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Article

Analysis of educational policies and environmental culture among Peruvian university students

José Calizaya-López*, Ariosto Carita-Choquecahua, Ana Rosario Miaury-Vilca, Lady Concha-Diaz, Claudia Patricia Cardenas-Ticona, Luz Gabriela Cuba-Pacheco, Jimena Rodriguez-Moscoso, Ferdinand Ceballos-Bejarano

Universidad Nacional de San Agustin de Arequipa, Arequipa 4001, Peru
*** Corresponding author:** José Calizaya-López, jcalizayal@unsa.edu.pe

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Abstract: Environmental culture in university students refers to the set of knowledge, values and behaviors that they acquire and practice with the protection of the environment within their academic space, supported by environmental educational policies. We proposed to understand the existence of an inadequate environmental culture in university students. The objective of this study was to analyze university educational policies and environmental culture in Peruvian students, comparing the results according to sociodemographic variables. A total of 2448 intentionally chosen university students participated, a non-experimental cross-sectional design was used, a quantitative approach of comparative descriptive level was used. In addition, in the data analysis, the descriptive results are presented in a table of frequencies and percentages, while the inferential analyses are presented in statistics. A medium level of environmental culture was found at 57.3% with a tendency to be low at 37.3% in university students. In addition, the comparison of sociodemographic variables indicates that there are statistically significant differences ($p < 0.05$), therefore, the students from public universities, the area of social sciences and the last years of study present higher scores than the other comparison groups. In conclusion, environmental educational policies have not been adequate and applied by universities to generate an adequate environmental culture in university students within the academic field.

Keywords: environmental educational policies; environmental culture; environmental protection; sustainability; volunteering; internal communication; institutional responsibility

1. Introduction

University education plays a vital role in the formation of citizens with environmental awareness, not only transmitting knowledge, but also influencing the construction of values and responsible behaviors towards the environment [1].

In this sense, the theory of planned behavior, developed by Ajzen [2], offers a useful structure to understand why people make certain decisions or adopt behaviors, especially on environmental issues. This theory suggests that the intention to act is the main driver of behavior, and that intention is influenced by three key elements: personal attitude toward behavior, perceived social pressure (subjective norms), and perceived control over action (perceived behavioral control).

In educational contexts, such as universities, this theory helps explain why being knowledgeable about the environment does not guarantee that students will adopt sustainable practices [3]. Students may be convinced that caring for the environment is important (positive attitude), but if their environment does not support it (lack of favorable social norms) or if they perceive obstacles to action (such as a lack of

infrastructure to recycle), they are less likely to act consciously. Therefore, the strength of this theory lies in the fact that it allows us to identify the factors that must be addressed to promote real changes in environmental behavior. Thus, universities can work not only on cognitive training, but also on creating a culture that values and facilitates environmental commitment [4].

In the Peruvian context, educational policies have progressively incorporated environmental approaches to strengthen environmental awareness in students, in this sense, these initiatives are framed in compliance with national regulations and in the promotion of an environmental culture within educational institutions. In addition, the Ministry of Environment and Education from Peru has proposed the regulations [5].

In this sense, a norm of institutional management and participation, encouraging universities to develop internal environmental policies that demonstrate their commitment to sustainable development. For the implementation of these policies, environmental committees were formed in charge of designing, coordinating, and evaluating strategies within their campuses [6].

Another policy was the responsible use of resources through internal environmental management, implementing programs to raise awareness of the reasonable use of water and energy, as well as solid waste management systems, with the intention of reducing the environmental footprint of institutions [6].

Likewise, the policy on the integration of sustainability in education generates environmental awareness in students, incorporating content on sustainability in universities in their curricula. In addition, research and sustainable development are regulated, promoting the execution of scientific studies and innovative projects focused on environmental conservation and climate change mitigation [7].

On the other hand, within the social projection activities, the link with the community was determined. Through social responsibility programs, universities must collaborate with local communities to disseminate good environmental practices [7].

And the university cooperation policy through collaboration networks allows participation in the inter-university environmental network (RAI), facilitating the exchange of knowledge and the execution of joint projects between different institutions, establishing alliances that allow the impact of environmental policies on higher education to be enhanced [7].

Literature review

In relation to environmental culture, Murillo [8] maintains that it's made up of habits, lifestyles and social norms that determine the interaction between human beings and their environment. This culture is based on the values, knowledge, and traditions of each community. In addition, environmental culture evolves over time, adapting to social, economic, and ecological changes [9].

With respect to environmental culture in university students, it refers to the set of knowledge, values, and behaviors that they acquire and practice with the protection of the environment within their academic space. This concept encompasses the level of ecological awareness, the degree of commitment to sustainable development and the adoption of responsible actions for the protection and conservation of natural resources [10,11].

Likewise, from an institutional perspective, environmental culture is essential for the implementation of sustainability strategies in different sectors, including academia. The adoption of environmental policies, the transition to renewable energies and the application of circular economy principles are necessary actions to reduce environmental impact [12].

According to dimensions of the study of environmental culture, the individual responsibility dimension evaluates the responsibility of students according to their actions in relation to the environment; the dimension of promotion of environmental culture, identifies the participation of students in environmental awareness and education activities through the promotion of environmental practices within the university environment; the environmental volunteering dimension measures the degree of involvement of students in volunteer initiatives related to environmental conservation; the institutional responsibility dimension evaluates how students value the institution's commitment to environmental protection in accordance with institutional policies focused on sustainability. The internal communication dimension on the environment, determines the frequency of access to information on the environment within the university; the environmental protection dimension, evaluates knowledge of standards and policies, participation in environmental research and reuse of resources; creativity and ability to realize identify the contribution of innovative ideas and the ability to undertake projects related to environmental protection [13].

From the review of previous studies, not enough scientific evidence was found that analyzes environmental policies and culture in universities; however, research on the subject was only found in university students within the academic context without analyzing environmental policies in depth. Gonzales-Pinedo et al. [11] carried out a systematic review of environmental culture in university education, finding that there are many theoretical approaches that address the issue from different contexts, valuing that environmental education strengthens the culture to raise awareness among students, assuming responsibilities in the management and protection of ecosystem resources.

On the other hand, Vásquez et al. [14] measured the level of environmental culture in university students, finding that students lack environmental knowledge, skills and values; likewise, Lezano [15] studied the influence of environmental education on environmental culture in university students, finding that education is a significant factor that influences culture. The attitude, aptitude and care for the environment suggest that more efficient plans and programs in environmental education should be implemented.

According to what has been described, it is necessary to collect empirical information on the research topic to fill the existing theoretical gap to analyze whether environmental policies are effective in academic institutions and to know the level of responsibility and environmental culture in university students. However, there are still challenges in the effective implementation of these strategies within the curricula and in the generation of sustainable behavioral changes. In this sense, it is relevant to study the impact of these policies on the perception and environmental commitment of university students, allowing us to improve educational strategies and promote greater environmental responsibility in the Peruvian academic community.

In this sense, we pose the following research questions: How are environmental policies considered in university contexts? What is the level of environmental culture presented by university students? And will there be significant differences in the level of environmental culture according to sociodemographic variables of university students?

Therefore, to analyze university educational policies and environmental culture in Peruvian students, compare the results according to sociodemographic variables.

2. Methods

A non-experimental cross-sectional design, quantitative of comparative descriptive level, utilized [16] the information collected during the last semester of 2024.

2.1. Participants

A total of 2448 university students from a public university and four private universities from a locality in Peru participated, intentionally chosen, considering the following inclusion criteria: being an active university student, from a public or private university, in an age range of 17 to 25 years. The aim was to achieve a sufficiently large sample size to find reliable estimates in the results.

To determine the sample size, the G*Power 3.1.9.4 program was used [17] considering the following criteria according to the statistical tests to be used: *F* tests (ANOVA, fixed effects, omnibus, one-way, six groups), *t* tests (means, difference between two independent means); with small effect sizes (0.10), probability of 0.95 and margin of error of 0.05.

2.2. Instrument

The environmental culture questionnaire of the Universidad San Pedro, Peru (n.d) applied, the instrument designed to evaluate the perception and environmental practices within the university community, including students, teachers, and administrative staff. Its main purpose is to measure the level of commitment and responsibility of environmental institutions.

The structure of the instrument consists of 30 items distributed in seven dimensions, individual responsibility (1–5) analyzes personal habits; the promotion of environmental culture (6–8) evaluates whether the university promotes environmental policies; participation in environmental volunteering (9–10); likewise, it values institutional responsibility (11–12); internal communication (13–16); environmental protection (17–27), and creativity—ability to carry out innovative ideas for the care of the environment (28–30). In addition, it measures the degree of involvement in environmental activities. For the assessment of the answers it uses a 5-point Likert scale where 1 is never and 5 is always. It is emphasized that there are no right or wrong answers and it is requested to answer honestly. The instrument is confidential and personal.

The instrument was revised and adapted to the selected sample (the original version was made in a region culturally different from the selected context), for this the content validity was carried out, where 5 expert judges in environmental education validated the

instrument obtaining high scores (> 0.90) with Aiken's V coefficient [18], finding relevance, clarity, congruence and representativeness. Likewise, the reliability of the instrument was estimated with Cronbach's alpha coefficient, finding high internal consistency ($\alpha = 0.894$) for the local sample (obtaining valid and reliable data).

2.3. Ethical considerations

The study was conducted respecting the ethical provisions of the Ministry of Health of Peru, in accordance with the guidelines established in resolution 233-2020-MINSA, the purpose of which is to ensure that research with human beings is conducted ethically. In addition, the international ethical principles contained in the Declaration of Helsinki were considered [19].

To apply the instrument, all the appropriate rigors were followed, so that both universities and students agreed with the collection of information and were informed of the study in progress, so informed consent was obtained. The collection of information was carried out individually, and after the end of the schedule of academic activities to ensure the greatest effectiveness of the answers and the anonymity of the respondents.

2.4. Data analysis

For data analysis, distribution, asymmetry, kurtosis, and normality tests were analyzed through the Shapiro-Wilk test [20], showing that there is no normal distribution ($p < 0.05$), criteria for determining the use of nonparametric statistical tests. The descriptive and comparative analysis of the environmental culture was conducted according to sex, age, occupation, type of university, year and area of study. For data comparison, as part of the analysis, the following non-parametric statistical tests were used [21], to compare two independent samples, the biserial correlation effect size (RT) Mann-Whitney U test (rbis) were used. The interpretative rules for rbis are as follows: no effect (rbis = 0.0), small (rbis ≥ 0.10), medium (rbis ≥ 0.30) and large (rbis ≥ 0.50). The comparison of K independent samples was performed using the Kruskal-Wallis H test and Post Hoc tests, with the effect size used being epsilon squared (ε^2). The interpretative norms are small for $\varepsilon^2 \geq 0.01$, medium for $\varepsilon^2 \geq 0.06$ and large for $\varepsilon^2 \geq 0.14$, using the Jamovi statistical program for the analysis of the information [22].

3. Results

Descriptive analyses of the sociodemographic variables of the students were carried out, finding, 21.3% were from public universities and 78.7% from private universities; 46% were men and 56% women; 95.2% were students and 4.8% shared their studies with some job. 41.6% were students in the area of social sciences, 36.6% in sciences and engineering, and 21.9% in health sciences; 28.1% were first-year students, 26.8% were second-year students, 21.7% were third-year students, 11.7% were fourth-year students, 11.0% were fifth-year students, and 0.7% were sixth-year students; According to the average age, it was 20.4 years in a range of 17 to 25 years.

Table 1 describes the results of the level of environmental culture in university students, finding a medium level in the general evaluation and in most of the

dimensions (percentages between 49% and 64%), however, for the creativity and capacity for achievement, the levels were low in a high percentage (79.5%).

Table 1. Level of environmental culture in university students.

Variable	Level					
	Low		Middle		High	
	F(*x*)	%	*F*(*x*)	%	*F*(*x*)	%
Environmental culture	952	38.9%	1492	60.9%	4	0.2%
Individual responsibility	358	14.6%	2084	85.1%	6	0.2%
Promotion of environmental culture	913	37.3%	1402	57.3%	133	5.4%
Volunteering	1205	49.2%	1194	48.8%	49	2.0%
Institutional accountability	636	26.0%	1569	64.1%	243	9.9%
Internal communication	985	40.2%	1449	59.2%	14	0.6%
Environmental protection	1177	48.1%	1265	51.7%	6	0.2%
Creativity and Ability to Perform	1945	79.5%	502	20.5%	1	0.0%

Note. *F*(*x*) = frequency; % = percentage.

In **Table 2**, the results of environmental culture were compared according to sex and occupation, no statistically significant differences were found to distinguish environmental culture between men and women, as well as students who only study and those who study and work; however, for the variable type of university there is sufficient statistical evidence ($p > 0.05$), finding that students from public universities have higher environmental culture scores compared to students from private universities (small effect sizes).

Table 2. Comparison of environmental culture in two independent groups.

Variable	*N*	Average Range	*U*	TE
Sex				
Male	1135	1219.70	739.675.5 ($p = 0.754$)	0.07
Female	1313	1228.65		
Type of university				
Public	521	1293.37	466.100.0 ($p = 0.012$)	0.007
Private	1927	1205.88		
Occupation				
Student	2330	1227.96	129.416.0 ($p = 0.282$)	0.058
Study and work	118	1156.25		

Note. *N* = Sample; *U* = U for Mann Whitney; TE = Effect size (biserial correlation).

Table 3 compares the level of environmental culture according to area of study, finding statistically significant differences ($p > 0.05$), demonstrating that it is the students in health sciences who present higher scores than students in science and engineering and social sciences (post hoc tests) with small effect sizes.

Table 3. Comparison of environmental culture by area of study.

Variable	Area of studies	*N*	Average Rank	*H*	Gl	*p*	ε^2
Environmental culture	Science and Engineering	895	1141.89	43.629	5	0.000	0.016
	Social sciences	1018	1208.00				
	Health Sciences	535	1394.10				

Note: *N* = sample; *H* = Kruskal Wallis statistic: *p* = significance (0.05); ε^2 = Epsilon-squared (effect size).

In **Table 4**, the results of the environmental culture were compared according to the year of study, statistically significant differences were found ($p > 0.05$), demonstrating that it is the students of the last years of study who present higher scores unlike the students of the first years (post-hoc tests) with small effect sizes.

Table 4. Comparison of environmental culture according to year of study.

Variable	Year of studies	*N*	Average Rank	*H*	*Gl*	*p*	ε^2
Environmental culture	First year	687	1225.90	11.192	5	0.048	0.018
	Second year	656	1201.12				
	Third year	531	1201.79				
	Fourth year	287	1202.73				
	Fifth year	269	1322.41				
	Sixth year	18	1577.03				

Note: *N* = sample; *H* = Kruskal Wallis statistic: *p* = significance (0.05); ε^2 = Epsilon-squared (effect size).

The results found show that the average level of environmental culture in university students implies that they have an intermediate degree of knowledge, awareness and commitment with respect to ecological issues. This means that they know some aspects related to the care of the environment, they show a generally favorable attitude towards its preservation, they participate in certain sustainable practices, although sporadically or limitedly, but they still do not demonstrate constant involvement or in-depth knowledge of environmental problems. In other words, this level represents a stage of development in which there is an environmental base, but there is still room to strengthen both information and concrete actions in favor of the natural environment.

4. Discussion

The aim of this study was to analyze university educational policies and environmental culture in Peruvian students, comparing the results according to sociodemographic variables. We found a medium level of environmental culture in university students with a tendency to be low, these results are somewhat related to those reported by Vásquez et al. [22] who found low levels of environmental culture in students, specifying that they lack environmental knowledge, skills and values, suggesting curricular redesign incorporating courses with transversal contents to overcome this problem. However, an analysis of all the provisions established in the environmental standards for higher education has not been conducted.

The previous study allows us to understand that in the course of time no adequate decisions have been taken to implement environmental policies within the universities at present, in this sense, the environmental policy of institutional management and participation has not been effectively promoted in the universities, although environmental committees were formed in charge of designing, coordinating, and evaluating strategies within their campuses that have not been sufficiently clear and applicable, due to the lack of interest of the educational authorities in prioritizing other academic aspects.

In addition, most social responsibility programs and projects are not sustainable. In most cases, there is an obligation towards students to bring social support to the community for a matter of compliance with activities, without involving them in ethical, social, and environmental challenges, to form a socially responsible conscience [23].

In relation to the environmental policy for the responsible use of resources through internal environmental management, some programs have been implemented in universities to raise awareness of the reasonable use of water and energy, as well as solid waste management systems, with the intention of reducing the environmental footprint of institutions. However, these provisions have not been common enough, there is publicity on how to rationalize the use of water and energy, as well as the implementation of containers for both waste and recyclable products, but the educational part has not been strengthened, likewise, the constant supervision for compliance with these provisions is not effective. observing that university students' wastewater and energy resources, such as waste disposal, generate a critical and ethical environmental problem [24].

Likewise, the environmental policy on the integration of sustainability in education to generate environmental awareness in students incorporates content on sustainability in their curricula in universities. It has been shown that in most academic programs there is at least one course related to the environment and/or sustainable development. There is implementation; however, the weakness is presented in the teacher who assumes the teaching of the course. Some present specialty and facilitate knowledge and awareness, as well as the integration of sustainability through experiential and project-based learning in the development of the subject, while most of the teachers who take on these courses do so to complete hours of workload, generating a distance in students to acquire skills in sustainability, moving them away from systemic thinking, the norm and the strategy to conserve the environment [25].

And with respect to the policy of university cooperation through collaboration networks, it allows participation in the inter-university environmental network. Continuous participation is the basis for sharing experiences on environmental actions in the different universities, however, the inter-university network does not make periodic calls to discuss, debate and above all, promote new projects. generating the abandonment and neglect of the implementation of all policies proposed by the governing bodies.

As can be seen, environmental policies for higher education exist, the main problem is in the execution of these policies, in the implementation, in the budgets allocated and in the willingness of the university authorities to manage and promote these policies throughout the university community.

Therefore, in the Peruvian context, the environmental policies implemented by universities have proven to be partially effective, particularly in those institutions that have the necessary institutional support to integrate sustainability into their processes and activities. The existence of a regulatory framework, promoted by the Ministry of the Environment, Education, and university networks, has made it easier for many universities to develop actions such as proper waste management, recycling programs and the inclusion of environmental content in their curricula.

However, this effectiveness is not homogeneous. Some universities, especially in regions with fewer resources, still face limitations in applying these policies in a structural and permanent way. In addition, the lack of formal environmental committees and the low participation of teachers and students weaken the impact of such policies. Therefore, although relevant advances are observed, it is necessary to consolidate a university environmental culture that transcends the normative and translates into sustainable practices sustained over time.

According to the results found in the dimensions of study that are related to the provision and implementation of environmental policies, it is specified that the individual responsibility dimension, evaluates the responsibility of students according to their actions in relation to the environment. The fact that the level of responsibility is not high suggests that most students recognize the importance of the subject, but they do not always adopt healthy habits consistently. This behavior can be influenced by several factors such as lack of motivation, insufficient information on ecological practices or the absence of a comprehensive environmental culture approach within institutions [26].

Dimension promotion of environmental culture, identifies the participation of students in environmental awareness and education activities through the promotion of environmental practices within the university environment. Finding a moderate level in this dimension indicates that students perceive some environmental initiatives within universities, however, these do not always achieve a lasting impact on their behavior. The dissemination of information on sustainability is an important step, but it must be accompanied by incentives and opportunities that motivate the participation of students in environmental conservation activities [14].

The volunteering dimension measures the degree of involvement of students in volunteering initiatives related to environmental conservation. The average level in this dimension can be due to several factors, such as the lack of dissemination of volunteering opportunities, the perception that these activities do not have a significant impact on their professional training or the existence of logistical difficulties. In addition, in most universities, the culture of environmental volunteering is not yet consolidated, restricting its development and scope [7].

The institutional responsibility dimension, evaluates how students value the institution’s commitment to environmental protection in accordance with institutional policies focused on sustainability. Among the factors that could explain the result found are the lack of integration of sustainability in institutional planning, the absence of adequate mechanisms to evaluate the impact of environmental policies and the dependence on occasional initiatives rather than structured strategies. Although some institutions have developed environmental programs, many rely on the initiative of specific groups, limiting environmental management [27].

Internal communication dimension on the environment, determines the frequency of access to information about the environment within the university, one of the main problems in promoting environmental culture is the lack of well-structured communication strategies, in most higher education institutions, the dissemination of environmental information is usually occasional, focusing on campaigns or temporary events, without integration into institutional communication channels on a permanent basis, therefore, this situation can make sustainability be perceived as a set of isolated activities and not as a permanent commitment, weakening environmental awareness in university social responsibility [28].

The environmental protection dimension evaluates knowledge of standards and policies, participation in environmental research and reuse of resources, by finding a novel means in the result. This could be due to the lack of effective integration of environmental policies in institutional management, despite the fact that some universities have implemented recycling, energy-saving, and waste reduction programs. These initiatives are often isolated and lack continuity, and the absence of clear mechanisms to evaluate and monitor these actions makes it difficult to measure their real impact on the sustainability of university campuses [29].

And the dimension of creativity and capacity for realization, which identifies the contribution of innovative ideas and the ability to undertake projects related to environmental protection, was found at a medium level. This result may be due to various factors, such as the limited availability of resources, the absence of adequate spaces for experimentation and the lack of institutional resources to promote environmental projects, Students may have an interest in designing green initiatives, but they face obstacles related to a lack of technical, financial, and academic support [30].

Another important aspect within the development of the research is the results found according to the sociodemographic variables of the students. Differences were found in the environmental culture according to type of university, students from public universities present higher scores compared to students from private universities, identifying that some environmental strategies are more efficient and are possible to promote environmental culture despite the economic constraints, placing greater value on institutional commitment and adequate management of resources.

Likewise, differences were found according to area and year of study, with the students of the area of health sciences and the last years of study presenting higher scores than the comparison groups. These results are supported by those reported by Gonzales et al. [31] recommending strengthening environmental awareness in students of the first years in order to improve awareness and sustainable practices to face the global ecological crisis.

During the development of the research, some limitations were presented, such as the difficulties in the measurement of subjective variables that may differ due to the variability between universities, given that each institution handles different strategies for the environment; as it is a cross-sectional study, there could be a risk of finding bias in the measurement by not using more robust statistical tests; and the limited funding for the present study has not allowed obtaining more information in larger and more diversified samples to establish a generality in the results.

In addition, there may be bias in the selection of the sample, since, by not including students from all academic areas or universities, the results may not reflect

the general reality of university students. As well as, when using self-report-based instruments, it is likely that some responses are influenced by social desirability, which could distort data on environmental attitudes or practices. Therefore, the findings cannot fully generalize to other educational institutions or contexts, given that environmental, political, and cultural conditions vary between universities.

From now on, it would be pertinent to expand the studies to include a more heterogeneous sample that integrates students from different regions, universities, and academic areas to achieve a broader understanding of the university's environmental culture. It's also suggested to use mixed methodologies that combine the quantitative and the qualitative, which would allow deepening aspects such as beliefs, motivations, and obstacles to sustainable practices. In addition, future research could focus on analyzing how institutional policies and environmental education programs affect student behavior, as well as developing follow-up studies over time to observe changes in ecological attitudes during vocational training.

Finally, it's suggested with the results found that both political and educational management authorities take into consideration implementing and promoting all environmental educational policies in their institutions to strengthen environmental culture by generating awareness and responsibility in university students.

5. Conclusions

A medium level of environmental culture is found with a tendency to be low in university students. It's concluded that environmental educational policies have not been sufficiently appropriate and applied by universities to generate an adequate environmental culture in university students within the academic field. Environmental culture in higher education institutions requires the reinforcement of environmental education strategies, the incorporation of sustainability content in curricula, the development of awareness campaigns and the creation of opportunities to participate in ecological activities, generating a change in the formation of a citizenship more committed to the environment.

Strengthening the environmental culture in universities requires effective internal communication and the promotion of innovative initiatives. A comprehensive approach that combines environmental education, participation and institutional commitment allows sustainable practices to consolidate. Therefore, it is key to establish stricter policies, incorporate renewable energies, reduce single-use plastics, and improve waste management to reduce the institutional ecological footprint.

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