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Original article

Environmental education to conserve Huascarán National Park. A quasi-experimental study using experiential activities

Educación ambiental para conservar el Parque Nacional Huascarán. Un estudio cuasiexperimental mediante actividades vivenciales

Educação ambiental para a conservação do Parque Nacional Huascarán. Um estudo quase experimental utilizando atividades experienciais

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ABSTRACT

Anthropogenic climate change, biodiversity loss, massive deforestation, and the greenhouse effect are some of the causes of terrestrial ecosystem degradation. In this regard, the study demonstrates that environmental education based on experiential activities significantly influences the conservation of Huascarán National Park. A quasi-experimental design was used, with students from preschool, primary, and secondary schools in the Paltay and Paria micro-watersheds (Áncash, Peru) as the study group. The survey technique was used, and four questionnaires were used as instruments to assess the dimensions of the HNP conservation variable. These questionnaires were subjected to validity by expert judgment and reliability testing. The results showed a P-value greater than 0.005 for the control group, indicating no significant changes in their grades. Meanwhile, the experimental group

obtained a P-value of .000. This demonstrates significant changes in the grades obtained, demonstrating that students in the experimental group possess adequate environmental education. The overall conclusion is that experiential activities such as guided tours and solid waste collection and segregation have generated changes in behaviors and attitudes toward conservation of the Huascarán National Park.

Keywords: experiential activities; environmental education; ecosystem; strategies; learning.

RESUMEN

El cambio climático antropogénico, la pérdida de la biodiversidad, la deforestación masiva y el efecto invernadero, son algunas de las causas de la degradación de los ecosistemas terrestres. En ese sentido, el estudio demuestra que la educación ambiental basada en las actividades vivenciales influye significativamente en la conservación del Parque Nacional Huascarán. Se empleó un diseño cuasiexperimental tomando como grupo de estudio a los estudiantes de las instituciones educativas de inicial, primaria y secundaria de las microcuencas de Paltay y Paria (Áncash, Perú). Se empleó la encuesta como técnica y como instrumento a cuatro cuestionarios que evaluaron las dimensiones de la variable conservación del Parque Nacional Huascarán. Estos cuestionarios se sometieron a la validez por juicio de expertos y la prueba de confiabilidad. Los resultados denotan un P-valor mayor a 0.005 para el grupo de control, lo cual indica que no se tuvo cambios significativos en sus notas. En tanto que en el grupo experimental se obtuvo P-valor de .000. Esto demuestra cambios significativos en las notas obtenidas evidenciado que los estudiantes del grupo experimental poseen una adecuada educación ambiental. La conclusión general es que las actividades vivenciales como las visitas guiadas y la recolección y segregación de residuos sólidos han generado cambios en las conductas y actitudes hacia la conservación del Parque Nacional Huascarán.

Palabras clave: actividades vivenciales; educación ambiental; ecosistema; estrategias; aprendizaje.

RESUMO

Mudanças climáticas antropogênicas, perda de biodiversidade, desmatamento em massa e efeito estufa são algumas das causas da degradação dos ecossistemas terrestres. Nesse sentido, o estudo

demonstra que a educação ambiental baseada em atividades experienciais influencia significativamente a conservação do Parque Nacional Huascarán. Foi utilizado um delineamento quase experimental, com alunos de escolas pré-escolares, primárias e secundárias das microbacias hidrográficas Paltay e Paria (Áncash, Peru) como grupo de estudo. Uma pesquisa foi utilizada como técnica e instrumento, e quatro questionários foram utilizados para avaliar as dimensões da variável de conservação do Parque Nacional Huascarán. Esses questionários foram submetidos à validade por julgamento de especialistas e testes de confiabilidade. Os resultados mostraram um valor de P maior que 0,005 para o grupo controle, indicando que não há mudanças significativas em suas notas. Enquanto isso, o grupo experimental obteve um valor de P de 0,000. Isso demonstra mudanças significativas nas notas obtidas, demonstrando que os alunos do grupo experimental possuem educação ambiental adequada. A conclusão geral é que atividades vivenciais como visitas guiadas e coleta e segregação de resíduos sólidos geraram mudanças de comportamentos e atitudes em relação à conservação do Parque Nacional Huascarán.

Palavras-chave: atividades vivenciais; educação ambiental; ecossistema; estratégias; aprendizagem.

INTRODUCTION

At present, the protection and conservation of ecosystems is linked to a number of public policies of a state. This is why various ecosystems in the world have been declared intangible assets and heritage of humanity, as they are highly vulnerable to human intervention. Although part of the responsibility lies with governments, this does not exempt the population who is still unaware of the importance of these areas which have abundant water resources and immense geothermal potential. This should be reflected in a context where the people of the zones of influence and the authorities join efforts to halt biodegradation and eradicate threats to its conservation.

The planet shelters a wide diversity of ecosystems that are in danger due to anthropogenic and other environmental causes, as demonstrated by various studies (Fuentealba, 2018; Esteban et al., 2017; Hernández et al., 2018). It is in this context that protected areas are legalized to preserve certain areas for historical, biological and social reasons. Despite this, biodegradation has grown to such an extent that many ecosystems are threatened with extinction by the indolence of authorities or the

predatory action of inhabitants. Among the many biosphere reserves is the Huascaran National Park (PNH) recognized as a Natural Heritage of Humanity in 1985.

The PNH, created in 1975 by the Peruvian state and recognized in 1977 as the core of Reserva de Biósfera Huascarán (RBH), by the United Nations Educational, Scientific and Cultural Organization (UNESCO), serves to protect the natural resources located in its core and regulates socio-economic activities such as tourism, aimed at raising the standard of living of local people.

The PNH is located in the Áncash region (Peru), covering 3400 km^2 of the territories of 10 Áncash provinces: to the east, the provinces of Huari, Asunción, Mariscal Luzuriaga and Pomabamba and to the west, the provinces of Bolognesi, Recuay, Huaraz, Carhuaz, Yungay and Huaylas. It covers almost the entire Cordillera Blanca and biogeographically is located in the natural regions of Suni, Puna and Janca (Figure 1).

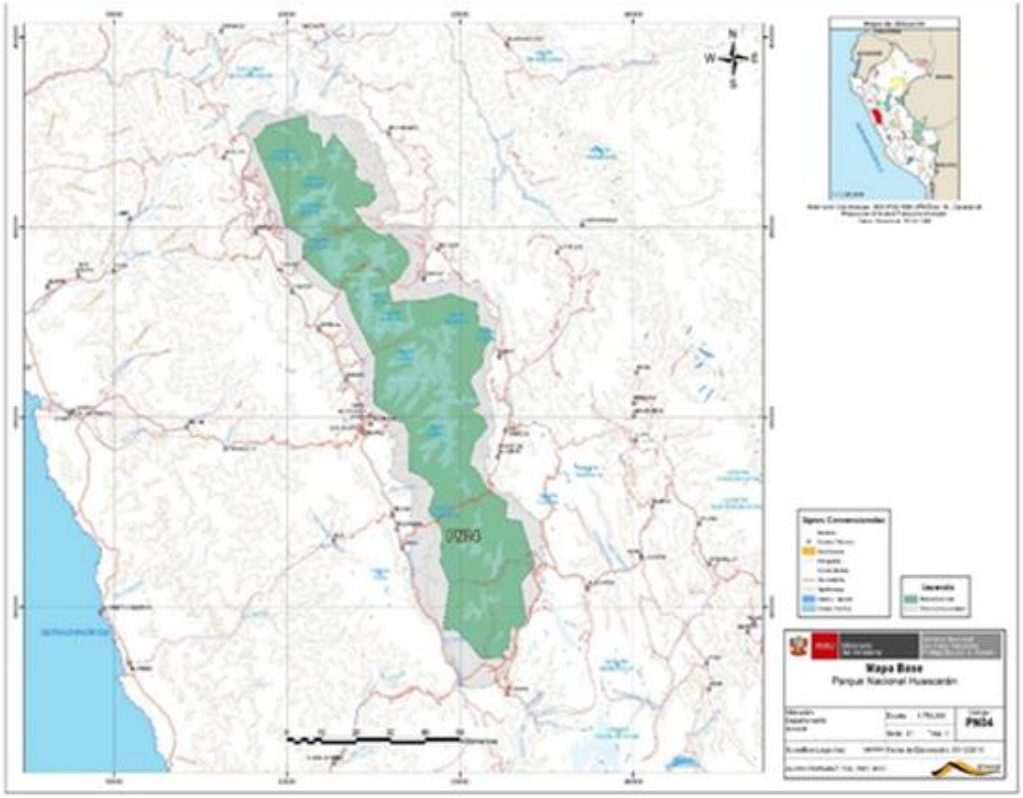

Figure 1. Huascarán National Park location map

According to Shoobridge (2005), it has endangered fauna such as the vicuña (*Vicugna*), the andean condor (*Vultur gryphus*) and the spectacled bear (*Tremarctos ornatus*). As for the flora, it has relictos forests of Puya Raimondi (*Puya*), quisuar (*Budleia coreacea*) and queñua (*Polylepis spp*). The imposing landscape of its mountains, rivers, lagoons and rock formations is the main attraction of the PNH, which generates tourist activities in the buffer zones and in the cities located in the transition zone. Another very important resource that provides is the quantity and quality of water that is used for hydroelectric power plants, human consumption and agriculture developed in the coastal areas of the Áncash and Libertad region.

According to the Master Plan (2010), drawn up in accordance with Law No. 26834 issued by the Peruvian state, the RBH is zoned into three areas: core area, constituted by the Huascarán National Park, which covers 340000 ha; buffer zone, of 170200 ha, which includes small landowners and peasant communities adjacent to the PNH; and the transition zone, with an extension of 645600 inhabitants that integrates the Callejón de Huaylas; and the area of Conchucos, These are the main economic corridors in the Áncash mountain area, with an urban population of approximately 295322.

It should be noted that in the core area constituting the PNH, seven zones of life have been identified, according to the estimation of zones of life of Holdrige (Sabino, 2019). It houses 13 species of mammals, one of reptiles, 111 species of birds, 779 plant species and 104 families, 340 genera and 729 species of flowers, according to the results of research carried out by David Smith with 3988 samples. As for the water resource, it contains 663 glaciers and 296 lagoons that feed the rivers Santa, Pativilca and Marañón.

However, the PNH experiences an intrinsic and extrinsic threat. In the first case, medium-capacity mining (75 companies) and agro-pastoral activities are carried out, which degrade plant cover and cause environmental pollution; in addition, there is a systematic disappearance of grassland; the wiping out of endangered species of flora and the removal of various animal varieties. There is a massive, atomized and predatory exploitation that is endangering a fundamental ecosystem for life on the planet. There is deforestation by florage and ramoneo due to the permanent incursion of tourists who leave their waste and manifest a devastating attitude. These factors, together with camping, are generating a degradation of ecological floors that does not recover despite the seasonality. While the extrinsic threat is perceived in climate change that are anthropogenic or natural causes that ultimately involve all ecosystems of the planet. Global warming is one of the factors that is producing an accelerated deglaciation of the snow of the Cordillera Blanca.

In response to this, containment measures have been taken in the PNH based on the review and update of the Master Plan (2017-2021). It sets out the social component as an objective; "to strengthen the capacities and identity of the actors and the population located in the RBH, with respect to the values of the PNH, and as a line of action increase the number of collaborating actors to strengthen participatory management" (p. 13). With regard to the description of the action line, it states that "the participation of the education sector in the development of formal environmental education is a priority, through school modules on topics related to the Park and the Biosphere Reserve, as well as for the execution of research to achieve the insertion of the concept of Biosphere Reserve in the educational curriculum" (p. 61). Within the framework of this line of action, the research team has intervened to contextualize and diversify the curriculum, prepare students for learning and develop teaching focused on experiential methodological strategies, to allow the knowledge, care and conservation of PNH in core and buffer zones. According to Díaz et al. (2019) and Castillo et al. (2016), environmental education is fundamental for developing the proenvironmental skills that consist in identifying the problems of the environment, to think critically in order to approach and solve such problems from a local level focused to a regional level. That is, pro-environmental skills are measured in situations of problem-solving contextualized in the localities or communities where students live, through active methods and participatory activities, encouraging reflection to optimize students' meaningful learning on environmental issues.

During the diagnostic visits carried out to observe in detail the intrinsic factors of the degradation, it was found that in the Ishinca and Llaca ravines, located in the core area of the PNH; The main polluters are the inhabitants of the buffer zones, who lack adequate environmental education to prevent them from leaving their waste in the mountain range. To this harmful practice is added overgrazing, the felling of native trees and burning of *pajonales* that arises from the belief that this way will form clouds in the absence of rain. This approach is corroborated by the PNH (2017), when it emphasizes that the condition of the *pajonales* is in the range of very poor to regular due to overgrazing, grassland fires, pollution generated by small and medium-sized mining, soil removal for road construction, loss of habitat due to tourism, deforestation of native trees and water stress caused by climate change. These data point to the urgency of intervening in this reality, widely mapped by Prosser and Romero (2019) and Torres et al. (2017).

Based on this diagnosis, the research question is posed: how does adequate environmental education based on living activities influence the conservation of the Huascarán National Park? The main

objective of the research is to demonstrate that adequate environmental education based on experiential activities has a significant impact on the conservation of Huascarán National Park.

Recent studies (Flórez et al., 2018; Mendoza and Sánchez, 2019) on the application of methodological strategies based on experiential activities are highly advantageous, since they start from everyday experiences and are extrapolated with environmental learning needs. In this perspective, Quintana (2017) has shown that learning based on experiential, social and experimental activities strengthens the sustainable relationship between man, nature and territory and promotes knowledge of natural and cultural biodiversity, as well as environmental awareness. In the same line, Cavalcante et al. (2021), in their study with a qualitative focus on the application of bromeliads in didactic sequences, carried out with 115 students aged 5 and 6 (Initial Education), and the fourth and ninth year of primary school in two schools of the basic education network of Rio Grande Do Norte has achieved the development of greater awareness, commitment and participation in the activities of care and conservation of the environment.

Although environmental education must start from home, it is in formal education that the conservation of the environment should be established as a transversal theme. Meireles et al. (2021) highlight, from the participant observation in the Guarativa State Biological Reserve (RBG); that the development of the program of education and interpretation of the Environment and the heritage of RBG is due to a set of interconnected factors, the integration of formal and non-formal education, reconciling school projects with actions for the care and conservation of ecosystems. Torres et al. (2021) went further: intervening in pedagogical practice through solid waste separation workshops, sorting and recycling in some cases.

The care and protection of animals is another issue that is threatened by hunting and habitat degradation. With the aim of educating to eradicate these practices, Castillo and Sáenz (2019) held workshops on environmental education with primary-preschool and high school students in Guaivo-Colombia, on knowledge of the Andean Condor, its ecological and cultural importance, accompanied by recreational activities on the topics covered. Conclude that the actions developed were instrumental in changing students' attitudes about endangered species and their importance within the ecosystem and the benefits they bring to local communities, Strengthening the link between society and nature.

Thus, the objective of the study was to demonstrate that environmental education based on experiential activities significantly influences the conservation of the Huascarán National Park.

MATERIALS AND METHODS

The research, according to its approach, was quantitative; because of its purpose it was applied and in terms of its level of depth, explanatory. It has a quasi-experimental and cross-sectional design with two groups, with pre and posttest tests. The population was made up of 629 students at initial, primary and secondary levels from educational institutions located in the Paltay and Paria micro-basins of the PNH area. It was worked with a census sample through non-probabilistic sampling for convenience, conforming the control groups with students from the Paria micro-basin and the experimental group with students from the Paltay micro-basin. The study sample conformed as shown in table 1.

Table 1. Sample study

Groups	Educational institution	Initial Education	Primary		High school	Subtotal
			1st and 2nd grade	3rd to 6th grade		
Control	86035 "San Cristobal" de Paria	31	50	83	99	263
	86029 de Huanchac	0	15	19	0	34
	Total	31	65	102	99	297
Experimental	86758 "Ciro Alegría" de Pashpa	33	18	31	54	136
	86691 "Inés Shereiber" de Collón	26	30	63	77	196
	Total	59	48	94	131	332

Instruments

The instruments used to collect data in the pre and posttest were four questionnaires, designed for boys and girls of Initial Education, Primary School first and second grade, Primary School third to

sixth grade and Secondary Education, with questions about knowledge of the PNH, as well as its care and conservation. Reliability was determined by the application of pilot test and Cronbach's alpha calculation with calculated values between .8 and .9, indicating high reliability. The validity of these instruments was determined by expert judgments and the binomial test with values calculated between .000 and .002 checking its validity.

Data collection and analysis procedure

The materials alluding to PNH prepared by the researchers were distributed to the experimental group: notebook with information about PNH on the cover and back cover, and pens with various slogans about the care of PNH. The pre-test was applied to both groups with the support of educational institution managers and classroom teachers (Figures 2 and 3).

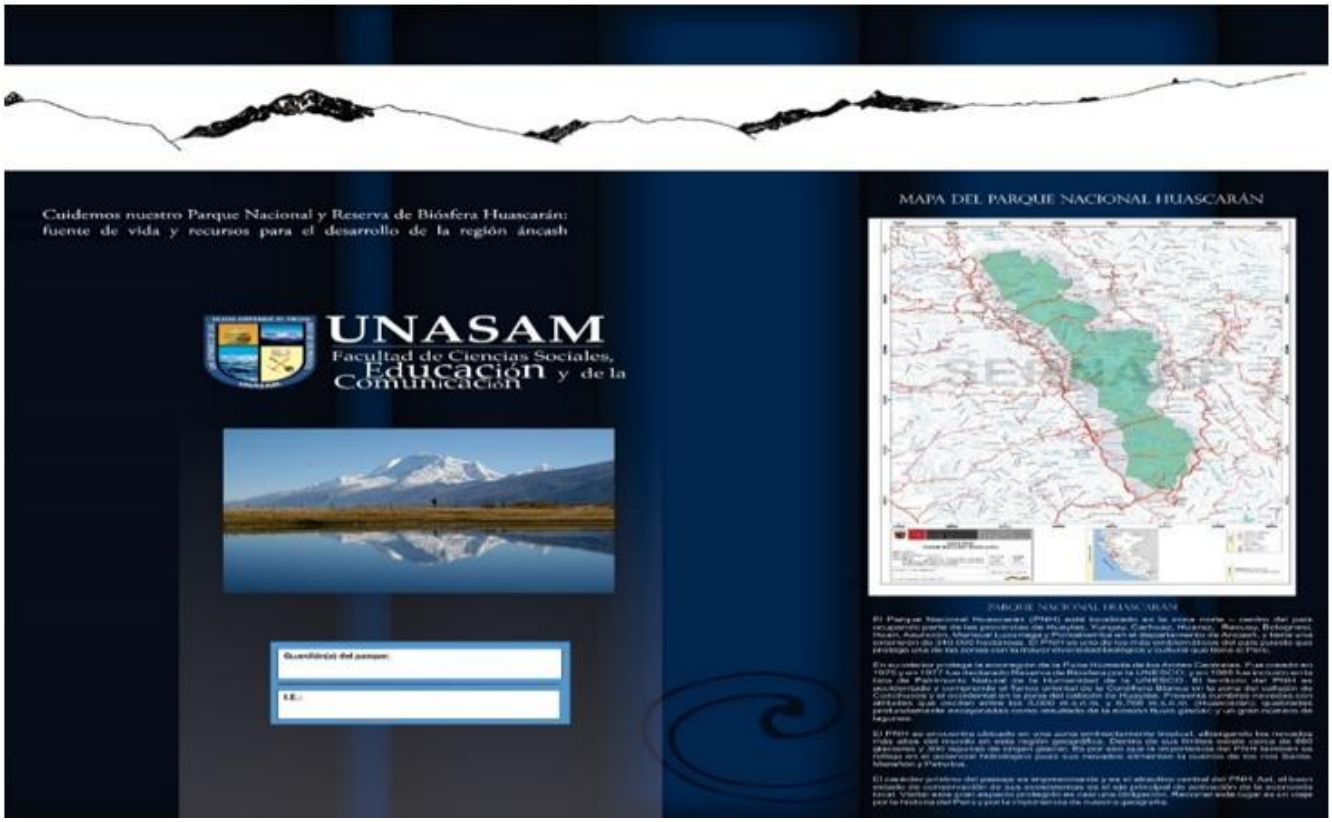

Figure 2. Design of the cover of the notebook delivered to the students

Figure 3. Pen design given to students

Coordinated and planned with the participation of parents, managers, teachers and administrative staff, guided tours to the Ishinca gorge, buffer zones and PNH core adjacent to EI "Ciro Alegría" of Pashpa, broken down by educational level and grade (Table 2 and Figure 4).

Table 2. Places and distances of the guided tour with EI "Ciro Alegría" of Pashpa

Level and grade	Place	Distance from the IE	Responsible
Initial Education	Qucha Pampa	one km	Teacher in the classroom
Primary 1st and 2nd grade	Bosques de Lachoc Cuta	two kms	Teacher in the classroom
Primary 3rd y 4th grade	Control post Service National of Natural Areas Protected by the State	four kms	Teacher in the classroom
Primary 5th y 6th grade	Campo base Ishinca	seven kms	Teacher in the classroom
High school	Campo base Ishinca	seven kms	Adviser to the each section

Note: The guided tour was conducted under the guidance of the PNH park ranger and voluntary participation of some parents

Figure 4. Indications and recommendations of the park ranger in the entrance area to the Ishinca Gorge

At the coordination meeting held with parents, teachers and administrative staff of EI "Inés Shereiber" de Collón, explained the topic by the researchers, the parents voluntarily took charge of planning the route, offering to participate as guides in the absence of PNH staff for such activity. The guided tour was planned in sections (Table 3 and Figure 5).

Table 3. Places and distances of the guided tour with EI "Inés Shereiber" de Collón

Level and grade	Place	Distance from IE	Responsible
Initial Education	Laguna Yuraq Qucha	one km	Teacher in the classroom
Primary 1st and 2nd grade	Laguna de Pultunku	two kms	Teacher in the classroom
Primary 3rd and 4th grade	Pastizales de Kuyoq	four kms	Teacher in the classroom
Primary 5 to 6 grade	Laguna de Janya	seven kms	Teacher in The classroom
High school	Laguna de Janya	seven kms	Adviser to each section

Note: The guided tour was conducted with the guidance of knowledgeable parents from the area and a researcher

Figure 5. Researcher telling stories in Quechua during the guided tour of the Janya lagoon

The parents are all Quechua-speaking and so are the students, so it was important to hold talks and coordination meetings in Quechua. The guided tours with both IE lasted approximately 11 hours (6 am-5 pm); therefore, appropriate security measures were taken and refreshments provided to all participants in these activities.

Subsequently, solid waste collection and separation activities were planned and developed with the pilot group, after preparation of necessary resources such as posters, Colour cylinders for the sorting and disposal of solid waste, and talks for teachers and students. Finally, the posttest was applied to students in both groups (Figure 6).

Figure 6. Primary school students participating in the collection and segregation of solid waste in the community

To process and analyze the data, SPSS version 25.0 and Microsoft Excel 2016 were used. Descriptive statistics were applied for the analysis of frequencies and percentages of results and inferential statistics for hypothesis testing using Wilcoxon, for related and independent samples, with a confidence level of 95%.

RESULTS

The results obtained with the application of data collection instruments were:

Table 4. Frequency distribution of pre and posttest for boys and girls in Early Education

Achievements	Control				Experimental			
	Pretest		Posttest		Pretest		Posttest	
	n	%	n	%	N	%	n	%
On start	25	80.6	23	74.2	47	79.7	1	1.7
In process	6	19.4	8	25.8	10	16.9	11	18.6
Expected accomplishment	0	0.0	0	0.0	2	3.4	47	79.7
Total	31	100.0	31	100.0	59	100.0	59	100.0
	Z=1.414; P-value=.157				Z=6.746; P-value=.000			

Note: Achievement levels of the children of Initial Education of the control and experimental group obtained in the pre and posttest tests on knowledge of PNH, its care and conservation, and results of the non-parametric test Wilcoxon

Table 4 shows that in the pretest test on knowledge, care and conservation of PNH, children from the control and experimental groups presented similar levels of achievement with 80.6% and 79.7% at baseline. After the development of experiential activities in the posttest, significant improvement was observed in the experimental group, because 79.7% of boys and girls had expected achievement; while in the control group, 74.2% of boys and girls were still at baseline with a slight variation compared to the pretest.

The nonparametric statistical test of Wilcoxon was performed for related samples, both for the control group (P-value=.157) and experimental group (P-value=.000) with pre and posttest achievement levels, the results confirm that the boys and girls in the experimental group experienced significant changes because of the application of experiential activities, while in the control group there were no statistically significant changes at a 95% confidence level.

Table 5. Frequency distribution of pre and posttest for students in the first and second grade

Descriptive statistics	Control		Experimental	
	Pretest	Posttest	Pretest	Posttest
n	65	65	48	48
Minimum	5.0	4.0	1.0	8.0
Maximum	18.0	17.0	17.0	20.0
range	13.0	13.0	16.0	12.0
Average	12.0	11.3	11.6	16.3
SD	3.4	2.1	3.9	2.3
median	12.0	11.0	12.5	16.0
Percentile 25	9.0	11.0	10.0	15.0
Percentile 75	15.0	12.0	14.5	17.0
Mode	9.0	11.0	10.0	16.0
	Z=1.099; P-value=.272		Z=5.165; P-value=.000	

Note: Notes from students of the 1t and 2nd grade of the control and experimental group obtained in the pre and posttest tests on knowledge of PNH, its care and conservation, and results of the non-parametric test Wilcoxon

In table 5, it is observed that in the pretest test the scores obtained by the control group and the experimental group have the same behavior, because the average score was 12 and 11.6, respectively, with a standard deviation of 3.4 and 3.9. After the application of experiential activities in the experimental group, the results of the posttest test show a significant change with an average grade of 16.3, while in the control group the average grade was 11.3.

Wilcoxon's nonparametric statistical test for related samples, with a 95% confidence level, both for the control and experimental group, the results confirmed that students in the experimental group had significant changes, whereas the students in the control group showed no revealing changes.

This shows the favorable impact of significant activities on the knowledge, care and conservation of PNH.

Table 6. Frequency distribution of pre and posttest for students from the third to sixth grade

Descriptive statistics	Control		Experimental	
	Pretest	Posttest	Pretest	Posttest
n	19	19	177	177
Minimum	4.0	4.0	2.0	2.0
Maximum	10.0	10.0	16.0	20.0
Range	6.0	6.0	14.0	18.0
average	7.0	6.8	8.8	12.5
SD	1.6	1.7	2.9	4.3
Median	7.0	7.0	9.0	12.0
Percentile 25	6.0	5.0	7.0	9.0
Percentile 75	8.0	8.0	11.0	17.0
Mode	7.0	5.0	9.0	17.0
	Z=1.633; P-value=.102		Z=7.251; P-value=.000	

Note: notes of students from the 3rd to 6th grade of the control and experimental group obtained in pre and posttest tests on knowledge of PNH, its care and conservation, and results of the non-parametric test Wilcoxon

In table 6, it is observed that in the pretest test the scores obtained by the control group and the experimental group have the same behavior, because the average score was 7 and 8.8, respectively, with a standard deviation of 1.6 and 2.9. After the application of experiential activities in the experimental group, the posttest test results show a significant change in the experimental group with an average grade of 12.5, while in the control group the average grade was 6.8.

Wilcoxon's nonparametric statistical test for related samples, with a 95% confidence level, both for the control and experimental groups, results confirm that students in the experimental group had significant changes, whereas the students in the control group showed no significant changes.

Table 7. Frequency distribution of pre and posttest for secondary school students

Descriptive statistics	Control		Experimental	
	Pretest	Posttest	Pretest	Posttest
n	99	99	131	131
Minimum	4.0	5.0	4.0	7.0
Maximum	13.0	14.0	15.0	20.0
Range	9.0	9.0	11.0	13.0
asverage	9.3	9.8	9.2	13.7
SD	2.3	2.1	2.2	3.0
Median	9.0	10.0	9.0	14.0
Percentile 25	8.0	8.0	8.0	11.0
Percentile 75	11.0	11.0	11.0	16.0
Mode	9.0	10.0	9.0	15.0
	Z=1.594; P-value=.111		Z=8.874; P-value=.000	

Note: notes from the secondary school students of the control and experimental group obtained in the pre and posttest tests on knowledge of PNH, its care and conservation, and results of the non-parametric test Wilcoxon

In table 7, it is observed that in the pretest test the scores obtained by the control group and the experimental group have similar behavior, because the average score was 9.3 and 9.2, respectively, with a standard deviation of 2.3 and 2.2. After the application of experiential activities in the experimental group, the posttest test results show a significant change in the experimental group, with an average grade of 13.7, while in the control group the average grade was 9.8.

The Wilcoxon nonparametric statistical test for related samples, with a 95% confidence level performed on the scores of both groups, confirms that students in the experimental group had significant changes, whereas the students in the control group showed no significant changes. The above shows that the implementation of significant activities had favorable results for the knowledge of PNH, its care and conservation (Table 8).

Table 8. Normality test for differences in scores in the pre and posttest of the control and experimental groups

Group		Kolmogórov-Smirnov			Shapiro-Wilk		
		Statistical	gl	P-value	Statistical	gl	P-value
Control Dif=Posttest-Pretest	Primary 1st and 2nd	.097	65	.200	.989	65	.828
	Primary. 3rd to 6th	.390	19	.000	.708	19	.000
	High school	.088	99	.057	.982	99	.189
Experimental Dif=Posttest-Pretest	Primary 1st and 2nd	.132	48	.037	.975	48	.402
	Primary 3rd to 6th	.084	177	.004	.977	177	.005
	High school	.075	131	.071	.987	131	.246
*. This is a lower limit of true significance							
a. Lilliefors significance correction							

The rating of the notes was with the vigesimal scale and to determine their distribution of normality it was contrasted with the statistics of Kolmogórov-Smirnov, appreciating that the notes have non-normal distribution, so it was decided to apply the non-parametric Wilcoxon test with a 95% confidence level for testing the hypothesis.

Wilcoxon's Z test results were for control group Zc = 0.27 and experimental group Ze =12.33, as shown in figure below.

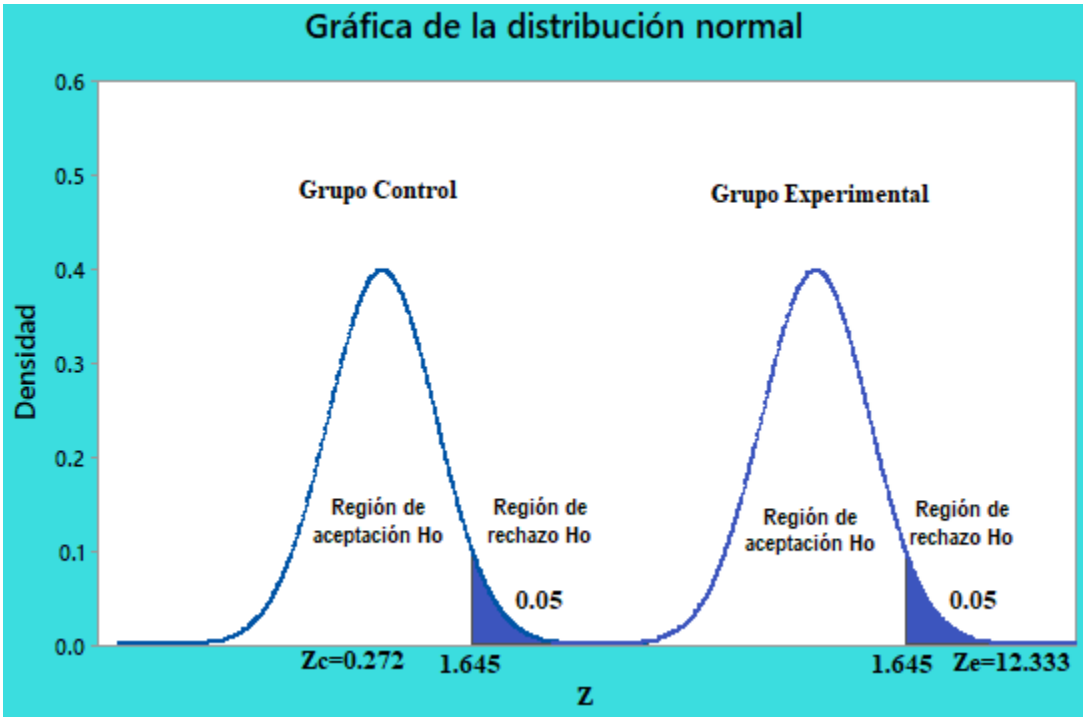

Figure 7. Normal distribution and rejection region of the null hypothesis Ho

It is observed that the Wilcoxon statistic Z of the experimental group is equal to 12.33 and is located in the region of rejection of the null hypothesis (Ho); therefore, the hypothesis that the application of experiential activities significantly influences the development of environmental education for the care and conservation of PNH is accepted.

DISCUSSION

In the experiential collection and separation of solid waste activities carried out at EI and in the community, students showed a positive attitude, especially boys and girls from Initial Education and students from Primary Education. The students of 5th grade of Secondary Education showed little participation and collaboration, so it should be focused on environmental education issues, especially in boys and girls to form solid bases of environmental awareness. In this we agree with Torres et al. (2021) in the sense that environmental education should be developed with participatory methodological strategies to develop ecological awareness in students; furthermore, we are in line with what Quintana (2017) who states that case studies through experiential learning enable the appropriation of natural and cultural biodiversity and environmental awareness.

If the context is unknown experientially through direct observation, however much information or a certain level of knowledge is available, the assessment may be very weak and quickly extinguished. Many people in the communities of the PNH buffer zone do not know the core area and do not value it properly, despite its enormous importance for the services it provides for the development of the region and Peru. On this point, the approach of Meireles et al. (2021), in the sense that the development of the program of education and interpretation of the Environment should be developed as a transversal theme in formal and non-formal education, is coherent, integrating school projects with environmental actions. That is, it is essential to contextualize environmental education and promote the participation of the community and school for the care and conservation of PNH.

In order to develop a plan for the rescue, evaluation, dissemination and care of PNH, it is necessary to know its virtues and significance for humanity. That is, as pointed out by Díaz et al. (2019), in order to develop proenvironmental skills it is necessary to identify the problems of the environment, reason critically to raise and solve these problems from a focused local level to a regional level. It is for this reason that the experiential activities were planned with the participation of parents, teachers, administrative workers and students from the educational communities of the Paltay micro-basin, which were reflected in the results of the present study. As can be seen, all students in the experimental group showed a significant improvement in the level of knowledge about environmental education for the care and conservation of PNH. There is agreement with what was stated by Cavalcante et al. (2021), because the students showed greater commitment and participation in the development of experiential activities, again falling on the boys and girls of Initial Education, the greatest commitment for the conservation of the PNH.

Trujillo and Colorado (2016) also mention that teachers play the role of promoter of culture and mediator of teaching and learning, that these spaces should be used to promote contextualized educational processes involving students' prior learning. Teachers and any actors involved in the teaching-learning processes on environmental issues constitute themselves as promoters of culture; therefore, the research team actively participated in the various activities organized by the educational institutions of the experimental group, such as sports, cultural, musical and religious activities (a priest was involved as a collaborator in the research team), in order to achieve empathy with the educational community and the community at large, socializing the project, its aims and objectives, as well as benefits for the communities in the area of influence.

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REFERENCES

Castillo Reyna J., Rivero Aranda R. E., & Ramírez Angulo, J. (2016). Aprendizaje vivencial y su conexión a un entorno social: de la práctica a la realidad. *ANFEI Digital*. 5. https://anfei.mx/revista/index.php/revista/article/view/294

Castillo-Figueroa, D., & Sáenz-Jiménez, F. (2019). Experiencias de educación ambiental para la conservación del Cóndor Andino (vultur gryphus) en la provincia del Guavio, Cundinamarca (Colombia). *Revista Luna Azul,* (49), 90-108. https://doi.org/10.17151/luaz.2019.49.5

Cavalcante B., Ferreira H. J., & Dias Da Silva, C. D. (2021). A importância das bromélias no meio ambiente: uma proposta de sequência didática para sensibilização ambiental de estudantes da educação básica. https://doi.org/10.1590/SciELOPreprints.2917

Díaz Grijalva, G., Camarena Gómez, B. O., Mirón Juárez, C. A., & Ochoa Ávila, E. (2019). Prácticas docentes en educación ambiental y habilidades proambientales en el estudiantado de quinto grado de primaria. *Revista Actualidades Investigativas en Educación, 19(3),* 1-18. https://doi.org/10.15517/aie.v19i3.38797

Esteban Ibáñez, M., Amador Muñoz, L. V., & Mateos Claros, F. (2017). Attitudes of University Students towards the Environment: Environmental Education and Innovation. *Revista De Humanidades*, (31), 17-38. https://doi.org/10.5944/rdh.31.2017.19071

Flórez-Yepes, G. Y., Rincón-Santamaría, A., Cardon, P. S., & Gallego, F. A. (2018). Learning tools in environmental education at fundación niños de los andes in Manizales, Colombia. *Revista Electrónica Educare, 22*(2). https://doi.org/10.15359/ree.22-2.5

Fuentealba, C. M. (2018). Attitudinal pro-environmental assessment: A global analysis in primary, secondary and tertiary education students. *Revista Luna Azul,* 47, 159-176. https://doi.org/10.17151/luaz.2019.47.9

Hernández Carretero, A. M., Burgui, M., Velázquez de Castro, F., & Corrales Vázquez, J. M. (2018). ¿Responden los libros de texto a las demandas de la educación ambiental? Un análisis para la educación secundaria. *Boletín de la Asociación de Geógrafos Españoles*, 77, 80-110. https://dx.doi.org/10.21138/bage.2535

Meireles, C., Schiatti, L., Reis, R., Creed, J. C. & Pimentel D. S. (2021). Estudo de caso: desenvolvimento do programa de educação e interpretação ambiental e patrimonial da Reserva Biológica Estadual de Guaratiba (Rio de Janeiro/Brasil). https://doi.org/10.1590/SciELOPreprints.2752

Mendoza, C. D., & Sánchez, K. P. (2019). Significant environmental learning through the implementation of an environmental education model. case study: Educational institution in Machado, Bolívar-Colombia. *Revista Luna Azul,* (48), 156-171. https://doi.org/10.17151/LUAZ.2019.48.9

Prosser B. G., & Romero M. I. (2019). Investigación en educación ambiental con menores en Iberoamérica: una revisión bibliométrica de 1999 a 2019. *Revista Mexicana de Investigación Educativa*. 24(83), 1027-1053. https://ojs.rmie.mx/index.php/rmie/article/view/331

Quintana-Arias, R. F. (2017). La educación ambiental y su importancia en la relación sustentable: Hombre-Naturaleza-Territorio. *Revista Latinoamericana de Ciencias Sociales, Niñez y Juventud*, 15(2), pp. 927-949. https://doi.org/10.11600/1692715x.1520929042016

Sabino, E., Lavado W., & Aybar C. (2019). Estimación de las zonas de vida de Holdridge en el Perú, Servicio Nacional De Meteorología E Hidrología Del Perú-Senamhi. Dirección de Hidrología-DHI. https://www.senamhi.gob.pe/load/file/01401SENA-87.pdf

Shoobridge, D. (2005). Perfil de área protegida-Perú. Parque Nacional Huascarán. https://www.parkswatch.org/parkprofiles/pdf/hunp_spa.pdf

Torres Cruz, D. L., Fonseca Villamil, W. P., & Pineda Jaimes, B. N. (2017). Las vivencias como estrategia de fortalecimiento del pensamiento crítico en educación rural. *Praxis y Saber*, 8(17), 201-224. https://doi.org/10.19053/22160159.v8.n17.2018.7207

Torres, B., Amérigo, M., & García, J. A. (2021). Evaluation of a proenvironmental intervention in primary school students (10-13 age) from Castilla-La Mancha (Spain). *Revista Electrónica Educare, 25*(3). https://doi.org/10.15359/ree.25-3.11

Trujillo Meza, J. & Colorado de Hernández, M. (2016). El conocimiento, conceptos valorativos y la preservación del medio ambiente. *Quipukamayoc*, *24*(46), 139-152. https://doi.org/10.15381/quipu.v24i46.13248

Conflict of interest

Authors declare no conflict of interests.

Authors' contribution

The authors participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.