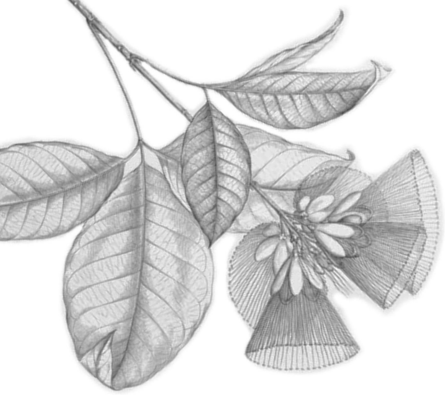

Internal consistency and factorial structure of the New Revised Ecological Paradigm Scale on university students from the southeast of Mexico

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ABSTRACT

The New Revised Ecological Paradigm (NEP-R) scale translated into Spanish is a widely used instrument in various countries, cultures, and populations to measure people´s environmental beliefs. Given the discrepancy over its dimensionality reported in previous studies and because there are no reports of its psychometric properties of the NEP-R scale in Mexican university population were analysed. The scale was administered to 503 students of the Autonomous University of Carmen, from different federal entities of the Mexican southeast. The internal consistency (Cronbach´s α) of the NEP-R scale was analysed and an exploratory factor analysis (EFA) with varimax rotation was performed. The finding revealed an optimal internal consistency coefficient (α = 0.702) and a 2-factor structure (ecocentrism and anthropocentrism), representing together 43.272% of the total variance in a 9-item version of the scale. It is concluded that the NEP.R scale is a useful tool. However, it is imperative to assess its reliability and dimensionality for different target populations.

Keywords: NEP-R, Environmental attitude, University students, Anthropocentrism, Ecocentrism.

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In 1969, considering the knowledge regarding the deterioration of several ecosystems, a scientific movement on creating awareness regarding the environment was created. However, its vision only focused on the deterioration of local spaces. The vision that emerged at the end of the 1960s consolidated a conscience of systemic character. According to Morin et al. (1991), the predominance of a *Western economic model* that was rooted in ideologies held since the Industrial Revolution had, until then, prevented the formulation of an essential global awareness. In 1968, the increasing concern for ecological deterioration led a group of individuals, comprising researchers, scientists, and politicians from 30 countries, to found the *Club of Rome*. The purpose of this group was to clarify the objectives aimed at investigating the multidimensional factors affecting the planet at that time (Solana 2005). They identified that the unlimited demographic growth, the irrational use of natural resources and the lack of control of non-biodegradable products were responsible for the degradation of the ecosystem. Based on their analysis, in 1972, they published the report *Meadows*. This document elaborated how the planet was at risk as a direct consequence of human actions.

Based on this report, legal and technical mechanisms were created to mitigate the consequences to nature (Meadows et al. 2004; Morin et al. 1991). However, considering the predictive hypothesis established by the document, which stated that the unlimited actions of humans will eventually lead to a decrease in its sustainability, we could say that, given the ongoing difficulties, these interventions may not have had any significant effects (Vilches & Gil 2013). According to Casas et al. (2017), we are currently facing a crisis that is expressed in multiple ways, including the increase in the average temperature of the Earth's surface, the contamination of freshwater bodies by toxic substances, the accelerated loss of forest cover, and the high extinction rates of species. In this context, García (2006) described the historic importance of the *Meadows* agreement with regard to environmental awareness and pointed out a personal obligatory institutional involvement that posed an optimistic rhetoric that decreased the consequences of the truths represented in the report. To a certain extent, the report has helped spread awareness regarding the consequences of exploiting ecosystems on certain social sectors over time.

The purpose of ecology as a scientific discipline, together with the pro-environmental movements that emerged during the last half of the 20th century, focused on denouncing the emerging ecological crisis and, therefore, laying the foundations for the activities that led to society to a critical review of the dominant positivist paradigm that placed nature as a tool for human benefit (Martínez & Figueroa 2014).

This model change proposal led in the late 1970s to Dunlap and Van Liere presented as the first challenge, to produce in the human being a new vision of their relationship with all ecosystems (Vozmediano & San Juan 2005). Decades later, several authors, such as Capra (1992); Díaz et al. (2012); Gavito et al. (2017); Leff (2000); Santes (1995); Solana (2005); Vilches & Gil (2013) would reiterate this imperative change by identifying what, despite the years, the degradation of the environment is accentuated by the power of transformation and management derived from uncontrolled economic decisions, that is, it is necessary to society make urgent changes to problematize the systems already instituted and the opening of new methodologies capable of guiding a process of reconstruction of knowledge, allowing an integrated analysis of ecological reality.

In Search of Ecological Balance

The idea of consolidating a New Ecological Paradigm (NEP) has existed since the last 30 years of the 20th century and continues to be relevant even today (Solana 2005). Its main promoters were natural scientists who began to systematically investigate the ways in which human behavior was detrimental to nature (Hawcroft & Milfont 2010). In 1978, based on their pioneering research, Dunlap and Van Liere explicitly challenged the dominant social paradigm (Moyano & Palomo 2014). They hypothesized the emergence of a new set of beliefs associated with environmentalism, as opposed to an ecological exploitation thinking scheme. According to Imhoff et al. (2014); Dunlap and Van Liere laid the groundwork for the social emergence of a series of alternative beliefs about the man–nature relationship, in which the environment was valued with a greater commitment and personal participation. The NEP proposed by Dunlap & Van Liere (1978) supported the emergence of a new human vision with respect to the natural environment. Subsequently, this paradigm reached a great acceptance, becoming one of the most welcome perspectives on pro-environment behavior (Amérigo & Cortés 2006; González & Amérigo 1999).

During the last decade, the debate on the deterioration of the environment has once again become important and is considered an international problem (Moyano & Palomo 2014). Klain et al. (2017) argue that, despite improvements in the socio-environmental field, it has not been possible to completely resolve the dilemma between those who still defend the instrumental. Value of nature and those who defend its intrinsic value. Authors such as Amérigo & González (2000); González et al. (2015) have pointed out that the main reason why humanity has not managed to build an ecocentric worldview has been the assumption that the ecological balance threatens social and economic growth necessary for human satisfaction (Rosas et al. 2014). In line with this idea, Novo (2003) once again

emphasized the urgency of discarding this apparent reality, due to the negative effects it has brought to reach innovative alternatives aimed at balancing man-nature relations, but proposes to return to the study of the behaviors and models that humanity has adopted, because that is where we will really discover the roots of our behavior as a species.

Alternatively, Hawcroft & Milfont (2010) suggested that it is necessary to measure environmental attitudes using valid and reliable instruments, to create a better understanding of why people treat the environment as they do. In other words, new research aimed at consolidating a new ecological worldview requires taking into account that the man-nature relationship is a continuous and dynamic process (Cerrillo 2010; Mshvenieradze 1982). The search for a transformation and unprecedented ecosystem management with ecocentric dimension needs to address the different degrees of specificity of the different environmental systems, since the consequences of deterioration have local and global scope at the same time (Cerrillo 2010, Díaz et al. 2012, Rathe 2017). Howard (2000) explained that, if information, beliefs and attitudes have contributed to the construction of social schemes based on production and deterioration, they can also contribute to the opposite.

MEASUREMENT OF THE NEW ECOLOGICAL PARADIGM

Since the appearance of the NEP, promoted by Dunlap and Van Liere in 1978 (Amérigo & González 2000; Cerrillo 2010), the measurement of environmental awareness (EA) has become a popular topic of research. However, the first measurement instruments were not appropriate because they simply evaluated how widespread the existence of this new paradigm was. As such, the researchers proposed using specific samples and replacing sociodemographic variables with other cognitive variables (Moreno et al. 2005; Cerrillo 2010). In this context, Stern et al. (1993) affirmed that the values involved in people's pro-environmental decisions are favored if they maintain the belief that environmental conditions have negative consequences on specific valued aspects of their lives, the other human beings and the biosphere as a whole.

To empirically test these ideas, Dunlap & Van Liere (1978) initially developed a scale consisting of 12 Likert-type elements, of which eight were related to the NEP, while the other four were related to the anthropocentric paradigm (Vozmediano & San Juan 2005), this instrument comprised three dimensions that for the authors constituted the cultural change that environmentalism supposed in opposition to the beliefs established in modern society. These dimensions were called "limitations on the growth of society", "human capacity to alter the environmental balance" and "the

right of human beings to rule over nature" (Cerrillo 2010; Fleury et al. 2015; Moyano & Palomo 2014; Vozmediano & San Juan 2005).

In the first application of the scale, its ability to discriminate against the supporters of the NEP of the general public, and these two participants of the dominant social paradigm was demonstrated. The scale also showed a good internal consistency, reaching a Cronbach's α of 0.81 in groups with a notable interest in the environment (Dunlap & Van Liere 1978; Hawcroft & Milfont 2010). Grúňová et al. (2018) reported that a variety of studies, carried out at different times and in different cultures and continents, have attributed significant validity to the original version of the NEP scale.

With respect to the prediction of attitude and general beliefs, Roberts & Bacon (1997); Dunlap & Van Liere (2000) noted that several studies have found significant correlations between the original NEP scale and a large number of behavioral intentions, which suggests its predictive validity. Regarding the factorial structure, Fleury et al. (2015) after a theoretical review reported that this has been tested several times, using different samples based on cultural characteristics, sociodemographic context and region. In this context, the authors identified that several investigations were conclusive when determining a structural inconsistency of the NEP scale, since it showed a very variable Cronbach's alpha in each population.

There is more evidence about the general validity of the scale. However, with respect to whether the scale measures a single dimension or if it is intrinsically multidimensional, consensus is lower (Dunlap & Van Liere 2000). In their initial study, the authors of the scale isolated a unique factor structure, which was then verified by other researchers (Edgell & Nowell 1989; Lefcourt 1996). However, Fleury et al. (2015) found that the majority of the scientific community has accepted a 2-factor structure. Noe & Snow (1990) suggested that the use of the instrument does not require radical changes, but that its dimensionality, reliability and validity should be evaluated with each new study.

REVISED VERSION OF THE NEW ECOLOGICAL PARADIGM SCALE (NEP-R)

As pointed out by Edgell & Nowell (1989); Lefcourt (1996), the authors of the NEP scale (Dunlap & Van Liere 1978) revealed a single-factor structure using a factor analysis (EFA), whereas later studies confirmed that it is composed of three clearly differentiable dimensions. Accordingly, the authors of the original scale recommended caution in using it, noting that, although the idea of paradigms implies a certain consistency, it should not be completely assumed that the 12 items of the NEP measure the assumed dimensions (Dunlap & Van Liere, 2000). Therefore, it is necessary to

confirm the underlying structure using EFA to decide how convenient it is to use the scale as a single variable or as several ones (Dunlap & Van Liere 2000).

Taking into account the variability of the factors of the original NEP scale and with the aim of expanding its content with respect to the ecological problems of the new era, Dunlap and Van Liere presented the instrument in the year 2000 with an improved version of the instrument (Gomera et al. 2013). The revised scale was structured maintaining a balance between the pro and anti-environmental elements, the three original areas were expanded to five, the sexist terminology that was present in some initial questions was modified and the "not sure" response was included as a mid-point to reduce the lack of answer to the questions. This new scale showed a slightly higher reliability and validity index compared to the original instrument, and produced a Cronbach's α of 0.83, and according to its authors, the elimination of any of the 15 elements reduces this value. Therefore, the evidence from this initial survey suggests that the set of 15 elements can be treated as an internally consistent measurement tool (Amérigo & González 2000; Dunlap & Van Liere 2000; Gomera et al. 2013).

Despite these improvements, the discussion on the one-dimensional or multidimensional nature of the scale continued (Moyano & Palomo 2014). In this sense, Hawcroft & Milfont (2010); Moyano & Palomo (2014) reported that the new scale retained some of the problems of the former, especially with respect to construct validity. Another inconsistency found on the NEP-R scale is that adults from Western and non-Western countries interpreted the underlying concepts of scale in a diverse way (Grúňová et al. 2018). In their study conducted with the general population of northern Mexico, Corral & Armendáriz (2000) found that participants expressed concern about the balance of the ecosystem and the impact that human actions have on it, despite believing that humans should govern about nature and being interested in the possible benefits that could derive from it. In summary, Hernández et al. (2001); Gomera et al. (2013); Moyano & Palomo (2014) agree in suggesting the employability of the NEP-R scale whenever their dimensionality is evaluated in each study.

Adaptation of The New Ecological Paradigm-Revised Scale to Spanish

According to our review of the literature, four validated adaptations of the NEP-R scale to Spanish existed at the time of the beginning of the present study. Amérigo & González (2000) developed their version using a sample of 184 university students and applying an EFA, revealing a structure of 6 factors that explained 62.1% of the total variance. The items were grouped according to these six factors, so there were only two or three items with a load factor of more than 0.4 within each factor, thus eliminating item 4 for not reaching this value. The structural grouping of the instrument

was similar to that of the version developed by Dunlap & Van Liere (2000). The researchers also reported a Cronbach's α reliability of 0.68 for the Spanish scale and recommended its use to measure general beliefs about the relationship between humans and the environment (Amérigo & González 2000; Moyano & Palomo 2014).

The second adaptation of the NEP-R scale to Spanish was developed by Vozmediano & San Juan (2005), who applied the instrument to 488 residents of Spain through the Internet. This 11-item questionnaire was structured in two dimensions: ecocentrism and anthropocentrism (Vozmediano & San Juan 2005). The authors performed an EFA of the main components, initially without using rotation, finding that all the items showed an acceptable weight in the first factor, as well as a high percentage of variance, with this data affirming that the scale points to a two-dimensional (Moyano & Palomo 2014; Vozmediano & San Juan 2005). The authors observed that anthropocentrism comprised six items, which represented 17% of the variance, while ecocentrism comprised five items, which represented 14% of the variance. In addition, internal consistency indices were calculated for each of the dimensions extracted during EFA, obtaining a value of $\alpha = 0.71$ for the anthropocentric dimension, and $\alpha = 0.71$ for the dimension of ecocentrism, as well as non-significant values of $\alpha = 0.3$ for factors 3 and 4, respectively.

Gomera et al. (2013) used Vozmediano & San Juan' (2005) version of the scale with students of the University of Córdoba (Spain). The sample comprised 1082 students with an average age of 21.6 years. Among them, 42.8% were men and 57.2% were women (Gomera et al. 2013). After performing an exploratory factor analysis (EFA), the presence of independent subscales was confirmed. Five factors that accounted for 58.6% of the variance were obtained during the first analysis. However, the authors claimed having found a moderate overall scale value of $\alpha = 0.5$. Acceptable α values (0.840, 0.682, and 0.646) were identified in three dimensions, namely, Ecocentrism, Anthropocentrism, and Limit Awareness. These empirical data contradict the validity of the scale reported in majority of similar studies that examined the unidimensional structure.

Moyano & Palomo (2014) assessed the psychometric properties of the version translated into Spanish in Chile of the NEP-R scale developed by Moyano et al. (2011). The sample consisted of 760 adults from different cities in the Maule, Bío-Bío, and Chile Metropolitan Regions. The general reliability of the instrument was measured through internal consistency, yielding a Cronbach's α of 0.80.

In the EFA performed using the main component method without rotation, four factors were obtained, which represented 30%, 11%, 8% and 7% of the variance, respectively. However, the

elements grouped in each factor were not similar to those of the version proposed by Dunlap & Van Liere (2000). Therefore, a new forced factor analysis was performed with two factors using the varimax rotation. Together, the two factors explained 42% of the variance, and the first comprised eight elements that accounted for 27% of the variance. The second factor comprised seven items that explained 15% of the variance. The 2 elements with the lowest factor loads in Factor 1 and 2 were repeated in both factors to avoid their elimination. This resulted in an 11-item NEP-R scale that included two dimensions, ecocentrism (6 items) and anthropocentrism (5 items), with an adequate Cronbach total α of 0.757. The dimension of ecocentrism had a high Cronbach's α of 0.817; however, the dimension of anthropocentrism had a low Cronbach's α of 0.561, suggesting the one-dimensional nature of the scale.

The fourth Spanish adaptation was developed by Reyna et al. (2018), who evaluated the psychometric properties of the scale in a sample of 480 residents of Córdoba, Argentina, from 18 to 65 years old. The authors performed an EPT on the 15-item scale with models of structural equations and reported inadequate indices for the structure of a single factor (Reyna et al. 2018). Better results were obtained for a posterior bifactor analysis. However, given that Items 1, 6, 9 and 11 exhibited factor loads below 0.30, another double factor EFA was performed after eliminating these items, which yielded better adjustment rates. The first and second factors were composed of five (items 3, 5, 7, 13 and 15) and six (items 2, 4, 8, 10, 12 and 14), respectively. The 5-item ecocentrism dimension explained 27.68% of the variance, while the 6-item anthropocentric dimensions explained 13.38% of the variance. Three of the reactants showed factor loads ranging from 0.30 to 0.40 in one of the factors, with a difference greater than 0.10 in relation to the other factor.

With reference to reliability and internal consistency, the 11-item instrument had a Cronbach's overall α of 0.74. The dimensions of ecocentrism and anthropocentrism exhibited a Cronbach's α of 0.72 and 0.69, respectively (Reyna et al. 2018). The authors concluded that this version of the NEP-R scale exhibited good psychometric properties in its sample from Argentina, considering that the 11-item version is a valid, reliable and reduced tool for use in research contexts. This is in accordance with the recommendation of Kaplan & Saccuzzo (2006) who assure that $\alpha = 0.70$ and 0.80 is adequate to estimate the reliability of an instrument, and Loewenthal's (2001) recommendation that $\alpha = 0.60$ is acceptable.

THE PRESENT STUDY

Among the four Spanish adaptations of the NEP-R scale that were used with Latin American populations, the one developed by Moyano & Palomo (2014) for a Chilean sample and that by Reyna et al. (2018) for Argentine residents stand out. With respect to other populations, Grúňová et al. (2018) recently adapted the scale for a population of Senegalese children, Xue et al. (2018) adapted it for a sample of Chinese citizens, and Izadpanahi & Tucker (2018) adapted it for a sample of Australian children.

In view of the results obtained by several researchers regarding the general internal consistency of the NEP-R scale, with the Cronbach's α ranging from 0.73 to 0.86 (Dunlap & Van Liere 2000; Gomera et al. 2013; Moyano & Palomo 2014; Reyna et al. 2018), and considering the existing disagreement regarding its dimensionality, we agree with Noe & Snow (1990) and Fleury et al. (2015) regarding the need to adapt the instrument to each study population. In this sense, ¿is it possible to obtain a version of the NEP-R Scale with validity and reliability indices to be used in a population of Mexican university students?

Accordingly, the present study aimed to examine the reliability and internal consistency of the NEP-R scale in a sample of 503 students from a public higher education institution located in the southeast of Mexico. Additionally, it aimed to develop an adaptation of the NEP-R scale (Dunlap et al. 2000) that was translated into Spanish by Moyano et al. (2011).

METHOD

An observational, analytical, cross-sectional design was employed to assess the reliability and factorial structure of the NEP-R scale. Specifically, the scale's Cronbach's α coefficient was computed, and an FA of the principal components using varimax rotation was conducted using data collected from university students. Finally, an adaptation of the NEP-R scale (Dunlap et al. 2000) was obtained.

PARTICIPANTS

A non-probabilistic sample of 503 volunteer students from undergraduate programs offered in the Autonomous University of Carmen was selected. All students were residents of southeast of Mexico, including the states of Tabasco, Campeche, Quintana Roo and Yucatán. The data was collected from july to september of 2018. The average response time to complete the survey was approximately 10 minutes.

INSTRUMENTS

GENERAL INFORMATION DOCUMENT

The objective of this document was to collect information on the participants' characteristics (gender, age, and discipline in which they were enrolled).

INFORMED CONSENT LETTER

The purpose of this letter was to: i) inform the students about the objective and procedure of the study, ii) ensure the privacy and confidentiality of their data, and iii) provide information regarding the possible risks and benefits of their participation in this study.

THE NEW ECOLOGICAL PARADIGM-REVISED SCALE

Developed by Dunlap et al. (2000) and translated into Spanish by Moyano et al. (2011), this instrument assesses the influence of participants' beliefs on their environmental attitudes and behaviors. It comprises 15 items (statements) written in the form of phrases that relate to beliefs about nature and relationships between human beings and the environment. The response options are polytomic, with 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, 5 = strongly agree. The authors reported a Cronbach's α of 0.83 (Dunlap et al. 2000).

PROCEDURE

The general information document and self-administered NEP-R scale were distributed to participants, who had to respond to the items on the scale according to the degree to which they agreed or disagreed with the described situation (belief).

STATISTICAL ANALYSIS

The reliability of the NEP-R scale was evaluated by calculating the Cronbach's α coefficient for the total scale. The factorial structure was examined using FA. Specifically, the principal components were extracted by applying varimax rotation (conserving factors with an eigenvalue ≥ 1.00). Additionally, the Spearman correlation coefficient was used to examine correlations among items. All analyses were conducted using SPSS version 25.0.

RESULTS

DESCRIPTIVE DATA

Of the 503 university students who participated in this study, 41.2% were men and 58.8% were women. Table 1 shows the descriptive statistics of age, sex and marital status of the participants in this study.

Table 01. Descriptive data of the population

	Mean	*Standard deviation*	*Minimum*	*Maximum*
Age	22.14	2.902	19	30
Gender	1.59	0.493	1	2
Marital status	1.11	0.423	1	3

Source: The Author

CRONBACH'S A COEFFICIENT

The internal consistency reliability of the 15-item NEP-R scale was not optimal, as evidenced by the Cronbach's α coefficient of 0.526.

CORRELATION BETWEEN ITEMS

First, statistical differences among variables were examined to determine if it was appropriate to conduct an EFA. The calculated statistics and their corresponding values were as follows: Bartlett's test of sphericity: 658.823, with a gl of 36 and a significance of 0.000; Kaiser-Meyer-Olkin (KMO) test: 0.750; individual measures of sampling adequacy, with values ranging between 0.688 and 0.839; and determinant of the correlation matrix: 0.266. These statistics indicated the adequacy of the data for running an FA (Ximénez & San Martín 2004). In the first EFA that was conducted using all 15 items, the extraction with the base method in the eigenvalues was retained, yielding five factors (Table 1).

Table 02. Findings of the exploratory factor analysis using a 5-factor structure for the NEP-R scale (Dunlap et al. 2000)

	Number/Items	**Factor**				
		1	**2**	**3**	**4**	**5**
Factor 1 (15.090% de la varianza explicada)						
1	We are approaching the limit number of people the earth can support.	.321				
3	When humans interfere with nature, it often produces disastrous consequences.	.539				
5	Humans are seriously abusing the environment.	.680				
6	The earth has plenty of natural resources if we just learn how to develop them	.705				
7	Plants and animals have as much right to exist as humans do.	.758				

15	If things continue on their present course, we will soon experience a major ecological catastrophe.	.454				
Factor 2 (10.580 % de la varianza explicada)						
2	Human beings have the right to modify the natural environment to meet their needs.		.665			
11	The earth is like a spaceship with very limited room and resources		.747			
13	The balance of nature is very delicate and it can be upset easily		.752			
Factor 3 (9.456 % de la varianza explicada)						
9	Despite our special abilities, human beings are still subject to the laws of nature.			.333		
10	The so-called "ecological crisis" of humanity has been greatly exaggerated.			-.780		
Factor 4 (9.211 % de la varianza explicada)						
4	Human inventiveness will ensure that we do not make the Earth uninhabitable.				.569	
12	Humans were created to dominate over the rest of the natural world.				.556	
Factor 5 (8.545 % de la varianza explicada)						
8	The balance of nature is strong enough to adjust to the impacts of modern industrial countries.					.614
14	Humans will learn enough about how nature works to be able to control it.					-.769

Source: The Author

Note. The item numbers correspond to those in the original instrument.

However, an analysis of the grouping of items in the factors revealed that three of the five factors comprised only two items, which saturated those factors. This is a common situation when working with test items, but it is not recommended (Lloret et al. 2014; Ximénez & San Martín 2004). Therefore, Item 2, 4, 8, 10, 12, and 14 were eliminated, which increased the Cronbach's α from 0.526 to 0.702, reaching acceptability. In addition, the eliminated items were not conceptually congruent with the factor in which they were grouped. Therefore, a new bi-factor model was used to evaluate the scale that excluded the eliminated items.

THE NEW ECOLOGICAL PARADIGM-REVISED SCALE ADAPTED TO OUR SAMPLE

On discarding the six items mentioned earlier (Item 2, 4, 8, 10, 12, and 14), a 2-factor EFA was performed with the remaining nine items, which is proposed by Lloret et al. (2017). On comparing the results of both EFAs (with five and two factors), it was decided to continue with the 2-factor model, given that it yielded the best adjustment indices.

DESCRIPTIVE STATISTICS OF THE NEP-R SCALE (DUNLAP ET AL., 2000)

Table 03. Descriptive statistics of the NEP-R scale (Dunlap et al. 2000)

	Number/Items	Mean	Standard deviation	Minimum	Maximum
1	We are approaching the limit number of people the earth can support.	3.54	0.992	1	5
3	When humans interfere with nature, it often produces disastrous consequences.	4.02	0.969	1	5
5	Humans are seriously abusing the environment.	4.40	0.937	1	5
6	The earth has plenty of natural resources if we just learn how to develop them	3.99	1.018	1	5
7	Plants and animals have as much right to exist as humans do	4.55	0.804	1	5
9	Despite our special abilities, human beings are still subject to the laws of nature.	3.77	0.939	1	5
11	The earth is like a spaceship with very limited room and resources	3.28	1.166	1	5
13	The balance of nature is very delicate and it can be upset easily	3.79	0.974	1	5
15	If things continue on their present course, we will soon experience a major ecological catastrophe.	4.34	0.934	1	5

Source: The Author

In table 3 it can be observed that the mean scores of the items on this scale were high, considering that the response interval was from 1 to 5. The highest mean was 4.55 in item 7 (Plants and animals have as much right to exist as humans do) and the lowest mean was 3.28 in item 11 (The earth is like a spaceship with very limited room and resources). The mean scores of the items show the following decreasing order: $7 \geq 5 \geq 15 \geq 3 \geq 6 \geq 13 \geq 9 \geq 1 \geq 11$.

NORMALITY ANALYSIS

In order to determine if our data present a normal distribution, the Kolmogorov-Smirnov test was used, obtaining a p value <0.05. Therefore, the alternative hypothesis is accepted: the analyzed data ($p=0.000$) do not follow a normal distribution, so the non-parametric test of Spearman's correlation coefficient was used.

FACTOR ANALYSIS OF THE PRINCIPAL COMPONENTS USING VARIMAX ROTATION

To understand the factorial structure of the scale, an EFA was performed using the principal component method. To minimize the number of statements with high saturation within one factor, an orthogonal rotation was applied using the varimax method. The rotation converged on three iterations, which maintained the independence between the rotated factors, thereby finally yielding a factorial structure comprising two factors with an eigenvalue ≥ 1. Together, these factors explained 43.272% of the variance. In the present study, an item was considered as a part of a factor if it had a factor loading of at least 0.380. Thus, items with saturations less than 0.380 were eliminated. The items were also

318 analyzed to evaluate their conceptual congruence and correspondence with the factor in which they
319 were circumscribed.

320 The identified factors, the percentage of variance explained by each factor, the constituent
321 items for each factor, and their factor loadings have been presented in Table 2. Through the FA of the
322 principle components with varimax rotation, two NEP-R subscales were formed to correspond to the
323 two factors identified in the EFA. The items in these subscales presented factor loadings ranging from
324 0.386 to 0.808. The first factor comprised Item 3, 5, 6, 7, and 15 (factor loadings of 0.578, 0.725, 0.658,
325 0.750, and 0.451, respectively), and it was named 'Ecocentrism'. The second factor comprised Item 1,
326 9, 11, and 13 (factor loadings of 0.445, 0.386, 0.636, and 0.808, respectively), and it was named
327 'Anthropocentrism' as well as the commonality between the factors (Table 4).

Table 04. Findings of the exploratory factor analysis using a 2-factor structure for the NEP-R scale (Dunlap et al. 2000)

	Number/Items	Factor		Communalities
		1	2	
3	When humans interfere with nature, it often produces disastrous consequences.	.578		0.368
5	Humans are seriously abusing the environment.	.725		0.473
6	The earth has plenty of natural resources if we just learn how to develop them	.658		0.230
7	Plants and animals have as much right to exist as humans do.	.750		0.510
15	If things continue on their present course, we will soon experience a major ecological catastrophe.	.451		0.371
1	We are approaching the limit of the number of people the earth can support.		.445	0.244
9	Despite our special abilities, humans are still subject to the laws of nature		.386	0.167
11	The earth is like a spaceship with very limited room and resources		.636	0.155
13	The balance of nature is very delicate, and it can be upset easily		.808	0.216

Source: The Author

Note. The item numbers correspond to those in the original instrument.

** The correlation is significant at the 0.01 level (bilateral).

328 SPEARMAN CORRELATION COEFFICIENT

329 Table 5 shows the correlation values for the Spearman statistic, as well as their corresponding
330 p-values of statistical significance. The items grouped in each factor presented in Table 4 showed a
331 statistically significant positive correlation with other items in the same factor. This strong correlation
332 among items in a factor robustly confirmed the belongingness of the constituent items to their
333 corresponding factor.

334

Table 05. Spearman´s correlation coefficients between the items

Ítems	1	3	5	6	7	9	11	13	15
1	1.000	.219**	.228**	.159**	.196**	.171**	.167**	.216**	.332**
3	.219**	1.000	.395**	.130**	.256**	.118**	.164**	.285**	.263**
5	.228**	.395**	1.000	.205**	.404**	.155**	.079	.189**	.368**
6	.159**	.130**	.205**	1.000	.426**	.137**	.132**	.063	.220**
7	.196**	.256**	.404**	.426**	1.000	.192**	.240**	.159**	.358**
9	.171**	.118**	.155**	.137**	.192**	1.000	.110*	.216**	.122**
11	.167**	.164**	.079	.132**	.240**	.110*	1.000	.306**	.181**
13	.216**	.285**	.189**	.063	.159**	.216**	.306**	1.000	.289**
15	.332**	.263**	.368**	.220**	.358**	.122**	.181**	.289**	1.000

Source: The Author

Note. The item numbers correspond to those in the original instrument.

** The correlation is significant at the 0.01 level (bilateral).

DISCUSSION

At the time of commencement of the present study, four Spanish adaptations of the NEP-R scale originally developed by Dunlap et al. (2000) existed. The first version was developed by Amérigo & González (2000), using a sample of 184 students. It was quite similar to the original scale in that it retained six factors. However, Item 4 was eliminated because it had a factor loading of less than 0.4. An FA yielded a Cronbach's α of 0.68, which was lower than that observed in the present study after eliminating Item 2, 8, 10, 12, and 14. The forced 2-factor scale developed in our study had a Cronbach's α of 0.691. Considering Kaplan & Saccuzzo's (2006) recommendation that α values of 0.70 and 0.80 are appropriate, it was decided to eliminate Item 4, as was done by Amérigo & González (2000), in addition to the other five items that were excluded. Finally, our version of the Spanish NEP-R scale comprised nine items across two factors (Ecocentrism and Anthropocentrism), with a Cronbach's α of 0.702. The two factors together explained 43.272% of the total variance, and both had eigenvalues ≥ 1.

The reliability index of our 9-item scale was very similar to the one obtained in the second Spanish adaptation developed by Vozmediano & San Juan (2005), who reported a Cronbach's α of 0.710. Our results are also similar to those obtained for the Spanish version adapted by Moyano & Palomo (2014) for a Chilean population. Their 11-item, 2-factor scale had a Cronbach's α of 0.757.

Similarly, Reyna et al.'s (2018) 11-item Spanish adaptation applied to an Argentine population also comprised two forced dimensions (ecocentrism and anthropocentrism), and the total scale had a Cronbach's α of 0.757.

Evidently, the first Spanish adaptation of Amérigo & González (2000) was the only one that retained similarity with the NEP-R (Dunlap et al. 2000); however, it had a low reliability index. The remaining the Spanish versions, two of which were administered to samples from Latin America, maintained an appropriate reliability index by forcing the 2-factor structure and retaining only 11 items in the scale. Our version further reduced the number of items to nine, while conserving an appropriate Cronbach's α. Specifically, we only retained items with factor loadings of over 0.38. We are in agreement with various authors (Hernández et al. 2001; Gomera et al. 2013; Moyano & Palomo 2014) with regard to suggesting the employability of the NEP-R by evaluating its dimensionality and reliability in each population. Finally, and despite achieving the objectives proposed in our study, within its limitations we have that, when using a non-probability sampling method due to the limitations of economic resources to obtain data, the results cannot be generalized with statistical precision.

CONCLUSION

The psychometric properties of the Spanish version of the NEP-R scale examined in the present study are consistent, and no radical changes are required for its utilization. However, it is necessary to evaluate the dimensionality, reliability, and validity of the scale in each population to obtain the best results. Our final 9-item abbreviated version can be employed in later research conducted in similar contexts, to generate new evidence on this topic in our country. On the other hand, while the NEP-R scale can be considered as a trustworthy and valid questionnaire, prior research indicates that its predictability must be supported by other instruments. This line of work could be explored further in future. Finally, as for the dimensions assessed by the NEP-R scale, controversies continue to exist. However, in line with our findings, and with the goal of conserving an optimal reliability index, a bidimensional structure was retained.

CONFLICTS OF INTEREST

The authors declare no conflicts of interest regarding the publication of this paper.

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Consistência interna e estrutura fatorial da Nova Escala Revisada de Paradigmas Ecológicos em estudantes universitários do sudeste do México

RESUMO

A nova Escala de Paradigma Ecológico revisada (NEP-R) traduzida para o espanhol é um instrumento amplamente utilizado em vários países, culturas e populações para medir as crenças ambientais das pessoas. Dada a discrepância em sua dimensionalidade relatada em estudos anteriores e como não há relatos de suas propriedades psicométricas da escala NEP-R na população universitária mexicana, eles foram analisados. A escala foi aplicada a 503 estudantes da Universidade Autônoma do Carmen, de diferentes entidades federais do sudeste do México. A consistência interna (α de Cronbach) da escala NEP-R foi analisada e uma análise fatorial exploratória (AFE) com rotação varimax foi realizada. A descoberta revelou um ótimo coeficiente de consistência interna (α = 0,702) e uma estrutura de dois fatores (ecocentrismo e antropocentrismo), que juntos representam 43,272% da variância total em uma versão da escala de 9 itens. Conclui-se que a escala NEP.R é uma ferramenta útil. No entanto, é imperativo avaliar sua confiabilidade e dimensionalidade para diferentes populações-alvo.

Palavras-Chave: NEP-R; Atitude Ambiental; Estudantes universitários; Antropocentrismo; Ecocentrismo.

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