ISSN: 2458-8989

Natural and Engineering Sciences

NESciences, 2024, 9 (2): 460-471 doi: 10.28978/nesciences.1574456

Effect of Health Education on Environmental Pollution as a Primary Factor in Sustainable Development

Fernando Escobedo [1*], Rosa Clavijo-López [2], Elia Anacely Córdova Calle [3], Sandra Ruiz Correa [4], Ancelmo García García [5], Fernando Willy Morillo Galarza [6], Alcides Muñoz Ocas [7], César Augusto Flores-Tananta [8]

[1*] Universidad Cesar Vallejo, Tarapoto, Perú, Universidad Nacional De Tumbes, Tumbes, Perú. E-mail: jescobedog@ucv.edu.pe

[2] Universidad Cesar Vallejo, Tarapoto, Perú. E-mail: rclavijol@ucvvirtual.edu.pe

[3] Universidad Cesar Vallejo, Tarapoto, Perú. E-mail: ecordovaca@ucv.edu.pe

[4] Universidad Nacional de San Martín, Tarapoto, Perú. E-mail: saruizcol@unsm.edu.pe

[5] Universidad Cesar Vallejo, Tarapoto, Perú. E-mail: agarciag@ucv.edu.pe

[6] Universidad Cesar Vallejo, Tarapoto, Perú. E-mail: fmorillog@ucvvirtual.edu.pe

[7] Universidad Nacional De San Martín, Tarapoto, Perú. E-mail: amunoz@unsm.edu.pe

[8] Universidad Cesar Vallejo, Tarapoto, Perú. E-mail: cflorest@ucvvirtual.edu.pe

Abstract

Environmental Pollution (EP) is an escalating worldwide issue affecting the entire planet. Environmental consciousness plays a crucial role in addressing EP's problems. Environmental Education (EE) is one of the methods used to instill these ideals in individuals. EE is a critical determinant of enhancing the condition of the ecosystem, and it is imperative to get instruction from a young age. Instructors influence children's interests, mindsets, and beliefs on environmental issues and their associated difficulties in Peru. The significance of EE is exceedingly elevated. This significantly impacts the nation's Economic Development (ED) and Public Health (PH). The Sustainable Development Goals (SDGs) serve as a comprehensive plan for achieving a more prosperous and environmentally responsible future for everyone. The establishment of SDGs aims to eliminate poverty, protect against natural calamities, and provide universal prosperity and security. This study investigates educators' potential, perspectives, and opinions in instructing the subject of EP and PH. The

*Corresponding Author: Fernando Escobedo, E-mail: jescobedog@ucv.edu.pe

research documents the correlation between EE and EP in Peru. The primary objective was to engage with instructors and ascertain their capacity to educate students about EP. The requisite information was acquired by a survey (240 participants) distributed to all pertinent elementary and secondary schools. The mean yearly number of classes taught is just 2.62, although the preferred number of lessons, as indicated by the instructors, is considerably more. Instructors find water and air contamination particularly intriguing among the various forms of pollution. When instructors mediate the curriculum, they prioritize respecting both living and inanimate nature, focusing on living nature for 19% of their efforts. Several instructors continue to depend on inadequate technological advancement, which is restricted by nature protection (2%). According to instructors, the conversation technique (34%) is a frequently used approach to engage students in learning about the issue of contamination. Studies have indicated that instructors believe that to address the concerns adequately, the number of classes devoted to this topic should be increased threefold. The collected results validate educators' endeavors in addressing environmental contamination, which is a positive trajectory.

Keywords:

Health education, environmental pollution, sustainable development, contamination.

Article history:

Received: 03/07/2024, Revised: 30/08/2024, Accepted: 23/09/2024, Available online: 30/10/2024

Introduction

The rapid growth of several cities, driven by its economic expansion, has resulted in a significant escalation in resource utilization and a wide range of environmental issues. Environmental Pollution (EP) has emerged as a prominent environmental issue (Xu et al., 2022; Llopiz-Guerra et al., 2024). Air pollutants exhibit differences in chemical structure, reactivity, emission, decay rate, and ability to spread over small or large areas (Glencross et al., 2020). Air pollution has detrimental effects on several body systems and organs, leading to exacerbated symptoms of breathing, increased reliance on medicine, diminished lung function, repeated utilization of healthcare services, and premature death (Knežević & Knežević, 2019).

The issue of water quality is a significant challenge for humanity in the 21st century (Uddin et al., 2021). The primary causes of water pollution are chemical pollutants, mainly inorganic and biological micropollutants, that contain hazardous metals, metalloids, and other artificial organic compounds. Despite economic growth, the quantity of wastewater generated has significantly increased due to the growing number of commercial pollutants, heavy metals, and algal contaminants (Hong & Chun, 2023). This rise in wastewater quantity has been associated with adverse health consequences, including fatalities from the liver and tumors in the stomach (Neelima et al., 2024).

An excessive number of people has led to the accumulation of substantial quantities of household waste, resulting in the formation of microbes and the contamination of the air and waterways (Zhao et al., 2022). Agricultural output has contaminated soil and groundwater due to fertilizers and residual pesticides. Noise, being a crucial Public Health (PH) issue, can result in various negative consequences such as hearing impairment, disturbances in sleep, cardiovascular disorders, limitations in social functioning, reduced efficiency, hindered education and learning, increased absenteeism, heightened drug usage, and fatalities (Clementine et al., 2014; Araújo Alves et al., 2020). Noise exposure is common in everyday life. It has frequently been perceived as less damaging than other contaminants in rural and urban regions. Heavy traffic and loud building sites can disrupt the tranquility of any residential area, both during the day and at night (Liu et al., 2021).

China has adopted Sustainable Development (SD) as a fundamental national policy since 1992 (Ayamba et al., 2020). The escalation of EP and ecological deterioration has persisted, significantly harming the economy and overall quality of life. It begins with a substantial pollution level and emphasizes advancing urban sustainability throughout its growth phase. The pressure-based authorities assessment process migrates EP from urban to rural regions in Peru.

EP refers to the undesired alterations in the chemical, psychological, and biological makeup of the surroundings, including the air, water, and soil. EP is the existence of detrimental contaminants in a particular environment, rendering it unsuitable for habitation. Environmental Education (EE) should incorporate the problem of EP as a fundamental component (Acosta Castellanos & Queiruga-Dios, 2022). EE is crucial for practical application in everyday life and should be encompassed in all elementary and secondary school curricula. It should be integrated into other events, such as meetings, seminars, and speeches. The pedagogical approach when teaching ought to be tailored to the children's age and level of development, encompassing not just academic concepts but practical applications, fostering interest and engagement.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) advocates including EE in classrooms (Mercan & Selçuk, 2023). EE has been integrated into the education systems of several European nations for many years. EE has been included in the educational curriculum as a cross-disciplinary theme, spanning many school courses over thirty years. EP is a significant concern in our lives. It is sometimes overlooked and undervalued in the field of teaching in Peru. EE aims to inform the public about the issues associated with EP using effective communication strategies. The instructor shapes their pupils' ecological consciousness by including EE components (Durmuş & Kınacı, 2021).

SD refers to the process of achieving SD Goals (SDGs) while ensuring that the requirements of both the current and future generations are met without causing harm (Pizzi et al., 2020). The United Nations' idea of SD, which has gained global recognition, was regarded as one of the most significant gatherings of world leaders. Increasing knowledge of the hazards and consequences of EP is a crucial component in effectively addressing them and implementing preventive actions. Not all aspects of environmental issues have been thoroughly examined in EP's educational curriculum in Peru. Considerable attention has been devoted to educating about air and water pollution (Yu et al., 2023).

Acknowledging the significance of all aspects of the natural environment and scenery is crucial. The subject is whether instructors equally focus on environmental protection in every field, including air, water, and soil. Both the instructors' mindset and their level of education, as well as the capabilities of the educational system, are crucial factors in the field of EE. This article aims to assess the appeal of the topic of EP as seen by instructors in schools. This study examines the instructor's perspective on the issue and provides information on its objectives, time allocation, teaching techniques, and principles followed by the instructor when delivering the syllabus.

Background

Significant scholarly interest studies the relationship between EP, ED, and PH. The current body of research centers on the correlation between EP and ED, economic stability and PH, and the link between EP and PH. Regarding the correlation between EP and ED, certain scholars have conducted a quantitative analysis using the Data Envelopment Assessment (DEA) (Camanho et al., 2024), Granger causality test assessment (Rosoł et al., 2022), and the Environmental Kuznets Curve (EKC) theories (Dkhili, 2023), focusing on sustainable ED. Shen et al. employed the super efficiency generalized distance function system to assess the efficiency of

resource-saving towns (Pan et al., 2022). Their findings indicate that the rapid growth of the urban economy frequently results in EP.

They proposed pertinent recommendations for the SD of the green economy. Apostolakis et al., (2021) analyzed to determine the causative link between financial policy uncertainties and EP in the United States Apostolakis et al., (2021). Their findings indicate a strong causality between these two factors. Chang et al. studied the EKC hypothesis utilizing 284 prefecture-level data panels (Chang et al., 2021). They employed a geographic dynamic panel data framework and found that the link between EP and financial growth follows a reverse U-shaped curve, which is consistent and reliable. After reviewing the research, there is a reciprocal link between monetary growth and PH.

PH exerts an influence on ED. Chiu et al. analyzed the association between financial situation and children's health, employing Canadian records on healthcare and ED (Chiu et al., 2020). They discovered a substantial positive correlation between the two variables, indicating that poverty significantly contributes to PH issues. Hao et al. empirically investigated 31 provinces using a person's fixed effect approach (Hao et al., 2020). They discovered that the relationship between the target setting of ED and PH quality followed a U-shaped pattern. Liu et al. analyzed the correlation between EP and health status (Uddin et al., 2021). They developed a model to assess health damage and discovered a direct association between poorer health levels and higher economic losses. Academia has extensively researched the correlation between EP and PH, yielding significant findings regarding the influence of EP on PH. Upon literature evaluation, researchers often start their study from two primary perspectives: analytical methodology and econometric modeling. Researchers commonly employed the dose-response connection and the exposure-response concept in the analytical approach. Chen et al., (2021) analyzed the impact of air pollution indications on pregnancy and discovered a positive correlation between exposure to airborne pollutants during pregnancy and premature birth (Chen et al., 2021). They found that EP has negative impacts on pregnant women. Parish et al. examined the approach for assessing pharmaceutical exposure (Parish et al., 2020). They determined that older adults, kids, and those with asthma are more vulnerable to the effects of elevated levels of EP. They concluded that there are both short-term and long-term effects, ultimately leading to an increase in mortality rate.

Researchers typically do studies using the Grossman health production model as a foundation for econometric modeling. Hong et al. analyzed the connections between EP and healthcare spending using Gaussian Mixture Modeling (GMM) (Shen et al., 2022). Their findings revealed a positive correlation between the severity of EP, the frequency of individuals seeking medical care, and the level of health spending (Kodric et al., 2021). There is an evident inverse relationship between environmental contamination and the degree of PH. Xing et al., (2023) employed the Stochastic Impacts of Regressive Behavior on Population, Affluence, and Technology models to demonstrate the correlation between haze pollution and the decline in PH (Xing et al., 2023). They found that higher disposable income per person and improved medical services are associated with increased PH and reduced mortality. This study underscores the significance of environmental management and proposes relevant recommendations.

The current body of research thoroughly examines the correlation between EP, ED, and PH. There is still potential for enhancement. The direct consequences of ED on EP might jeopardize PH. Examining ED and EP's influence on PH is essential (Yu et al., 2023). There is significant variation in PH levels across various areas, mainly attributable to disparities in local ED. Most current research only examines specific regions, neglecting the comprehensive understanding. It employs a personal fixed impact model centered on the Grossman health output function. It categorizes the study area into four areas: the eastern area, the northeastern area, the central area, and the western area. The objective of researching the correlation between EP, ED, and

PH in different regions is to offer policy suggestions for achieving health fairness. This research intends to provide valuable insights and guidance for PH initiatives in other emerging nations.

Materials and Methods

Pilot Study

A preliminary investigation was conducted to determine areas that provide problems, shortcomings in the research tools, and the procedure before the final deployment. The pilot survey of 25 inquiries was administered as a component of a bachelor's thesis in Peru. A total of 15 elementary schools were targeted for participation. The responses from 20 participants were assessed. The last survey was created according to the gathered data and instructor comments.

Questionnaire

The final survey consisted of 29 inquiries categorized into three areas.
1. The questionnaire includes 12 inquiries specifically addressing EP in EE. These inquiries consist of 4 open-ended inquiries, seven semi-closed inquiries, and one closed-ended question. 2. The questionnaire includes four inquiries that specifically pertain to the practical work of an instructor in the field of education from Peru. These inquiries consist of 1 open-ended inquiry and three closed-ended questions. 3. 13 inquiries in the questionnaire focus on gathering personal information from the instructor. These inquiries consist of 2 open-ended inquiries and 11 closed-ended inquiries.

The survey was conducted in 2019 using a partially automated computerized survey distributed via email. An e-mail survey was distributed to every elementary and high school administrator from Peru. The Gmail addresses were obtained from the Center for Statistical and Technical Data. There were 2800 email addresses, out of which 50 were found to need to be delivered.

A total of 242 inquiries have been finished and exchanged. 2 were excluded because they included missing data. A minimum relevant number of samples from the starting file, consisting of 1000-10000 units, must be at least 7.8%. The statistics condition was met as the collected surveys accounted for 8.2%. The study sample comprised educators who specialize in delivering science courses and disciplines that allow for incorporating EP in Peru. The information gathered was analyzed using dependency tables as well as pie charts.

Respondent Data

The sample of participants consisted of instructors teaching at secondary and primary schools. Most participants, comprising 32%, resided in a community with a population ranging from 1000 to 5000 individuals. Only 6% of the participants lived in Peru or a large town. Most of the participants, at 17%, were from the Peru city areas, which accounted for 14% of the total. Only 5% of the professors were from Bratislava. The participants comprised 84% females and 16% males. Two hundred thirty-eight participants provided their gender information, while two instructors did not disclose their gender. Of the total participants, 36% were 40-50 years old. Out of the total number of responders, which was 16, only 8% fell into the age range of 20-30.

A total of 202 instructors, accounting for 84% of the sample, have finished secondary education, while 35 instructors, representing 16% of the sample, have further education. A total of 237 participants provided information on their educational background. 24% of the participants reported engaging in a pedagogical

practice lasting 18 to 24 years, the most extensive duration. Of the responses, only 7% had experience as educators exceeding 36 years.

Questionnaire

A well-designed survey was created and employed during the inquiry. The survey was conducted anonymously, and the respondents' subjective opinions were assessed in Peru. The survey utilized in this study was a component of the primary survey and included inquiries regarding (1) participants' overall socioeconomic status, (2) perceived EP, and (3) self-rated healthiness in Peru. The demographic inquiries encompassed information regarding the participants' gender, age, place of origin, relationship status, educational attainment, and the academic level of their father.

The respondents were asked four questions regarding EP: Have you encountered air, water, garbage, or noise pollution daily? (Comparison between Yes and No). If the response was "Yes," perceived EP was classified as "1"; alternatively, it was classified as "0". All the parameters were binary. The respondents were queried about their health state, which was assessed using a Likert scale consisting of five categories ranging from excellent or good to fair or extremely poor. Self-rated health is a dependable and accurate way to assess overall health state. It is linked with many objective health indicators and is a powerful predictor of future death.

Data Analysis

The data evaluations were conducted using Stata software version 15.0. The analysis had three components. The statistical techniques were employed to illustrate the respondents' demographic details, perceived EP, and PH condition. The statistics were given in the form of percentages.

Multivariate analyses were conducted using cross-tabulations and Likelihood-ratio Chi-square testing to establish associations between observed air pollution, water pollution, waste pollution, noise pollution (independent parameters), and health conditions (dependent factor).

Multivariate analyses were conducted further to ascertain the relationships between the independent and dependent factors. The dependent factor, PH situation, was categorized as 0 for general health, 1 for good health, and 2 for bad health. Multinomial regression evaluations were ultimately conducted. The study evaluated the effects of EP on the PH conditions of both urban and rural populations. The variables controlled in the study were gender, age, marital situation, education, and father's education. A p-value below 0.05 was statistically noteworthy.

Results and Findings

The objectives of instructors in the method of teaching about EP. The issue regarding the objectives of instructors in the procedure of teaching EP was presented as a multiple-choice inquiry, and it received responses from 239 participants in Peru. Figure 1 displays the outcomes of instructors' educational objectives. One hundred eighty-nine instructors, accounting for about 30% of the sample, include education about EP in their curriculum to raise awareness about potential PH risks. Perspectives, values, and capabilities for environmental conservation are the second most prevalent aim sought by 26% of instructors in Peru. 2% of the professors selected a different response. Instructors believe that by incorporating EE, they not only serve as role models for learners but also instill a sense of accountability for their behavior. This approach fosters active citizenship and a sense of obligation towards future generations, promoting awareness of possibilities to mitigate EP.

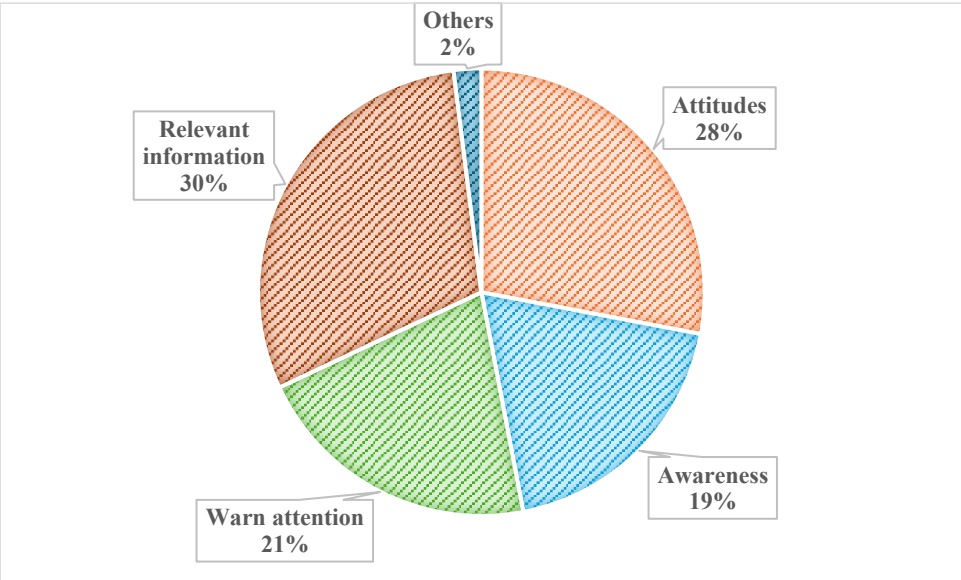

Figure 1. Teaching process analysis regarding EP

Empirical research demonstrates that environmental risk factors have an impact on PH. The research discussed the phenomenon of heightened awareness and concern for PH risks concerning EP. Studies conducted around Peru have established a correlation between residing in polluted regions and experiencing adverse PH conditions. The findings suggest that instructors are aware of these hazards and bring them to the forefront. Instructors emphasize the importance of fostering environmental consciousness since they effectively transmit this understanding to pupils, who can disseminate it to their families. Research has revealed that children who engage in environmental activities can convert environmental concepts into actions and develop a sense of responsibility to alert others about actions that harm the environment.

Quantity of instructional sessions dedicated to the teaching of EP. Table 1 displays the following information: (a) What is the average number of classes per year that instructors dedicate to EP in the teaching procedure? (b) How many hours should be allocated for teaching about EP? (c) According to their view, what is the optimal number of sessions that should be devoted to this issue? It has been shown that instructors need more chances to tackle the challenges of EP as part of their method of instruction. The maximum average yearly number representing the potential for addressing the issue through instruction is 2.74 classes. Although teaching chances are limited, instructors, on average, dedicate 5.52 classes to teaching during the school year. It is intriguing to analyze the outcomes, which indicate the optimal number of classes conducted over the academic year. The collected data reveal a threefold increase across all categories of environmental pollutants, including air, water, soil, and other contaminants. Instructors demonstrate a keen interest in EP, as indicated by their desire to allocate a maximum of 14.86 classes to this subject in Peru. Mean classes devoted to teaching EP shown in table 1.

Table 1. Mean classes devoted to teaching EP

Pollution	Air		Water	Soil	Others
	Count		Count	Count	Count
Possibility of learning	2.63		2.74	2.13	1.84
Lessons per class	5.21		5.52	5.19	3.02
Teacher perspective	13.54		16.02	14.23	11.12

According to the study's attractiveness assessment of specific themes, water contamination emerged as the most captivating subject among the surveyed instructors. Instructors find the other sorts of EP, such as

light, noise pollution, and radiation, to be the least fascinating. On average, instructors allocate 2.63 lessons to teaching this specific material throughout the school year. The findings indicate that incorporating EP topics into the regular elementary and secondary school curriculum in Peru might provide educators with challenges. The primary requirement for achieving EE is the provision of subsidies for science classes. The key to incorporating EP into the curriculum is consistently and strictly following an interdisciplinary approach to teaching EE. Environmental science is the methodical examination of the environment and its position. Environmental issues necessitate a multidisciplinary strategy due to their intricate nature and reliance on several knowledge domains.

An intriguing initiative was implemented in Peru, which involved the introduction of Mathematics and Environmental Exploration as subjects. The originality was the incorporation of mathematics and components of natural sciences into a single course, promoting an integrated approach to learning. Educators regard the choice to incorporate the incorporated topic into primary school as quite commendable—forms and methodologies employed in the educational procedure of the EP subject. The inquiry about the forms and methods used in the educational process was presented in a multiple-choice format, and it received responses from 239 participants.

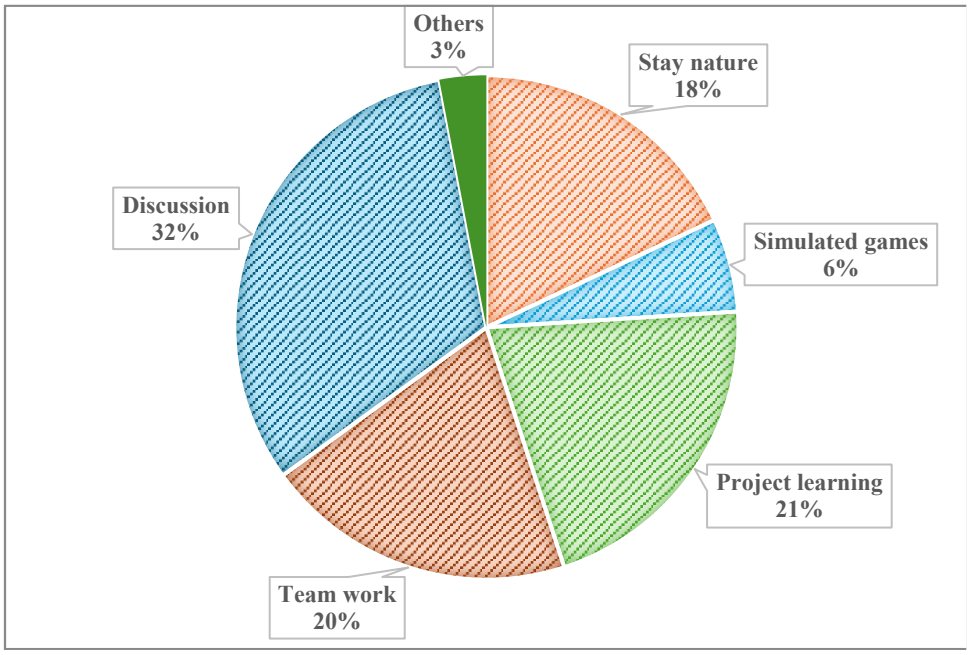

Figure 2. EE process analysis over EP

Approximately 32% of instructors employ the discussion approach (Figure 2) during the instructional process. The second most prevalent type of project instruction is used by 21% of participants in Peru. The utilization of simulation games as an educational tool for teaching EP is minimal. Out of the participants, just 3% reported using other forms and techniques. Instructors employ problem-based education, field visits, and experimentation in addition to the previously described methods and formats. Kids engage in activities such as screening environmental documentaries, practicing modeling, and video journalism as part of their education. Discovering diverse teaching approaches is a highly beneficial outcome for the education framework. The subjects within the field of EE are often well-suited for learning through inquiry, allowing for the use of various educational formats and methodologies.

Articulation of educational ideas employed in EE. The question about the manifestation of pedagogical principles employed in EE was presented in a multiple-choice format. A total of 239 participants responded to

the question from Peru. A total of 203 instructors, accounting for 13% of the sample, incorporate the idea of reverence for both living and non-living nature into their teaching practices (Figure 3). 12% of instructors apply the concept of using EE from the viewpoint of everyday life, making it the second most widely utilized principle.

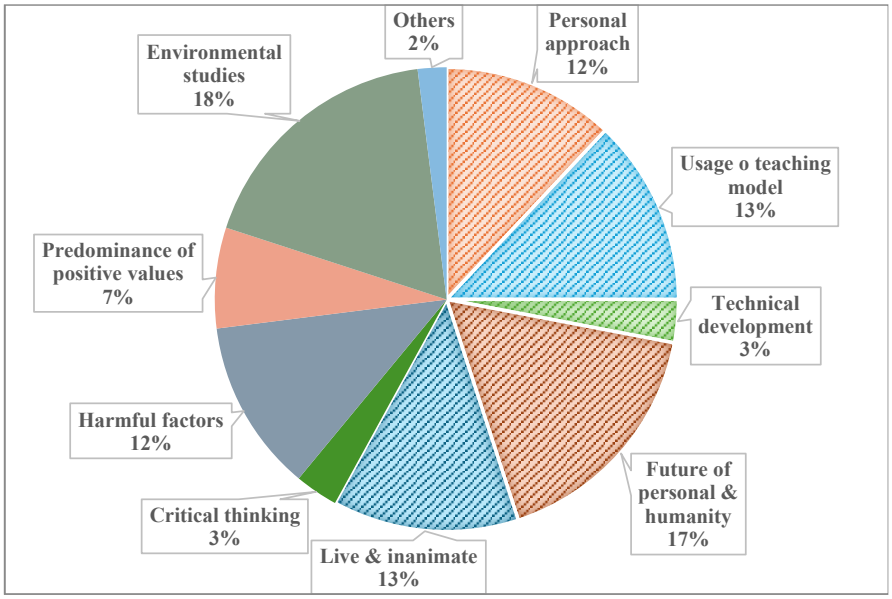

Figure 3. Pedagogical data analysis over environmental education

Out of 18 instructors, just 3% believe that highlighting environmental thought is detrimental to technical growth and that nature protection hinders the advancement of technology. Out of all the responses, only five individuals selected the alternative answer option. These respondents expressed their reason for taking accountability, showing civic initiative, setting an example for others by involving learners in environmental initiatives, or following the idea of simplicity and leading by a good example. The diverse range of educational concepts employed indicates instructors' high level of preparation and proficiency. A more significant proportion of principles accurately represented the proper attitudes of instructors in EE.

Conclusion and Findings

Education for SD refers to instructing and acquiring knowledge on significant SD-related subjects, including climate change, catastrophe mitigation, biodiversity, poverty reduction, and sustainable consumerism. It requires dynamic learning and teaching methods that motivate learners to modify their actions and proactively contribute to sustainable growth in Peru. Training for SD fosters the development of abilities such as critical thinking, envisioning potential futures, and collaborative decision-making. Environmental sustainability is the responsible utilization of earth's resources to guarantee their availability for future generations. The Earth is a bounded ecosystem with restricted land, water, and animal resources, making it of utmost importance. Sustainable resource usage is the sole means of ensuring that subsequent generations will have the necessary resources to survive in Peru. A core principle of SD is to abide by the limitations of the natural environment. Climate change is a consequence of inaction towards addressing it. SD encompasses a broader scope than only environmental issues. It entails ensuring a robust, healthy, and equitable society.

The instructors determine the forms and techniques through which they communicate the curriculum to the pupils and the number of classes dedicated to it. This study has investigated the instructors' interest in EP as a significant factor that might impact their views and opinions in Peru. Instructors included in their

research have demonstrated a heightened curiosity for the problem of EP. The findings indicate that instructors would require more instructional sessions to address EP subjects beyond the current courses. Based on learners' thinking processes, the activating approaches have yielded the most significant response rate regarding the formats and techniques utilized in the instruction process. Considering the present global circumstances, it is imperative to highlight the importance of addressing the challenges of pollution, which have detrimental effects on the environment and the psychological and physical health of people worldwide. It is crucial to provide extensive support to learners to encourage their active engagement in understanding, contemplating, and acting on environmental issues.

Author Contributions

All Authors contributed equally.

Conflict of Interest

The authors declared that no conflict of interest.

References

Acosta Castellanos, P. M., & Queiruga-Dios, A. (2022). From environmental education to education for sustainable development in higher education: a systematic review. *International Journal of Sustainability in Higher Education*, 23(3), 622-644.

Apostolakis, G. N., Floros, C., Gkillas, K., & Wohar, M. (2021). Financial stress, economic policy uncertainty, and oil price uncertainty. *Energy Economics*, 104, 105686. https://doi.org/10.1016/j.eneco.2021.105686.

Araújo Alves, J., Neto Paiva, F., Torres Silva, L., & Remoaldo, P. (2020). Low-frequency noise and its main effects on human health—A review of the literature between 2016 and 2019. *Applied Sciences*, 10(15), 5205. https://doi.org/10.3390/app10155205

Ayamba, E. C., Haibo, C., Abdul-Rahaman, A. R., Serwaa, O. E., & Osei-Agyemang, A. (2020). The impact of foreign direct investment on sustainable development in China. *Environmental Science and Pollution Research*, 27, 25625-25637.

Camanho, A. S., Silva, M. C., Piran, F. S., & Lacerda, D. P. (2024). A literature review of economic efficiency assessments using Data Envelopment Analysis. *European Journal of Operational Research*, 315(1), 1-18.

Chang, H. Y., Wang, W., & Yu, J. (2021). Revisiting the environmental Kuznets curve in China: A spatial dynamic panel data approach. *Energy Economics*, 104, 105600. https://doi.org/10.1016/j.eneco.2021.105600.

Chen, J., Fang, J., Zhang, Y., Xu, Z., Byun, H. M., Li, P. H., & Wu, S. (2021). Associations of adverse pregnancy outcomes with high ambient air pollution exposure: Results from the Project ELEFANT. *Science of the Total Environment*, 761, 143218. https://doi.org/10.1016/j.scitotenv.2020.143218.

Chiu, M., Gatov, E., Fung, K., Kurdyak, P., & Guttmann, A. (2020). Deconstructing The Rise In Mental Health–Related ED Visits Among Children And Youth In Ontario, Canada: Study examines the rise in mental health-related emergency department visits among children and youth in Ontario. *Health Affairs*, 39(10), 1728-1736.

Clementine, G., Willy, S., Thomas, P., Kaitai, L., & Duncan, S.W. (2014). Empowering Personal Health Records with Cloud Computing. *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications*, 5(4), 3-28.

Dkhili, H. (2023). Investigating the theory of environmental Kuznets curve (EKC) in MENA countries. *Journal of the Knowledge Economy*, 14(3), 2266-2283.

Durmuş, E., & Kınacı, M. K. (2021). Opinions of social studies teacher education students about the impact of environmental education on ecological literacy. *Review of International Geographical Education Online*, 11(2), 482-501.

Glencross, D. A., Ho, T. R., Camina, N., Hawrylowicz, C. M., & Pfeffer, P. E. (2020). Air pollution and its effects on the immune system. *Free Radical Biology and Medicine*, 151, 56-68.

Hao, Y., Chen, Y. F., Liao, H., & Wei, Y. M. (2020). China's fiscal decentralization and environmental quality: theory and an empirical study. *Environment and Development Economics*, 25(2), 159-181.

Hong, J., & Chun, H. (2023). A prediction model for healthcare time-series data with a mixture of deep mixed effect models using Gaussian processes. *Biomedical Signal Processing and Control*, 84, 104753. https://doi.org/10.1016/j.bspc.2023.104753

Knežević, D., & Knežević, N. (2019). Air Pollution-Present and Future Challenges, Case Study Sanitary Landfill Brijesnica in Bijeljina. *Archives for Technical Sciences*, 1(20), 73–80.

Kodric, Z., Vrhovec, S., & Jelovcan, L. (2021). Securing edge-enabled smart healthcare systems with blockchain: A systematic literature review. Journal of Internet Services and Information Security, 11(4), 19-32.

Liu, J., Varghese, B. M., Hansen, A., Xiang, J., Zhang, Y., Dear, K., & Bi, P. (2021). Is there an association between hot weather and poor mental health outcomes? A systematic review and meta-analysis. *Environment international*, *153*, 106533. https://doi.org/10.1016/j.envint.2021.106533

Llopiz-Guerra, K., Daline, U.R., Ronald, M.H., Valia, L.V.M., Jadira, D.R.J.N., Karla, R.S. (2024). Importance of Environmental Education in the Context of Natural Sustainability. *Natural and Engineering Sciences*, 9(1), 57-71.

Mercan, G., & Selçuk, Z. V. (2023). Environmental Education in Non-Governmental Organizations: The Significant Contributions of United Nations Units. *Journal of Multidisciplinary Studies in Education*, 7(3), 102-111.

Neelima, S., Govindaraj, M., Subramani, D. K., ALkhayyat, A., & Mohan, D. C. (2024). Factors influencing data utilization and performance of health management information systems: A case study. *Indian Journal of Information Sources and Services*, 14(2), 146-152. https://doi.org/10.51983/ijiss-2024.14.2.21

Pan, D., Hong, W., & He, M. (2022). Can campaign-style enforcement facilitate water pollution control? Learning from China's Environmental Protection Interview. *Journal of Environmental Management*, 301, 113910. https://doi.org/10.1016/j.jenvman.2021.113910

Parish, S. T., Aschner, M., Casey, W., Corvaro, M., Embry, M. R., Fitzpatrick, S., & Boobis, A. (2020). An evaluation framework for new approach methodologies (NAMs) for human health safety assessment. *Regulatory Toxicology and Pharmacology*, 112, 104592. https://doi.org/10.1016/j.yrtph.2020.104592

Pizzi, S., Caputo, A., Corvino, A., & Venturelli, A. (2020). Management research and the UN sustainable development goals (SDGs): A bibliometric investigation and systematic review. *Journal of cleaner production*, 276, 124033. Ahttps://doi.org/10.1016/j.jclepro.2020.124033

Rosoł, M., Młyńczak, M., & Cybulski, G. (2022). Granger causality test with nonlinear neural-network-based methods: Python package and simulation study. *Computer Methods and Programs in Biomedicine*, 216, 106669. https://doi.org/10.1016/j.cmpb.2022.106669

Shen, Z., Liu, N., Li, X., & Kang, Z. (2022). A Method for Evaluating the Green Economic Efficiency of Resource-Based Cities Based on Neural Network Improved DEA Model. *Computational Intelligence and Neuroscience*, 2022(1), 9521107. https://doi.org/10.1155/2022/9521107.

Uddin, M. G., Nash, S., & Olbert, A. I. (2021). A review of water quality index models and their use for assessing surface water quality. *Ecological Indicators*, 122, 107218. https://doi.org/10.1016/j.ecolind.2020.107218.

Xing, L., Khan, Y. A., Arshed, N., & Iqbal, M. (2023). Investigating the impact of economic growth on environment degradation in developing economies through STIRPAT model approach. *Renewable and Sustainable Energy Reviews*, 182, 113365. https://doi.org/10.1016/j.rser.2023.113365

Xu, H., Jia, Y., Sun, Z., Su, J., Liu, Q. S., Zhou, Q., & Jiang, G. (2022). Environmental pollution is a hidden culprit for health issues. *Eco-Environment & Health*, 1(1), 31-45.

Yu, H., Wang, J., Hou, J., Yu, B., & Pan, Y. (2023). The effect of economic growth pressure on green technology innovation: Do environmental regulation, government support, and financial development matter?. *Journal of Environmental Management*, 330, 117172. https://doi.org/10.1016/j.jenvman.2022.117172

Zhao, Y., Chang, H., Liu, X., Bisinella, V., & Christensen, T. H. (2022). Climate change impact of the development in household waste management in China. *Environmental Science & Technology*, 56(12), 8993-9002.