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Behavioral Sciences

Validation of the Ecological Behavior Scale in Mexican University Students

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ABSTRACT – The current environmental deterioration of ecosystems is unquestionable, even though for some time now work has been done to change the dominant social paradigm that places Nature as a tool at the service of human beings. Environmental psychology proposes that environmental problems are strongly related to human behavior, thus, its studies are oriented to measure behavioral variables. To propose a version of the Ecological Behavior Scale (EBS) for use in Mexican populations, the psychometric properties of the instrument were explored, obtaining as a result an EBS scale of 28 items and three factors, with an overall Cronbach's alpha of .79.

KEYWORDS: validation study, behavior, environmental psychology

Validación de la Escala de Comportamiento Ecológico en Universitarios Mexicanos

RESUMEN – Es incuestionable el actual deterioro ambiental de los ecosistemas, a pesar de que desde hace tiempo se ha trabajado en cambiar el paradigma social dominante que coloca a la Naturaleza como una herramienta al servicio del ser humano. Desde la psicología ambiental se propone que los problemas ambientales están fuertemente relacionados con el comportamiento humano, con esto, sus estudios se han orientado a medir las variables comportamentales. Con el objetivo de proponer una versión de la Escala de Comportamiento Ecológico (ECE) para su uso en poblaciones mexicanas, se exploraron las propiedades psicométricas del instrumento obteniendo como resultado una escala ECE de 28 ítems y tres factores, con un alfa de Cronbach global ($\alpha = 0{,}79$).

PALABRAS-CLAVES: estudios de validación, conducta, psicología ambiental

The clarification of an object of study for ecology by Tansley in 1935 and the exciting industrialization progress, added interest in the ecosystem's conservation (Dominguez et al., 2021), however, during this same period it was also outlined that humanity's concern about the environment was not directly proportional to the actions that were carried out in favor of it (Bernedo & Cazorla, 2020). In this sense, the existence of a critical imbalance in ecosystems is conceivable at present (Casas et al., 2017; Palavecinos et al., 2016).

In 1949 the United Nations Organization for Education, Science and Culture (UNESCO) as a result of a study carried out globally, concluded that it was necessary through education to change the Dominant Social Paradigm that until then had placed nature as a tool at the service of mankind (Martínez & Figueroa, 2014; Moreno et al., 2022). This proposal has enjoyed great international acceptance since its appearance, becoming the main cause of the planet's deterioration (Cifuentes et al., 2018).

The context described above allowed that within the scientific community, the environmental theme captured the interests of many researchers, from the perspective that the environmental issue constitutes a multidisciplinary field, and its understanding requires multiple approaches (Cacuassa et al., 2019; Pato & Tamayo, 2006). Specifically in the field of environmental psychology, it is assumed that environmental problems are strongly related to human behavior; therefore, investigations aimed at explaining this relation have been centered on the study of behavioral variables (Schultz & Kaiser, 2012; Sevillano, 2019). According to Amérigo (2006), Bamberg e Möser (2007), López et al. (2015), and Tosi et al.

(2019), there is an important number of studies about this topic, which can be grouped into two lines of investigation, the first oriented to understand the factors that make an individual behave ecologically and the second, focused on development of instruments that allow the quantification of these variables (López et al., 2015).

ECOLOGICAL BEHAVIOR MEASURES

Following what was previously described, according to Domingues et al. (2019), in environmental psychology the measurement of ecological behavior has been fundamental, especially because thanks to these studies, knowledge has been generated that has served as a reference for the implementation of strategies oriented towards the development of favorable attitudes with the environment (Musitu-Ferrer et al., 2020).

On the other hand, regarding the construction of psychological tests, there is a lack of consensus and constructs by researchers about the variables that most influence ecological behavior (Álvarez & Vega, 2009; Laso et al., 2019; López et al., 2015), has encouraged the elaboration of behavioral measures essentially of two types, of specific measurement and of general measurement (Bolzan, 2008; López et al., 2015). Regarding specific measurements, the production has been as numerous as the result of the diversity of factors applicable to ecological behavior combined with the multiplicity of environmental problems attributable to the context that is investigated (Laso et al., 2019; Pato & Tamayo, 2006). For Kaiser et al. (1999), Kaiser and Fuhrer (2003), and López et al. (2015) the use of specific measurement instruments may lead to errors due to which the quality of the answers prevents checking their reliability, being subject to the influence of external and contextual limits.

Regarding general measurement instruments, the proposals published by Karp (1996) and Kaiser et al. (1999) were achieved with greater preference by researchers, as they were demonstrated to measure with greater consistency the dimensions of ecological behavior in distinct groups (Bolzan, 2008; López et al., 2015; Pato & Tamayo, 2006). Concerning the previous one, Kaiser et al. (1999), through a probabilistic study, developed a General Ecological Behavior Scale (GEB) composed of seven factors that constitute active or passive actions of the individual in pro-environmental activities (Carabias, 2002; González, 2002). Although the instrument in its reliability and internal consistency reveals acceptable validity when used in different populations, this scale has required significant changes (Caballero, 2018; González, 2002; López et al., 2015; Vandecasteele & Geuens, 2010). This situation is due to the EGCE being standardized in a society with elevated levels of development where the sociocultural reality is different compared to those countries with emerging economies (Bolzan, 2008; Pato & Tamayo, 2006).

On the other hand, the scale proposed by Karp (1996) consisted of valuing pro-environmental actions through a series of self-declared activities. For Karp (1996) ecological behaviors are mediated by interest and therefore can be classified and studied in the following way: a) self-transcendent, motivated by a collectivist interest; b) self-transcendent, motivated by personal interest; c) common regulations, easy to carry out and d) atypical regulations, requiring greater effort to carry them out. The instrument finally consists of 16 items, after factorial analysis three factors were identified: good citizen, activist, and healthy consumer. The reliability index for the general scale was a Cronbach's alpha of .82 (Karp, 1996).

According to Karp (1996), Pato et al. (2005), and Pato and Tamayo (2006) the scale allows one to effectively identify personal values of self-transcendence as positive predictors of ecological behavior. According to Bolzan (2008) and Pinheiro et al. (2021), there are few instruments with these qualities that can be applied in Latin American countries. Derived from this situation, Pato (2004) based on Karp's proposal, undertook a study in a sample of 234 Brazilian university students to elaborate and validate a scale adjusted to the reality of Latin America. As a result, the Ecological Behavior Scale (ECE) is obtained. The instrument initially consisted of 44 items, later and after a factorial analysis a cut version was obtained consisting of 29 items, including only those whose factorial loadings were greater than .40. The scale revealed four factors, all above .80 in its reliability index (Pato et al., 2005).

In correspondence with what was previously mentioned and referred to by several authors, from environmental psychology, have highlighted the prevailing social need to form responsible citizens who, with actions, can act to counteract the deterioration of the ecosystems (Musitu-Ferrer et al., 2020), and considering that the university is a microcosm that synthesizes the characteristics present in the social macrocosm (Atcon, 2005; Palavecinos et al., 2016) and that, in its ethical and moral character, it assumes the responsibility of forming citizens with a favorable vision towards the environment in its professional area (Martínez et al., 2002; Valencia-Ordóñez, 2020), this investigation is relevant.

This study was guided by two objectives, firstly, to explore the reliability and internal consistency of the Ecological Behavior Scale (Pato et al., 2005), and, secondly, to obtain an adaptation of the reliable ECE to be used in future investigations in Mexico, I believe that, following a review of the literature carried out, a very small number of instruments aimed at measuring ecological behavior in our country were identified.

METHOD

An observational, cross-sectional analytical study was conducted, which was designed to evaluate the reliability and factorial structure of the Ecological Behavior Scale (ECE) by Pato et al. (2005) by calculating the Cronbach's alpha coefficient and exploratory factor analysis, using the principal axis method (PAF) to extract factors with Promax rotation. Data is available upon request to the authors.

Participants

The sample is composed of 503 students who decided to collaborate voluntarily (41% men and 59% women), the age range of the participants was between 19 and 30 years, with an average of 22.14 and a standard deviation of 2.902. All are enrolled in some degree program belonging to the Universidad Autónoma del Carmen and originating from the southern region of the Mexican territory that includes the federative entities of Tabasco, Campeche, Quintana Roo, and Yucatán.

Instruments

General data sheet. The objective of this syllabus was to record information regarding the characteristics of the participants (gender, age, semester they are studying, and discipline in which they are enrolled).

Letter of informed consent. Its purpose is: a) to inform students of the objective and procedure of the study, b) to ensure the privacy and confidentiality of the participant's data, and c) to inform them about the possible risks and benefits derived from their participation in this study.

Ecological Behavior Scale (ECE). This instrument was developed by Pato (2004), the original scale in Portuguese is made up of 44 items. To the objectives of this study, a second version of the ECE in Spanish was used, validated by Pato et al. (2005). According to the authors and after factorial analysis, this finally consisted of 29 items, written in the form of sentences that describe specific dimensions of actions: Activism (9 items; $\alpha = .80$); Water and Energy Savings (12 items; $\alpha = .84$); Urban cleaning (5 items; $\alpha = .84$) and, finally, Recycling (3 items; $\alpha = .82$).

Procedure

Before data collection, permission was obtained from the authorities of the institution where investigative activities were conducted. Subsequently, with the help of educational program teachers, information collection was programmed and organized to be conducted during the first quarter of 2020, within class classes. Before providing the Ecological Behavior Scale, it was necessary to explain to all students the focus and scope of the study, those who voluntarily decided to participate signed an informed consent so that they authorized their collaboration in writing, immediately after this the procedure consisted of a total of 25 groups of approximately 20 university students each. Under the researchers' supervision, the Ecological Behavior Scale was submitted for their contestation, and it was self-administered, in such a way that the participants responded according to their level of compliance or not with the planned ecological behaviors. The estimated time to respond to the questionnaire was between 10 and 15 minutes.

Ethical Considerations

The study adheres to the *Reglamento de la Ley General de Salud en Materia de Investigación para la Salud* (Secretaría de Salud, 1987) and the Code of Ethics of the Psychologist of the *Sociedad Mexicana de Psicología* (2009) following the guidelines of voluntariness, anonymity, and independence of the participating population.

Statistical Analysis

The reliability of the ECE was evaluated by calculating Cronbach's alpha coefficient per total scale and factor. The factorial structure of the instrument was identified using the extraction method of main components with Promax rotation. To extract factors, those with *eigen* value (proper value) ≥ 1.00 were used as criteria and to assign items to factors, factor loadings $\geq .3$ were considered.

For the factorial analysis of feasibility, the following calculations were made Bartlett sphericity test, Kaiser-

Meyer-Olkin (KMO) test, individual sample adequacy index (MSA), and the determinant of the correlation matrix, which indicate the adequacy of data for the factorial analysis of the survey (Ximénez & San Martín, 2004). Statistical analyses will be conducted using the Statistical Package for the Social Sciences (SPSS) version 25.0.

RESULTS

Descriptive data

Of the 503 university students who participated in this study, there were 207 men and 296 women. While the average age of the population is 22.14 years.

Correlation Between Items and Cronbach's Alpha, Original Version 4 Factors

The initial feasibility results of the factorial analysis for the Ecological Behavior Scale (ECE) in its original version of 29 items and four factors (Pato et al., 2005) came to the following: Bartlett's sphericity test (4393.129, gl = 406, $p < .001$), test Kaiser-Meyer-Olkin (KMO; .855), individual sample adequacy index (MSA; 75.86% of values above .80) and the determinant of the correlation matrix ($p < .001$), these indicate adequacy of data for the factorial analysis of the survey (Ximénez & San Martín, 2004). On the other hand, the internal consistency reliability of the ECE was determined by calculating Cronbach's alpha coefficient, giving a general result of $\alpha = .779$, thus showing an adequate index (Table 1). Subsequently, to understand its factorial structure, an exploratory factorial analysis was conducted by applying the principal axes method (PAF) to extract factors with Promax rotation, to minimize the number of reactants with high saturations in a single factor (Table 1). The rotation converged in seven iterations, which allowed for maintaining independence among the rotated factors in a factorial structure of four dimensions with higher eigenvalues than one, which together explained 44.821% of the total variance, which is a satisfactory value. The analysis also revealed that the total weight load range oscillates between .283 and .801.

To conduct an analysis of each factor and to avoid underestimating its global internal consistency, Cronbach's alpha was calculated for each group of items that make up each of the four factors (Oviedo & Campo, 2005). This process revealed that Factor 1 showed an adequate index (α = .770), consisting of 13 items that together explain 20.048% of the total variance (factorial loads that oscillate between .283 and .595) containing this factor, which reactive "I avoid buying heavy plastic products" was the only reactive with a saturation lower than .30; regarding Factor 2 this showed an adequate value (α = .796) containing 6 items, which contributed to 12.975% of the total variance (factorial loadings between .472 and .758); Factor 3 presented a Cronbach's alpha of low value (α = .438) for seven items, which contributed 6.818% of the total variance (factorial loadings between .330 and .772); Factor 4 also presents a low Cronbach's alpha (α = .185) which is made up of 3 items that contribute 4.980% of the total variance (factorial loadings that fluctuate between .438 and .801).

Correlation Between Items and Cronbach's Alpha, Proposed Version of 3 Factors

Considering the previous results and considering that, in the original structure of the scale, factors 3 and 4 obtained low-reliability indices, it was decided to conduct a second analysis considering a factorial structure of three factors (Table 2). The results obtained were the following: Bartlett's sphericity test (4296.303, $gl = 378$, $p < .001$), Kaiser-Meyer-Olkin (KMO; .857) test, individual sample adequacy index (MSA; 75.86% of values above .80) and the determinant of the correlation matrix ($p < .001$), which indicate the adequacy of data for the factorial analysis of the instrument (Ximénez & San Martín, 2004), in addition to the ECE obtaining one General Cronbach's alpha was adjusted to .790, which is a higher value than that obtained in the first analysis with four factors. The values of Bartlett's sphericity test, the Kaiser-Meyer-Olkin (KMO) test, the individual sample adequacy index (MSA), and the determinant of the correlation matrix were like those reported by Pato et al. (2005).

Regarding exploratory factorial analysis applying the principal axes method (PAF) for the extraction of factors with Promax rotation to minimize the number of reactants with high saturations in a single factor, we have that the rotation converges in 6 iterations, which allowed maintaining independence among the rotated factors, each of the three factors resulted in eigenvalues greater than one, which in their set explained 40.698 % of the total variance if this is a satisfactory value. In this study, for an item to be considered as part of a factor, a weight greater than .300 was used as a criterion, I say that no item was found with saturation lower than .300. In this same context, the item "I throw all kinds of rubbish in any trash can" was eliminated as it had a low value in anti-image correlation.

The exploratory factorial analysis (Table 2) also determined that the 3 ECE factors presented weight loads that ranged between 0.775 and 0.320. Factor 1, which consists of 11 items that together explain 20.048% of the total variance (factorial loadings that oscillate between .775 and .320), with an adequate Cronbach's alpha of .836;

Table 1
The results of the exploratory factor analysis using a 4-factor structure for the ECE scale

ECE Items		Factor				
		1	2	3	4	α
Factor 1 (20.048% total explained variance)						
Urban cleaning	I avoid throwing papers on the floor.	.595				
Energy and water saving	I avoid wasting energy.	.592				
Energy and water saving	When I open the refrigerator, I avoid leaving the door open for too long so as not to waste energy.	.576				
Energy and water saving	I avoid turning on many electrical appliances at the same time during times of highest energy consumption.	.546				
Energy and water saving	I avoid wasting natural resources.	.541				
Energy and water saving	When I can I save water.	.525				
Urban cleaning saving	When I cannot find a trash can to dispose of paper, I put it in my pocket.	.497				.770
Energy and water saving	I turn off the lamp when I leave the room.	.467				
Activism	I avoid eating foods that contain chemicals (preservatives or agrochemicals).	.466				
Urban cleaning	I help keep the streets clean.	.428				
Urban cleaning	When I cannot find a trash can nearby, I throw the empty cans on the ground.	.352				
Activism	I avoid using products manufactured by a company when I know that the company is polluting the environment.	.348				
Activism	I avoid buying products made of plastic.	.283				
Factor 2 (12.975 % total explained variance)						
Activism	I talk about the importance of the environment with people.		.758			
Activism	I participate in public protests to defend the environment.		.714			
Activism	I do volunteer work for an environmental group.		.688			.796
Activism	I mobilize people for the conservation of public spaces.		.640			
Urban cleaning	I collaborate with the preservation of the city where I live.		.541			
Activism	I participate in activities that take care of the environment.		.472			
Factor 3 (6.818% total explained variance)						
Energy and water saving	I leave the faucet running all the time while I take a shower.			.722		
Energy and water saving	When I feel like eating something that I do not know what it is, I open the refrigerator and look at what is there.			.589		
Energy and water saving	When I am at home, I leave the lamps on in places where they are not needed.			.521		.438
Energy and water saving	I leave the TV on even when no one is watching.			.473		
Energy and water saving	While I brush my teeth, I leave the faucet running.			.392		
Energy and water saving	While I take a shower, I turn off the faucet to soap up.			.344		
Activism	I buy food without worrying if it has preservatives or agrochemicals.			.330		
Factor 4 (4.980% total explained variance)						
Recycling	I separate trash by type in my house.				.801	
Recycling	I separate garbage according to its type.				.708	.185
Recycling	I throw all kinds of garbage in any trash can.				.438	

Note. The first column shows the name of the factors to which each item corresponds according to the original version of the scale (Pato et al., 2005).

Factor 2 also consists of 11 items, which explain 12.975% of the total variance (factorial loads between .704 and .403), achieving an "adequate" reliability index of .757; Factor 3, made up of 6 items, which contribute 6.818% of the total variance (factorial loads between .712 and .444), obtaining an "acceptable" value of .660.

Regarding the results of the descriptive analysis and Communities for the ECE (Table 3) it is possible to observe

Table 2
The results of the exploratory factor analysis using a 3-factor structure and 28 items for the ECE scale

	ECE items	Factor			
		1	2	3	α
Factor 1 (20.747% total explained variance)					
Activism	I participate in public demonstrations to defend the environment.	.775			.836
Recycling	I separate the garbage by type in my house	.754			
Recycling	I separate garbage according to its type.	.745			
Activism	I do volunteer work for an environmental group.	.707			
Urban cleaning	I collaborate with the preservation of the city where I live	.628			
Activism	I mobilize people for the conservation of public spaces.	.626			
Activism	I talk about the importance of the environment with people.	.546			
Activism	I avoid buying products made of plastic.	.438			
Activism	I participate in activities that take care of the environment.	.404			
Activism	I avoid using products manufactured by a company when I know that the company is polluting the environment.	.373			
Activism	I avoid eating foods that contain chemicals (preservatives or agrochemicals).	.320			
Factor 2 (13.337% total explained variance)					
Urban cleaning	I avoid throwing papers on the floor.		.704		.757
Urban cleaning	I put the paper I do not want in my pocket when I cannot find a trash can nearby.		.659		
Energy and water saving	I avoid wasting energy		.610		
Energy and water saving	When I open the refrigerator, I avoid leaving the door open for too long so as not to waste energy.		.587		
Energy and water saving	I turn off the lamp when I leave the room.		.578		
Energy and water saving	When I can I save water.		.567		
Energy and water saving	I avoid wasting natural resources.		.537		
Urban cleaning	When I cannot find a trash can nearby, I throw the empty cans on the ground		.512		
Energy and water saving	I avoid turning on many electrical appliances at the same time during times of highest energy consumption.		.497		
Urban cleaning	I help keep the streets clean		.490		
Energy and water saving	While I shower, I turn off the faucet to soap up.		403		
Factor 3 (6.614% total explained variance)					
Energy and water saving	I leave the faucet running all the time while I take a shower.			.712	.660
Energy and water saving	When I feel like eating something that I do not know what it is, I open the refrigerator and look at what is there.			.661	
Energy and water saving	When I am at home, I leave the lamps on in places where they are not needed.			.582	
Energy and water saving	I leave the TV on even when no one is watching.			.537	
Activism	I buy food without worrying if it has preservatives or agrochemicals.			.524	
Energy and water saving	While I brush my teeth, I leave the faucet running.			.444	

Note. Total variance 40.698, global Cronbach's alpha of .790.

that the average scores of the items were averages, keeping in mind the response interval from 1 to 6. The highest average was item 23 with 4.938 (I keep the paper that I don't want in my pocket when I find a piece of paper nearby) belonging to Factor 2; while the mean was lower in item 24 with 1.721 (When I can't find a trash can nearby, I throw the empty cans on the ground) placed in the same factor. The average scores for items show the following decreasing order: 24≥, 2 ≥, 11 ≥, 3 ≥, 10 ≥, 14 ≥, 16 ≥, 27 ≥, 28≥, 6≥, 1 ≥, 26≥, 9 ≥, 4 ≥, 5≥, 20 ≥, 7≥, 8≥, 25≥, 21≥, 19≥, 18≥, 13≥, 15≥, 12≥, 22 ≥, 17≥, 23≥. Regarding the Communalities, these present a wide variation, with the lowest value of .241 (I avoid turning on many electrical appliances at the same time during times of highest energy consumption) corresponding to Factor 2 and the highest of .571 (I participate in demonstrations public institutions to defend the environment) belonging to Factor 1.

Table 3
Descriptive statistics of the ECE structure of 3 factors and 28 items

	ECE items	Min.	Max.	Mean	Std. deviation	Variance	Communalities
Núm.	**Factor 1**						
2	I participate in public demonstrations to defend the environment.	1	6	1.912	1.757	1.757	.535
27	I separate the garbage by type in my house	1	6	2.749	1.542	2.380	.586
28	I separate garbage according to its type.	1	6	2.844	1.637	2.682	.560
3	I do volunteer work for an environmental group.	1	6	2.195	1.327	1.762	.448
26	I collaborate with the preservation of the city where I live.	1	6	3.105	1.569	2.462	.533
6	I mobilize people for the conservation of public spaces.	1	6	2.914	1.498	2.246	.426
7	I talk about the importance of the environment with people.	1	6	3.272	1.472	2.167	.442
4	I avoid buying products made of plastic.	1	6	3.171	1.380	1.907	.304
1	I participate in activities that take care of the environment.	1	6	2.974	1.355	1.838	363
9	I avoid using products manufactured by a company when I know that the company is polluting the environment.	1	6	3.135	1.424	2.030	.347
5	I avoid eating foods that contain chemicals (preservatives or agrochemicals).	1	6	3.223	1.536	2.361	.238
	Factor 2						
22	I avoid throwing papers on the floor.	1	6	4.876	1.450	2.104	.502
23	I put the paper I do not want in my pocket when I cannot find a trash can nearby.	1	6	4.938	1.383	1.914	.425
12	I avoid wasting energy.	1	6	4.743	1.340	1.796	.475
18	When I open the refrigerator, I avoid leaving the door open for too long so as not to waste energy.	1	6	4.352	1.638	2.684	.268
17	I turn off the lamp when I leave the room.	1	6	4.880	1.442	2.081	.408
15	When I can I save water.	1	6	4.701	1.266	1.603	.403
19	I avoid wasting natural resources.	1	6	4.109	1.493	2.229	.415
24	When I cannot find a trash can nearby, I throw the empty cans on the ground.	1	6	1.721	1.286	1.655	.404
21	I avoid turning on many electrical appliances at the same time during times of highest energy consumption.	1	6	3.737	1.696	2.877	.218
25	I help keep the streets clean	1	6	3.723	1.603	2.572	.428
13	While I shower, I turn off the faucet to soap up.	1	6	4.663	1.704	2.906	.376
	Factor 3						
14	I leave the faucet running all the time while I take a shower.	1	6	2.280	1.540	2.374	.514
20	When I feel like eating something that I do not know what it is, I open the refrigerator and look at what is there.	1	6	3.261	1.640	2.640	.365
10	When I am at home, I leave the lamps on in places where they are not needed.	1	6	2.205	1.360	1.852	.451
16	I leave the TV on even when no one is watching.	1	6	2.304	1.562	2.440	.337
8	I buy food without worrying about whether it has preservatives or agrochemicals.	1	6	3.392	1.526	2.331	.249
11	While I brush my teeth, I leave the faucet running.	1	6	1.990	1.451	2.106	.228

Note. In the first column, the item number follows the original scale (Pato et al., 2005).

Spearman's Linear Correlation Coefficient

The items grouped in each of the factors (Table 4) showed a statistically significant correlation (weak positive; .01 to .10) to a very strong positive correlation (.75 to .90), medium positive (.11 to .50) a considerable positive (.51 to .75) and weak positive (.01 to .10) a medium positive correlation (.11 to .50), as above, is indicative that certain items are correlated among them (Montes et al., 2021), confirming in this way, robustly the sense of belonging to the factor in which it was shaped by the factorial model. It is worth highlighting that in factor 2, item 24 (When I cannot find a trash can nearby, I throw the empty cans on the ground) showed an average negative correlation in comparison with the rest of the items of this factor. This result could suggest that this item is not contributing equally to measuring the same construct.

Table 4
Spearman correlation coefficients among items.

					Factor 1						
	1	**2**	**3**	**4**	**5**	**6**	**7**	**9**	**26**	**27**	**28**
1	1										
2	.221**	1									
3	.334**	.565**	1								
4	.326**	.194**	.246**	1							
5	.194**	.107*	.169**	.340**	1						
6	.322**	.430**	.408**	.281**	.154**	1					
7	.414**	.321**	.390**	.299**	.191**	.490**	1				
9	.275**	.221**	.222**	.356**	.357**	.301**	.315**	1			
26	.448**	.317**	.429**	.299**	.273**	.391**	.479**	.292**	1		
27	.209**	.380**	.305**	.279**	.289**	.318**	.248**	.254**	.409**	1	
28	.248**	.386**	.329**	.229**	.278**	.339**	.234**	.272**	.416**	.789**	1
					Factor 2						
	12	13	15	17	18	19	21	22	23	24	25
12	1										
13	.372**	1									
15	.510**	.276**	1								
17	.467**	.400**	.350**	1							
18	.424**	.212**	.388**	.266**	1						
19	.404**	.315**	.420**	.336**	.224**	1					
21	.314**	.192**	.241**	.220**	.281**	.324**	1				
22	.400**	.448**	.374**	.479**	.340**	.390**	.263**	1			
23	.344**	.332**	.295**	.314**	.305**	.297**	.199**	.520**	1		
24	-.289**	-.306**	-.233**	-.402**	-.245**	-.187**	-.161**	-.481**	-.379**	1	
25	.334**	.212**	.340**	.269**	.196**	.423**	.230**	.360**	.298**	-0.165**	1
					Factor 3						
	8	10	11	14	16	20					
8	1										
10	.192**	1									
11	.037	.314**	1								
14	.178**	.388**	.411**	1							
16	.158**	.369**	.293**	.302**	1						
20	.180**	.296**	.223**	.362**	.239**	1					

Note. ** $p < .01$. * $p < .05$.

DISCUSSION

In recent years, studies about environmental behavior have proliferated, both those aimed at identifying factors associated with pro-environmental behavior and those oriented towards the development of specific and general measurement instruments (Amérigo, 2006; Bamberg & Möser, 2007; López et al., 2015; Tosi et al., 2019). According to some researchers on this topic, specific measurement instruments can lead to errors due to which the quality of the answers prevents verifying their reliability (Kaiser et al., 1999; Kaiser & Fuhrer, 2003; López et al., 2015; Pato & Tamayo, 2006). As regards general measurement, these have enjoyed greater acceptance in being able to measure better ecological behavior in distinct groups, managing to make comparisons between different populations (Bolzan, 2008; López et al., 2015; Pato & Tamayo, 2006).

In another context, despite the high production of scales for the measurement of ecological behavior, these are regularly validated in those countries called the first world, preventing, on the one hand, from adapting to the reality of societies with economic emerging countries such as Latin America and elsewhere, it is not possible to make comparisons among more homogeneous groups (Bolzan, 2008). Therefore, the interest of this investigation is to analyze the factorial structure of the ECE and offer it a version validated in Mexico for its use in future investigations in the region about this topic.

According to the previous and based on factor analysis carried out using the Ecological Behavior Scale (ECE) by Pato et al. (2005) in the first analysis a structure of four factors was found, and the same number of dimensions reported by the original authors and similar to those found later in other populations (Bolzan, 2008; Herrera, 2015; Medina et al., 2019). In this sense, this first analysis reveals the difference between the original version and its subsequent validations (Bolzan, 2008; Herrera, 2015; Medina et al., 2019; Pato et al., 2005), from the variations in its organization, on the one hand, none of the factors retained the same number of items and others, each factor being made up of items belonging to more than one factor, making it impossible to conceptually categorize them as in their original version. However, in the Brazilian version, four factors were defined theoretically and constituted by a specific number of items (Factor 1, Activism, 9 items; Factor 2, Energy savings, 12 items; Factor 3, Urban cleaning, 5 items and Factor 4, recycling 3 items), it is probable that within the Mexican population the environmental situation is socially represented differently, preventing the ECE from being able to be theoretically grouped in the same way. This divergence has previously been reported in cross-cultural comparative studies (Amérigo et al., 2017; Côrtes et al., 2016). Regarding the global reliability index of the ECE, in this first analysis, the results revealed an adequate Cronbach's alpha (α = .779) similar to those reported by Abud (2013), Herrera (2015), and Medina et al. (2019) and below the data reported by Bolzan (2008) who agreed to find a general Cronbach's alpha above .840.

While the values per factors Pato et al. (2005) indicated that all factors showed an adequate reliability index, these data were similar to those reported by Herrera (2015) and contrary to our previous research, from which the reliability indexes for each factor resulted in the following Factor 1 manner, α = .770; Factor 2 of α = .796; Factor 3 of α = .438; Factor 4 of α = .185; only Factors 1 and 2, reached adequate levels, while Factors 3 and 4 revealed very low values. In this same sense, our results were closer to those described by Bolzan (2008) who, when applying the instrument to a population of Brazilian residents, found that Factor 4 achieved a Cronbach's alpha much lower than that originally reported (α = .262), this data coincides with those obtained for the same factor by Pinheiro and Farias (2013), in a similar population.

Regarding the explanatory variation for the general scale, our analysis revealed 44.821%, much higher than the original scale and other data reported for later versions established by Abud (2013).

By conducting a second exploratory analysis in a three-dimensional structure the global index increased slightly, obtaining a Cronbach's alpha (α = .790), revealing a general explanatory variation of 40.698% greater than that reported in the original version and validations of other authors (Abud, 2013; Pinheiro & Farias, 2013). For an item to be considered as part of a factor used as a criterion that had a weight greater than .300, in this sense no one was found to be reactive with saturation lower than .300, however, the item "I throw all kinds of rubbish in any trash can" was eliminated because it had a low value in the anti-image correlation. As I said earlier, the elimination of this item may suggest that it does not contribute to the factorial structure because it is redundant for the variable that queries the item it is confusing in a way.

In this context, the Ecological Behavior Scale proposed three factors that consisted of 28 items. Factor 1, 11 items, 20.048% of explanatory variance, α = .836, these items mostly reference behaviors related to environmental preservation; Factor 2, 11 items, 12.975% of explanatory variance, α = .757; this group of items is integrated by behaviors aimed at cleaning public spaces and caring for natural resources; Factor 3, 6 items, 6.818% of explanatory variance, α = .660; consisting of items related to consumer actions. It is worth noting that these results are like those reported by Bolzan (2008). In what corresponds to the correlation among the items analyzed by each factor, in the 3 factors, statistically significant relations among the items were found.

Finally, Amérigo et al. (2017), it clear that several studies have demonstrated that ecological behavior is influenced by the socioeconomic and cultural context, therefore, each measurement scale aimed at quantifying this variable and

making comparisons among groups with significant cultural, social, and economic differences tends to need to take these factors into account. Concerning this, recent studies have confirmed that both the Brazilian and Mexican populations in terms of environmental behavior, present marked socio-economic and cultural similarities (Amérigo et al., 2017; Côrtes et al., 2016; Larios, 2019), these comparative studies between the two societies allow us to assume that both cultures have built a holistic vision regarding the environment, that is, a more favorable behavior towards nature without renouncing economic growth (Ámerigo et al., 2017; Côrtes et al., 2016; Larios, 2019).

These socio-economic and cultural similarities between the population of Brazil and Mexico, have allowed us to possibly obtain comparable results in the internal consistency index of the ECE, resulting in the adaptation of this scale in the Mexican population being reliable for its application future in the region.

FINAL CONSIDERATIONS

The results demonstrate that the Ecological Behavior Scale (ECE) instrument measured three factors for the Mexican sample studied. In each of the factors, the items are linked to their respective groups with greater loads to methodologically acceptable superior values.

The adaptation of the ECE instrument to 28 items with 3 factors, achieved a level of global reliability index considered as "good" as for the first 2 factors, although for the third "Factor" the analysis revealed an acceptable Cronbach's alpha.

According to the previous statement, the instrument allows measuring in the reality of the Mexican sample the understanding of variables associated with ecological behavior, becoming a feasible, dependable, and easy-to-apply research tool to measure this phenomenon and be able to conduct comparisons within similar Mexican populations.

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Data availability statement
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