries.

This paper aims to analyse the psychometric properties of the MECS and the measurement of invariance in different contexts. To address this objective, two studies are presented where the MECS has been applied to four different countries (Argentina, India, Mexico and Spain) and two different samples (university students and general population). The expected outcome would be to find the same proposed four-dimensional structure in both studies. Nevertheless, and according to previous literature, differences should be found in the relationships obtained among dimensional scores depending on the analysed country. In order to analysed MECS' factorial invariance, two approaches will be used: the traditional Multiple Group Confirmatory Factor Analysis (MGCFA) and the more flexible alignment method proposed by Asparouhov and Muthén (2014). The complementarity of both approaches will provide a deepening on the research aim.

Method

STUDY 1

Participants

The convenience sample was composed by 907 undergraduate students from health and social sciences degrees (M_{age} = 23.66, SD = 5.39), 77.9% females and 22.1% males from Argentina (N = 342), India (N = 265) and Spain (N = 300). There was a gender bias in the sample, because most of the students enrolled in these degrees were female. No significant differences were found in the mean age, $F(2, 904) = 1.415$, $p = .243$, $\eta^2 = .003$, and gender distribution, $\chi^2(2) = 0.104$, $p = .949$, among countries.

Instruments and procedure

An online questionnaire consisting of two sections was designed. The first section gathered socio-demographic information (i.e., age and gender). The second section included the MECS (Amérigo et al., 2012). MECS measures four dimensions of the environmental concern (environmental apathy, anthropocentrism, connectedness and emotional affinity toward nature) and is composed by 20 items (5 for each dimension) rated on a 5-point Likert-type scale ranging from strongly disagree (1) to strongly agree (5).

The questionnaire was administered in Spanish to participants from Argentina and Spain. A pilot questionnaire with Argentinian students did not detect any idioms differences on the Spanish version of the MECS. In India, common language university students' tuition is English, therefore the questionnaire was administered in that language.

Data analyses

Statistical analyses were carried out using Mplus version 8.0 (Muthén & Muthén, 2017), R version 3.6.0, and the following R packages: GPArotation (Bernaards & Jennrich, 2005), psych (Revelle, 2018), and Rcmdr (Fox & Bouchet-Valat, 2019). In order to account for the ordinal nature of the items, the polychoric correlation matrix was used (Gadermann, Guhn, & Zumbo, 2012). Thus, following the Viladrich, Angulo-Brunet, and Doval's (2017) recommendations: (1) the weighted least squares mean and variance adjusted (WLSMV) estimator was used for the MGCFA; and (2) the ordinal omega coefficient (ordinal ω) was used to estimate internal consistency reliability of the scores because the underlying models were congeneric not essentially tau-equivalent.

In order to evaluate the factorial invariance across groups (countries) of the MECS two different approaches were used. The first one was the traditional MGCFA and the hierarchical procedure described by Steenkamp and Baumgartner (1998). Specifically, we focus on the examination of configural, metric and scalar/threshold invariance. Comparing covariances across the groups is possible when metric invariance is satisfied, but scalar/threshold invariance is required for the comparison of mean factor scores (Dimitrov, 2010; Pendergast, von der Embse, Kilgus, & Eklund (2017); Steenkamp & Baumgartner, 1998). The procedure and recommendations for ordinal data described by Pendergast et al. (2017) was followed in this case. Taking into consideration the suggestion of Chen (2007), for a total sample size higher than 300 participants and relatively equal sample sizes across the groups, it is assumed that differences between metric and configural models (M1 and M0) and scalar/threshold and metric models (M2 and M1) in comparative fit index (CFI) that do not reach -.010, supplemented by a change in root mean square error of approximation (RMSEA) less than .015, indicates factorial invariance across groups. The second approach was the alignment method, which is more flexible than the traditional MGCFA (Byrne & van de Vijver, 2017; Muthén & Asparouhov, 2018). The maximum likelihood estimation with robust standard errors (MLR) and the Mplus ALIGNMENT option was used for these analyses.

Subsequently, in order to compare covariances/correlations between factors across countries, we used the DIFFTEST option, which is available in the case of WLSMV estimator in Mplus (Muthén & Muthén, 2017). A significant DIFFTEST ($p < .05$) suggests that constraining a covariance parameter across countries worsens model fit.

Study 2

Participants

A general population sample of 557 adults ranging from 18 to 65 years old (M_{age} = 30.99, SD = 11.08) from Mexico (N = 312) and Spain (N = 245) participated in this study. 62.3% were women. Most respondents had a university degree (41.7%), while the percentage of participants without university education was of 34.3% and the remainder had postgraduate studies. There were no significant differences in age, $t(555)$ = -0.525, p = .600, η^2 = .000, gender, $\chi^2(1)$ = 0.058, p = .809, and education level, $\chi^2(2)$ = 3.516, p = .172, between the Mexican and Spanish subsamples. Participants were recruited by means of a snowball sampling in both countries.

Instruments and procedure

The questionnaire was administered online in Spanish. No idioms adaptations were necessary in Mexico. In addition to the socio-demographic data (i.e., gender, age, and education level) and the MECS, the questionnaire also included: (1) a single item, five pairs of overlapping circles labelled 'self' and 'nature', to assess the degree of the Inclusion of Nature in Self (INS), adapted from Schultz (2002); and (2) an open-response question, inspired in Thompson and Barton (1994), in which respondents were asked to provide their email address as contact information to participate in a future environmental activism campaign organised by the university. Afterwards, a dummy variable was created to measure whether (1) or not (0) the respondent reported an activism intention.

Data analyses

Analyses of the structure and factorial invariance of the MECS were performed following the same procedure as described above for Study 1. Additionally, criterion validity of the MECS' scores was assessed by: (1) examining correlations between the factor scores of the MECS and the INS; and (2) exploring the impact of these scores on activism intention through forward stepwise logistic regressions. These additional statistical analyses were performed using SPSS version 19.0.

Results

MECS' factorial invariance

Table 1 presents the results for both studies regarding the four-factor model fit and the differences between metric and configural models (M1 and M0) and scalar/threshold and configural models (M2 and M1). The configural invariance was first examined. A well-fitting M0 (CFI > .90, RMSEA < .08) suggested that a similar measurement model was plausible across countries for both studies. All loadings were statistically significant ($p < .001$), although one item (APA1) was deleted in Study 1 because of very low standardised loadings (λ < .20). We also tested MGCFA with three factors (environmental apathy, anthropocentrism, and connectedness and emotional affinity towards nature as a one-factor), according to Thompson and Barton (1994), and two factors (environmental apathy and anthropocentrism as a one-factor, and connectedness and emotional affinity as another factor), according to Milfont and Duckitt (2010); but the model fit was extremely poor in both analysis. Secondly, the metric invariance was tested. The M1 fit was also adequate, with ΔCFI and ΔRMSEA within the threshold of acceptable differences, indicating that the factor loadings could be assumed as equal across groups. It allowed comparisons of covariances across countries. Thirdly, the scalar/threshold invariance was evaluated. The differences in the fit between M2 and M1 did not satisfy the criteria for ΔCFI (in both studies) and ΔRMSEA (in Study 1) proposed by Chen (2007), and full scalar/threshold invariance could not be established.

Nevertheless, recent studies showed that a poorly scalar/threshold model fit is usually obtained when using MGCFA (Byrne & van de Vijver, 2017; Muthén & Asparouhov, 2018). In contrast, the alignment method (Asparouhov & Muthén, 2014): (1) is based on the configural model; (2) simplifies measurement invariance

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Table 1
MGCFA approach: MECS factorial invariance test

Study/Model	$\chi 2$ (*df*)	TLI	CFI	RMSEA (90% CI)	Δdf	ΔCFI	ΔRMSEA
Study 1. University students							
Single group solution							
Argentina (*N = 342*)	297.473*** (146)	.951	.958	.055 (.046, .064)			
India (*N = 265*)	388.169*** (146)	.937	.947	.079 (.070, .089)			
Spain (*N = 300*)	291.641*** (146)	.961	.967	.058 (.048, .067)			
M0. Configural invariance	980.115*** (438)	.949	.957	.064 (.055, .069)			
M1. Metric invariance	1092.513*** (468)	.946	.950	.066 (.061, .072)	30	-.007	.002
M2. Scalar/threshold invariance	1822.554*** (574)	.911	.901	.085 (.080, .089)	106	-.049	.019
Study 2. General population							
Single group solution							
Mexico (*N = 312*)	318.424*** (164)	.970	.974	.056 (.047, .065)			
Spain (*N = 245*)	319.403*** (164)	.963	.968	.060 (.050, .071)			
M0. Configural invariance	637.827*** (328)	.967	.972	.058 (.051, .065)			
M1. Metric invariance	683.653*** (344)	.966	.969	.059 (.053, .066)	16	-.003	.001
M2. Scalar/threshold invariance	852.029*** (400)	.961	.959	.064 (.058, .070)	56	-.010	.005

Note: $\chi 2$ = Chi-square test of model fit, TLI = Tucker-Lewis fit index, CFI = Comparative fit index, RMSEA = Root mean-square error of approximation, ΔCFI = Change in CFI, ΔRMSEA = Change in RMSEA, *df* = degree of freedom.
*** $p < .001$

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analysis; and (3) provides a detailed account of parameter (non) invariance in every group. Tables 2 and 3 report the evidences of approximate measurement (non)invariance across countries in Studies 1 and 2, respectively. Table 2 shows that only seven parameters (6.1%) were noninvariant across countries in Study 1; while table 3 indicates that only two parameters (2.6%) were noninvariant in Study 2. In addition, we tested the MECS' factorial invariance considering the interaction of country and gender (in both studies); and country and age/education level (in Study 2). In all these analyses the noninvariant findings were far below the cut-point of 20% (Asporuhoy & Muthén, 2014). These results indicated that the MECS' factorial structure was invariant: (1) across the analysed countries; and (2) in terms of gender (in both studies), age and education (in Study 2) both between and within countries.

MECS' scores internal consistency and correlation patterns

Table 4 shows that the estimation of the internal consistency reliability (ordinal ω) for the MECS' scores were adequate in all the analysed countries in both studies.

Table 5 shows the correlations between the four dimensions of the MECS in Study 1. Connectedness correlated significantly and positively with emotional affinity in the three countries, without significant differences (DIFFTEST $p > .05$) in the magnitude among them. Apathy correlated significantly and positively with anthropocentrism, and negatively with connectedness and emotional affinity in the university student samples from the three countries; although there were differences in correlations magnitude as follows. The association between apathy and anthropocentrism was weaker in India than in the other two countries (DIFFTEST $p < .05$). Additionally, the negative correlations of apathy with connectedness and emotional affinity were more intense in Argentina than in India. In the comparison of student samples from

Spain and Argentina, the only statistically significant difference was that apathy and connectedness were two dimensions more opposed in Argentina than in Spain. Lastly, anthropocentrism correlated significantly and negatively with connectedness and emotional affinity in Argentina and Spain; but the opposite resulted in India.

The results presented in table 6 allowed us to compare the patterns of correlations between the dimensions of MECS in the samples of the general population from Mexico and Spain. Apathy positively and significantly correlated with anthropocentrism and negatively and significantly correlated with emotional affinity, without any statistical differences between the two countries. A positive and strong correlation was observed between connectedness and emotional affinity in both countries. The differences between the countries were as follows: (1) apathy is more negatively associated with connectedness and emotional affinity in Spain than in Mexico; and (2) anthropocentrism correlated negatively and significantly with connectedness in Spain, but there was not association in Mexico.

Criterion validity of the MECS' scores

The general population data from Mexico and Spain (Study 2) allowed us to assess the criterion validity of the MECS' scores. On the one hand, the criterion validity was examined by correlating the factor scores of environmental apathy, anthropocentrism, connectedness and emotional affinity toward with the INS. In the case of Mexico, a positive and statistically significant correlation was found between the INS and the dimensions of emotional affinity ($r_s = .586$, $p < .001$) and connectedness ($r_s = .609$, $p < .001$). The INS was negatively and significantly correlated with anthropocentrism ($r_s = -.294$, $p < .001$) and apathy ($r_s = -.559$, $p < .001$). A similar correlation pattern was found in the case of Spain, although all the correlation coefficients between the INS and the

Table 2
Alignment method: Approximate measurement (non)invariance for groups (Study 1. University students)

Construct/Variable	Country		Country x Gender	
	Loadings	Intercepts	Loadings	Intercepts
Apathy				
APA1				
APA2	AIS	AIS	AmImSmAwIwSw	AmImSmAwIwSw
APA3	AIS	AIS	AmImSmAwIwSw	AmImSmAwIwSw
APA4	AIS	AI(**S**)	AmImSmAwIwSw	(**Am**)ImSmAwIw(**Sw**)
APA5	AIS	AIS	AmImSmAwIwSw	AmImSmAwIwSw
Anthropocentrism				
ANT1	AIS	AIS	AmImSmAwIwSw	AmImSmAwIwSw
ANT2	AIS	AIS	AmImSmAwIwSw	AmImSmAwIwSw
ANT3	AIS	AIS	AmImSmAwIwSw	AmImSmAwIwSw
ANT4	AIS	AIS	AmImSmAwIwSw	AmImSmAwIwSw
ANT5	AIS	(**A**)IS	AmImSmAwIwSw	AmImSmAwIwSw
Connectedness				
CON1	AIS	AIS	AmImSmAwIwSw	AmImSmAwIwSw
CON2	A(**I**)S	AIS	AmImSmAwIwSw	AmImSmAwIwSw
CON3	AIS	A(**I**)S	AmImSmAwIwSw	Am(**Im**)SmAw(**Iw**)Sw
CON4	AIS	AIS	AmImSmAwIwSw	AwAmImSmAwIwSw
CON5	AIS	AI(**S**)	AmImSmAwIwSw	AmImSmAwIwSw
Emotional Affinity				
EMO1	AIS	AIS	AmImSmAwIwSw	AmImSmAwIw(**Sw**)
EMO2	AIS	A(**I**)S	AmImSmAwIwSw	AmImSmAw(**Iw**)Sw
EMO3	AIS	AIS	AmImSmAwIwSw	AmImSmAwIwSw
EMO4	AIS	A(**I**)S	AmImSmAwIwSw	AmImSmAw(**Iw**)Sw
EMO5	AIS	AIS	AmImSmAwIwSw	AmImSmAwIwSw
Noninvariant rate	6.1%		3.1%	

Note: A = Argentina, I = India, S = Spain, A/I/Sm = Argentinian/Indian/Spanish men, A/I/Sw = Argentinian/Indian/Spanish women. Groups that are deemed to have a significantly noninvariant measurement parameter are shown in boldface within parentheses

dimensions of the MECS were lower in absolute value than those found in the Mexican population sample: apathy (r_s = -.283, $p <$ .001), anthropocentrism (r_s = -.205, $p <$ .001), connectedness (r_s = .251, $p <$ .001), emotional affinity (r_s = .275, $p <$ .001).

On the other hand, forward stepwise logistic regression models were used to estimate the relationship of the four dimensions of the MECS with the intention of environmental activism. These results showed that: (1) in the Mexican population sample, the connectedness increased the activism intentions, b = 0.696, Odds Ratio (OR) = 2.002, p = .028, Nagelkerke R^2 = .059; and (2) in the Spanish population sample, the apathy negatively impacted on the intentions to participate in an environmental campaign, b = -1.103, OR = 0.332, $p <$ .001, Nagelkerke R^2 = .112.

Discussion

Results empirically show the adequacy of the multidimensional EC measurement model in four countries and in two samples: university students (Study 1) and general population (Study 2). The MGCFA and alignment method allowed assuring an acceptable degree of invariance of the MECS' scores among the countries considered. Taking both approaches in a complementary way, the traditional MGCFA ensured the MECS' metric invariance allowing

to compare the correlation patterns between EC dimensions. The alignment method, more flexible and based on realistic assumptions which soften the invariance restrictions imposed on configural model, allowed to conclude that there was a pattern of approximate measurement invariance in the data (Asparouhov & Muthén, 2014).

The correlation analysis between the four proposed attitudinal dimensions of EC showed different associations depending on the analysed country, which allows in depth explore the different conceptualization of this construct. The major differences among countries resulted from the association of anthropocentrism and the other attitudinal dimensions. In the Study 1, anthropocentrism is a dimension highly opposed to connectedness and emotional affinity in Argentinian and Spanish students. This result has been found in previous studies using MECS with similar samples in Spain (Amérigo et al., 2012). Nevertheless, and when comparing with Indian students, anthropocentrism was highly and positively associated with these two dimensions. The same result was obtained in previous studies using MECS with Brazilian undergraduates (Amérigo, García et al., 2017). Additionally, and in the same line of research, the inverse correlations between anthropocentrism and apathy were considerably more intense in Argentina and Spain than in India. Considering Study 2, another difference in the same

Table 3
Alignment method: Approximate measurement (non)invariance for groups (Study 2. General population)

Construct/ Variable	Country		Country x Gender		Country x Age		Country x Education	
	Loadings	Intercepts	Loadings	Intercepts	Loadings	Intercepts	Loadings	Intercepts
Apathy								
APA1	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
APA2	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSn(**Mu**)SuMpSp	MnSnMuSuMpSp
APA3	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySy(**Mma**)Sma	MnSnMuSuMpSp	MnSnMuSuMpSp
APA4	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
APA5	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
Anthropocentrism								
ANT1	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
ANT2	MS	MS	MmSm(**Mw**)Sw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
ANT3	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
ANT4	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	Mn(**Sn**)MuSuMpSp
ANT5	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
Connectedness								
CON1	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
CON2	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
CON3	MS	(**M**)(**S**)	MmSmMwSw	Mm(**Sm**)Mw(**Sw**)	MySyMmaSma	My(**Sy**)Mma(**Sma**)	MnSnMuSuMpSp	(**Mn**)Sn(**Mu**)SuMpSp
CON4	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
CON5	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
Emotional Affinity								
EMO1	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
EMO2	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
EMO3	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
EMO4	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
EMO5	MS	MS	MmSmMwSw	MmSmMwSw	MySyMmaSma	MySyMmaSma	MnSnMuSuMpSp	MnSnMuSuMpSp
Noninvariant rate	2.6%		1.9%		1.9%		1.7%	

Note: M = Mexico, S = Spain, M/Sm = Mexican/Spanish men, M/Sw = Mexican/Spanish women, M/Sy = Mexican/Spanish youth (people aged 30 years or younger), M/Sma = Mexican/Spanish middle-aged (people aged over 30 years), M/Sn = Mexican/Spanish without university education, M/Su = Mexican/Spanish with a university degree, M/Sp = Mexican/Spanish with a postgraduate education. Groups that are deemed to have a significantly noninvariant measurement parameter are shown in boldface within parentheses

Table 4
Estimation of the internal consistency reliability of the scores: ordinal ω

Construct	Study 1. University students			Study 2. General population	
	Argentina	India	Spain	Mexico	Spain
Apathy	.76	.70	.71	.88	.85
Anthropocentrism	.74	.79	.80	.88	.76
Connectedness	.74	.90	.84	.90	.84
Emotional Affinity	.90	.88	.90	.94	.91

direction was found: there was a negative association between anthropocentrism and connectedness in the Spanish population sample, but in Mexico these dimensions were not associated. A quite similar result was obtained in a sample of Chilean university students, where no association was found between anthropocentrism and emotional affinity and connectedness (Amérigo, Palavecinos et al., 2017).

Regarding to the evidences of the relation with external criterion, two variables were used: the environmental activism intention and INS. Considering the first one, results provide empirical evidence of the potential value of MECS as a predictor for the environmental activism intention in Mexico and Spain, although with some differences on attitudinal dimensions across countries: connectedness increased activism intentions in Mexico; and apathy decreased those environmental intentions in Spain. These results could guide future pro-environmental campaigns designed on both countries.

As regards to the second criterion, the association patterns between INS and MECS' scores with general population samples were similar in Mexico and in Spain. The inclusion of nature in the self-concept was inversely associated with apathy and anthropocentrism and directly with connectedness and emotional

Table 5
Correlation matrix between constructs and DIFFTEST (Study 1. University students)

Construct/Country	Apathy	DIFFTEST (value, *p*), *df* = 2	ANT	DIFFTEST (value, *p*), *df* = 2	CON	DIFFTEST (value, *p*), *df* = 2
Anthropocentrism (ANT)		(15.921, <.001)				
Argentina	.353***					
India	.147*	I ≠ A [*p* = .042], S [*p* <.001]				
Spain	.539***					
Connectedness (CON)		(13.139, .001)		(39.013, <.001)		
Argentina	-.740***		-.122*			
India	-.507***	A ≠ S [*p* = .047], I [*p* <.001]	.305***	I ≠ A [*p* <.001], S [*p* <.001]		
Spain	-.549***		-.142*			
Emotional Affinity (EMO)		(7.037, .030)		(64.674, <.001)		(2.165, .339)
Argentina	-.563***		-.145*		.718***	
India	-.369***	A ≠ I [*p* = .012]	.423***	I ≠ A [*p* <.001], S [*p* <.001]	.780***	
Spain	-.522***		-.238***		.763***	

Note: A = Argentina, I = India, S =Spain, *df* = degree of freedom
* *p* < .05, *** *p* < .001

Table 6
Correlation matrix between constructs and DIFFTEST (Study 2. General population)

Construct/Country	Apathy	DIFFTEST (value, *p*), *df* = 1	ANT	DIFFTEST (value, *p*), *df* = 1	CON	DIFFTEST (value, *p*), *df* = 1
Anthropocentrism (ANT)		(0.557, .455)				
Mexico	.488***					
Spain	.427***					
Connectedness (CON)		(24.220, <.001)		(4.670, .031)		
Mexico	-.467***		-.056			
		M ≠ S		M ≠ S		
Spain	-.807***		-.152*			
Emotional Affinity (EMO)		(16.140, <.001)		(1.461, .227)		(1.042, .307)
Mexico	-.504***		-.213***		.701***	
		M ≠ S				
Spain	-.781***		-.322***		.788***	

Note: M = Mexico, S =Spain, *df* = degree of freedom.
* *p* < .05, *** *p* < .001

affinity. Previous studies using MECS have also shown statically significant correlations among MECS dimensions and INS providing a criterion validity indicator, although the intercorrelation directions were different depending on the country. Considering undergraduate samples, Amérigo et al. (2012) found the same association pattern with Spanish students; but anthropocentrism had a direct association with INS in Brazilian students (Amérigo, García et al., 2017).

The inclusion with nature construct stated by Schultz (2002) means a continuum where the individual can locate him/her-self whether near the self or the nature pole, depending on the degree of independence-interdependence with nature he/she perceives. As the nature pole implies the "other", INS could be interpreted in terms of individualism/collectivism cultural dimension (Hofstede, Hofstede, & Minkov, 2010), where nature is a part of an extended self in collectivist societies instead of an independent "other". Some results obtained through cross-cultural literature question a universal, dual and instrumental-based relationship between

human and nature, which is deeply rooted by the Judeo-Christian dogma of creation in Western culture (White, 1967). Disparities on the direction of these relationships found in some studies carried out from distinct cultures, suggest different and more holistic approaches where human instrumental use of nature (anthropocentrism) can live together with an interdependent (connectedness) or even a human-nature transactional (emotional affinity with nature) view (Corral, Carrus, Bonnes, Moser, & Sinha, 2008; Hernández, Suárez, Corral-Verdugo, & Hess, 2012). Other value orientations, such as those relational values "linking people and ecosystems via tangible and intangible relationships to nature as well as the principles, virtues and notions of a good life" might be an alternative to the anthropocentric-ecocentric debate (Klain, Olmsted, Chan, & Satterfield, 2017, p. 1). The individualism-collectivism dimension which respectively makes a difference between Western (North America and Western Europe), on the one hand, and Latin American-East Asian cultures, on the other (Hofstede et al., 2010); might explain some cross-cultural

differences on environmental attitudes. According to Peng and Nisbett (1999), a holistic way of thinking characterizes East Asians, as opposed to a more analytic way of thinking identified among Westerns cultures. Following these authors, Westerns are prone to the law of non-contradiction, whereas other Eastern Asian cultures favour a naive dialectical thinking, where two opposing arguments can include some truth, so there is no point in establishing a debate between them. These differences in cognitive style might be applied to understand different associations among dimensions of EC found in this study depending on the analysed country.

Unfortunately, and although the obtained results point to these reflections, inferences based on cultural terms must be interpreted with caution due to these results are based on individual-level analysis, incidental and no representative samples. Further studies are required with a larger number of countries and samples allowing research aimed to explore the relationships among EC dimensions measured by MECS and cultural variables such as those proposed by Hofstede et al. (2010). The interaction with the natural environment must thus be included among the topics analysed at the cultural level by these authors, such as health, education, workplace, etc. This task will imply the use of multilevel methodological strategies with a major progress in trying to understand socio-psychological factors underlying the relationships between nature and humans, and promoting environmental sustainability across countries (Eom, Kim, Sherman, & Ishii, 2016; Milfont, 2012). Such kind of research will make some progress on Environmental Psychology where cultural diversity has been inconsiderate in the literature (Medina et al., 2019; Tam & Chan, 2017).

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