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Responsible Ecological Behavior in Participation, Resource Saving, Recycling and Reuse in Peruvian University Students

Jessica Acevedo Flores[1], Edith Olivera[2], John Morillo Flores[3], Yadira Cabrera Contreras[4], Victor Pulido[5]

Abstract

This paper analyzes, within the framework of responsible ecological behavior (REB), participation and environmental concern, resources saving, recycling and reuse of products in students from a Peruvian private university. Data for this study was obtained by completing self-administered questionnaires from a sample of 523 undergraduate students attending a university based in Lima and Ica, Peru. REB was segmented into three dimensions: Participation and Environmental Concern (PEC), Resources Saving (RS) and Recycling and Reuse (RR). A medium positive correlation was found between REB and PEC, while REB showed a positive correlation between the RS and RR dimensions at a significance level of 99%. A weak negative correlation was identified between REB and student gender; no correlation was found with age and region of origin. More than half of the students frequently practice habits that contribute to the protection of the environment; especially actions related to RS. RR behaviors reported less frequency in their usual practice, specifically reuse activities of aluminum cans and plastic containers, while PEC was the least common factor in pro-environmental practices. The apathy for externalization of environmental interest and lack of commitment in ecological campaigns demonstrate the low level of internalization of environmental culture in Peruvian university students.

Keywords: *Responsible ecological behavior; environmental participation; recycling; reuse; resource saving.*

Introduction

In recent decades, the deterioration of the environment has increased around the world, which has led to environmental pollution, irresponsible use of resources, destruction of the ozone layer and climate change which have caused a great threat to the life and health of human beings (Chen, 2021). Nonetheless, environmental problems are not only seen as technological issues in nature, but also as problems of perception and behavior (Ibáñez *et al*., 2020); consequently, the solution lies in the modification of human behavior (Koger, 2013). This implies a change in individual and collective values, beliefs, lifestyles, and practices seeking to promote pro-environmental behaviors to achieve a more sustainable future (Cortes *et al*., 2017).

Acquiring responsible ecological behaviors or pro-environmental behaviors is the objective of environmental education and the result of the commitment of all socializing agents, especially educational institutions at all levels. Environmental education has the function of training citizens who practice sustainable behaviors and develop actions that promote the responsible use of natural resources, so that they practice lifestyles that promote a sustainable environment and habits that contribute to protect the environment (Camacho-Rodríguez and Jaimes-Carvajal, 2016).

In this regard, since the pro-environmental behavior has the utmost importance at the political, governmental, business, social and educational levels, the role of the university takes on special relevance. Due to their nature and social function, universities, as training and research institutions, must be engaged in the promotion of pro-environmental behavior (Chakraborty *et al*., 2017). Universities have a fundamental role to understand and develop environmental behavior as they constitute the ideal scenario to promote initiatives that develop students' environmental awareness and change behavioral patterns that threaten environmental sustainability (Meyer, 2016).

[1] Escuela Profesional de Medicina Humana Filial Ica, Universidad Privada San Juan Bautista, Lima, Peru Address: Jr. D. Roca Varea Sur 196 – D302, Urb. Vista Alegre, Surco, Lima – Peru, Telephone number: +51-1-944995253. Email: jessica.acevedo@upsjb.edu.pe
[2] Escuela Profesional de Medicina Humana, Universidad Privada San Juan Bautista, Lima, Peru, Email: edith.olivera@upsjb.edu.pe, Orcid ID: 0000-0002-7400-8625.
[3] Universidad Privada San Juan Bautista, Lima, Peru, Email: john.morillo@upsjb.edu.pe, Orcid ID: 0000-0002-2136-4458.
[4] Escuela Profesional de Medicina Humana Filial Ica, Universidad Privada San Juan Bautista, Lima, Peru, Email: yadira190702@gmail.com, Orcid ID: 0000-0002-4256-4942.
[5] Escuela Profesional de Medicina Humana, Universidad Privada San Juan Bautista, Lima, Peru, Email: victor.pulido@upsjb.edu.pe, Orcid ID: 0000-0002-9238-5387.

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Although in 2018 the Law regarding Climate Change was approved (United Nations, 2021), Peru is far from achieving the advances that have been developing in other countries of America and Europe in the preservation of the environment and sustainable development because it has seven out of nine characteristics defined by the United Nations to be classified as a "particularly vulnerable" country against the negative effects of climate change; in fact, there are characteristics beyond being a developing country which contributes to such a vulnerability, namely, insufficient infrastructure, natural catastrophes such as floods, deforestation, illegal mining and low labor productivity as a result of malnutrition (UN, 2021). Besides, 79.3% of Peruvians live in urban populated centers and 20.7% in rural populated centers (National Institute of Statistics and Informatics, 2017; Padder & Bommayasamys, 2023; Pamungkas et al., 2023); that is to say, most people live in spaces dominated by cement with fewer and fewer green spaces, as green space per inhabitant in Peru barely exceeds 3 m^2 in cities such as Lima, Arequipa and Tacna (Torrico, 2020), while the WHO recommends sustainable cities with 9 m^2 of green space per inhabitant (National System of Environmental Information, 2020; WHO, 2021).

Consequently, the UN and the Peruvian Government, which is responsible for proposing and promoting the environmental educational program, have established a set of national priorities for development and one of them is sustainable development and environmental management, which comprises a set of policies and mechanisms at all levels, included education (UN, 2021).

Responsible Ecological Behavior (REB)

Environmental behavior is referred to the actions taken with the goal to minimize the impact of human activities on the natural environment (Kollmuss and Agyeman, 2002). Thus, equivalent labels such as responsible ecological behavior (REB), and pro-environmental behavior or conduct, or ecological and sustainable behavior, are used indistinctively as all of them are referred to constructs that are assumed to be affected by factors such as values, and have some aspects in common, such as reduction of resources usage (Tian and Liu, 2022).

Environmental behavior involves the orderly development of a sequence of conducts, individual or collective, specific, and directed towards a specific objective (Ramos, 2019). Bamberg and Möser (2007) indicates that pro-environmental behavior is a mixture of self-interest and pro-social motives; that is, to reduce one's own health risk and of concern for others (people, species, generations, and ecosystem). The so-called REB refers to human actions that contribute to the preservation of the ecosystem; namely, it includes specific activities to protect the environment, such as energy conservation, water saving, participation and activism, reduction of pollution and waste, recycling of products, sustainable consumption and / or ethical purchases, among others (Ramos, 2019). However, it should be noted that the fact that a person practices certain environmental behavior does not imply that he/she will commit to habitually perform another behavior favorable to protect the environment; thus, each person decides which the actions contribute to protect the environment.

REB reflects the level of commitment that a person has with the preservation of the environment in response to the internalization of pro-environmental values and attitudes, which could come from environmental education, social and institutional standards, and family environment, among other internal and external influential factors (Cantú-Martínez, 2020).

Environmental behavior is a special type of prosocial behavior that seeks to promote individual and collective well-being (Prati *et al.*, 2017). There is a number of theories to explain human pro-environmental behavior; the more widely known and cited are the theory of planned behavior (TPB) (Ajzen, 2005), particularly referred in the field of social psychology, and, the value-belief-norm (VBN) (Stern, 2000). Intention, according to TPB theory, is the immediate antecedent of behavior and is itself a function of attitudes to behavior, subjective norms, and perceived behavioral control; and each of these determinants derives from beliefs about the likely consequences of behavior, normative expectations of significant others, and the existence of factors that control behavioral performance (Ajzen, 2005). While the VBN theory proposes that values influence pro-environmental behavior via pro-environmental beliefs and personal norms.

For Stern (2000) REB is characterized by associating variables:

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- *Variable oriented to the attitudinal aspect*, referring to characteristics of the individual's consciousness, such as beliefs, and environmental predisposition, manifested in activism, and participation in activities related to the care of the environment.
- *Variable oriented to personal abilities*, composed of those aspects that the individual is able to execute in his daily private life as a form of environmentalism, such as sustainable purchase and lifestyle, saving resources, and waste disposal, among others.
- *Variable oriented to contextual factors*, includes aspects related to regulation, social norms, available technology, support policies, and advertising.

From all the above mentioned, in this study REB is constituted by three dimensions: participation and concern, resources saving and, reuse and recycling.

The participation and concern for the environment are mediated by environmental knowledge and reflected in the attitude towards the growing concern for the preservation of the environment (Ramos, 2019; Olivera *et al.*, 2020). Activism, collaboration, participation in ecological campaigns, and the externalization of concern for environmental care are activities resultant by participation and concern. Regarding saving resources, it involves reducing the consumption of natural resources and responsible use of them (Alvarez-Risco *et al.*, 2018). Reuse refers to the attempt to extend the useful life of a product by reusing it without any additional transformation process being exercised while recycling is referred to as any activity that allows a waste to be reused through a process of material transformation to fulfill its initial purpose or other purposes (Government of Mexico, 2022); i.e. it consists of the transformation of the usual forms and formats of objects, such as cardboard, paper, tin, glass, some plastics, and organic waste, into raw materials, and thus, seeking the recovering of solid waste in order to reintegrate it into the economic cycle, bringing several ecological and social benefits.

Environmental Education in Peruvian University and REB

Environmental education is an important influential factor to promote environmental knowledge to reinforce a responsible ecological behavior; nonetheless, environmental education does not begin at university. Early knowledge shapes future adults-thinking and decisions; hence a solid knowledge concerning the consequences of pollution and irresponsible environmental behavior has the potential to prepare children to practice REBs (Dameerell *et al.*, 2013). Consequently, environmental education at university must be seen as a later step in the education process that begins in basic education in the early youth.

Although there is an effort to establish global environmental policies, their implementation has limitations; mainly because environmental knowledge, attitudes and behavior are different in each country, as there are some influential factors such as geographic and demographic characteristics, in rural as well as in urban areas, culture, society, economics, politics, and natural system (Braun *at al.* 2018).

Environmental culture is not yet strongly rooted in society; some studies suggest that, although some universities have taken the commitment to develop sustainability on campus (Richardson and Kachler, 2016), it is still necessary to strengthen environmental education in basic and higher education (Ibáñez *et al.*, 2020; Olivera *et al.*, 2020). To achieve fundamental changes in environmental culture, it is necessary to provide an education aimed at promoting REB in future professionals, who will graduate from university to have leadership roles and must act as agents of change toward more sustainable economic, political, and industrial practices (Márquez *et al.*, 2016).

The university seeks the integral development of the student, which includes the acquisition of values, critical thinking, and respectful interaction with nature (Esteban and Amador, 2018). Universities are the training centers of the leaders of the present and the future, and they are responsible for making decisions that have effects on other individuals, and those decisions will mostly influence the state of the environmental crisis (Márquez *et al.*, 2016).

Therefore, university education plays a key role in transmitting values and helping to develop the so-called sustainable thinking which seeks to promote positive changes in the attitudes and environmental behaviors of children and young people (Ibáñez *et al.*, 2020), and with the formation of citizens with a view to the preservation of the environment. Currently, it is expected that environmental problems will be addressed

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through actions to promote environmental behavior at the university level, through environmental content and topics included in the curricula, the creation of pro-environmental workshops, the promotion of research on ecological issues and social responsibility, among others (Ibáñez *et al.*, 2020).

It is important to mention the different challenges that Peru faces to implement a comprehensive environmental education program. The last decade the Peruvian government went through a great political instability with rapid and unexpected changes of president and ministers, which in turn had an impact on the implementation of laws and their regulations, interfering with the progress of public policies for development and even have economic repercussions (UN, 2021).

The objective of this study is to evaluate, within the framework of responsible ecological behavior, the participation and environmental concern, natural resources saving, and the recycling and reuse of products by students from a Peruvian university, analyzing the frequency of these characterized pro environmental behaviors to identify their level of consolidation in daily practice. Additionally, the possible correlation between REB and its dimensions and sociodemographic variables such as age, gender and origin of the students participating in the study was explored. However, it is important to mention that for this research, the variable oriented to contextual factors, more likely related to organizational policies and advertising, is not considered because of its complexity, as its inclusion should be explored further and with the participation of not only university students, but also educators, researchers, directors, and the university staff. This study has been carried out in Peru in 2022-2023.

Materials And Methods

Research Sample

This study is quantitative, cross-sectional, and descriptive. A sample of undergraduate university students from a private university based in Metropolitan Lima and two branches in the Ica region were evaluated (Ica and Chincha).

A pilot test was carried out with 50 participants; experts' opinion was requested to adjust the designed scale. The instrument consisted of a survey, once it was finished, it was applied through Google Forms. The survey was sent through email to undergraduate students, and only those who accepted informed consent to participate voluntarily were considered in the study.

The sample consisted of 523 students, 270 men (51.6%) and 253 women (48.4%). The age of the participants was distributed as shown in Table 1 (SD=6.98), 62.3% of participants from the Ica region and 37.7% from the Lima region.

Table 1. Sociodemographic characteristics of the sample.

		Frequency	Valid Percentage
Sex	Female	253	48.4
	Male	270	51.6
Age	16-19	226	43.2
	20-25	230	44.0
	>25	67	12.8
Region	Ica	326	62.3
	Lima	197	37.7
Total		523	100.0

Instrument

Based on Stern's characterization (Stern, 2000), an instrument was developed by the authors, it is a structured self-report questionnaire on responsible ecological behavior and comprised 18 multiple-choice items based on a 5-level Likert scale, from Never to Always, asking about the frequency in practice of certain actions or habits that protect the environment. In addition to the 18 questions on the scale, the questionnaire collected demographic data such as sex, age, and the participant's university branch.

The Kolgomorov-Smirnov normality test of the REB variable was performed, obtaining a significance level of 0.002, below 0.05, which leads to rejecting the hypothesis of normality of scores of the scale. Consequently, since it does not follow a normal distribution, non-parametric tests were used.

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Data Collection and Analysis

The data collection was carried out integrally using digital resources. Due to the isolation measures, quarantine by Covid-19, the link of the self-report questionnaire developed on Google Forms was distributed to students through the institutional email of the private university considered for this study; furthermore, some faculty colleagues shared the link through messaging to invite their undergraduate students to fill out the survey.

In the questionnaire, only demographic data was collected, no personal identification data of the participants was requested, so confidentiality was guaranteed. Likewise, the ethical standards were met, being a study reviewed by the Institutional Ethics Committee of the university; moreover, an informed consent section was added, being an exclusion criterion for not having voluntarily agreed to participate in the research.

The data was tabulated and processed through Microsoft Excel and then analyzed using the statistical software SPSS version 26.

Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA)

The EFA was carried out to distinguish the dimensions of the REB construct. The EFA process (KMO: 0.895; $p<0.05$) determined that the instrument maintains stability in the data and was segmented into three factors: Environmental Participation and Concern (PEC), Resources Saving (RS), and Reuse and Recycling (RR). This three-dimensional REB structure was obtained through a varimax rotation that explained 50.4% of the variance.

Table 2 shows the factorial loads of the items of the REB scale and its factors; it was confirmed that the reliability of the three subscales was greater than the minimum acceptable value of 0.707. The PEC subscale showed a reliability of 0.758 and explains 6.69% of the variance. The RS subscale showed a reliability of 0.842 and explains 32.69% of the variance. Finally, the RR subscale showed a reliability of 0.771 and explains 10.92% of the variance.

Once the three dimensions of REB were identified: Participation and Environmental Concern (PEC), Resources saving (RS), and Recycling and Reuse (RR), each of them was explained according to its indicators.

Finally, CFA was used to confirm the dimensions of REB. This instrument was proposed to measure pro environmental behaviors of university students according to the characteristics of variables related to the variables of attitudinal abilities and personal aspects.

Participation and Environmental Concern (PEC)

It comprises 5 items related to individual and collective activism, participation in campaigns in favor of environmental care and recycling, interest, and attitude towards ecology. The maximum score obtained in this subscale is 25, and the minimum is 5.

Resources Saving (RS)

It includes 6 items regarding the conscious and responsible use of available resources, such as electricity and water, avoiding their waste and unnecessary use. The maximum score obtained in this subscale is 30, and the minimum is 6.

Recycling and Reuse (RR)

This dimension embraces 7 items, related to recycling and reuse of materials activities; the materials could be paper, plastic, glass, or aluminum. Sustainable purchase, that is, buying products that do not harm the environment, is also included in this dimension. The maximum score is 35, and the minimum is 7.

Table 2. Factor analysis of the scale and validity of the construct.

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Dimensions	#	Items	Loadings			α
PEC	3	To communicate and externalize interest in ecology and environment	.747			.758
	4	Participation in environmental conservation campaigns	.651			
	5	To watch/listen to programs about ecology and environmental conservation	.647			
	1	Interest in ecology and environment	.578			
	6	To contribute to recycling degradable and disposable material from other people	.469			
RS	9	To wash dishes and utensils controlling the amount of water		.746		.842
	8	To turn off the TV or computer that others leave on		.741		
	7	To turn off the lights that others leave them on		.735		
	10	Washing clothes by controlling the amount of water		.714		
	11	Controlling water for personal hygiene		.650		
	2	Indignation with people with attitudes that threaten the environment		.516		
RR	14	To reuse aluminum cans from packaged products			.753	.771
	15	To reuse plastic packaging for products			.646	
	18	To buy drinks with returnable glass container			.566	
	12	To reuse glass jars of packaged products			.528	
	16	To use plastic bags			.509	
	17	To buy products that do not harm the environment			.503	
	13	To use recycled paper			.470	
		Weight (50.4%)	6.69%	32.69%	10.92%	

Instrument Consistency

On the other hand, the instrument showed an acceptable reliability of 0.877, which was measured by the statistic Cronbach's alpha, whose value exceeds the recommended minimum (0.707). Likewise, the composite reliability of the three dimensions of REB was verified, obtaining values of 0.737 for the PEC dimension, 0.825, and 0.773 for RS and RR, respectively (Table 3).

Table 3. Reliability statistics.

	Cronbach's alpha	Number of elements
REB	0.877	18
Dimensions		
PEC	0.737	5
RS	0.825	6
RR	0.773	7

Results And Discussion

Responsible Ecological Behavior (REB) in Students and Data Concentration

Similar to the criterion followed by Álvarez-Risco *et al.* (2018), the results of our variable have been categorized according to the frequency of the practice of habits considered ecologically responsible. Thus, the answers Always and Many times are considered a consolidated habit, while, if the frequency fell on the option Sometimes, it can be said that the habit is in the process of consolidating. Never and Almost Never frequencies denote very poorly practiced pro-environmental behaviors. Therefore, the more items that have responses of consolidated habits, the REB achieved a higher score. From the results shown in Table 4, after obtaining an average of 64.05 (SD: 10.0987), it is assumed that most of the scores fluctuated between habits in the process of consolidation and habits already consolidated. Responses mostly were concentrated on the response Many times; this occurred in most of the items in the construct. Likewise, when analyzing the scores achieved according to the dimensions of REB, the answers that concentrated the highest percentage in each factor were Many times or Always (Fig. 1).

Table 4. Results of the variable (REB) and its dimensions (PEC, RS, RR).

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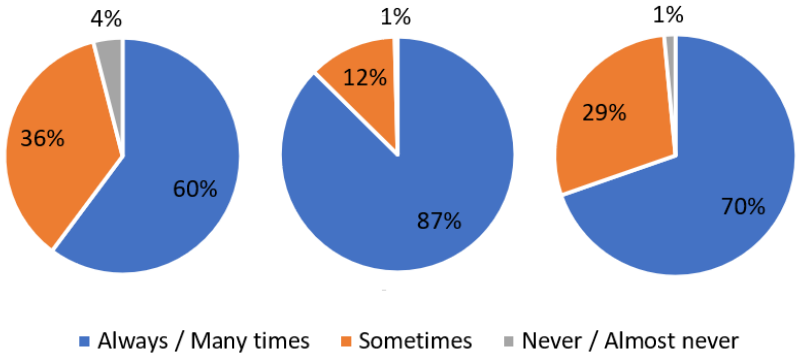
	Range	Min.	Max.	Mean	SD	Variance
REB	59.00	31.00	90.00	64.0516	10.09871	101.984
Dimensions						
PEC	20.00	5.00	25.00	16.3250	3.30121	10.898
RS	20.00	10.00	30.00	23.7055	4.23375	17.925
RR	28.00	7.00	35.00	24.0210	4.69792	22.070



a) PEC b) RS c) RR

Figure 1. Descriptive statistics by dimension: a) PEC, b) RS, c) RR.

Correlation of REB and its Dimensions

A median positive correlation has been found between responsible ecological behavior and environmental participation and concern. Likewise, a considerable positive correlation was found between REB and the second and third dimensions, resources saving, and recycling and reuse, with a significance level of 99% (Table 5).

Table 5. Correlation coefficient of the construct and its dimensions.

Dimensions	REB	PEC	RS	RR
PEC	0.731**	--		
RS	0.812**	0.414**	--	
RR	0.839**	0.518**	0.493**	--

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

Regarding the correlation between responsible ecological behavior and the demographic variables of the participants; that is, sex, age, and region of university branch, no correlation was found between REB and age, nor was a correlation found with the region; however, a weak negative correlation was identified between REB and the sex of students (-0.241), with a significance level of 99% (Table 6). Additionally, the correlation of each subdimension with the demographic variables (sex, age, and region) was evaluated, corroborating the weak negative correlation with the sex of the university student.

Table 6. Correlation coefficient of REB and its dimensions with demographic variables.

	Sex	Age	Region
Correlation coefficient	-.241**	.021	-.098*
Sig. (bilateral)	.000	.627	.024
Dimensions			
PEC	-.150**	.024	-.037
RS	-.232**	-.008	-.159**
RR	-.201**	-.064	-.018

Note: *** The correlation is significant at level 0.01 (bilateral).*
**The correlation is significant at level 0.05 (bilateral).*

Analysis of Consolidated Environmental Behaviors

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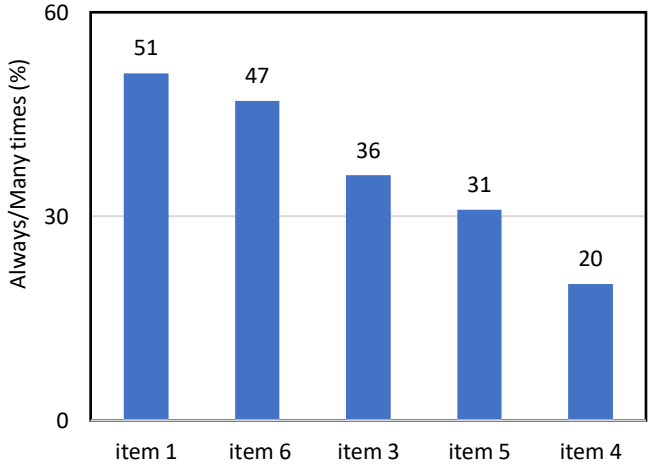
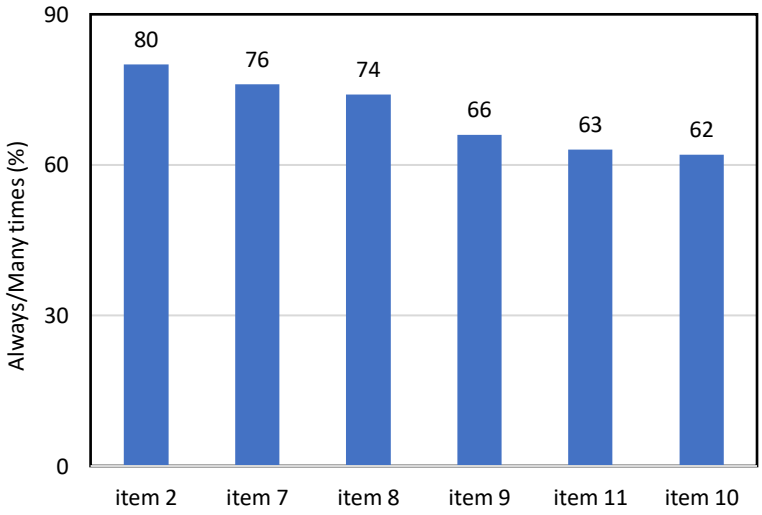
A detailed descriptive evaluation of the items that achieved the highest score (mean) in the evaluation allows to visualize an analysis at the factorial level, showing the items that had the highest percentage of responses Many times/Always; that is, habitual behaviors or practices consolidated in the lifestyle of the participant.

As shown in Fig. 2, there were a total of 10 consolidated items; that is, more than half of the participants practice them frequently. Likewise, 4 items in the process of consolidation were identified since they are practiced by more than a third of the participants. Four items less frequently practiced were found; that is, the less consolidated pro-environmental behaviors among the participants. It is important to highlight that all the items of the resources saving dimension are consolidated in the lifestyle of the university students, especially regarding reducing electricity and water consumption.

On the other hand, an analysis of the items with the highest level of consolidation (Fig. 3) and the lowest level of consolidation (Fig. 4) is included considering the demographic variable sex, because it was the one that obtained a significant statistical correlation. Regarding the consolidated items, they are very frequently practiced by female students, who show greater commitment to everything related to resource saving.



a) PEC



b) RS

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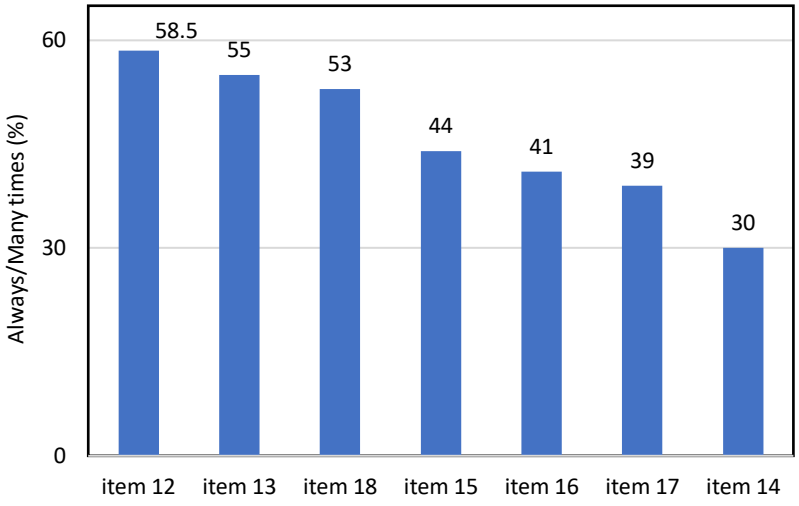

c) RR

Figure 2. Consolidated ecological habits by dimension: a) PEC, b) RS, c) RR.

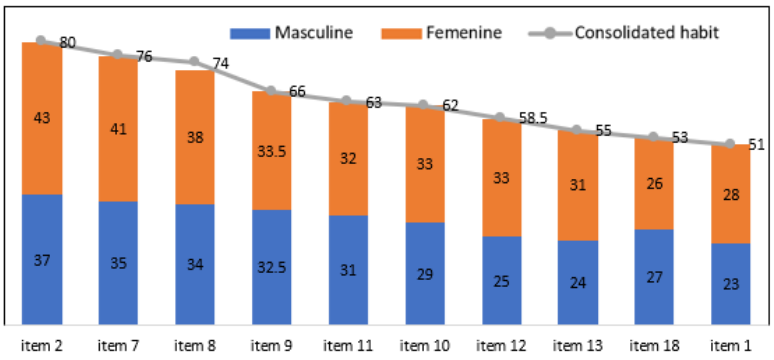

Fig. 3: Items with the highest level of consolidation according to sex.

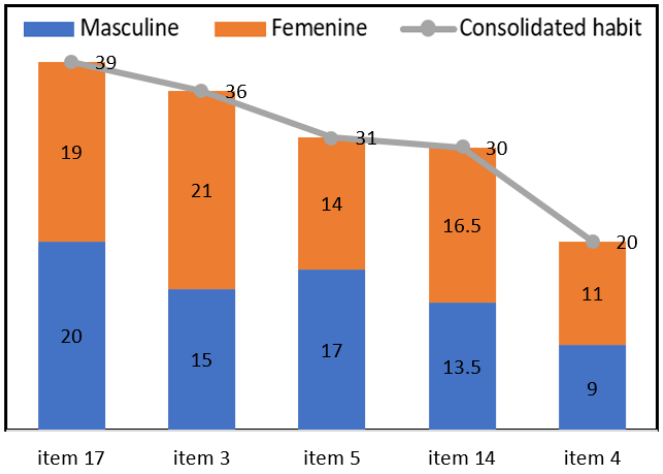

Figure 4. Items with a lower level of consolidation according to sex.

As shown in Table 7, item 2 has a higher score and is a question with an attitudinal-emotional connotation, since it refers to indignation in the face of indifference to environmental problems. As it can be observed, the type of items with the highest level of consolidation; that is, more frequently practiced by students within their lifestyle, are those related to electrical energy saving (items 7 and 8) and water minimization (items 9, 11, and 10). In contrast, the three items with the lowest score (average) are those related to

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participation in environmental care campaigns and listening/watching programs related to ecological issues. Similarly, recycling aluminum is not a popular habit among the participants.

Table 7. Higher and lower averages of items of the REB scale.

Item	2	7	8	9	10	11	12	18	13	...	3	5	14	4
Mean	4.16	4.11	4.03	3.85	3.78	3.78	3.69	3.61	3.59	..	3.32	3.19	3.00	2.83
SD	.881	.893	.964	1.006	1.017	1.025	1.092	0.957	1.099	…	0.889	0.917	1.144	0.992

It is important to note that the items in the process of consolidation are those whose practice is still not regular, and it is necessary to reinforce it in students. The lowest score is observed in items regarding participation and diffusion of ecological and environmental care topics. Likewise, there is a medium score in questions related to plastic use, sustainable-ethical purchasing, or responsible consumption.

Discussion

The study allowed to determine the level of REB in Peruvian students of a private university. The reported results indicate a consolidated pattern of environmental behaviors, more than half of the students frequently practice habits that contribute to the protection of the environment; especially behaviors related to RS (electricity and water). While RR reported less frequency in its usual practice, specifically reuse activities of aluminum cans and plastic containers. Likewise, PEC is the least common factor in the pro-environmental practices of the university students participating in the survey, especially participation in ecological campaigns and the externalization of interest in environmental issues. Moreover, the participants in this study show a pro-environmental behavior in the process of consolidation, since even though most of them show adequate levels of internalization of resource saving, and this is part of their daily behavior as part of their contribution to the environmental care; however, there is still weakness in the practice of recycling aluminum, glass and paper, and sustainable purchasing. The low participation in environmental awareness activities is another aspect to be highlighted; however, the reason for this could be due to the lack of implementation of these activities in their city or the lack of diffusion of ecological campaigns in the university where they study.

Studies carried in Peru among higher education students (Larrea *et al.*, 2022), concluded that there is a medium environmental knowledge in most participants; however, experiential environmental programs may lead to a deeper knowledge and consequently, increasing students´ commitment to daily practice of REB.

This is confirmed by the results obtained by Alvarez-Risco *et al.* (2018), who also found a greater concentration of responses around Many times/Always in the practice of environmental behaviors in Peruvian students, globally, and specifically in saving resources. Correspondingly, the results of reuse and recycling actions also showed less frequency than resource saving behaviors. Camacho-Rodriguez and Jaimes-Carvajal (2016) confirm these results of a greater consolidation of the behavior related to resource saving in Peruvian nursing students, unlike the interest and participation in environmental campaigns, and sustainable purchases. Moreover, most Peruvian citizens are worried and informed about pollution and its negative effects; nonetheless, there is not enough information regarding which is the environmental friendliest packaging they should use (Quispe *et al.*, 2021), thus, it is inferred that a lack of information regarding sustainable purchases in Peru is probably leading to a low consolidation of behavior in this matter.

The research of Heyl *et al.* (2013) on environmental attitudes and behaviors of Chilean students obtained comparable results as saving electricity and water were activities habitually practiced, and the least common actions were those related to paper recycling, sustainable ethical purchasing, and participation in ecological activities. Similarly, Saldaña-Almazám *et al.* (2020), in their study in 1013 Mexican students of three different educational levels (high school, college/university and postgraduate) found that about a third of the participants had pro environmental behavior, especially in the aspects of resources saving and respect for environment, mainly expressed by turning off the lights, closing the tap, taking care of green areas, and other simple activities at home and school; however, the students did not know about or practice the solid waste disposal, neither participate in volunteering activities in the community.

Furthermore, Diaz *et al.* (2020) compared pro environmental behavior of university students of Nicaragua and Colombia, showing that most of the participants tend to take care of their water and electricity

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consumption, thus, avoiding actions that lead to these resources' wastage; nonetheless, traveling less, recycling, or replacing the car by a bicycle in daily transportations are activities less popular. Those results in Latin America are similar in other geographic areas, for example, in the study by Alsaati *et al.* (2020), in university students in Saudi Arabia, the frequencies of sustainable purchasing behaviors reached percentages greater than 50%, while recycling activities were above 60%. The percentages regarding the resource saving exceed 60%, which would indicate greater commitment to resource saving than to sustainable purchases by students.

A weak negative correlation between REB and the gender of the student was identified in this research. Similarly, Alvarez-Risco *et al.* (2018) and Camacho-Rodríguez and Jaimes-Carvajal (2016) showed the same trend, especially in resource-saving behavior. Likewise, Cifuentes-Faura *et al.* (2020) found that female students also obtained higher scores in resource savings and in general pro-environmental behavior, although they achieved higher scores with statistically significant differences in behaviors related to recycling. In a study about pro environmental behavior of Spaniards university students (Vicente-Molina *et al.*, 2017), it was concluded that women were more likely to have a pro environmental behavior; and, although the difference was significant in most dimensions, the general pro environmental behavior index did not show significant difference. Therefore, there seems to be a prevalence of female commitment to the responsible use of resources; however, the correlation between gender and pro environmental behavior seems to be weak or not significant for university students, as the female gender role stereotypes might be decreasing in society or is less relevant in university students (Vicente-Molina *et al.*, 2017).

Regarding the age of the participants and REB, unlike the results of Camacho-Rodríguez and Jaimes-Carvajal (2016), no significant correlation between age and pro-environmental behavior was found in the present study. Heyl *et al.* (2013) showed tendencies to raise the frequencies of behaviors for environmental conservation as the students progressed in their professional studies; that is, a positive association between the student's age and REB. Similarly, in Mexico, Saldaña-Almazám *et al.* (2020) found a more consolidated REB in higher educational levels; thus, as students progressed from high school to university or college and then postgraduate, they have a better pro environmental behavior.

External conditions are important factors to take into account in future studies about REB, since they can determine the low frequency of the practices of certain pro-environmental behaviors, such as recycling, because as it has been seen in some research, students blame universities for the lack of organization of activities related to recycling and the lack of recycling stations on university campuses (Alsaati *et al.*, 2020), or they even point to the government and industry as responsible for environmental protection, without taking any responsibility of their own contribution in the ecological matter (Saza-Quintero *et al.*, 2021).

Baranov *et al.* (2019) studied knowledge and attitudes regarding ethical purchasing, and responsible or sustainable consumption in Russian university students, finding a lack of knowledge in more than half of students. In addition, the low level of practice of this behavior was due to, among other reasons, economic issues, because sometimes sustainable products are a little more expensive than those that are not eco-friendly. Likewise, participants showed a positive attitude towards the usual practice of recycling, however, they emphasized the need to install more recycling points on campus. Furthermore, some studies remarks that the participation in activities like ecological campaigns and volunteering do not seem to stand out in the interest of young students (Heyl *et al.*, 2013).

This apathy and lack of commitment in this type of events demonstrate the low level of internalization of environmental culture of Peruvian students; thus, organization and promotion of "green" campaigns in universities, as well as in basic education, would be essential to strengthen environmental education (Pulido and Olivera, 2018). Nonetheless, as it was previously mentioned, 4 out of 5 Peruvian citizens live in the urban area, with scarce green spaces and with very limited connection with ecosystems and wild animals; hence, in such a context the environmental identity, the commitment with the nature care, and the REB are not strongly rooted in Peruvian society.

The results in our study and previous research are of particular interest due to what the UN reported regarding environmental education in Peru, that is, "volunteering at central and regional levels is growing and becoming a tool for the promotion of environmental education and culture; thus, citizens, mainly young people, get involved in actions promoted by their authorities at all levels" (UN, 2021).

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Environmental campaigns not only raise the level of knowledge of participants, but also aim to increase the degree of environmental motivation of the participants; thus, environmental motivation has a positive impact on the pro-environmental attitude, and it influences ecological behavior as well (Cortes *et al.*, 2017). Therefore, ecological campaigns function as external stimulation that, together with intrinsic motivations acquired by individuals through experiences, generate actions that become habitual, constituting conducts and behaviors that are related to environmental culture. Motivation stimulates people to perform and persist in certain actions until they are finished, even motivating others to practice them as well. The level of ecological motivation of the person is reflected in their attitude, manifested in the degree of commitment to the protection of the environment, which can be determinant for behavioral intention; consequently, behavior is favored by motivation and is therefore considered a key factor of ecological behavior (Vila-Tojo *et al.*, 2019).

Although Peruvian university students show positive trends towards the consolidation of REBs, (Alvarez-Risco, 2018; Camacho-Rodríguez and Jaimes-Carvajal, 2016), it is still urgent that public and private universities promote eco-friendly environments and provide training aimed at developing values and practices aligned with environmental care (Olivera *et al.*, 2020). Additionally, a comprehensive educational program, with more experiential activities, should be developed by the local and regional governments since their annual budget considers providing logistics and economic resources for this kind of activities in basic and middle schools.

Conclusions

The level of Responsible Ecological Behavior in Peruvian students was acceptable, considering that more than half of the students frequently practice habits that contribute to the protection of the environment; especially behaviors related to resource saving. Behavior related to reuse and recycling reported less frequency in its usual practice, specifically reuse activities of aluminum cans and plastic containers. Participation and environmental concern are the least common factor in the pro-environmental practices of the university students surveyed, particularly participation in ecological campaigns and the externalization of interest in ecological topics, the reason for this could be due to the lack of implementation of these activities in their city or the lack of diffusion of ecological campaigns in the university where they study. Pro-environmental behavior is in the process of consolidation, even though most university students show adequate levels of internalization of resource saving in their daily behavior; however, there is still weakness in the practice of recycling aluminum, glass, and paper, and sustainable purchasing. A weak negative correlation was identified between Responsible Ecological Behavior and the student's sex; nonetheless, there seems to be a prevalence of female commitment to the responsible use of resources. On the contrary, no significant correlation was found between age and pro-environmental behaviors. The apathy and lack of commitment in events related to the care of the environment demonstrate the low level of internalization of environmental culture, as most Peruvians live in urban areas. Organization and promotion of ecological campaigns within universities would be fundamental to strengthen environmental education since some behaviors are consequence of a lack of information and regarding environmental care. Peruvian central government is responsible for developing a long-term legal framework that protects the environment and promotes environmental education, including scientific and research capabilities improvement in students and teachers, since the deeper the environmental knowledge of teachers, the higher the commitment of young students. Regarding regional and local governments, they may support experiential environmental education programs to reinforce the connection of students with the environment and to strengthen the practice of Pro-environmental behavior. The results in this study indicate that there is a necessity to inquire about the values and norms that an individual takes as a frame of reference to plan and execute certain environmental actions and dismiss others. Developing studies of this type also implies evaluating conditions of personal and educational development allowing the appearance of Responsible Ecological Behavior as a complex behavior aimed at preserving the environment.

Author Contributions

J. Acevedo, the corresponding author, contributed in preparing the statistical analysis, interpreting the results and supervising the authors in preparing the manuscript, E. Olivera, J. Morillo and V. Pulido

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designed the instrument, contributed in the interpretation of the results and wrote the manuscript. Y. Cabrera collected and coded the data, and prepared the figures and tables of the results.

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Conflict Of Interest

The author declares that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

Abbreviations

REB	Responsible ecological behavior
TPB	Theory of planned behavior
VBN	Value-belief-norm
EFA	Exploratory Factor Analysis
CFA	Confirmatory Factor Analysis
PEC	Participation and Environmental Concern
RS	Resources saving
RR	Recycling and Reuse

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