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Environmental awareness and environmental health among university students

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Abstract

Environmental health is an important factor for the well-being and sustainability of the educational environment. The purpose of this study was to identify the factors associated with the environmental health of secondary school students at the Faculty of Education Sciences of the National University of the Altiplano. A cross-sectional design with a descriptive-explanatory approach was used, which is suitable for describing the current reality and analyzing causal relationships in a limited period. The methodology included the application of Pearson's correlation and multiple linear regression analysis to evaluate the predictive power of environmental health perception based on variables such as environmental education, environmental awareness, environmental responsibility, and forest awareness. The results showed that the model explained 75.4% of the variability in environmental health, highlighting environmental education ($\beta = 0.419$) and, especially, environmental awareness ($\beta = 0.529$) as significant predictive factors ($p < 0.001$). It is concluded that both formal environmental education and sensitivity and commitment to the ecosystem are key determinants for improving environmental health in future teachers, highlighting the importance of strengthening environmental awareness to promote sustainable practices.

Keywords: Environmental awareness, Environmental education, Environmental health, Multiple linear regression, Secondary education.

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1. Introduction

Environmental health is a global problem and has become a serious threat to public health, affecting the quality of life and survival of populations. The World Health Organization (WHO) estimates that around 13.7 million deaths per year (approximately 24%) are due to modifiable environmental risks, including air pollution, ecosystem degradation, and climate change [1]. Air pollution is one of the main environmental risks, caused primarily by industrial emissions, transportation, and biomass burning, and is linked to noncommunicable diseases such as cardiovascular disease, chronic respiratory disease, and cancer [2, 3]. In addition, environmental degradation also tends to increase the burden of infectious diseases, as it transforms ecosystems and favors the proliferation of pathogen vectors [4]. The WHO promotes a multisectoral response with evidence-based policies to reduce pollution and improve environmental conditions, highlighting the need for coordinated governance and the integration of sustainable strategies that protect both human health and ecological balance [1]. The urgency of this issue is reflected in global conferences and international agendas that call for strengthening monitoring, education, and climate action mechanisms to ensure a healthy environment for future generations.

Environmental health in Peru faces a series of problems that directly affect the well-being of the population and the sustainability of the environment. The General Directorate of Environmental Health is the technical and regulatory body of the Ministry of Health, which proposes the National Environmental Health Policy, in accordance with the provisions of Article 48 of the Regulations on the Organization and Functions of the Ministry of Health, approved by Supreme Decree No. 023-2005-SA [5]. In the context of Peru, where many regions still face development challenges, environmental health becomes a critical factor, as approximately 25% of the mortality burden can be attributed to causes related to environmental and occupational conditions [5]. This shows that exposure to pollutants, water and air pollution, and unsafe working environments contribute significantly to the incidence of preventable diseases and premature mortality [6]. Air, water, and soil pollution resulting from mining, industrial, and urban activities represents one of the main challenges, especially in vulnerable areas such as communities near extractive operations [7, 8]. In addition, deforestation and inadequate solid waste management cause ecological imbalances [9] which increase the incidence of respiratory diseases, gastrointestinal diseases, and other health problems linked to exposure to pollutants [10]. In addition, the lack of comprehensive policies and effective environmental control mechanisms limits response and prevention capabilities, highlighting the urgent need to strengthen environmental management from a multisectoral perspective that includes community participation and environmental health education [11].

Including environmental education in university prepares future professionals to make a real and concrete commitment to protecting the environment [12]. This awareness-raising process promotes strategies based on science and community participation. Understanding forestry as a broad social commitment is key to reducing negative impacts on the environment and building more resilient and sustainable societies. Thus, the university promotes the development of skills that combine environmental ethics with concrete action, generating a positive and lasting impact on our relationship with the planet. In this sense, this research aimed to identify the factors associated with the environmental health of secondary school students in the Faculty of Education Sciences at the National University of the Altiplano.

2. Materials and Methods

This study was conducted at the Professional Secondary Education School of the Faculty of Education Sciences (FCEDUC) of the National University of the Altiplano of Puno (UNAP), Peru, during the period from March to August 2025. The research was conducted using a cross-sectional design with a descriptive-explanatory approach, which was appropriate for this work as it facilitated the efficient collection of relevant information, allowed for a description of the current situation, and, at the same time, enabled the investigation of possible causal or explanatory relationships within a limited time frame. With the data obtained in this study on forest awareness, it is clear that the sample was mainly composed of young students, with an average age of 21.56 ± 3.33 years. The most common age group is 20 to 22 years old, representing 47.1% (n = 379). In terms of gender, the sample consists of a population of young university students with a fairly balanced percentage distribution (51.7% male and 48.3% female).

This study involved 804 students from a vocational secondary school specializing in four areas: Mathematics, Physics, Computing, and Information Technology (29.0%), Social Sciences (28.1%), Science, Technology, and Environment (22.9%), and Language, Literature, Psychology, and Philosophy (20.0%). Finally, the year of study of the participants shows a relatively homogeneous profile in the first three years, followed by a slight decline in the higher grades, with 74.2% of participants concentrated in the first to third academic years. These results provide a deeper understanding of the sociodemographic and academic characteristics of the group studied. This information is relevant for designing strategies aimed at promoting awareness and participation in reforestation actions.

Table 1.
Sociodemographic and academic characteristics of participants (n = 804).

Variable	$\bar{X}$ ± D.E.	Frequency	Percentage
Age	21.56 ± 3.334		
< 20 years old		212	26.4
between 20 and 22 years old		379	47.1
> 22 years old		213	26.5
Gender			
Female		388	48.3
Male		416	51.7
Academic program			
Science, Technology, and Environment		184	22.9
Social Sciences		226	28.1
Language, Literature, Psychology, and Philosophy		161	20.0
Mathematics, Physics, Computing, and Information Technology		233	29.0
Year of study			
First year of study		195	24.3
Second year of study		185	23.0
Third year of study		216	26.9
Fourth year of study		146	18.2
Fifth year of study		62	7.7

Before administering the instruments in person, the objective of the study was clearly explained to the participants. Subsequently, written informed consent was obtained, thus ensuring voluntary participation and the confidentiality of the information provided. The importance of answering all questions on the questionnaires completely and honestly was emphasized, highlighting that their responses would be fundamental in guiding future actions. The data collected was handled under strict confidentiality measures and was used exclusively for research purposes. Participants were also informed of the potential benefits that the study results could generate for the community of the FCEDUC Professional Secondary School of Education at UNAP.

The researchers designed questions to assess sociodemographic variables, considering their respective measurement levels, such as: age (in years, then categorized as < 20 years; between 20 and 22 years old, and > 22 years old), year of study (first to fifth year), gender (female/male), and academic program (Science, Technology, and Environment; Social Sciences; Language, Literature, Psychology, and Philosophy; Mathematics; Physics; Computing and Information Technology). To assess forest awareness, perception of environmental health, environmental education, environmental awareness, and environmental responsibility, an environmental perception and sustainable development questionnaire was administered at university centers [13]. This instrument consists of 20 items distributed as follows: forest awareness (5 items), environmental perception (4 items), environmental education (7 items), environmental awareness (2 items), and environmental responsibility (2 items). Each item was evaluated using a Likert scale with five levels: strongly disagree (1 point), disagree (2 points), neither agree nor disagree (3 points), agree (4 points), and strongly agree (5 points). The internal consistency of the questionnaire was high, with a Cronbach's alpha coefficient of 0.924, indicating excellent consistency between items and ensuring that the instrument reliably measures the construct or variable of interest.

In addition, the use of IBM SPSS v.25 software and AMOS Graphics SPSS software ensures rigorous data handling and facilitates the execution of reliable statistical tests. The significance level set at $p < 0.05$ ensures that results considered significant have less than a 5% chance of having been obtained by chance, which is a widely accepted standard for statistically validating findings. Taken together, this methodological approach allows for an adequate interpretation of the interrelationships between variables, contributing to solid and well-founded conclusions for the study. Spearman's correlation was used to investigate the association between forest awareness, environmental perception, environmental education, environmental awareness, and environmental responsibility. In addition, a multiple linear regression analysis was performed to evaluate the predictive power of environmental health perception based on environmental education, environmental awareness, environmental responsibility, and forest awareness. Finally, structural equation modeling (SEM) was used in the study to evaluate the complex relationships between the variables that influence perceptions of environmental health.

3. Results

Table 2.
Correlation between factors influencing the perception of environmental health.

		CFO	RAM	CAM	FAM	PSA
Rho de Spearman	Forest awareness (CFO)	-	0.056	-0.015	0.017	0.025
	Environmental responsibility (RAM)		-	0.191**	0.558**	0.249**
	Environmental awareness (CAM)			-	0.592**	0.756**
	Environmental education (FAM)				-	0.637**
	Perception of environmental health (PSA)					-

**. The correlation is significant at the 0.01 level (two-tailed).

The results show that the perception of environmental health has a statistically significant relationship with three key environmental variables: environmental responsibility, environmental awareness, and environmental education. First, the correlation with environmental responsibility (Rho = 0.249; P<0.01) suggests that those who perceive the health of the environment more positively tend to be more committed and take a more active approach to protecting and caring for the environment. On the other hand, the strongest association with environmental awareness (Rho = 0.756; P<0.01) highlights that a positive perception of the state of the environment is closely linked to a high level of knowledge, sensitivity, and appreciation of environmental problems and needs. Finally, the relationship with environmental education (Rho = 0.637; P<0.01) indicates that education and training on environmental issues contribute significantly to improving perceptions of environmental health, reinforcing responsible behaviors and attitudes. Taken together, these findings suggest that promoting environmental education and awareness may be critical to strengthening environmental responsibility and improving collective perceptions of environmental health [14, 15].

Table 3.
Correlation between factors influencing the perception of environmental health.

	Non-standardized coefficients		Standardized coefficients			95.0% confidence interval for B	
Model	**B**	**Desv. Error**	**β**	**T**	**Sig.**	**Lower limit**	**Upper limit**
FAM	0.606	0.045	0.419	13.392	0.000	0.517	0.695
CAM	2.094	0.104	0.529	20.150	0.000	1.890	2.298
RAM	-0.102	0.090	-0.025	-1.126	0.261	-0.279	0.076
CFO	-0.006	0.006	-0.017	-0.967	0.334	-0.018	0.006
Gender	-0.014	0.282	-0.001	-0.051	0.959	-0.569	0.540
Age	0.067	0.046	0.028	1.463	0.144	-0.023	0.156
Year of study	-0.138	0.122	-0.022	-1.136	0.257	-0.377	0.101

Note: a. Dependent variable: Perception of environmental health.

The multiple linear regression model used in this study had a coefficient of determination $R^2 = 0.754$, indicating that approximately 75.4% of the variability observed in the environmental health of trainee teachers can be explained by two key predictor variables: environmental training and environmental awareness. Both variables proved to be statistically significant predictive factors, with standardized beta values (β) of 0.419 for environmental training and 0.529 for environmental awareness, both with a significance level of less than 0.001.

The structural equation model (SEM) presented shows the relationships between four latent variables: FAM, CAM, RAM, and CFO, as predictors of the latent variable PSA. The standardized regression coefficients (β) indicate that FAM (β = 0.419**) and CAM (β = 0.529**) have a positive and significant influence on PSA. In contrast, RAM (β = -0.025) and CFO (β = -0.017) do not show significant effects on PSA.

These findings suggest that environmental training, understood as formal education or training related to ecological and sustainability issues, contributes significantly to improving environmental health by equipping trainee teachers with critical knowledge and skills for caring for the environment [16]. However, environmental awareness has an even greater impact, indicating that the degree of sensitivity, commitment, and perception of environmental issues is a stronger determinant of environmental health [17]. This result emphasizes the crucial role of cognitive and attitudinal processes in the internalization of healthy and sustainable practices, beyond formally imparted knowledge [18]. Consequently, this evidence supports the need to design educational interventions that not only provide information but also foster active and committed environmental awareness, which can translate into significant improvements in the psychosocial well-being of teachers in training and their environment.

4. Discussion

Findings that reflect a significant correlation between perceptions of environmental health and variables such as responsibility, awareness, and environmental education provide valuable evidence for the theory of pro-environmental behavior from a psychological perspective. These relationships suggest that perceptions of environmental health are not just a passive construct, but a dynamic process that can influence motivation and attitudes toward sustainable practices. From a theoretical perspective, this link supports cognitive-behavioral models in which environmental awareness and education act

as mediators that facilitate the internalization of pro-environmental values and promote the adoption of individual and collective responsibilities [19-21]. This evidence is particularly relevant for the design of psychoeducational interventions, as it emphasizes the importance of strategies that not only convey knowledge but also modify basic perceptions and attitudes in order to generate lasting behavioral changes [22-24]. In practice, these results can guide educational and environmental communication programs aimed at fostering actively engaged citizenship, contributing to public policies that integrate the psychological dimension as a core element in promoting sustainable behaviors and improving environmental quality [25, 26]. This opens up a path for strengthening the role of environmental psychology in mitigating ecological problems from a comprehensive and multidisciplinary approach.

Analysis of the multiple linear regression model reveals a substantial explanation for the variability in the environmental health of trainee teachers, highlighting the combined importance of training and environmental awareness as key predictors [27]. Theoretically, these results reinforce the hypothesis that it is not enough to simply transmit knowledge related to environmental education; rather, it is essential to promote profound cognitive and attitudinal processes represented by environmental awareness in order to generate sustainable and healthy behaviors [28-30]. This opens up a line of reflection on the need to integrate pedagogical approaches that transcend traditional instruction, incorporating experiential and reflective strategies that strengthen emotional and ethical commitment to the environment. In practical terms, the evidence supports the design of educational programs that prioritize active environmental awareness, which could enhance the psychosocial well-being of future teachers and, therefore, amplify the positive impact on educational communities and their natural environment [31, 32]. Finally, the model supports the application of the theoretical framework used and suggests that public and educational policies focused on sustainability should emphasize both technical training and the development of integrated environmental awareness in order to promote lasting changes in collective environmental health [33].

5. Conclusions

The results obtained confirm that the perception of environmental health is significantly related to environmental responsibility, awareness, and education, highlighting the interdependence between these factors in promoting environmentally responsible behavior. This implies that strengthening environmental education and awareness can enhance not only knowledge but also individual motivation and commitment to protecting the environment. Therefore, integrating educational and communication strategies that address these dimensions is essential to encourage active and conscious participation in environmental conservation, thus contributing to sustainable development and collective well-being.

This study concludes that both environmental education and environmental awareness are determining factors in explaining the environmental health of teachers in training, with greater weight assigned to environmental awareness. These findings emphasize the need to complement formal education with strategies that foster active and committed ecological awareness, establishing a solid link between knowledge, attitude, and sustainable practice. Likewise, the results support the importance of designing comprehensive educational interventions that promote not only learning, but also environmental awareness and commitment, with the potential to improve overall well-being and contribute to the construction of healthier and more environmentally responsible educational communities.

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