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ORIGINAL

Education for Sustainability: A Data-Driven Methodological Proposal for the Strengthening of Environmental Attitudes in University Students and Their Involvement in Policies and Decision-Making

Educación para la sostenibilidad: Una propuesta metodológica basada en datos para el fortalecimiento de actitudes ambientales en estudiantes universitarios y su implicación en políticas y toma de decisiones.

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ABSTRACT

Introduction: in the context of global environmental challenges, university education emerges as a fundamental pillar to cultivate proactive attitudes towards sustainability. This research not only seeks to influence individual perceptions, but also the ability of these students to contribute significantly to policies and decision-making processes related to the environment.
Objective: implement a methodological proposal that uses educational events, artistic events and social responsibility projects to strengthen attitudes towards environmental sustainability in university students.
Method: a quantitative approach and a pre-experimental design were used, applying pre-test and post-test to students from five majors at a public university. The intervention was based on four thematic axes: classification and selection of solid waste, rational use of water, efficient use of electrical energy and university safety.
Results: the results revealed positive changes in student attitudes, with significant increases in solid waste classification (from 28 % to 72 %), university safety (from 32 % to 75 %), rational use of water (from 34 % % to 76 %) and energy efficiency (from 43 % to 82 %). In addition, a strengthening of continuous environmental knowledge was observed by 46 %, representing an increase of 81 %.
Conclusions: these findings suggest that universities can play a crucial role in promoting environmental educational policies that train professionals committed to nature and future generations, thus contributing to the construction of a paradigm that integrates ethics and socio-environmental responsibility.

Keywords: Methodological Proposal; Sustainable Education; Environmental Sustainability; Strengthening Environmental Attitudes.

RESUMEN

Introducción: en el contexto de los desafíos ambientales globales, la educación universitaria emerge como un pilar fundamental para cultivar actitudes proactivas hacia la sostenibilidad. Esta investigación no solo busca influir en las percepciones individuales, sino también en la capacidad de estos estudiantes para contribuir significativamente a políticas y procesos de toma de decisiones relacionados con el medio ambiente.
Objetivo: implementar una propuesta metodológica que utiliza eventos educativos, eventos artísticos y proyectos de responsabilidad social para fortalecer las actitudes hacia la sostenibilidad ambiental en estudiantes universitarios.

Método: se empleó un enfoque cuantitativo y un diseño preexperimental, aplicando pretest y post test a estudiantes de cinco carreras de una universidad pública. La intervención se basó en cuatro ejes temáticos: clasificación y selección de residuos sólidos, uso racional del agua, uso eficiente de la energía eléctrica y seguridad universitaria.
Resultados: los resultados revelaron cambios positivos en las actitudes de los estudiantes, con aumentos significativos en la clasificación de residuos sólidos (de 28 % a 72 %), seguridad universitaria (de 32 % a 75 %), uso racional del agua (de 34 % a 76 %) y eficiencia energética (de 43 % a 82 %). Además, se observó un fortalecimiento del conocimiento ambiental continuo en un 46 %, representando un aumento del 81 %.
Conclusiones: estos hallazgos sugieren que las universidades pueden desempeñar un papel crucial en la promoción de políticas educativas ambientales que formen a profesionales comprometidos con la naturaleza y las generaciones futuras, contribuyendo así a la construcción de un paradigma que integre la ética y la responsabilidad socioambiental.

Palabras clave: Propuesta Metodológica; Educación Sostenible; Sostenibilidad Ambiental; Fortalecimiento de Actitudes Ambientales.

INTRODUCTION

Universities began to show interest in environmental problems in the 1970s, which generated international responses and the need to adopt sustainability measures in higher education.[1] Education has historically been fundamental to form citizens with environmental awareness.[2]

However, education for environmental sustainability shows signs of weakening, evidenced by inadequate practices in water management, solid waste, electrical energy and insufficient planning and delimitation of security zones.[3,4,5,6] It warns about an environmentally alarming future, where humanity seems to lack consciousness and uses natural resources in an unlimited way, guided by science, technology, economics and the search for economic benefits.[7]

Currently, there is a lack of environmental awareness both in society and in schools, which is reflected in limited knowledge and application of strategies by teachers to promote more harmonious attitudes with the environment.[8] To address this problem, it is crucial to implement educational policies and concrete actions that promote greater environmental awareness and culture. It is essential to integrate the values associated with sustainable development in the educational process to promote behavioral changes necessary to build a society that promotes education for sustainability.[9]

In the National Environmental Policy for 2030, approved by Supreme Decree No. 023, the "Decrease in the goods and services provided by ecosystems, affecting human development and environmental sustainability".[10] The lack of integration of the environmental approach in formal and community education in the universities of Peru stands out. Of a total of 122 universities, only 35 (affiliated with the Interuniversity Environmental Network) reported progress in incorporating the environmental approach in training, institutional management, research, and social projection in 2018. Inadequate management of solid waste is also highlighted, with a high percentage incorrectly disposed of in dumps, a situation aggravated by population growth and urban expansion, with a 6 % increase in the per capita generation of solid waste in the last ten years. Furthermore, the inefficient and unsustainable use of water resources in the country, with a waste of 37 % according to the National Water Authority (ANA), is another problem identified. The unsustainable environmental behavior of citizens is influenced by current consumption patterns, which put pressure on ecosystems. The ecological footprint per capita in Peru has increased by 39 % between 2004 and 2016, indicating a significant increase in the consumption of goods and services from ecosystems. To address these challenges, it is proposed to strengthen the efficiency of entities dedicated to research on environmental issues.

It is essential to train individuals with knowledge and skills to make decisions on environmental issues through reflection and critical thinking.[7] In the university environment, behaviors and practices that satisfy basic needs and promote a full life must be encouraged. The university stage represents a period of change from adolescence to adulthood, during which habits are established that will influence the person's future.[11]

It is necessary to promote innovative learning and implement participatory projects that encourage social commitment to improve quality of life.[12] Educational competencies, based on knowledge, values and practical skills, must enable students to participate responsibly and effectively in the prevention and solution of environmental problems.

It is essential to adopt a comprehensive approach to addressing environmental problems, which includes understanding environmental reality, identifying problems, promoting environmental sensitivity, and finding concrete solutions and actions. This approach should promote the development of cognitive (ideas), affective (emotions), conative (attitudes) and active (behaviors) aspects related to the environment, encouraging

information, perception, and the willingness to adopt pro-environmental criteria, as well as practices environmentally responsible both individually and collectively.[13]

In the study on "Models of environmental behavior in university students" that they constitute a crucial group for the promotion of actions in favor of the environment from the private sphere. Therefore, it is essential to understand the characterization of university students in Mexico, these study subjects being relevant to achieving the objectives of sustainable development. This situation raises the question about how to strengthen environmental attitudes for the development of sustainability in future professionals, which led to the objective of implementing a methodological proposal based on the participation and execution of educational events and artistic activities that allow strengthening attitudes with environmental sustainability goals of future professionals.[14]

Literature review

Education for sustainability

Sustainability and the Sustainable Development Goals (SDGs) have been a priority focus on international agendas since 2015, which is also reflected in educational research, which seeks to make the SDGs a reality.[15] From an epistemological perspective, this research is based on the essential characteristics of the concepts of sustainable development and sustainability. These concepts address the systemic and complex relationship between the natural system (biodiversity, ecosystems, water, air, soil, etc.) and the human system (social, cultural, political, economic, technological, etc.), and the need for Human beings do not exhaust natural resources for future generations.[16]

Education for sustainable development (ESD) is conceived as a continuous process in which people, individually and collectively, become aware of their natural environment, acquire knowledge, values, skills, and experiences that motivate them to understand, address and solve environmental problems with determination.[17] This educational process, which can be formal, non-formal and informal, requires the implementation of joint actions. In the case of higher education institutions (HEIs), due to their diversity and plurality as a community, as well as the social impact derived from their educational management, these joint actions have the potential to have a positive impact on the achievement of objectives. of sustainable development, starting with its internal applicability.[18]

Rational use of water and sustainability

At the university level, efficient water management is crucial not only for daily operations, but also as an opportunity to educate the academic community about the importance of using this resource sustainably. This contributes to increasing awareness about water use and sustainability in the university environment.

Although Latin America has approximately 33 % of the planet's water resources, the proper management of this resource faces various challenges. These include the scarcity and insufficiency of sanitation services, the lack of wastewater treatment, inappropriate use, pollution, inequality in tariff systems, financial limitations, and deficiencies in management models, among other factors.[19]

The overexploitation of natural resources is one of the fundamental causes of the current environmental crisis. The Water Footprint (HH) is an indicator that provides information on how human activities affect water, which can help educate people about the proper management of this resource.[20] Water is an essential resource to meet the needs of the academic community on the university campus, supplying drinking fountains, laboratories, bathrooms, cafeteria, cleaning services and green areas, among others.[21]

In conclusion, efficient water management at universities is not only vital for their daily functioning, but also represents a significant opportunity to educate the academic community about the importance of using this resource sustainably. Although Latin America has a large amount of water resources, it faces important challenges in its management, such as the shortage of sanitation services and the overexploitation of this resource. It is essential to promote responsible practices in the use of water to guarantee its future availability and contribute to education for sustainability in the university environment.

Efficient use of energy and sustainability

Energy efficiency is fundamental in the National Energy Policy of Peru 2010-2040, as established by Objective 4, approved by Supreme Decree No. 064-2010-EM. This objective seeks to achieve maximum efficiency in the production and use chain of energy, promoting a culture of responsible use through the transparency of information, dissemination, and education.[22]

In the field of buildings, the implementation of efficiency and energy saving measures is essential to reduce greenhouse gas emissions that contribute to climate change. Currently, electricity consumption in the country is supplied by 78,89 % through renewable sources and 21,08 % through non-renewable sources. However, both energy production and consumption are the main causes of greenhouse gas (GHG) emissions, which highlights the importance of continuing to promote energy efficiency measures.[23] Universities, as public buildings that

constantly use energy in occupancy, lighting, air conditioning and equipment, have the responsibility of making efficient use of energy consumption.[24]

Classification and selection of solid waste and sustainability

Solid waste has been defined as the remains of human activities that are considered useless or disposable at some point during their generation, without considering their potential usefulness for other purposes.[25]

Solid waste management represents one of the main challenges for cities, given the increase in waste generation derived from demographic growth, the restriction of resources that leads to reduced public spending, the lack of education and environmental awareness, among others. These problems translate into unclean public areas and the presence of landfills, which contribute to the proliferation of vector-borne diseases, in addition to generating bad odors and unpleasant visual impacts.[26]

The design of the Waste Management System includes programs for the classification and treatment of waste, appropriate technologies, environmental awareness activities, strategies for temporary storage and final disposal. This system is based on the Deming method.[27]

Therefore, the proper management of solid waste is essential for the sustainable development of cities, and universities play a crucial role in this process. Training future professionals in comprehensive solid waste management will allow them to understand the importance of reducing, reusing, and recycling, as well as implementing sustainable practices in their work and daily lives. This will contribute significantly to building cleaner, healthier, and more sustainable cities for present and future generations.

University security and sustainability

To address the issue of security and sustainability, it is important to consider the Sustainable Development Goals of the 2030 Agenda, which outline a path towards sustainable development. These objectives are integrated into the current concept of security and the security strategies adopted in the European Union. There is a growing consensus on expanding the concept of security to include aspects such as the protection of human rights, inclusive societies, and a peaceful and sustainable world. This highlights the need for all organizations and administrations to align towards this common objective, which justifies the adoption of a comprehensive vision of security that includes local structures.[8]

In the university environment, safety also covers the state of the facilities, spaces, and work environment, considering safety, hygiene, and cleanliness standards. These factors not only affect physical safety, but also the satisfaction and performance of those who are in this place.[26] Furthermore, organizations require efficiency and competitiveness, and safety must be developed and maintained as an active system that values human beings and provides better working conditions.[28]

In this context, universities have a fundamental role in training professionals with solid knowledge in security, both in the physical and digital spheres, to prevent risk situations in the university field and in society in general. It is crucial that students gain a deep understanding of safety regulations and how to apply them in their future work environment, thereby contributing to the creation of safe and sustainable environments in their communities.

METHOD

The research was carried out with a mixed and experimental approach, using the pretest/posttest design with a single group (G O1 X O2). This design involved administering an initial test to the group before the experimental intervention, then administering the treatment, and finally administering a postintervention test to evaluate the effects.

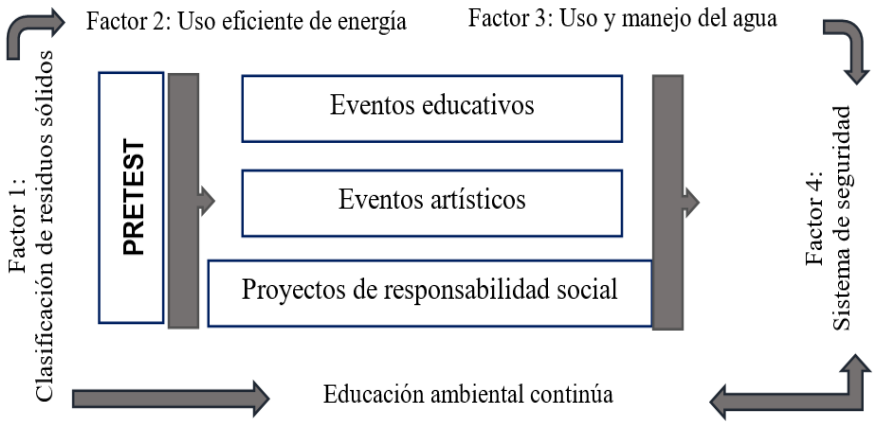

Figure 1. Methodology for strengthening environmental attitudes

During the implementation of the methodological proposal to strengthen environmental attitudes in university students, a situational diagnosis was carried out that identified four thematic axes to guide the research: the classification and selection of solid waste, the rational use of water, efficiency energy and university security. In addition, the need for continuous environmental education was identified to reinforce knowledge in young people, a crucial aspect to promote responsible attitudes. For the intervention, three events were designed: academic, artistic, and social responsibility projects, all of them based on the four thematic axes mentioned above. These activities are detailed in figure 1.

The first intervention consisted of the organization of educational events called "Educating for environmental sustainability", carried out in different scenarios and moments. These events focused on the 4 thematic axes identified (classification and selection of solid waste, rational use of water, efficient use of electrical energy and university safety) and involved the participation of experts in each of these topics. These specialists not only provided relevant information, but also shared their practical experiences in the field, which contributed to strengthening the environmental competencies of university students in a comprehensive manner.

The second intervention consisted of holding artistic events that encouraged student participation in music competitions, theatrical performances, and rehearsals. These events addressed the thematic axes of solid waste, university safety, rational use of water and energy efficiency. The participating students had the opportunity to express their ideas and reflections through art, thus promoting a critical and conscious vision about their role in the preservation of the environment and sustainable development.

The third intervention consisted of carrying out community practices, which included activities such as tree planting and beach cleaning, as well as promoting the efficient use of energy. In addition, solid waste classification containers were installed in each academic headquarters of the university. These actions not only fostered practical commitments among students, but also helped educate them about the importance of taking concrete actions to improve their environment.

The technique used in this study was the survey, using the questionnaire as an instrument. This was of a closed type, based on the Likert scale (pretest - posttest), through which relevant information on the established thematic axes was collected.

To determine the reliability of the instrument, the Exploratory Factor Analysis technique of principal components and Varimax rotation was applied. The Kaiser-Meyer-Olkin (KMO) sampling adequacy index, represented in table 1, obtained a coefficient of 0,807, considered acceptable. Furthermore, Bartlett's Test of Sphericity yielded a significance value of 0,000 ($x2 = 5193,902$; g.l. = 1225; $p < 0,05$).

Table 1. KMO and Bartlett Test

Kaiser-Meyer-Olkin measure of sampling adequacy		
Bartlett's test of sphericity	Approximate chi-square	5 193,902
	g.l.	1 225
	Sig.	0,000

The sample consisted of 324 university students from a Peruvian public university. The analysis of the frequencies of the sample characteristics, according to the school, cycle, and shift variables, is presented in table 2-4.

Table 2. Frequencies of the variable Professional school

Professional school	Frequency	Percentage	Valid percentage	Cumulative percentage
Accounting	54	16,7	16,7	16,7
Systems engineer	33	10,2	10,2	26,9
Tourism and hospitality administration	121	37,3	37,3	64,2
Agronomy	55	17,0	17,0	81,2
Administration	61	18,8	18,8	100,0
Total	324	100,0	100,0	

Cronbach's Alpha coefficient was used to evaluate the homogeneity of the questions, given that the instrument used was of the ordinal polytomous type. The results showed an internal consistency index of 0,864 ($\alpha > 0,6$), which indicates high reliability of the instrument. Furthermore, the specific consistency analysis of each dimension yielded results greater than 0,6 ($\alpha > 0,6$), thus confirming the general reliability of the instrument.

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Table 3. Frequencies of the "School year" variable

Academic cycles	Frequency	Percentage	Valid percentage	Cumulative percentage
I Cycle	57	17,6	17,6	17,6
III Cycle	85	26,2	26,2	43,8
V Cycle	81	25,0	25,0	68,8
VII Cycle	28	8,6	8,6	77,5
VIII Cycle	29	9,0	9,0	86,4
IX Cycle	44	13,6	13,6	100,0
Total	324	100,0	100,0	

Table 4. Frequencies of the "Turn" variable

	Frequency	Percentage	Valid percentage	Cumulative percentage
Tomorrow	150	46,3	46,3	46,3
Late A	52	16,0	16,0	62,3
Late B	30	9,3	9,3	71,6
Evening	92	28,4	28,4	100,0
Total	324	100,0	100,0	

Table 5. Internal consistency indices (Cronbach's Alpha)

Factor	Cronbach's alpha (α)
Total (General internal consistency)	0,864
Factor 1: classification of solid waste	0,610
Factor 2: efficient use of energy	0,742
Factor 3: use and management of water	0,492
Factor 4: security system	0,632
Continuous environmental education	0,826

Table 6. Cronbach's Alpha

Factor	Items	(α)
F1 1	For recycling purposes, it is good to separate disposable plastic cans and bottles from other solid waste	0,863
F1 2	For recycling purposes, solid waste can be classified into organic and inorganic contaminants	0,862
F1 3	To recycle, I separate cardboard and paper from other solid waste at home	0,862
F1 4	Recycling allows us to save by giving solid waste a longer use time	0,862
F1 5	Campaigns should be promoted for the classification of solid waste at the university	0,863
F1 6	At home I separate glass containers from other waste to recycle them	0,860
F1 7	In my home I separate fruit and vegetable scraps to recycle them as fertilizer	0,863
F1 8	Attention should be called to the person who throws garbage on the ground	0,860
F1 9	For shopping I use cloth bags instead of plastic ones	0,861
F1 10	I dispose of batteries and batteries with great care	0,861
F2 1	For recycling purposes, it is good to separate disposable plastic cans and bottles from other solid waste	0,861
F2 2	For recycling purposes, solid waste can be classified into organic and inorganic contaminants	0,859
F2 3	To recycle, I separate cardboard and paper from other solid waste at home	0,859
F2 4	Recycling allows us to save by giving solid waste a longer use time	0,858
F2 5	Campaigns should be promoted for the classification of solid waste at the university	0,859

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F2 6	At home I separate glass containers from other waste to recycle them	0,861
F2 7	In my home I separate fruit and vegetable scraps to recycle them as fertilizer	0,858
F2 8	Attention should be called to the person who throws garbage on the ground	0,861
F2 9	For shopping I use cloth bags instead of plastic ones	0,860
F2 10	I dispose of batteries and batteries with great care	0,860
F3 1	For recycling purposes, it is good to separate disposable plastic cans and bottles from other solid waste	0,861
F3 2	For recycling purposes, solid waste can be classified into organic and inorganic contaminants	0,858
F3 3	In order to recycle, I separate cardboard and paper from other solid waste at home.	0,861
F3 4	Recycling allows us to save by giving solid waste a longer use time	0,866
F3 5	Campaigns should be promoted for the classification of solid waste at the university	0,867
F3 6	At home I separate glass containers from other waste to recycle them	0,863
F3 7	In my home I separate fruit and vegetable scraps to recycle them as fertilizer	0,861
F3 8	Attention should be called to the person who throws garbage on the ground	0,861
F3 9	For shopping I use cloth bags instead of plastic ones	0,861
F3 10	I dispose of batteries and batteries with great care	0,864
F4 1	For recycling purposes, it is good to separate disposable plastic cans and bottles from other solid waste	0,862
F4 2	For recycling purposes, solid waste can be classified into organic and inorganic contaminants	0,861
F4 3	In order to recycle, I separate cardboard and paper from other solid waste at home	0,862
F4 4	Recycling allows us to save by giving solid waste a longer use time	0,859
F4 5	Campaigns should be promoted for the classification of solid waste at the university	0,861
F4 6	At home I separate glass containers from other waste to recycle them	0,860
F4 7	In my home I separate fruit and vegetable scraps to recycle them as fertilizer	0,863
F4 8	Attention should be called to the person who throws garbage on the ground	0,862
F4 9	For shopping I use cloth bags instead of plastic ones	0,860
F4 10	I dispose of batteries and batteries with great care	0,862
EAC 1	The proposals and conclusions of environmental work must be heard and analyzed by the university community	0,862
EAC 2	The university must promote sustainable pro-environmental projects	0,860
EAC 3	The university must establish alliances with institutions or offices that promote education for pro-environmental sustainability	0,861
EAC 4	Well-developed pro-environmental practices should be encouraged	0,861
EAC 5	Pro-environmental social practices should help us integrate with the population	0,861
EAC 6	I would like to participate in conferences or other activities related to the topic	0,860
EAC 7	I would like there to be coordination between the practice to be developed and the social services	0,860
EAC 8	I would like the practical work of pro-environmental projects to be as a team	0,861
EAC 9	I would like research activities to be carried out on the topic	0,860
EAC 10	I would like to have more time dedicated to my training on the subject	0,861

RESULTS

In this results section, comparative data on the change in environmental attitudes of students extracted from the pretest and posttest will be presented, analyzed according to the thematic axes established in the study. In addition, the reflections and commitments expressed by the participants in the artistic events will be considered, especially in their essays, to enrich the understanding of the results obtained.

Strengthening environmental attitudes in solid waste classification

In figure 2, of the 324 students who made up the sample, a significant improvement was observed in their environmental attitudes in the thematic axis of classification and selection of solid waste, going from an initial

28 % to 72 % after the application of the methodological proposal. Furthermore, interventions that involved writing essays and songs provided valuable contributions that reflect their change in attitude. For example, one of the participants expressed: "The most important thing is to use the Rs such as recycling, reusing, repairing, rejecting, and reducing solid waste. It can be mentioned that the selection and classification of waste is the most effective way to take advantage of materials that no longer have a use from organic and inorganic materials. The selection and classification of waste is a process that benefits everyone and is a responsible attitude toward the environment in which we live" (E138CO).

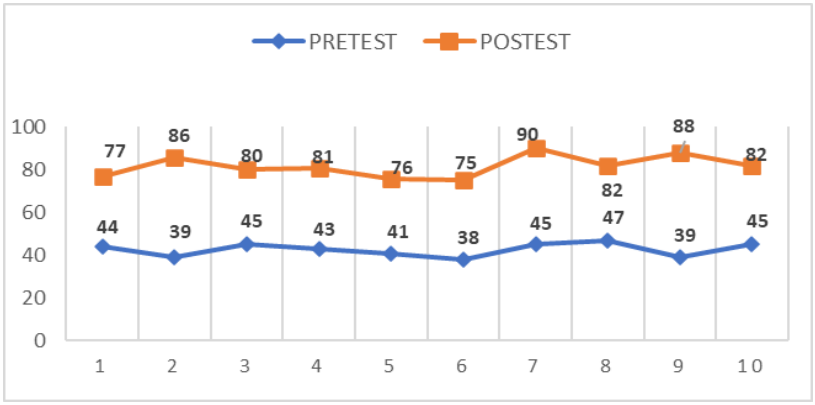

Figure 2. Classification and selection of solid waste

Another student reflected on the environmental unconsciousness of humans: "We believe that everything we still possess will always be at our disposal and even more so we are so selfish that we do not think about the children or grandchildren who will come and inhabit this earth and will need food to survive." their subsistence, but of course, we hard-headed men only think of ourselves and we hoard everything in our path (...), the solid waste that we create we rather throw into the streets, into the rivers, into the house of the neighbor, out the window when we use a transport vehicle and many times we use or buy unnecessary things" (E200AG).

These testimonies reflect the importance of environmental awareness and the positive impact it can have on people's behavior. Another student highlighted: "Solid waste is not there to contaminate the environment, as we have just seen, it can be used in different ways, it only requires time, but it will generate economic income and, above all, an environmental balance. We must work with the 7Rs such as: Redesign, reduce, reuse, repair, renew, recover and recycle" (E123AD).

These testimonies demonstrate the importance of continuous environmental education and the adoption of sustainable practices in daily life. Another student highlighted: "From an ecological point of view, the solution does not require large technologies or multimillion-dollar investments: it is about applying savings, use and recycling plans, accompanied by appropriate training campaigns, which allow maximum performance and recovery. of all those materials present in the garbage, but usable as raw materials" (E101AD).

Likewise, the importance of selective waste collection and garbage separation at home was highlighted: "Throwaway products or packaging should be avoided as much as possible, especially plastics, cans and aerosols, as it is very its biodegradation is complicated or non-existent" (E122AD). These reflections and proposals for action demonstrate the positive impact that the methodological proposal had in strengthening the environmental attitudes of university students.

Strengthening environmental attitudes in university students: focus on the efficient use of energy

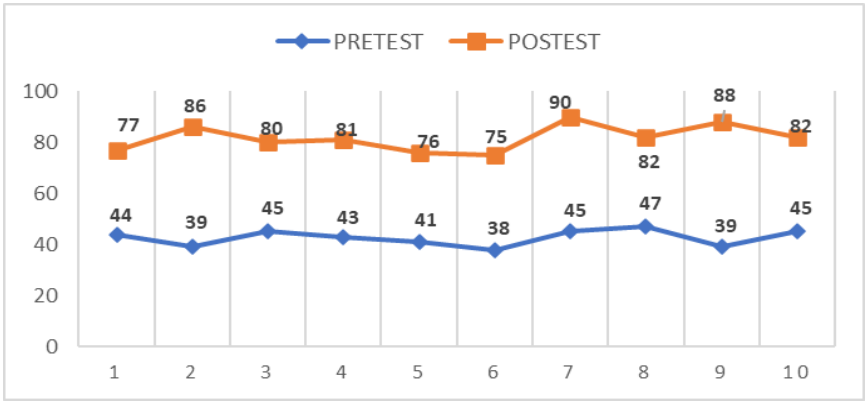

Figure 3. Efficient use of electrical energy

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According to figure 3, in relation to the thematic axis of efficient use of electrical energy, a significant improvement was observed in the environmental attitudes of the 324 students in the sample, going from 43 % initially to 82 % after the application of the methodological proposal. Furthermore, during the interventions, through the preparation of essays and songs, various reflections were collected that show greater environmental awareness and responsibility:

"Energy is a vital resource for our world, but its misuse can harm it. It is important to be aware of how we use it." (E43CO)

"We must implement awareness campaigns about the rational use of electrical energy. Savings in lighting begin by recognizing the magnitude of the problem and establishing appropriate energy policies." (E114AD)

"The energy problem is not only the responsibility of governments or companies, but of the entire society. We must act now to benefit future generations." (E2AG)

"Information and awareness about the efficient use of electrical energy is essential. We must all contribute by consciously using our electrical resources and benefits." (E11AG)

These reflections, based on the experiences and knowledge of the students, demonstrate the positive impact of the methodological proposal in strengthening environmental attitudes towards the efficient use of electrical energy in university students.

Strengthening environmental attitudes: impact on the rational use of water among university students

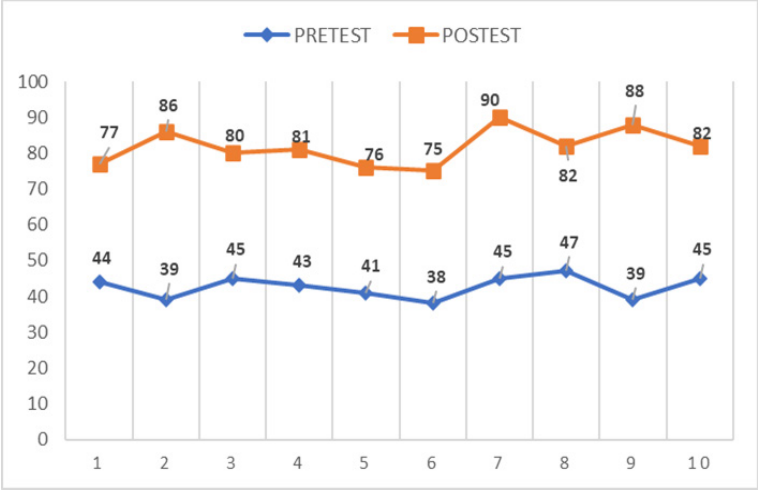

Figure 4. Rational use of water

Of the 324 students who were part of the sample, according to figure 4, a significant improvement was observed in their environmental attitudes regarding the rational use of water, going from 34 % initially to 76 % after the intervention. The essays they prepared reflect a shift in focus toward this crucial issue:

"Water is essential for life on Earth. As human beings, we must be aware of our responsibility in its care and conservation. Every action we take, from turning off the tap while brushing our teeth to repairing leaks in our homes, contributes to the rational use of this vital resource" (E25AG).

"Climate change has intensified water scarcity in our environment. It is necessary for each individual to take measures to conserve water, since it is a finite and fundamental resource for our survival and that of future generations" (E52AG).

"Water pollution is a serious problem that affects future generations. We must act now to preserve this resource for ourselves and for generations to come, promoting sustainable practices in our daily lives" (E105CO).

"As university students, we have the responsibility to be examples of change. We must educate and motivate others to be aware of their use of water, thus promoting its conservation for future generations" (E33AD).

In summary, the results show a significant improvement in attitudes towards the rational use of water among university students. These findings underscore the importance of promoting greater awareness of water conservation and the need to adopt responsible practices to ensure its availability for future generations.

Analysis of attitudes towards university safety: impact of a methodological proposal for environmental education

In figure 5, of the 324 students who made up the sample, a significant improvement was observed in their environmental attitudes regarding university security, going from an initial 32 % to 75 % after the implementation of the methodological proposal.

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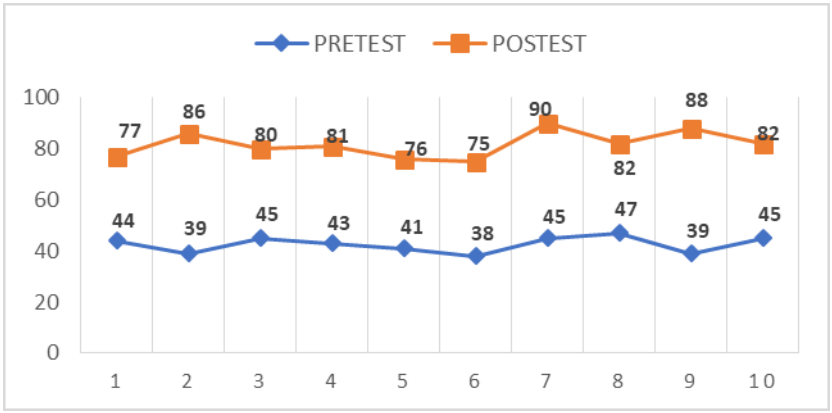

Figure 5. University security

The students expressed their commitment to this topic:

"It is essential that all members of the university community are aware of the importance of security in our academic environment" (E55AG).

"Security at the university not only depends on the authorities, but on all of us, as students, we must contribute to maintaining a safe and secure environment" (E102CO)

These figures, supported by direct feedback from students, underscore the importance the student community places on safety in their academic and social environments. This change represents not only a tangible improvement in the perception of safety, but also a palpable commitment to creating a safer and more secure university environment for all members of the community.

Continuous environmental education: strengthening environmental attitudes

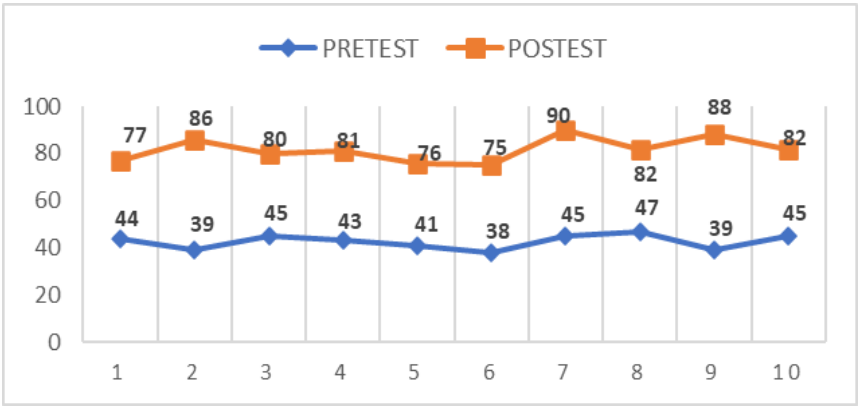

Figure 6. Continuing environmental education

In figure 6, of the 324 students who made up the sample, a notable improvement was observed in their environmental attitudes in the thematic axis of continuous environmental education, going from 46 % initially to 81 % after the intervention. The writings collected reflect a positive change in the perception and commitment of young university students towards sustainability:

"The solutions and prevention methods for this problem are already available, the only thing missing is a change in people's attitudes. Although it may seem difficult, we can join the small group of people who are generating real changes" (E99ATH).

"It is crucial to become aware and change our selfish approach to a caring and empathetic one. We need to leave a healthy world for future generations, where they can coexist in harmony with the flora and fauna that is currently being damaged. Every small action count, and together we can achieve significant change for the benefit of present and future humanity" (E18AG).

These results reinforce the importance of integrating education for sustainability as a transversal axis in the academic activities of universities, promoting a sustainable approach towards our planet.

DISCUSSION

Faced with objective 1 of implementing a methodological proposal to strengthen attitudes for the purposes of environmental sustainability in energy efficiency, university students showed a significant improvement

in their attitudes, with an increase from 43 % to 82 % after the application of the proposal. During the interventions, they expressed greater environmental awareness and responsibility, highlighting the importance of implementing awareness campaigns and appropriate energy policies.

These results are in line with the proposals of them, who concluded that the participation of universities in programs focused on energy efficiency can benefit economically and create environmental awareness.[24] They also agree with them, who highlighted that electricity consumption in Ecuador comes mostly from renewable sources, but even so, energy consumption is one of the main causes of greenhouse gas emissions.[23] Furthermore, the study by them on energy efficiency at the Universidad Católica Azogues headquarters emphasizes the importance of raising awareness about the responsible use of facilities, highlighting that this measure does not require investment to achieve responsible consumption.[23]

Faced with objective 2 of implementing a methodological proposal to strengthen attitudes towards environmental sustainability in the classification and selection of solid waste, we observed that, of the 324 students, their attitudes increased significantly, going from 28 % to 72 % after the application of the proposal. The testimonies collected during the intervention reflect a positive change in the students' perception and commitment to the environment, highlighting the importance of environmental awareness and the positive impact it can have on human behavior. A change is evident in the way of thinking and acting of the students, who now value the importance of reducing, reusing, and recycling solid waste, as well as adopting sustainable practices in their daily lives.

These findings coincide with those obtained by it in his work on the evaluation and characterization of common solid waste from the UCSM Arequipa Peru university campus, where it was concluded that the data obtained should be used in planning the management and handling of solid waste of the university, having observed a consolidation and strengthening of the SR Management Plan, as well as adequate awareness of waste management from generation to final disposal with participation and training of the student and administrative population of the university on the importance of proper management of solid waste, and even the health risks if there is inadequate management were made known.[29]

Also, they agree with the study by them in the article on the evaluation and characterization of common solid waste from the UCSM Arequipa Peru university campus, where it is highlighted that, although the university has implemented the environmental management system (EMS) under the ISO 14001:2015 standard, The way in which this process is carried out by the actors shows shortcomings in its implementation and the need to strengthen it through training processes in solid waste management, to maximize its use and implement strategies regarding its disposal.[19]

Faced with the objective of implementing a methodological proposal to strengthen attitudes towards environmental sustainability in the rational use of water, we observed a significant improvement in the attitudes of the 324 students, with an increase from 34 % to 76 % after the intervention. The essays reflect a change in focus towards water care, highlighting the importance of individual and collective actions for its conservation.

These results coincide with them in their study on the state of the water resource on the campus of the University of Magdalena, Colombia, where it was concluded that a comprehensive management plan established from senior management is required to improve the security of water supply and sustainability. on campus.[21]

Furthermore, they are shared with them in their research on the Water Footprint as an educational strategy for the responsible consumption of water at the Santiago de Cali University, where it was concluded that the Water Footprint is an indicator of environmental sustainability with great educational potential, useful not only for analysis of environmental sustainability in organizations but also to propose environmental education strategies focused on the responsible management of water resources.[20]

Faced with the objective of implementing a methodological proposal to strengthen attitudes towards environmental sustainability in university safety, we observed a significant improvement in the attitudes of the 324 students, with an increase from 32 % to 75 % after the intervention. The students expressed an active commitment to security at the university, highlighting the importance of the participation of the entire student community in this aspect.

These results coincide with the contribution of it, who exposes the need to move from words to actions and adopt the decision to integrate the multiple and diverse local police groups into a Security Strategy that allows their structuring in the global scope of security, configuring the appropriate management bodies, both at the regional level and at the rest of the administrations.[30]

CONCLUSIONS

The methodological proposal strengthens the environmental attitudes of university students and promotes responsible and sustainable practices, highlighting the importance of continuing to promote environmental education for a more sustainable future.

The methodological proposal proved to be effective in strengthening the environmental attitudes of university students towards the efficient use of electrical energy, highlighting the importance of continuing to promote

sustainable practices in society through the reflection and awareness generated during the interventions.

The results highlight the effectiveness of the intervention in strengthening the environmental attitudes of university students towards the rational use of water, highlighting the importance of promoting greater awareness about its conservation and the adoption of responsible practices to guarantee its availability for future generations.

The results reflect the effectiveness of the methodological proposal in strengthening the environmental attitudes of students towards university safety. This improvement not only represents a more positive perception of safety, but also a tangible commitment from students to contribute to a safer and more secure academic environment.

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